



MISSISSAUGA



**SPECIFICATIONS FOR
ANIMAL SERVICES CENTRE
EXTERIOR & INTERIOR RENOVATION
PHASE-02 PROJECT**

**AT
735 CENTRAL PARKWAY W,
MISSISSAUGA, ON L5C 4H4**

Contractors shall carefully examine and study all of the Contract Documents and shall visit the site(s) of proposed work in order to satisfy themselves by examination as to all conditions and dimensions.

ISSUED FOR TENDER

JULY 05, 2024

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SPECIFICATIONS

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1 GENERAL

- 1.1 Comply with Division 1 requirements and documents referred to therein.
- 1.2 In addition to the General Conditions of the contract, the Contractors shall familiarize themselves with all Section of the Specifications.
- 1.3 Contractor shall include in contract Price all Contingency Allowances specified therein.

2 CASH ALLOWANCES

- 2.1 Refer to City of Mississauga Front End Documents for Cash Allowance amount that to be included in contract.
- 2.2 Cash Allowances, unless otherwise specified, cover the net cost to the General Contractor of services, products, construction, machinery and equipment, freight, handling, unloading, storage installation and other authorized expenses incurred in performing the Work.
- 2.3 The Contract Price, *and not the Cash Allowance*, includes the General Contractor's profit in connection with such cash allowance.
- 2.4 The Contract Price will be adjusted by written order by the Consultant to provide for an excess or deficit to each Cash Allowance. Any unused portions of these allowances shall be returned to the Client on the conclusion of the Contract.
- 2.5 Expend Cash Allowances as directed by the Consultant in writing. Allowances will be adjusted to actual cost with no adjustment to Contractor's charges. Cash expenditure must identify the H.S.T. separately.
- 2.6 **The following is a summary of work included in cash allowances:**

- Door Hardware (General Contractor (GC) to use finishing door hardware Section 08 71 00 and procure the base building hardware vendor "Royal Security Solution Inc" for supplying the hardware only under cash allowances. All the hardware installation has to be done by the GC as part of their contract. GC to also carry the price under their contract for night watch while replacing the existing exterior door, window and new security connections work for new doors).
- All Security Related Work (GC to procure the base building vendor "Securitas Technology" under the cash allowance).
- Pylon Sign (See reference drawings A007- A010)
- Existing Wi-Fi and Ceiling Mounted TV Screen Re & Re Work .
- Testing and Inspection

Base Building Vendor Contact Information:

Royal Security Solutions Inc.
Lawrence Vrbanek
80 Hale Road, #9-10 Brampton, ON L6W 3N9
Tel: 905-840-0522 Ext. 251
Cell: 416-896-5799

Securitas Technology
Gerry Hegarty
2495 Meadowpine Blvd, Unit #1, Mississauga,
ON. L5N 6C3
Cell: (416) 206-0454

3 CONTINGENCY ALLOWANCE

- 3.1 Refer to City of Mississauga Front End Documents for Contingency Allowances amount that to be included in contract.
- 3.2 Expend Contingency Allowance as directed by the Consultant, in writing, in accordance with the Client *Stipulated Price Contract*. Refer to City of Mississauga Front End Documents.
- 3.3 Contractor's charges for expenses and profit on Contingency Allowance expenditure shall not be included in Contract Price.
- 3.4 Changes to the Work shall be added to, or deducted from, the Contingency Allowance, not from the Client approved Contract. The Contract shall be adjusted by Client approval, only once – at the end of the Project. Credit the Contract with any unused portion of the Contingency Allowance only in the final payment statement.
- 3.5 In submitting final adjustments of Contingency Allowances, include duplicate, summary statements and copies of receipted invoices substantiating purchases under Contingency Allowances.

END OF SECTION

PART 1 – GENERAL

1.1 SETTING OUT THE WORK

- 1.1.1 The Contractor shall be responsible for the construction layout.
- 1.1.2 Verify all elevations, lines, levels, and dimensions and report any errors, discrepancies or conflicts to the Consultant.
- 1.1.3 Establish and maintain benchmarks, location stakes and batter boards as required.
- 1.1.4 Verify and record proposed location and finished elevations relative to existing grades.
- 1.1.5 Determine actual location and elevation of existing underground utilities where connections are required.
- 1.1.6 Call in relevant utility companies where required to locate utilities.
- 1.1.7 Undertake test digging where required.
- 1.1.8 Verify and coordinate finished elevations and dimensions of the work of one Section with respect to a related Section of the Work.
- 1.1.9 Prepare interference drawings of system and equipment components to ensure that all elements can be accommodated within the spaces provided.
- 1.1.10 Ensure that all clearances required by authorities having jurisdiction are maintained in the installed work.

1.2 SURVEYOR'S CERTIFICATE

- 1.2.1 Provide an Ontario Land Surveyor's Certificate with a Surveyor's Plan to verify the location of the building in relation to the existing property lines.
- 1.2.2 Submit to the Consultant four (4) copies of the Surveyor's Certificate and the Surveyor's Plan within seven days of completion of the exterior foundations.
- 1.2.3 On completion of the work submit to the Consultant the same Survey to show the outline of paved areas, final finished grades throughout the site and the location of buried services. Note any deviations from the approved working drawings.

END OF SECTION

PART 1 - GENERAL

1.1 PERMITS, LICENSES AND FEES

1.1.1 The Owner shall obtain and pay for, in a timely manner in order to avoid delays to the construction, the Building Permit and Occupancy Permit.

1.2 BUILDING CODE BY-LAWS AND REGULATIONS

1.2.1 Carry out all work in accordance with the regulations of the Ontario Building Code, latest issue, including all amendments and revisions.

1.2.2 Comply with all requirements, regulations and ordinances of all jurisdictional authorities.

1.2.3 Comply with and pay for requirements of local authorities regarding any necessary work outside the property lines such as curbs and sidewalks.

1.2.4 Inform the Consultant of any known variance of the Contract Documents from the requirements of the Building Code and authorities having jurisdiction and assume responsibility for work known to be contrary to such requirements and performed without notifying the Consultant.

1.3 FIRE PROTECTION

1.3.1 Materials and components required to construct fire rated assemblies and materials requiring fire hazard classification shall be listed and labelled.

1.3.2 Fire rated assemblies shall be constructed in accordance with applicable fire test report information issued by the fire rating authority. Deviation from fire test report will not be allowed.

1.3.3 Construct fire rated assemblies as continuous, uninterrupted elements except for permitted openings. Extend fire rated walls and partitions from top of floor assembly to underside of the fire rated assembly above.

1.4 HAZARDOUS MATERIALS

1.4.1 Comply with requirements of the Occupational Health and Safety Act, as amended to include WHMIS (Workplace Hazardous Materials Information System).

1.4.2 Ensure that a current Material Safety Data Sheets (MSDS) arrives before or with the first delivery of every controlled product.

1.4.3 Check the date to ensure that the MSDS is up-to-date (MSDS are valid for three years from date of production).

1.4.4 Ensure that worksite copies of the MSDS are available to workers wishing to consult them and to the health and safety representative and/or joint health and safety committee.

1.4.5 Ensure that workers are instructed in the purpose and content of MSDS.

END OF SECTION

PART 1 - GENERAL

1.1 CONTRACT REFERENCE

1.1.1 The General Conditions and all Sections of Division 1 shall be part and govern all Sections of these Specifications.

1.1.2 All Subcontractors and suppliers shall carefully read and study the General Conditions and Division 1 before commencing their respective work. Delay and/or extra expense will not be accepted by reason of non-compliance with this requirement.

1.2 SCOPE AND DIVISION OF WORK

1.2.1 Mention in the Specifications or indication on the Drawings of materials, products, operations, or methods, requires that the Contractor provide each item mentioned or indicated of the quality or subject to the qualifications noted; perform according to conditions stated for each operation prescribed; and provide all labour, materials, products, equipment and services to complete the Work.

1.2.2 The Specifications have generally been divided into trade division and the trade divisions into Sections for the purpose of ready reference, but a Section may consist of the work of more than one subcontractor or supplier. The responsibility for determining which subcontractor or supplier shall provide labour, material, products, equipment and services to complete the Work rests solely with the Contractor.

1.3 WORK PROVIDED BY OWNER OR PERFORMED UNDER SEPARATE CONTRACTS

1.3.1 The term "NIC" shall be construed to mean that work of this Project which is not being performed or provided by the Contract; the term shall mean "Not in This Contract" or "Not a Part of the Work to be Performed or Provided by the Contractor".

1.3.2 "NIC" work is indicated on the Drawings and specified herein as an aid to the Contractor in scheduling the amount of time and materials necessary for the completion of the Contract.

1.4 DISCREPANCIES/OMISSIONS

1.4.1 Notify the Consultant of any discrepancies in, or omissions from the Drawings, Specifications or other Contract Documents or any doubt as to the meaning or intent of any part thereof. The Consultant will send written instructions, clarifications or explanations. Neither the Owner nor the Consultant will be responsible for oral instructions.

1.5 DEFECTS

1.5.1 Defective material or workmanship whenever found at any time prior to the final acceptance of the work will be rejected regardless of previous inspection. Inspection by the Consultant will not relieve the Contractor from responsibility, but it is a precaution against oversight or error.

1.5.2 Remove and replace defective materials at no extra cost to the Owner. Be responsible for all unnecessary delays and expenses caused by the rejection.

1.6 DIMENSIONS

1.6.1 Check all dimensions at the site before fabrication and installation commences and report all discrepancies to the Consultant.

- 1.6.2 Where dimensions are not available before fabrication commences the dimensions required shall be agreed upon between the Sections concerned.
- 1.6.3 Wall thicknesses shown on the Drawings are nominal only, and actual sizes shall be in all cases ascertained at the building.
- 1.6.4 Verify dimensions of shop fabricated portions of the Work on the site before shop drawings and fabrications are commenced. The Owner will not accept claims for extra cost on the part of the Contractor by reason of non-compliance with this requirement.
- 1.6.5 In areas where equipment will be installed, check dimensional data on equipment to ensure that the area and equipment dimensions are compatible with the necessary access and clearance provided. All equipment supplied shall be dimensionally suitable for space provided.
- 1.6.6 The mechanical and electrical drawings are intended to show approximate locations of mechanical and electrical apparatus, mechanical fixtures, mechanical equipment, piping and duct runs, electrical fixtures, electrical outlets, electrical equipment, electrical units, and conduit in diagrammatic form and are not dimensioned, their locations shall be considered approximate. Check the Architectural drawings and consult with the Consultant to settle the actual locations of these items as may be required to suit aesthetic and job conditions. Such relocation shall be done without charge to the Owner.
- 1.6.7 Leave areas clear when space is reserved for future equipment, including access to such future equipment.
- 1.6.8 Whether shown on the drawings or not, leave adequate space for and provision for servicing of equipment and removal and reinstallation of replaceable items such as motors, coils, and tubes.
- 1.6.9 Furr in all exposed pipes located not more than 12" from the wall (exception storage rooms, janitor, service, mechanical and electrical, telephone and garage) and/or ceiling surfaces and finish similar to the respective wall and/or ceiling surfaces.
- 1.6.10 Conceal pipes, service lines and ducts, in chases, behind furring, or above ceiling except where such items are noted as being exposed, and except to where no ceiling is provided.
- 1.6.11 Install equipment, materials and products to present a neat appearance. Run piping, ducts, and conduit parallel to or perpendicular to building planes.
- 1.6.12 Install all ceiling mounted components including but not limited to air terminals, sprinkler heads, and lighting fixtures in strict accordance with ceiling plans.
- 1.7 CO-OPERATION AND CO ORDINATION
 - 1.7.1 All Sections shall co-operate with each other, to ensure that the work will be carried out expeditiously and will be satisfactory in all respects at completion.
 - 1.7.2 All Sections shall examine the Drawings and Specifications covering the work of all other Sections which may affect the performance of his own work. Examine the work of other Sections at the building, and report to the Consultant any defects or deficiencies which may adversely affect the work. In the absence of such a report the Contractor shall be held to have waived all claims for damage to or defects in such work.
 - 1.7.3 All trades and Sections shall co-operate with other Sections whose work attaches to or is affected

by their own work, and ensure that minor adjustments are made to make adjustable work fit fixed work.

1.7.4 Trades and Sections requiring foundations, supports or openings to be left for the installation of their work shall furnish the necessary information to the sections concerned in ample time so that proper provision can be made for such items. Failure to comply with this requirement will not relieve the Section at fault of the cost of cutting, drilling, etc., at a later period, and the subsequent patching of other work required.

1.7.5 Supply all items to be built-in (including anchors, ties, dovetail slots, nailing strips, blocks, bolts, sleeves, etc.) foundations and openings, when required by the trades concerned, together with templates, measurements and shop drawings. The responsible Section shall pay for any necessary cutting, fixing, and make good to the work of other Sections for failure to comply with this requirement.

1.7.6 Where the Work of this Contract involves changes, revisions or connections to the Base Building, mechanical, electrical, sprinkler or structural, and the changes, revisions, or connections hereto would adversely affect the Owner's guarantees or warranties, the Owner will specify the method in which such item of work shall be done so as not to void the guarantee or warranty, or he may insist on doing such items of work, the cost chargeable to this Contract. The Contractor shall strictly follow such method or be responsible for any loss or damage suffered by the Owner.

1.8 SERVICES PRIORITY

1.8.1 In the event of interference occurring between equipment shown in a concealed area, the following order of priority shall be observed:

- .1 Structural Elements
- .2 Plumbing Drains
- .3 Sprinkler Piping
- .4 Duct Work
- .5 Heating Piping
- .6 Plumbing Piping
- .7 Electrical Conduit

1.9 WORKMANSHIP

1.9.1 The work of all Sections shall be fabricated and installed in accordance with the best practice by craftsmen skilled in the work of the respective Section. Unless otherwise specified, the manufacturer's latest printed instructions shall be rigidly complied with in the methods and materials to be used in the installation of the work.

1.9.2 Notify the Consultant in writing if these Specifications and/or Drawings conflict in any way with manufacturer's instructions. The Consultant will then rule which specifications shall be followed. If applicable, a copy of those instructions shall be made available at job site.

1.10 PROTECTION

1.10.1 Adequately protect the work at all stages of the operations and maintain the protection until work is completed. Remove and replace any work and materials damaged that cannot be repaired or restored to the Consultant's approval.

1.10.2 The Owner assumes no responsibility for the safeguarding of tools or equipment from theft.

- 1.10.3 Be responsible for the protection of existing curbs, roads, sidewalks, lawns, trees, landscaping, utility lines, existing uncompleted work of other contracts, services and similar items located on job site and adjoining properties. Replace and make good any of the damaged existing work without extra cost to the Owner and to the approval of the Consultant.
- 1.10.4 Provide proper guard devices, and lights for the prevention of accidents. Provide and maintain temporary sidewalks, fences, barricades, etc., as necessary to ensure the safety of the public and other persons on or adjacent to the project site, and maintain sufficient and noticeable warning lights at night to prevent accidents and injuries to persons or property.
- 1.10.5 Protected at all times all public areas that are affected by construction under this Contract. Repair immediately any damages.
- 1.11 OVERLOADING
 - 1.11.1 Do not overload any part of the structure during the construction with a load greater than it is calculated to bear safely when complete. Be solely responsible and liable for any damage resulting from violation of this requirement. Provide temporary support as strong as the permanent support. Do not load concrete floors until they have obtained their design strength.
 - 1.11.2 Do not cut, bore or sleeve load bearing members without approval of the Consultant.
- 1.12 CONSTRUCTION SAFETY
 - 1.12.1 Observe and enforce all construction safety measures, as contained in the requirements of Provincial Government and local Municipal Statutes and Authorities.
 - 1.12.2 Comply with the Occupational Health and Safety Act and Bill 208 an Act to amend the Occupational Health and Safety Act and the Workers' Compensation Act.
 - 1.12.3 Comply with WHMIS Regulation, Ont. Reg. 644/88.
 - 1.12.4 In the event of conflict between any of the provisions of Municipal By-laws, the Provincial Acts and the Canadian Construction Safety Code, the most stringent provision shall apply.
 - 1.12.5 Manufacturers and suppliers providing materials that fall under WHMIS Regulation Ont. Reg.644/88, shall submit material safety data as required by the above legislation.
 - 1.12.6 Ensure that "controlled products" brought on site are labelled as required.
 - 1.12.7 Maintain and make available to workers and Consultant, MSDSs for "controlled products" brought on site.
 - 1.12.8 Ensure that workers are familiar with WHMIS and are trained in the use of "controlled products".
 - 1.12.9 Resolve any WHMIS-related conflicts between trade sections.
 - 1.12.10 Provide and maintain adequate First Aid facilities during the construction period.
- 1.13 SETTING OUT
 - 1.13.1 Verify on the site, all lines, levels and dimensions shown on the Drawings and report any discrepancies in levels or dimensions to the Consultant before commencing work. Work done prior to the receipt of the Consultant's directions shall be at the risk of the Contractor.

1.13.2 Lay out the location of all walls on the floor as a guide to the various Sections.

1.14 FASTENINGS

1.14.1 Supply fastenings, anchors and accessories as required for the fabrication and erection of the Work.

1.14.2 Use exposed metal fastenings and accessories of the same texture, colour and finish as the base metal on which they occur.

1.14.3 Provide metal fastenings of the same material as the metal component they are anchoring or of a metal which will not set up an electrolytic action, which would cause damage to the fastening of metal component under moist conditions.

1.14.4 In general, exterior anchors for windows, waterproofing, roofing, sheet metal, and anchors occurring on or in an exterior wall or slab shall be non-corrosive or hot dip galvanized steel. Prime paint will not be accepted as suitable protection against corrosion.

1.14.5 Use fastenings of a type and size to provide positive permanent anchorage of the unit to be anchored in position. Install fastenings in a manner and at spacing required to provide load bearing capacity.

1.14.6 Keep exposed fastenings to a minimum, evenly spaced and neatly laid out, unless otherwise specified.

1.14.7 Provide adequate instructions and/or templates and, if necessary supervise, installation where fastenings or accessories are required to be built into work of other Sections.

1.14.8 Wood plugs will not be permitted.

1.14.9 Fastenings which cause spalling or cracking of material to which anchorage is being made will not be permitted.

1.14.10 Do not use powder-activated fastenings on any portion of the Work unless written approval for a specific use is obtained from the Consultant. Only tools of low velocity, double guidance type are acceptable.

1.14.11 Powder actuated tools, low velocity type, meeting CSA Z-166 latest edition may be used for drywall partitions.

1.14.12 No drilling of holes into window members, T-bars, or induction unit covers is permitted.

1.15 WELDING

1.15.1 No open flames for welding, cutting or other purposes are permitted without prior approval of the Owner. If pressurized gas cylinders are used, the Contractor shall ensure that such use is in accordance with requisite safety provisions and requirements. All welding shall be accompanied with fire extinguisher.

1.16 OWNER'S RIGHT TO RELOCATE DOORS AND/OR PARTITIONS

1.16.1 The Owner reserves the right to relocate doors and frames and/or partitions at a later date, but prior to installation, without cost, assuming that there will be no increase in the number of doors and/or frames, or greater lengths or heights of partition, or no increase in number of corners.

1.16.2 Should there be an increase or decrease in doors, frames or lengths of partition after such relocation adjustments in costs shall be made.

1.17 OWNER'S RIGHT TO RELOCATE MECHANICAL/ELECTRICAL ITEMS

1.17.1 The Owner reserves the right to relocate electrical outlets at a later date, but prior to installation, without cost, assuming that the relocation per outlet does not exceed 10'-0" from the original location. No credits shall be anticipated where relocation per outlet of up to 10'-0" reduces materials, products, and labour.

1.17.2 Should relocations per outlet exceed 10'-0" from the original location, the contract price will be adjusted accordingly.

1.17.3 Make necessary changes, due to lack of co-ordination, and as required when approved, at no additional cost, to accommodate structural and building conditions. The location of pipes and other and other equipment shall be altered without charge to the owner, if approved, provided the change is made before installation.

1.18 CODES AND STANDARDS

1.18.1 All contract forms, codes, specifications, standards, manuals, and installation, application and maintenance instructions, referred to in the Contract Documents shall be of the latest published editions at the date of submission of the Bid unless otherwise stated in the Contract Documents or acceptable to the authorities having jurisdiction.

1.18.2 The purpose of specifying standard reference specifications is to establish minimum acceptable standards of materials and workmanship. Materials and workmanship shall meet or exceed requirements of the reference standards specified.

1.18.3 Where a material or product is specified in conjunction with a referenced standard, do not supply the material or product if it does not meet the requirements of the standard. Supply another specified material or product, or acceptable material or product of another approved manufacturer which does meet the standard, at no additional cost to the Owner.

1.18.4 Where no standard is referred to, materials or workmanship shall meet requirements of the applicable standards of the Canadian Standards Association, Canadian General Specifications Board or the Ontario Building Code.

1.18.5 Where a material or product is required to conform to a standard such as CSA, ASTM, ULC, ULI, CGSB, OBC, etc., supply to the Consultant, on request, satisfactory evidence that the material or product complies with the standard specification or test requirements.

1.19 EMERGENCY CONTACT

1.19.1 The Contractor shall post at the site at least two names and telephone numbers for emergency contact.

1.20 TESTING AND TIE-INS

1.20.1 Obtain the Owner's permission prior to installing of any tie-ins to mechanical, fire protection, life safety, or electrical systems, or tests of such tie-ins.

1.20.2 The Contractor shall be held fully responsible for any damages which result from tie-ins to such

systems or any tests thereof.

1.21 FIRE RATINGS

1.21.1 Where specifications require a material, component or assembly to be fire rated, the fire rating shall be as determined or listed by one of the following testing authorities if approved by Authorities having jurisdiction:

- .1 Underwriters' Laboratories of Canada
- .2 Underwriters' Laboratories Inc. (U.S.A.)
- .3 Factory Mutual Laboratories
- .4 The National Building Code of Canada
- .5 The National Board of Fire Underwriters
- .6 Warnock Hersey International

1.21.2 Where reference is made to only one testing authority, an equivalent fire rating as determined or listed by another of the aforementioned authorities is acceptable if approved by authorities having jurisdiction.

1.22 DOCUMENTS

1.22.1 Maintain one copy of each of the following on the job site;

- .1 Contract Drawings
- .2 Specifications
- .3 Addenda
- .4 Reviewed shop drawings
- .5 Change Orders
- .6 Test reports
- .7 Approved work schedule
- .8 Manufacturer's installation and application instructions.

1.23 BY LAWS AND REGULATIONS

1.23.1 Comply with codes and references as indicated in General Notes on Drawings and in these Specifications.

1.23.2 Nothing contained in the Contract Documents shall be so construed as to be in conflict with any law, by law or regulation of the municipal, provincial or other authorities having jurisdiction. Perform work in conformity with all such laws, by laws and regulations.

1.24 FAIR WAGES

1.24.1 Rates of wages, hours and conditions of work of persons employed on the work shall be in accordance with provincial codes and as generally accepted and recognized in the locality.

1.25 LOCAL SUPPLIERS AND TRADES

1.25.1 Where appropriate the General Contractor is encouraged to use local suppliers and trades where possible.

1.26 TRADEMARKS AND LABELS

- 1.26.1 Trademarks and labels, including applied labels shall not be visible in the finished work. Remove such trademarks or labels by grinding if necessary, or paint where the particular material has been painted.
- 1.26.2 The exception of this requirement shall be those essential to obtain identification of mechanical and electrical equipment and those required to be visible by authorities having jurisdiction.
- 1.27 CLEAN UP
 - 1.27.1 Maintain the Work in a tidy condition and free from the accumulation of waste products and debris, other than that caused by the Owner, other Contractors or their employees.
 - 1.27.2 Clean and make good, to the Consultant's approval, surfaces soiled or otherwise damaged. Pay cost of replacing fixtures or materials that cannot be satisfactorily cleaned.
 - 1.27.3 Remove all debris, equipment and excess material resulting from the site.
 - 1.27.4 All rubbish must be segregated for, and kept in recycling containers and removed from the site on a regular basis.
 - 1.27.5 Do not burn rubbish on the site.
 - 1.27.6 Do not bury rubbish or waste material on the site.
 - 1.27.7 Do not dispose of waste or volatile materials such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.
- 1.28 ACCESS
 - 1.28.1 Maintain, without interruption, unrestricted circulation by the public on City Sidewalks and access by the public to bus stops and waiting areas.
 - 1.28.2 Arrange for delivery of materials, products and equipment to arrive when needed, and at times to prevent interference with vehicular traffic on the streets, at Owner's Service area, and with pedestrian traffic on sidewalks.
- 1.29 ACCESS PANELS
 - 1.29.1 Provide access panels in walls and/or ceilings, as required by codes and as directed by the Owner's representative to permit necessary access to equipment and/or services.
- 1.30 SECURITY
 - 1.30.1 Comply with Owner's security requirements.
 - 1.30.2 Watch the site at all times including weekends and holidays. No compensation will be paid by the Owner for materials of work stolen, lost damaged, or destroyed.
- 1.31 PUBLIC UTILITIES
 - 1.31.1 Before commencement of the Work, ensure that the area occupied by the public utilities; including but not limited to Electricity, Gas, Water, and Telephone, meet the correct requirements of the respective utility company.
 - 1.31.2 Notify the Consultant immediately in writing if the requirements of the utility companies are not

met.

1.32 EXISTING PUBLIC SERVICE LINES

1.32.1 Where existing public service lines are indicated to be removed and/or relocated, do such work in compliance with all authorities having jurisdiction.

1.32.2 Make good to the requirements of authorities having jurisdiction all soiled or damaged public roads, walkways, sidewalks, curbs, public utilities, hydro and telephone lines, and supports.

1.33 NOISE CONTROL

1.33.1 Comply with the requirements of Authorities having jurisdiction and noise control by laws to ensure noise generated by the work is not excessive and not disturbing to the Public and the Owner's and users of adjacent buildings.

1.34 TESTING AND MIX DESIGNS

1.34.1 Arrange for tests as required to establish design parameters, to verify the characteristics or quality of products and materials, and any other tests which the Consultant may reasonably require. Such tests will be paid by the Owner unless specifically stated in the Contract Documents to be at the Contractor's expense. The Consultant will appoint the independent testing agencies or facilities which may be required to effectively carry-out such tests.

1.34.2 Co-operate with independent testing agencies while latter are performing above tests.

1.35 SCHEDULING

1.35.1 Schedule segments of construction and demolition according to staging indicated on Drawings.

1.35.2 Construction, demolition, and renovation shall be carried out with a minimum of disturbance to the Owner's use of the premises.

1.36 IMPERIAL/INTERNATIONAL SYSTEM OF UNITS

1.36.1 Where measurements are indicated in both Imperial and International System of Units (SI), the Imperial System of Units will apply.

1.37 EXPANSION AND CONTRACTION

1.37.1 Make provisions for expansion and contraction due to temperature changes, within components, products and assemblies and between adjacent components, products, or assemblies. Provisions for expansion and contraction shall ensure no damages occur to and within components, products, and assemblies.

1.38 AIR AND FLUID MOVEMENTS

1.38.1 Make provisions in pipes, plenums, ducts and vessels containing air and fluids as is necessary to prevent damages due to fluid and air induced pressure, surges, and vibrations, to pipes, plenums, ducts and vessels, and to adjacent components, assemblies, and constructions to which pipes, ducts, plenums and vessels are attached or pass through.

1.39 BUILDING VOLTAGES

- 1.39.1 All motors with 1/2 hp or above shall be 208 volt 3 phase unless otherwise specified in Divisions 23 and 26.
- 1.39.2 All motors under 1/2 hp shall be 120 volt single phase unless otherwise specified in Divisions 23 and 26.
- 1.39.3 Verify available voltages to be utilized for equipment and co-ordinate with Division 23 and 26.
- 1.40 SPIRITUOUS LIQUORS
 - 1.40.1 The Contractor shall neither permit nor allow the introduction or use of spirituous liquors upon or about the Works embraced in this Contract, or upon any of the grounds occupied by him.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

- 1.1.1 This Section outlines the mandatory minimum Health and Safety protocol for all renovation, addition and new construction Project where all or a portion of the existing building remains occupied and in use.
- 1.1.2 These Health and Safety protocols are mandatory minimum requirements, procedures and standards that the Owner insists are fully complied with by all parties involved with the Projects.

1.2 RELATED SECTIONS

- 1.2.1 These specifications apply to all Divisions of this Project specification. It is the responsibility of the Contractor to apply these provisions wherever practical within specification limits to all products and services used on this Project.
- 1.2.2 The requirements of this Section supersede those of all other specification Sections and Drawings. Where conflicts exist in procedures, methods or materials, they shall immediately be brought to the attention of the Consultant and Owner Project Manager. Where clarification is not immediately available, the Contractor shall assume the specifications contained in this Section are a minimum standard and the more stringent specification shall apply.
- 1.2.3 The Contractor must receive approval from Owner Project Manager for any deviations from this specification Section.
- 1.2.4 The General Contractor shall recognize that it is they who are the Constructor of the Project. The General Contractor shall also recognize that they are solely responsible for site safety at the Place of the Work and compliance with the requirements of this Section does not limit or remove his total responsibility for site safety as Contractor of the Project.

1.3 REFERENCES

- 1.3.1 Applicable related regulations, standards and laws related to safety include but are not limited to:
 - .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.
 - .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
 - .3 Province of Ontario
 - .1 Latest Occupational Health and Safety Act and Regulations for Construction Projects, R.S.O.

1.4 COMPLIANCE SPECIFICATION

- 1.4.1 Notwithstanding the requirements of this Section, the Contractor must comply with all applicable health, safety and environmental regulations and statues.

1.5 BEYOND COMPLIANCE SPECIFICATION

- 1.5.1 These specifications apply in addition to all applicable health, safety and environmental compliance regulations. They are incorporated here to reflect the Owner's intention to develop a specification which provides the safest practical procedures and policies for construction project sites that are occupied and in use by staff, students, and visitors during the execution of the Construction Contract.

- 1.5.2 Beyond compliance specifications recognize that performance well beyond the minimum regulatory standard is often desirable, possible and affordable, often with no cost or low cost options. It also recognizes that application methods or protocols may be as important as the material specified. Therefore, these specifications cover both material and methods.
- 1.5.3 These provisions apply to both indoor and outdoor applications equally.

PART 2 - EXECUTION AND COMPLIANCE REQUIREMENTS

2.1 APPLICATION OF COMPLIANCE REQUIREMENTS

- 2.1.1 The articles set out herein are to be applied together as a set of related policies and procedures to achieve a comprehensive Health and Safety working protocol.
- 2.1.2 The Contractor shall execute all of the procedures and meet all of the requirements set out herein and apply these protocols from the outset of the Construction Phase.
- 2.1.3 These procedures or requirements are to be maintained for the duration of the Construction Phase. The Contractor shall not discontinue any of the individual procedures or requirements without the prior approval of the Owner Project Manager.

2.2 SITE SUPERVISOR (SITE SUPERINTENDENT)

- 2.2.1 A full-time Site Supervisor (Site Superintendent) is required for each site at any site, regardless of the number of active workers on site.
- 2.2.2 Site Superintendent shall have as a minimum:
- .1 Recent, previous experience with renovation or addition projects involving occupied buildings including (but not limited to) government and office building construction, sites with tenants, employees, retail customers, pedestrian and vehicular traffic.
 - .2 Successful completion of a multi-session Supervisor's training course conducted by a recognized Construction Association in Ontario.
- 2.2.3 Site Superintendent must carry a cell phone at all times during construction with the ability to be reached directly during all work hours and the ability to have voicemail recorded during all non-work hours including weekends and holidays.
- 2.2.4 Site Superintendent must have means of live phone or walkie-talkie communication with the site Flagman during all work hours.

- 2.2.5 Site Superintendent shall not be charged throughout projects unless confirmed and approved by the Owner Project Manager.

2.3 ONTARIO OCCUPATION HEALTH & SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS

- 2.3.1 General Contractor to comply with the Ontario Occupational Health & Safety Act and Regulations for Construction Projects, latest edition – including all amendments.
- 2.3.2 Beyond compliance in item .1 above, regardless of the number of labourers active on the Project, the General Contractor shall form a contractor's Health and Safety Committee at the outset of construction. This Committee shall then follow the standard requirements for such a Committee as set out in the *Occupational Health & Safety Act and Regulations for Construction Projects*.

2.4 ON-SITE COMMUNICATIONS

2.5 The building will remain occupied during the course of construction.

2.5.1 At the outset of the project the General Contractors shall provide to the Owner Project Manager all relevant contract information for the Site Superintendent, General Contractor Project Manager and key sub-contractors including names and cell phone numbers.

2.5.2 The General Contractor shall provide at least one 'emergency contact' telephone number at which the Contractor' representative can be reached directly during all work hours and have the ability to have voicemail recorded during all non-work hours including weekends and holidays. As outlined below, this may be designated to the Site Superintendent's cell phone number.

2.5.3 Regardless of compliance method for the emergency contact telephone number stated above, Site Superintendent must carry a cell phone at all times during construction with the ability to be reached directly during all work hours and the ability to have voicemail recorded during all non-work hours including weekends and holidays.

2.5.4 Site Superintendent must have means of live phone or walkie-talkie communication with the site Flagman during all work hours.

2.5.5 The Contractor is to ensure that the Owner Project Manager is immediately apprised of any safety issues as each arise and related request and/or resolution. The Owner Project Manager is responsible for any decisions that have an effect on the contract execution.

2.5.6 Notwithstanding the reporting to the Owner Project Manager noted above the Site Superintendent shall liaise with Facility Manager or designated on all safety related matters as required on a daily basis.

2.5.7 In the event of a safety issue requiring contractual clarification or action (i.e. Change Notice, etc.), the contractor shall ensure that, where applicable, the action is followed up with appropriate documentation.

2.6 FULL-TIME ON-SITE FLAGMAN

2.6.1 A full-time, designated Flagman is required at all vehicular construction entrances.

2.6.2 In the event there is more than one entrance to the hoarded/fenced construction area, there must be a separate Flagman for each entrance.

2.6.3 Flagman shall not be same person as Site Superintendent or other construction worker.

2.6.4 Flagman shall not be changed throughout the Project unless confirmed and approved by the Owner Project Manager.

2.6.5 Flagman must have means of phone communications with Site Superintendent (phone or walkie-talkie).

2.6.6 The Flagman shall not be designated for any other duties than to act as a Flagman for safety purposes as described herein.

2.6.7 The Flagman shall meet and escort any construction traffic from the site entrance into and out of the hoarded/fenced construction area (including through open site areas until entrances to hoarding).

- 2.6.8 The Flagman shall only open hoarded areas when construction traffic moves through and immediately re-close gates.
- 2.6.9 The Flagman shall control construction parking at the site (including vehicles parking or traveling in unauthorized areas).
- 2.6.10 The location of the Flagman shall be set to ensure the safe guarding of staff, student, and pedestrian traffic.
- 2.6.11 If not designated on the Contract Documents, the location of the Flagman shall be confirmed with the Owner Project Manager and Consultant at the outset of the project and before the replacement of hoarding and fencing.
- 2.6.12 Where the Contractor deems it necessary, in order for the Flagman to carry out the required full-time duties, the cost of a temporary shelter shall be included in the Tender Price.
- 2.6.13 The Flagman shall be properly attired to carry out his duties, including the use of safety equipment(e.g. wear reflective vest, have appropriate traffic hand-held "Stop" sign and have a visible identification tag).
- 2.7 SITE SAFETY SIGNAGE
- 2.7.1 Standardized Safety Signage is required at all construction entrances. Refer to detail drawings for types and requirements.
- 2.7.2 If not designated on the Contract Documents, the location of the Safety Signage shall be confirmed with the Owner Project Manager and Consultant at the outset of the Project and before the placement of hoarding and fencing.
- 2.7.3 Safety Signage is to be posted at all street entrances to site and at each entrance to hoarded/fenced construction area.
- 2.7.4 Total surface area of signage is to avoid exceeding municipal standards that would require a separate signage permit.
- 2.7.5 Access signage texts shall include cell phone contact number for Site Superintendent.
- 2.8 ACCESS / EGRESS CONTROLS
- 2.8.1 At the outset of the Contract, the General Contractor shall advise all suppliers and subcontractors of the protocols listed herein and of the requirement to contact the Site Superintendent by Cell phone prior to entering the site.
- 2.8.2 The drivers of all construction vehicles entering the site, including delivery vehicle drivers, are to contact Site Superintendent by cell phone prior to entering site; the Site Superintendent shall, in turn, give notice to the Flagman to be aware of the traffic and authorize the Flagman to allow entry of that vehicle.
- 2.8.3 Vehicular Gates are only for entry and exit of for construction purposes such as construction personnel, Authorities performing inspections, the Owner representative, delivery personnel, and disposal pick up and ONLY under escort by the Flagman. As such vehicular gates much remain closed and locked at all times and only opened for access/egress under escort by the Flagman then closed and locked again.
- 2.8.4 Gates are to be lockable swing gates for vehicles and man gates at all access points to be hoarded/fenced construction area.

2.9 CONTRACTOR PARKING

2.9.1 Contractor parking shall be restricted to hoarded areas or designated parking areas only where pre-approved by the Owner.

2.9.2 Contractor parking is restricted from all off-site street areas that interfere with the site specific parent drop-off and parking areas.

2.10 REQUIRED PRECONSTRUCTION MEETINGS

2.10.1 Meeting 1: Contractor shall receive approval from the Architect and the Owner Project Manager for parking, vehicular movements, access/egress strategies at a Pre-construction meeting taking place in advance of mobilizing on site.

2.10.2 Meeting 2: Once hoarding and fencing is erected BEFORE site construction is fully active and vehicles or equipment is mobilized on site, an initial site meeting shall take place at which time the layout of trailers and staging, deliveries, storage of materials, parking areas and vehicular movement to be reviewed and approved by the Owner Project Manager.

2.10.3 See article 2.12- '*Site Meetings*' following.

2.11 CONSTRUCTION FENCING AND HOARDING

2.11.1 construction hoarding requirements shall be a site based decision to be determined by the Architect and Owner Project Manager at the design stage and shown on the Contract Documents.

2.11.2 No fencing or hoarding shall be less than a continuous 1800mm high.

2.11.3 In portions of the site where chain link is approved, it shall be continuous 1800mm high chain link fencing, wire-tied staked iron 'tees' at 1800mm on centre – OR – leased, modular 'quick fencing' if staked down and wire tied together.

2.11.4 All fenced and hoarded areas to be gated with lockable vehicular and man gates- minimum construction to be steel rail and chain link construction.

2.11.5 Plastic snow fencing is NOT permitted.

2.11.6 All hoarding and fencing shall be maintained in a stable condition, for the duration of construction period as part of the base contract price and to include Superintendent's inspection at the beginning and end of each work day.

2.11.7 All Fire Routes to be outside all fenced and hoarded areas and maintained clear at all times.

2.11.8 'Covered Way' protection shall be provided when accesses or pathway are proximity to construction, in accordance with Ministry of Labour *Occupational Health & Safety Act* Regulations.

2.12 OWNER'S HEALTH, WELLNESS & SAFETY DEPARTMENT REPRESENTATIVE

2.12.1 A representative of the Owner's Health, Wellness & Safety Dept, ('Environment, Health and Safety Officer') may visit site at any time throughout the duration of the Contract to review the site, as it relates to the safety of the occupied areas of the site. Such sites review shall neither constitute an inspection or approval for the Contractor.

- 2.12.2 Concerns or issues identified by the representative from the Owner's Health, Wellness & Safety Dept. shall be communicated through the Owner or Owner's Project Manager for corrective action.
- 2.12.3 Contractor shall ensure full access to all site areas, at all times, for the Owner's Health, Wellness & Safety Department Representative.
- 2.13 SITE MEETINGS
- 2.13.1 Initial site meeting to take place after erecting fencing and hoarding but prior to the mobilization of any vehicles, equipment or start of Work.
- 2.13.2 Contractor shall ensure that the Owner, Owner's Project Manager and a representative of the Owner's Health, Wellness & Safety Department attend the initial site meeting.
- 2.13.3 The initial meeting shall review and approve a standardized agenda for all site meetings and thorough review of the Site Safety Protocol.
- 2.13.4 The standardized agenda shall include a Checklist and Report of Health and Safety items at the beginning of the agenda. This Checklist shall be included and each item reviewed at all site meetings for the duration of the project.
- 2.13.5 The Checklist of Site Safety items shall include but not limited to:
- .1 Contractor's report of site safety record and report of recent site activities, precautions or actions.
 - .2 Review any visits to the site and actions required by Ministry of Labour or Owner's Health, Wellness & Safety representatives or other Authorities Having Jurisdiction.
 - .3 Contractor's Health & Safety policy manual posted in site trailer.
 - .4 Copy of Ministry of Labour *Occupational Health & Safety Act and Regulations for Construction Projects* in site trailer.
 - .5 Name of General Contractor H&S representative.
 - .6 Continuing compliance with Safety Signage.
 - .7 Hoarding and fencing layout and condition.
 - .8 Access and egress measures and any breaches of requirements.
 - .9 Confirmation of communications link between Site Superintendent & Flagman.
 - .11 Work that may produce any noxious odours and the containment measures, (i.e.: schedule, type, approvals required therefore).
 - .12 Copies of Material Safety Data sheets in site trailer.
 - .13 Complete meeting minutes including details of Safety Checklist shall be copied to Architect, the Owner and Owner's Project Manager.
- 2.13.6 Contractor to produce record of written Memorandum to all sub trades and suppliers detailing but not limited to: hours of delivery; site access procedures and restrictions; use of existing facilities.
- 2.13.7 Contractor to prepare detailed and accurate written record of all meetings to be kept and issued to all parties.
- 2.14 CONTRACTOR'S HEALTH AND SAFETY COMMITTEE MEETINGS
- 2.14.1 As required in item 2.1.2, the Contractor shall form a Health and Safety Committee, hold meetings and record minutes of meetings for the duration of the Contract.
- 2.14.2 Contractor to maintain a copy of Health and Safety Committee minutes on site for review by Ministry of Labour or Owner representative(s).

END OF SECTION

PART 1 - GENERAL

1.1 PRE-CONSTRUCTION MEETING

1.1.1 Immediately prior to construction, upon notification attend at location of Owner's choice, a pre construction meeting, along with authoritative representatives of key subcontractors, project superintendent, inspection and testing company representatives, and the consultants.

1.1.2 Purpose of meeting is as follows:

- .1 Review project communications procedures.
- .2 Review Contract administration requirements including submittals, payment and change order procedures.
- .3 Identify all critical points on Construction Schedule for positive action.
- .4 Review Consultant's inspection requirements.
- .5 Review any points which require clarification.

1.2 SITE MEETINGS

1.2.1 Hold regular site meetings every two weeks. Ensure that persons, whose presence is required, Are present and that relative information is available to allow meetings to be conducted efficiently. The Consultant will attend these meetings. The Owner may also choose to attend these meetings, at his discretion.

1.2.2 Schedule additional meetings, if required.

1.2.3 Prepare an agenda for each meeting and distribute a copy to all required participants prior to the meeting.

1.3 SUPERVISION

1.3.1 Employ an experienced and qualified superintendent for the project who shall devote his time exclusively to the work of this Contract and who shall be in complete charge of the work from commencement to completion. A working foreman will not be acceptable. The superintendent shall not be changed after commencement of work without the Consultant's approval. The Superintendent shall possess a C.C.S. and/or Gold Seal Certificate designation and be acceptable to the Owner.

1.3.2 Supervise, direct, manage and control the work of all forces carrying out the work, including subcontractors and suppliers. Carry out daily inspections to ensure compliance with the working drawings and detailed specifications and the maintenance of quality standards. Ensure that the inspection staff includes personnel competent in supervising the mechanical and electrical trades.

1.4 PROGRESS RECORD

1.4.1 The Contractor shall maintain on site, permanent written record of progress of work. Record shall be open to inspection by Owner at all times and copy shall be furnished to Consultants upon the Consultant's request.

1.4.2 This record shall show weather conditions, dates of commencement, progress and completion of

various trades and items of work. Particulars pertaining to erection and removal of forms, pouring of concrete, installation of roofing and other critical or major components as well as number of employees of various trades and type and quantity of equipment employed daily, shall be noted.

- 1.4.3 Display a copy of the construction schedule in the site office from start of construction to completion. Superimpose actual progress of work on schedule at least once each week.

1.5 AS-BUILT DRAWINGS

- 1.5.1 Maintain an accurate set of As-Built Drawings showing progress of the work and all changes, revisions and additions to the work and deviations from the Contract Documents in red ink.
- 1.5.2 Include accurate location, depth, position, size and type of concealed and underground services, both inside and outside shall be as part of these As-Built Drawings.
- 1.5.3 As-Built Drawings shall be available for review at each site meeting by the Consultant.

1.6 DOCUMENTS ON SITE

- 1.6.1 The Contractor's field office shall at all times contain a complete set of Contract Documents (Schematic Drawings and Performance Specifications) with all addenda, site instructions, change orders, reviewed shop drawings and samples, colour schedule, paint materials schedules, hardware list, progress reports and meeting minutes.
- 1.6.2 The Contractor's field office shall at all times contain a complete set of all construction documents, as issued for building permit and bearing the stamp of the appropriate municipal authority.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

1.1.1 No work requiring a sample or shop drawing submission shall be commenced until the submission has received the Consultant's final review. All such work shall be in accordance with reviewed samples and shop drawings.

1.1.2 Provide submittals as requested by the Contract Documents, as specified herein, and in accordance with the conditions of the Contract.

1.1.3 In addition to submittals specifically requested by the Contract Documents, provide other submittals as may be reasonably requested by the Consultant, or as are required to coordinate the Work and to provide the Owner with choices available, within the scope of Contract Documents.

1.1.4 Contractor's review of submittals:

- .1 Review submittals for conformity to Contract Documents before submitting to Consultant. Submittals shall bear stamp of Contractor and signature of a responsible official in Contractor's organization indicating in writing that such submittals have been checked and coordinated by Contractor. Contractor's review shall be performed by qualified personnel who have detailed understanding of those elements being reviewed and of the conditions at the Place of the Work proposed for installation.
- .2 Check and sign each submittal and make notations considered necessary before submitting to Consultant for review. Where submittal is substantially and obviously in conflict with requirements of Contract Documents, reject submittal without submitting to Consultant and request resubmission. Note limited number of reviews of each submittal covered under Consultant's services as specified below.
- .3 Contractor shall assume sole responsibility for any conflicts occurring in the Work that result from lack of comparison and coordination of submittals required for the Work.
- .4 Submittals that have not been reviewed, checked, and coordinated by Contractor prior to submission to Consultant, will be rejected.
- .5 Notify Consultant in writing of changes made on submittals from Contract Documents. Consultant's review of submittals shall not relieve Contractor of responsibility for changes made from Contract Documents not covered by written notification to Consultant.

1.1.5 Consultant's review of submittals:

- .1 Review of submittals by Consultant is for the sole purpose of ascertaining conformance with the general design concepts and the general intent of the Contract Documents. This review shall not mean that Consultant approves the detail design inherent in the submittals, responsibility for which shall remain with the Contractor. Such review shall not relieve the Contractor of responsibility for errors or omissions in the submittals, or responsibility for meeting requirements of Contract Documents.
- .2 Contractor shall be responsible for dimensions to be confirmed and correlated at the Place of the Work for information that pertains solely to fabrication processes or to techniques of construction and installation, and for coordination of the Work.
- .3 As part of their scope of work, Consultant shall review shop drawings no more than twice. Should three or more reviews be required due to reasons of Contractor omissions causing resubmission requests, then Contractor shall reimburse the Consultant for time expended in these extra reviews. Time shall be invoiced to the Owner (to be deducted from monies due to the Contractor and paid to Consultant by Owner) at rates recommended by Consultant's professional association and disbursements shall be

- invoiced at Consultant's cost. The Contractor shall cover directly costs and administration associated with courier services and the like for these extra shop drawing reviews.
4. Consultant's review and markings on submittals do not authorize changes in the Work or the Contract Time.
 - .5 Submittals received but not required by the Contract Documents or requested by the Consultant will not be reviewed by the Consultant and will be marked 'NOT REVIEWED' by the Consultant and returned to the Contractor.
- 1.1.6 Make submittals with reasonable promptness and in an orderly sequence so as to cause no delay in the Work. Be responsible for delays, make up time lost and pay added costs, at no additional cost to the Owner, incurred because of not making submittals in due time to permit proper review by Consultant.
 - 1.1.7 Do not proceed with work affected by a submittal, including ordering of Products, until relevant submittal has been reviewed by Consultant.
 - 1.1.8 Contractor's responsibility for errors and omissions in submittals is not relieved by Consultant's review of submittals.
 - 1.1.9 Contractor's responsibility for deviations in submittal from requirements of Contract Documents is not relieved by Consultant's review of submittal, unless Consultant gives written acceptance of specific deviations.
 - 1.1.10 Engineered submittals:
 - .1 Submittals for items required to be sealed by professional engineer (or as otherwise indicated as engineered), shall be prepared under the direct control and supervision of a qualified professional engineer registered in the Place of the Work, and having minimum professional liability insurance required in accordance with the General Conditions, as amended.
 - .2 Design includes life safety, sizing of supports, anchors, framing, connections, spans, and as additionally required to meet or exceed requirements of applicable codes, standards, regulations, and authorities having jurisdiction.
 - .3 Engineered submittals shall include design calculations, complete with references to codes and standards used in such calculations, supporting the proposed design represented by the submittal. Prepare calculations in a clear and comprehensive manner so that they can be easily reviewed. Incomplete or haphazard calculations will be rejected.
 - .4 The professional engineer responsible for the preparation of engineered submittals shall undertake periodic field review, including review of associated mock-ups, at locations wherever the work as described by the engineered submittal is in progress, during fabrication and installation of such work, and shall submit a field review report after each visit. Field review reports shall be submitted to the Consultant, to authorities having jurisdiction as required, and in accordance with the building code.
 - .5 Field reviews shall be at intervals as necessary and appropriate to the progress of the work described by the submittal to allow the engineer to be familiar with the progress and quality of such work and to determine if the work is proceeding in general conformity with the Contract Documents, including reviewed shop drawings and design calculations.
 - .6 Upon completion of the parts of the Work covered by the engineered submittal, the professional engineer responsible for the preparation of the engineered submittal and for undertaking the periodic field reviews described above, shall prepare and submit to the Consultant and authorities having jurisdiction, as required, a letter of general conformity for those parts of the Work, certifying that they have been Provided in accordance with

the requirements both of the Contract Documents and of the authorities having jurisdiction over the Place of the Work.

.7 Costs for such field reviews and field review reports and letters of general conformity are included in the Contract Price.

1.1.11 Keep copies of reviewed submittals at the Place of the Work in a neat, orderly condition. Only submittals that have been reviewed by the Consultant's and are marked with Consultant's review stamp, as applicable, are permitted at the Place of the Work.

1.1.12 The Work shall conform to reviewed submittals subject to the requirements of this section. Remove and replace materials or assemblies not matching reviewed submittals at no increase in the Contract Time and at no additional cost to the Owner.

2 PART 2 - PRODUCTS

2.1 MATERIAL LIST

2.1.1 Within 15 days of award of Contract, submit a complete list of manufactured materials to Consultant.

2.1.2 List is required to enable Consultant to verify that materials meet Specifications prior to submission of shop drawings or installation, and to select colours and/or patterns.

2.1.3 Should materials not meeting requirements be included, the Consultant will require re-submission.

2.1.4 Only the listed materials shall be used, unless otherwise approved by the Consultant.

3 PART 3 - EXECUTION

3.1 PROJECT MEETING

3.1.1 Prior to commencement of the work, the Contractor together with the Owner shall mutually agree to a sequence for holding regular "on-site meetings".

3.1.2 Organize all necessary site meetings. Ensure that persons, whose presence are required, are in attendance and that relevant information is available, to allow meetings to be conducted efficiently.

3.1.3 Record minutes of each meeting and distribute copies to all participants, and all others requiring information of recorded minutes, within one week of date meeting.

3.2 SHOP DRAWINGS

3.2.1 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.

3.2.2 Contractor shall arrange for the preparation of clearly identified shop drawings called for by the Contract Documents or as the Consultant may reasonably request.

3.2.3 Submitted shop drawings must indicate the name of the project and specific information as to location within the project including reference to the drawing or specification section to which it

relates.

- 3.2.4 The shop drawings shall show, but not necessarily be limited to the following:
- .1 Clear and obvious notes of any proposed changes from Drawings and Specifications.
 - .2 Fabrication and erection dimensions.
 - .3 Provisions for allowable construction tolerances and deflections provided for live loading.
 - .4 Details to indicate construction arrangements of the parts and their connections, and interconnections with other work.
 - .5 Location and type of anchors, and exposed fastenings.
 - .6 Materials and finishes.
 - .7 Descriptive names of equipment.
 - .8 Mechanical and electrical characteristics when applicable.
 - .9 Information to verify that superimposed loads will not affect function, appearance, and safety of the work detailed as well as of interconnected work.
 - .10 Assumed design loadings, and dimensions and material specifications for load bearing members.
 - .11 Dimensions and dimensioned locations of proposed chases, sleeves, cuts and holes in structural members.
- 3.2.5 Prior to submission to the Consultant the Contractor shall review all shop drawings. By this review the Contractor represents that he has determined and verified all field measurements, field construction criteria, materials, catalogue numbers, and similar data, or will do so, and that he has checked and coordinated each shop drawing with the requirements of the work and of the Contract Documents. The Contractor's review of each shop drawing shall be indicated by stamp, date, and signature of a responsible person.
- 3.2.6 Contractor shall submit drawings to the Consultant for his review with reasonable promptness and in orderly sequence so as to cause no delay in the work or the work of other Contractors. If either the Contractor or the Consultant so requests they shall jointly prepare a schedule fixing the dates for the submission and return of shop drawings. Shop drawings shall be submitted in the form of one reproducible transparency and one white print. Where the subject of the shop drawings involves the structural, mechanical, or electrical Engineers, in addition to the one reproducible transparency, submit two white prints. At time of submission the Contractor shall notify the Consultant in writing of any deviation in the shop drawings from the requirements of the Contract Drawings.
- 3.2.7 Contractor shall make any changes in the shop drawings which the Consultant may require consistent with the Contract Documents and resubmit unless otherwise directed by the Consultant. When resubmitting, Contractor shall notify the Consultant in writing of any revision other than those requested by the Consultant.
- 3.2.8 Shop drawings shall define the division of responsibility between the trades and items shown on shop drawings. Shop drawings shall show materials, methods of construction, and attachment or anchorage, erection, connections and other details necessary to complete the work. Shop drawings shall show cross references to Drawings and specifications.
- 3.2.9 Review by the Consultant is for the sole purpose of ascertaining conformance with the general design concept. Review shall not mean that the Consultant approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same and such review does not relieve Contractor of his responsibility for errors or omissions in the shop drawings, or his responsibility for meeting all requirements of the Contract Documents. Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or technique of construction and installation, and for

coordination of the work of all its subtrades and work of other Contractors.

- 3.2.10 Any adjustments made on the shop drawings by the Consultant are not intended to change the Contract Sum. If the Contractor deems that such adjustments affect the value of the work, he shall so state in writing before proceeding with the fabrication and installation of the work.
 - 3.2.11 After final review, the Consultant will return reviewed copies to the Contractor, who shall reproduce, at his expense the number of prints required.
 - 3.2.12 Submit 6 copies of standard pre-printed shop drawings. Assemble submittals of more than 2 pages in individual booklet form, after final review. Consultant will return at least 3 copies of shop drawings to the Contractor.
 - 3.2.13 Shop drawings which require the approval of a legally constituted authority having jurisdiction shall be submitted by the Contractor to such authority for approval. Such shop drawings shall receive final approval of authority having jurisdiction before being submitted to the Consultant.
 - 3.2.14 No work requiring a sample or shop drawing submission shall be commenced until the submission has received the Consultant's final review. All such work shall be in accordance with reviewed samples and shop drawings.
- 3.3 SAMPLES
- 3.3.1 For the purpose of this Article samples means: samples, models and templates.
 - 3.3.2 Samples shall be submitted to the Consultant in a number as specified in the respective Section in sufficient time to permit review process before the item is needed to be installed or as directed otherwise.
 - 3.3.3 If either the Contractor or the Consultant so requests, they shall jointly prepare a schedule fixing the dates for submission and return of samples, including time allowances for re-submissions.
 - 3.3.4 Samples shall be submitted by the Contractor only.
 - 3.3.5 Samples which are "rejected" shall be removed by the Contractor.
 - 3.3.6 Samples will receive consideration only when hand delivered or mailed accompanied with a covering letter signed by the Contractor. Letter shall be sent via First Class mail and shall contain a list of samples being submitted, name of project, Contractor, Subcontractor, manufacturer, brand, also the project number, specification article and paragraph numbers to which the samples refer, and such additional information as may be required by the specification for the particular item being furnished. A copy of the letter shall be enclosed with the samples and any sample received without identification letter will be considered "unclaimed goods" and will be held for a limited time only.
 - 3.3.7 Each sample shall be labelled to indicate name of project, Contractor, Subcontractor, manufacturer, brand, job number, as required.
 - 3.3.8 Where samples are rejected by the Consultant, new samples shall be submitted as soon as possible after notification of the rejection and shall be marked "Second submissions" or subsequent submissions in addition to the other information required on the label.
 - 3.3.9 Review by the Consultant is for the sole purpose of ascertaining conformance with general design concept. This review shall not mean that the Consultant approves the detail design inherent in

the samples, responsibility for which shall remain with the Contractor submitting same and such review shall not relieve the Contractor of his responsibility for errors or omissions or of his responsibility for meeting all requirements of the Contract Documents.

- 3.3.10 Cost of all samples shall be paid by the Contractor including all carrying charges, which shall be prepaid.
- 3.3.11 Where colour, pattern, or texture is a criterion, submit the full range of samples.
- 3.3.12 Field samples and mock-ups may form part of the Work if so agreed to by the Consultant.
- 3.3.13 Construct each sample or mock-up complete, including the work of all trades.
- 3.3.14 Reviewed samples or mock-ups will become standards of workmanship and material against which installed work shall be checked.

3.4 ACCESS PANELS AND ACCESS DOORS

- 3.4.1 Before commencing the installation of mechanical and electrical work, the Contractor with his mechanical and electrical Subcontractors shall prepare on a set of Drawings provided for that purpose, a complete lay out of all access panels and access doors which will be required. These lay outs shall be submitted for review as specified for shop drawings, and shall show exact sizes and locations of access panels and doors. Revisions may be required to the lay out before final review.
- 3.4.2 Items requiring access panels shall be located behind removable materials wherever possible. Location of access panels may be relocated by the Consultant to more unobtrusive locations.
- 3.4.3 Access panels and doors shall be finished to match adjacent wall and/or ceiling finish unless otherwise specified or indicated.

3.5 PROGRESS SCHEDULE

- 3.5.1 Contractor shall prepare and deliver to the Consultant for submitting to the Owner, within fourteen (14) days after the award of the contract, a progress schedule, indicating the dates for:
 - .1 Submission of shop drawings for the various Sections of the Work; shop drawings schedule for mechanical and electrical work shall contain a list identifying the contents of each shop drawing by subject matter, item, manufacturer's name and supplier's name.
 - .2 Commencement and completion of each major division of work, including the work to be done by the Subcontractors.
 - .3 Final completion date.
- 3.5.2 Furnish monthly progress reviews as related to the work schedule. Reviews shall include comments on both, the parts of the Work and general progress of the project. Correlate reviews to progress payment applications.
- 3.5.3 Update and re-issue the progress schedule as required to conform to monthly progress reviews.
- 3.5.4 Maintain progress schedule, as the work progresses.
- 3.5.5 Progress review shall show weather conditions, dates of commencement, progress and completion of various trades and items of work. Particulars pertaining to erection and removal of forms, pouring of concrete and type and quantity of equipment employed daily, shall be noted.

- 3.5.6 Completely update schedule and cash flow chart whenever changes occur to scheduling, in a manner and at times satisfactory to the Owner.
- 3.5.7 Provide competent and experienced staff familiar with scheduling work of this type to prepare, maintain, revise, direct and check implementation of schedule.
- 3.6 Metric
 - 3.6.1 Contractor's submittals containing measurements of any kind shall be in the Metric system of measurement.
- 3.7 PROGRESS PHOTOGRAPHS
 - 3.7.1 Before starting work, photograph interiors and site to record existing conditions. File two prints of each with the Consultant for examination and safekeeping.
 - .1 The number of photographs, close up or otherwise, must be sufficient to ensure that existing conditions are adequately recorded to minimize the possibility of unjustified claims against the Contractor and Owner.
 - .2 Where parts of existing buildings are concealed pending demolition work of this Contract, take photographs immediately on exposure.
 - 3.7.2 Upon commencement of the Work, and thereafter at monthly intervals until Completion of the Contract, the Contractor shall supply the Consultant with three copies of photographs with sufficient views, 4 locations, of the progress on all parts of the Work.
 - 3.7.3 Contractor shall include for the total number of photographs stated herein, but the Consultant shall have the right to request that fewer photographs be taken at certain intervals, so that more photographs may be taken at other times, providing the total number of photographs taken remains the same.
 - 3.7.4 Photographs shall be taken from exterior locations as determined by the Consultant.
 - 3.7.5 Monthly digital photographs by email is acceptable.
- 3.8 AS-BUILT DRAWINGS
 - 3.8.1 Upon completion of Work, provide three sets of as-built drawings, and prints of photographs. Where possible, provide electronic as-built drawings in CAD format.
- 3.9 MOCK-UPS
 - 3.9.1 Where required by the Contract Documents or as may reasonably be requested by the Consultant during the course of the Work, Provide field or shop erected example of work complete with specified materials and workmanship.
 - 3.9.2 Erect mock-ups at locations as specified and as acceptable to Consultant. Do not proceed with work for which mock-ups are required prior to Consultant's review of mock-ups.
 - 3.9.3 Modify or remove and replace mock-ups as many times as required to secure written acceptance of the Consultant. Such removal and replacement shall be done at no increase in either the Contract Price or the Contract Time.

3.9.4 Protect and maintain mock-ups until directed to be removed. Commence work demonstrated in mock-up only after review and acceptance of workmanship. If possible, mock-up may become part of finished work, at sole discretion, and with prior written acceptance, of Consultant.

3.9.5 Reviewed and accepted mock-ups will become standards of workmanship and material against which installed work will be compared.

3.9.6 Remove and replace materials or assemblies not matching reviewed mock-ups.

3.10 EXTRA MATERIALS

3.10.1 Supply extra materials at completion of Project as specified in Trade Sections of this Specification.

3.10.2 Deliver extra materials to location designated by the Owners representative.

3.11 WASTE MANAGEMENT

3.11.1 Contractor shall prepare and submit waste audit and reduction plan in compliance with the requirements of Ontario Regulations 102/94, Waste Audits and Waste Reduction Workplans and 103/94, Industrial, Commercial and Institutional Source Separation Programs under the Environmental Protection Act of Ontario. For definitions refer to Ontario Regulation 105/94, Definitions.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

- 1.1.1 Comply with all Sections of Division 1, General Requirements and all documents referred to therein.
- 1.1.2 Provide all labour, materials, products, equipment and services required to complete the work of alterations and make good to existing building according to the Specifications and/or Drawings.
- 1.1.3 Execute each part of the Work related to existing building by tradesmen specializing in such work.
- 1.1.4 Schedule Work to avoid interference with progress of new construction Work.

1.2 PERMITS AND REGULATIONS

- 1.2.1 Arrange and pay for all permits, notices and inspections necessary for the proper execution and completion of the alteration work.
- 1.2.2 Building Permit issued by the City Building Department will be provided to the successful GC.
- 1.2.3 Follow Ontario Office of the Fire Marshall "Guidelines for Maintaining Fire Safety During Construction in Existing Buildings".

1.3 EXISTING BUILDING

- 1.3.1 Visit the site and become fully knowledgeable of existing building drawings and specifications and of conditions affecting the Work.
- 1.3.2 Ensure the operations of the existing building, the existing tenants' premises and access to the existing building areas, are not restricted or disrupted.
 - .1 Maintain existing exits and ensure that proper and safe means of egress from all parts of existing building to open spaces are provided at all times to the approval of authorities having jurisdiction. Locate and install exit lights, and illuminate temporary means of egress.
- 1.3.3 Before any work is commenced in any portion of the existing building, the Owner will remove all furnishing and movable furniture that do not require disconnecting from services, storing same in some other portion of the building or off the premises. All other items not removed from any section of the building being renovated, shall be removed from the premises by the Contractor.
- 1.3.4 Obtain Owner's approval to commence alterations in existing building. Execute Work as quietly as possible in and around existing building at all times Owner and their tenants are occupying it. Schedule noisy operations with Owner, to achieve least disturbance to the Owner, tenants and the public.
- 1.3.5 The removal of hazardous and asbestos-containing materials will be under separate contract and shall have been completed before any other work of this Contract is commenced.

PART 2 - PRODUCTS

2.1 SALVAGE MATERIALS

- 2.1.1 Salvage materials, products, and equipment indicated. Carefully remove items to be salvaged, protect during alteration and reinstall in locations indicated.
 - 2.1.2 Refer to sprinkler, mechanical and electrical Drawings and specifications for sprinkler, mechanical and electrical work to be reused.
 - 2.1.3 Salvage the items as indicated on the Drawings for reuse and return to the Owner in an adequately preserved and usable condition on date of Substantial Performance or other mutually agreed date.
 - 2.1.4 All materials and products from the alteration not required for reuse shall become the property of the Contractor. Remove all material and debris from the site as quickly as possible and dispose of legally. Burning of debris on the site will not be permitted.
- 2.2 SERVICES IN EXISTING BUILDING
- 2.2.1 Ensure that existing services are not damaged during demolition and construction. Arrange with mechanical and electrical Subcontractors to immediately cut off and cap concealed services uncovered during work.
 - 2.2.2 Do not interrupt mechanical or electrical services of the existing building except for temporary close-downs to make connections to new work, and as approved by prior arrangements. Give Owner two (2) working days' notice of intention to interrupt mechanical or electrical services in existing building in any area.
 - 2.2.3 In no case shall service interruptions affect the total existing building.
 - 2.2.4 Should existing services be accidentally uncovered and disrupted, make complete restoration immediately, and ensure adequate protection to avoid further disruption until alternative means of providing permanent continuation of the services are made.
 - 2.2.5 Make payment for work specified in the foregoing at no additional cost to the Owner if, in the opinion of the Consultant, such work could have been reasonably foreseen by examination at time of bidding and which has been caused by lack of proper care and protection.
 - 2.2.6 Unless otherwise specified, restore services on which work is performed to original condition.

PART 3 - EXECUTION

- 3.1 SCREENS
- 3.1.1 Provide temporary fire rated partitions, screens, enclosures, tarpaulins etc., as may be required to enclose work areas from other areas of the building, to maintain security and to confine dust, noise and workmen to the work area. Locate screens as directed by the Consultant.
 - 3.1.2 It is essential that the existing building be maintained weather-tight at all times. Provide temporary protection, enclosures, tarpaulins, etc., as may be required to weatherproof any openings made in the Work.
 - 3.1.3 Construct fire rated, dust proof and wind-proof screens as required to completely enclose the work areas and the access passages to the work areas from the other areas of the existing building. Locate partitions as directed by the Consultant.
 - 3.1.4 Build screens of 3-5/8" metal studs at 16" centres sheathed with sheets of 5/8" sheetrock firecode 'c' panels on both sides with close joints smoke and fire sealed at junctions typical. Where

exposed to the weather, fully cover screens with a heavy waterproof and dustproof paper with lapped and sealed joints. Fill spaces between studs with 4" fibrous glass or mineral wool insulation batts to deaden sound.

- 3.1.5 Thoroughly pack framing and sealed at junctions of screens with floors, walls and ceilings with batt insulation in a manner to prevent infiltration of smoke, dust, dirt, etc. Over all junctions of screens with floors, walls and ceilings, apply continuous 1-1/2" wide strips of masking tape both sides of screen to ensure that rooms within closed off areas which are not being altered are kept dust free.

3.2 SEQUENCE OF ALTERATIONS

- 3.2.1 Schedule phasing of alterations and demolition as indicated on Drawings.

3.3 DEMOLITION

- 3.3.1 Demolition of, or alteration to, any portion of the existing buildings shall proceed only after approval of the Owner, and after weather-tight and dustproof partitions have been erected to provide thorough protection to the adjoining areas and rooms.
- 3.3.2 When permission has been granted to proceed with alterations in the existing buildings, work shall be carried out expeditiously and continuously to completion.
- 3.3.3 If suspected hazardous or contaminated materials are encountered, advise Consultant and await instructions regarding removal and disposal of such contaminants which may be considered hazardous to health, prior to demolition.

3.4 RECONSTRUCTION, ALTERATIONS AND MAKING GOOD

- 3.4.1 The work shown on the Drawings, Schedules and Specifications may or may not be all the work required, do all demolition, make good all finishes and execute all necessary work including incidentals to make a complete job of the alterations.
- 3.4.2 Do not undermine, damage, or endanger existing pipe lines, electrical conduit and wiring by digging, cutting or any other operation in the performance of the Work of the Contract. Immediately repair and make good to any existing work so affected to the Consultant's satisfaction at the Contractor's expense.
- 3.4.3 Cut off, cap, divert, or remove existing water, gas, electric and other services in areas being altered which are affected by the changes as required or as directed by the municipal authorities and the utility company concerned, and the Consultant. Protect and maintain active services to the existing building.
- 3.4.4 Perform the Work in such a manner so as to cause a minimum of noise or interference to the use of the existing building.
- 3.4.5 Whenever it becomes necessary to cut or interfere in any manner with existing apparatus for short periods of time, Do work at such times as agreed upon between the Owner, Consultant, and the Contractor.
- 3.4.6 Where new work connects with existing and where existing work is altered, all necessary cutting and fitting required to make satisfactory connections with the existing work shall be performed under this Contract, so as to leave the entire work in a finished and workmanlike condition.

- 3.4.7 Make good materials and finishes which are damaged or disturbed during the process of additions and reconstruction under the Contract.
- 3.4.8 Where existing work is to be made good, the new work shall match exactly the old work in material, form, construction and finish unless otherwise noted or specified.
- 3.4.9 Perform drilling of existing work carefully, leaving a clean hole no larger than required.
- 3.4.10 Provide, throughout the entire construction period, proper and safe means of fire exit from all zones of the existing building at all times to the approval of the authorities having jurisdiction.
- 3.4.11 Protect work in the existing buildings, such as floors, finishes, trim, etc., as completely as possible to hold the replacing of damaged work by each Section to a minimum.
- 3.4.12 Provide openings through existing roof as required by new mechanical equipment. Maintain watertight at all times. Provide new blocking, curbs and cants and make good roof and provide flashing as may be required.
- 3.4.13 Protect existing roofs, roof flashings, parapets and all items on roofs from damages of any cause, and make good damages at no cost to the Owner.
- 3.4.14 Ensure the public is protected against falling debris, chemicals and water.
- 3.4.15 Properly co-ordinate the various Sections taking into account also the existing installations to assure the best arrangement of pipes, conduits, ducts and mechanical, electrical and other equipment, in the available space. Under no circumstances will any extra cost be allowed due to the failure by the Contractor to co-ordinate the work. If required, in critical locations, interference and/or installation drawings shall be prepared showing the work of the various Sections as well as the existing installation, and these drawings shall be submitted to the Consultant for review before the commencement of work.
- 3.4.16 Removal and relocation of mechanical and electrical items indicated as relocated and reused are specified under respective Mechanical and Electrical Drawings. Co-ordinate the removal and relocation of these items.
- 3.4.17 Remove existing finishes as indicated on the Drawings to neat, straight lines and leave substrate clean and even, suitable for new finishes indicated.
- 3.4.18 Without limiting the generality of the foregoing, do the following repairs:
 - .1 Replace existing windows as located on the Drawings. Solidly anchor and make weather tight.
- 3.4.19 Remove temporary partitions and screens when no longer required, and make good damaged or blemished adjoining work as directed by Consultant.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

1.1.1 For the purposes of this Section, independent inspection and testing agencies are referred to as "Inspector(s)".

1.1.2 The Owner, or the Consultant on his behalf, may obtain the services of Inspectors for the purpose of maintaining quality assurance and compliance with the Contract Documents. Reports by Inspectors shall in no way relieve the Contractor of his obligation to perform the work in accordance with the Contract Documents, or to maintain his own quality control.

1.1.3 The cost of supplying materials, products, and labour for testing purposes, and erection of entire mock ups, prototypes, and sample installations where specified, shall be borne by the Contractor and constitutes a part of the Work

1.2 REFERENCES

1.2.1 ASTM E329-14a Standard Specification for Agencies Engaged in Construction Inspection, Testing or Special Inspection.

1.3 QUALIFICATION OF INSPECTORS

1.3.1 Inspectors shall be authorized to operate in the Province in which the Project is located.

1.3.2 Inspectors required to provide laboratory services shall meet "Recommended Requirements for Independent Laboratory Qualification", published by the American Council of Independent Laboratories.

1.3.3 Where applicable, Inspector shall meet basic requirements of ASTM E329.

1.4 APPOINTMENT AND PAYMENT

1.4.1 Cost of inspection and testing shall be paid out of cash allowances listed in Section 01 21 00 Allowances, where so specified. Additional inspection and testing required for Owner's quality control will be paid by the Owner, except as otherwise stipulated in the Contract Documents.

1.4.2 The Consultant will appoint Inspectors to perform services specified in respective Specification Sections, except for the following:

- .1 Inspection and testing required by laws, ordinances, rules, regulations, or orders of public authorities.
- .2 Inspection and testing performed exclusively for Contractor's convenience or their own quality control.
- .3 Testing, adjustment, and balancing of conveying systems, mechanical and electrical equipment and systems.
- .4 Mill tests and certificates of compliance.
- .5 Tests specified to be carried out by Contractor under the supervision of the Consultant.

1.5 INSPECTOR'S RESPONSIBILITIES

1.5.1 Co-operate with the Consultant and the Contractor; provide qualified personnel after due notice.

1.5.2 Perform specified inspections, sampling, and testing of materials and methods of construction:

- .1 Comply with specified standards, requirements of authorities having jurisdiction and as specified.
 - .2 Ascertain compliance of materials with requirements of Contract Documents.
- 1.5.3 Promptly notify Consultant, Owner, and Contractor of observed irregularities or deficiencies of work and products.
- 1.5.4 Submit within 4 days of inspection and testing 5 copies of reports of such inspection and tests to:
- .1 Owner: 1 copy
 - .2 Consultant: 1 copy
 - .3 Contractor: 3 copies
- 1.5.5 Submit additional copies as directed or as specified under respective Sections.
- 1.5.6 Include in each report:
- .1 Date issued.
 - .2 Project title and number.
 - .3 Testing and inspection agency name, address and telephone number.
 - .4 Name and signature of individual responsible for test or inspection.
 - .5 Date and time of sampling or inspection.
 - .6 Record of temperature and weather conditions.
 - .7 Date of Test.
 - .8 Identification of produce and reference to Specification Section.
 - .9 Location of sample or test in Project.
 - .10 Type of inspection or test.
 - .11 Results of tests and compliance with Contract Documents.
 - .12 Interpretation of test results, when requested by the Consultant.
- 1.5.7 Perform additional services as required by Owner.
- 1.5.8 Inspector is not authorized to:
- .1 Revoke, alter, enlarge on, or release requirements of Contract Documents.
 - .2 Approve or accept any portion of the Work.
 - .3 Perform any duties of the Contractor's.

PART 2 - EXECUTION

2.1 CONTRACTOR'S RESPONSIBILITIES

- 2.1.1 Contractor shall maintain his own quality control to ensure that the requirements of the Contract Documents are attained.
- 2.1.2 Co-operate with Inspector's personnel. Provide access to work, and to manufacturer's operations to facilitate execution of required services.
- 2.1.3 Secure and deliver to Inspector adequate quantities of representative samples of materials proposed to be used which require testing.

- 2.1.4 Furnish mix designs proposed to be used for concrete, mortar, grout, and other material mixes with certification by an independent inspection and testing company that such mix designs meet the requirements of the Contract Documents.
- 2.1.5 Furnish copies of product tests, or mill test reports of steel products, as required.
- 2.1.6 Furnish labour and facilities to:
 - .1 Provide access to work to be inspected.
 - .2 Facilitate inspections and tests, including obtaining and handling samples at Project site or at source of product to be tested.
 - .3 Make good any work disturbed by inspection and test.
- 2.1.7 Provide storage on site for Inspector's exclusive use to store equipment and cure test samples.
- 2.1.8 Notify Inspector and Consultant sufficiently in advance of operations to allow assignment of personnel and scheduling of tests. When tests or inspections cannot be performed after such notice, reimburse Owner for Inspector's personnel and travel expenses incurred due to Contractor's negligence.
- 2.1.9 Pay costs for uncovering and make good work that has been covered before the required inspection or testing is completed and approved by the Consultant.

2.2 RESPONSIBILITIES OF THE CONSULTANT

- 2.2.1 The Contractor will submit a list of Inspection and Testing companies to the Consultant for his review.
- 2.2.2 The Consultant and Contractor will direct inspection and testing companies in the type and extent of inspection and testing to be undertaken.
- 2.2.3 The Consultant will receive submitted reports of inspections and tests for evaluation and will decide upon any actions that may be required.
- 2.2.4 The Consultant will provide Drawings and Specifications required by inspection and testing companies.

2.3 FAULTY WORK

- 2.3.1 Where tests or inspections reveal work not in accordance with Contract requirements, the Contractor shall bear costs for such additional tests or inspections as the Consultant deems necessary to verify the acceptability of corrected work.
- 2.3.2 All testing shall be conducted in accordance with the requirements of the Consultant.
- 2.3.3 Defective work discovered before expiration of the warranty period specified in the General Conditions of the Contract, as may be extended in this Specification, will be rejected, whether or not it has been previously inspected. If rejected, defective materials or work incorporating defective materials or workmanship shall be promptly removed and replaced or repaired to the satisfaction of the Consultant, at no expense to the Owner.

2.4 TOLERANCES FOR INSTALLATION OF WORK

2.4.1 Unless acceptable tolerances are otherwise specified in a Section or a reference standard or are otherwise required for proper functioning of equipment, site services, and mechanical and electrical systems:

- .1 "plumb and level" shall mean plumb or level within 3mm in 3048mm (1/8" in 10').
- .2 "square" shall mean not in excess of 10 seconds lesser or greater than 90 degrees.
- .3 "straight" shall mean within 3mm (1/8") under a 3048mm (10') long straight edge.

END OF SECTION

PART 1 - GENERAL

1.1 ABBREVIATIONS OF SPECIFYING AUTHORITIES

1.1.1 The following abbreviations used in the Contract Documents, shall have the meanings listed and the applicable standards shall apply.

AA	Aluminum Association (USA)
AAMA	American Architectural Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
APEG BC	Guidelines for Structural Engineering Services for Building Projects
ASHRAE	American Society of Heating, Refrigeration and Air-Conditioning Engineers, Inc.
ASTM	American Society for Testing and Materials
AWMAC	Architectural Woodwork Manufacturer's Association of Canada Materials
AWI	Architectural Woodwork Institute
BCLMA	British Columbia Lumber Manufacturer's Association
BHMA	Builders Hardware Manufacturers Association
CAN	Canadian Standards Association
CCA	Canadian Construction Association
CCDC	Canadian Construction Documents Committee
CEC	Canadian Electrical Code (published by CSA)
CEMA	Canadian Electrical Manufacturers' Association
CGSB	Canadian General Standards Board
CISC	Canadian Institute of Steel Construction
CLA	Canadian Lumberman's Association
COFI	Council of Forest Industries of British Columbia
CPCA	Canadian Painting Contractors' Association
CPCI	Canadian Prestressed Concrete Institute
CPMA	Canadian Paint Manufacturers Association
CRCA	Canadian Roofing Contractor's Association
CSA	Canadian Standards Association
CSC	Construction Specifications Canada
CSDFMA	Canadian Steel Door and Frame Manufacturers' Association
CSI	Construction Specifications Institute (USA)
CSSBI	Canadian Sheet Steel Building Institute
FM	Factory Mutual
ISO	International Organization for Standardization
LEED	Leadership in Energy and Environmental Design
MFMA	Maple Flooring Manufacturers Association (USA)
MCCR	Ministry of Consumer and Commercial Relations
MSDS	Material Safety Data Sheet
MTC	Ministry of Transportation and Communications (Ontario)
NAAMM	National Association of Architectural Metal Manufacturers

NBC	National Building Code of Canada
NBFU	National Board of Fire Underwriters (USA)
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Prevention Bureau
NHLA	National Hardwood Lumber Association (USA)
NLGA	National Lumber Grades Authority
NRC	National Research Council
NSC	National Standards of Canada
OAA	Ontario Association of Architects
OBC	Ontario Building Code
OGCA	Ontario General Contractors Association
OHSA	Occupational Health and Safety Act
OIRCA	Ontario Industrial Roofing Contractor's Association
OFM	Ontario Fire Marshal
OPSS	Ontario Provincial Standard Specifications
PEI	Porcelain Enamel Institute (USA)
RAIC	Royal Architectural Institute of Canada
SCAQMD	South Coast Air Quality Management District
SSPC	Steel Structures Painting Council
TTMAC	Terrazzo, Tile and Marble Association of Canada
ULC	Underwriters Laboratories of Canada
UL or ULI	Underwriters Laboratories Incorporated
USSL	United States Sports Surfacing Laboratories (USA)
WCB	Workers' Compensation Board
WDMA	Window and Door Manufacturers Association
WHMIS	Workplace Hazardous Materials Information System

END OF SECTION

PART 1 - GENERAL

1.1 TEMPORARY OFFICES AND SHEDS

1.1.1 Provide an adequate site office for own use with space for the use of the Consultant. The office space for the Consultant shall have a separate bench or table for drawings and a drawer beneath the bench.

- .1 Temporary field offices shall be designated on site until such time where an area located inside the constructed building, can be designated by the Owner. No other location shall be used for temporary field office. Temporary site office shall not exceed 3048mm (10') x 15240mm (50').
- .2 Facilities shall consist of: an office desk and chair, a two drawer filing cabinet, two chairs, use of a telephone, use of facsimile machine, and a layout table for drawings located so that when drawings are spread out their orientation is same as that of building under construction.
- .3 Heat, cool and light offices to minimum code requirements for office buildings.
- .4 Keep temporary field office clean and remove all rubbish at the end of each work day.
- .5 Include construction and operating hardware, with security locks, as required by the Owner.

1.1.2 Site Storage:

- .1 Until such time where an area can be located inside the constructed building, designated by the Owner as a temporary site storage, provide storage trailers or construct weather-tight storage sheds for storage of materials that may be damaged or defaced by weather, in locations indicated by the Owner.
- .2 Include security locks, as required.
- .3 Install lighting in storage areas and heat in those storage areas containing materials damaged by low temperature.
- .4 Provide separate shed located where directed in writing by Consultant for storage of volatile materials.
- .5 Owner is not responsible for securing Products or materials at the Place of the Work.
- .6 Handle and store materials so as to prevent damage or defacement to the Work and surrounding property.

1.2 TEMPORARY SERVICES

1.2.1 Power, light, water and heat are available on the site. Make arrangements with the Owner for use of these services.

1.2.2 Be responsible for the distribution of temporary power during construction. Exposed extension cords are not permitted outside the work areas.

1.2.3 Provide an adequate pure fresh water supply for the use of all Sections. Run supply pipe or pipes from the nearest available sources and maintain in good condition until the permanent system is installed and ready for use.

1.2.4 Provide temporary lighting to requirements of authorities having jurisdiction and at a level for the proper execution of the Work.

1.2.5 Provide and maintain sanitary temporary toilets of a chemical type for the use of the workmen engaged in the work in compliance with local by laws.

- 1.2.6 Provide a temporary telephone and fax machine on the site for own use and that of the Consultant. All long distance charges shall be paid for by the party making the call.
- 1.3 REMOVALS
- 1.3.1 Provide temporary and/or permanent supports and bracing as indicated, before demolition of walls, floors, roofs or other structural members that would endanger portion of building to remain.
- 1.3.2 Provide temporary and/or permanent mechanical and electrical service as indicated, to maintain Owner's operation without interruption, before cutting, relocating or removal of existing services.
- 1.4 HANDLING AND STORAGE
- 1.4.1 Handle and store materials and products on the job in such a manner that no damage shall be done to the material and products, the structure, the site and surrounding property. Construct and maintain such service roads as may be necessary to provide at all times safe, convenient and adequate access for materials, products and other supplies.
- 1.4.2 Confine operations of the work of this Contract to limits indicated on Drawings.
- 1.4.3 Allocate an area of the site for the storage of materials and products brought to the job by all Sections. Keep the storage area tidy at all times. Do not use other areas of the site for storage.
- 1.4.4 Lobbies, corridors, and washrooms shall be kept clean of construction materials at all times.
- 1.4.5 The building shall be properly closed and locked at nights, Sundays, holidays and other occasions when the work is not in progress.
- 1.4.6 Protect materials and products from damage during handling, storage and installation.
- 1.4.7 Store materials in dry weather-tight, lockable enclosures.
- 1.4.8 Store cementitious and clay products clear of the earth or concrete floors and away from walls.
- 1.4.9 Keep sand dry and clean and store on tight, wooden platforms, and covered with tarpaulins during inclement weather, if exposed to same.
- 1.4.10 Protect metals against damage, dirt or dampness.
- 1.4.11 Store packaged or bundled products in original and undamaged condition with manufacturer's seals and labels intact.
- 1.4.12 Provide flat, solid support for all sheet products during storage.
- 1.4.13 Store and mix paints in a room assigned for this purpose. Keep room under lock and key. Remove oily rags and any other combustible materials every night. Take every precaution to prevent spontaneous combustion.
- 1.4.14 Make good or replace damaged materials to the satisfaction of the Consultant.
- 1.5 SIGNS ON PROPERTY
- 1.5.1 Signs on the Project will be restricted to one sign showing the name of the Project, the names of Owner, Architect and Consultants designed by the Consultant to be supplied and erected by the

Contractor, one sign showing the Contractor's name and site safety signage specified in Section 01 00 00 General Requirements.

- 1.5.2 Do not exhibit other signs or advertisements other than warning signs on the site.
- 1.5.3 No construction signs will be permitted on the building or site.
- 1.5.4 Maintain signage until Certificate of Substantial Performance of the Work, unless otherwise directed by the Consultant.
- 1.5.5 Destroy and dispose of signage off site.
- 1.6 LIMITS OF THE SITE
 - 1.6.1 Confine materials, products, equipment and temporary structures within the limits of the site as shown on the Drawings.
- 1.7 PLANT AND MACHINERY
 - 1.7.1 Provide formwork, scaffolding, ladders, cranes, derricks, tackle, gangways, planks, fans, screens, gentries, tarpaulins, tools and machinery for the proper execution of the Work.
- 1.8 ACCESS/DELIVERIES AND TRAFFIC CONTROL
 - 1.8.1 Arrange for delivery of materials, products and equipment to arrive when needed and at times to prevent interfering with vehicular traffic on the streets and pedestrian traffic on sidewalks.
 - 1.8.2 Provide Access roads as may be necessary to provide safe and adequate access for materials, products and other supplies. Provide and maintain access sidewalks, roadways, and similar facilities as may be required for access to the Work. Do not block public roads, or impede traffic or danger safety of the students during work of this Project and to temporary block traffic then provide flag person to direct traffic acceptable to Ministry of Labour Standard. Remove accumulations of ice and snow from areas providing access to Site. Ensure that access is available for emergency vehicles. Comply with fire plan for vehicular traffic. Bridge excavations with construction and steel cover plate to safely support any load that could be imposed and provide personnel to assist in deliveries to building(s) as required.
 - 1.8.3 Access to the site shall be as established by the Owner at the commencement of the Work.
- 1.9 HOURS OF WORK TO BE CONFIRMED BY FACILITY MANAGER.
 - 1.9.1 Normal working hours shall be 7:00 am to 5:00 pm Monday through Sunday, except holidays. Special permission shall be obtained from the Owner to change to a different time schedule.
- 1.10 TEMPORARY FIRE PROTECTION
 - 1.10.1 Operable fire extinguishers shall be provided by the Contractor, and shall be kept within the work areas throughout the construction period. Extinguishers shall be sufficient in number and of suitable types to combat potential fires in the work area.
- 1.11 SYSTEM SHUT DOWNS
 - 1.11.1 Requests for any system shutdowns will be processed a week in advance.

1.12 GARBAGE REMOVAL

- 1.12.1 The Contractor shall ensure that all his subcontractors, including telephone company, remove all garbage and debris from the Work on a daily basis. Should it be necessary for the Owner to remove Contractor's garbage or debris due to inaction by the Contractor, the Contractor shall be invoiced for the cost thereof. Temporary storage of garbage or debris outside the Work areas is not permitted.
- 1.12.2 Corridors, lobbies, and other common areas are to be kept clear of any residual debris.
- 1.12.3 Garbage of a flammable nature (eg paper) shall not be allowed to accumulate, but shall be removed from the site as quickly as possible.

1.13 TRANSPORTING MATERIALS ON STREETS

- 1.13.1 The Contractor shall, if so directed by the Consultant or the City Engineer, provide "tight trucks", approved by the Engineer, to haul soft or wet material over streets, in order to prevent litter on the streets. In all cases where any materials are dropped from the trucks of the Contractor, he shall clean up same as often as directed and also keep all sidewalks clean and free from dirt and mud.
- 1.13.2 If the Contractor refuses or neglects to clean up said litter when order to do so by the Consultant or Engineer, the Owner will have the necessary cleaning and the cost of same will be deducted from monies due to the Contractor.
- 1.13.3 All construction and demolition materials shall be transported in accordance with the City requirements and by-laws, including all amendments.

1.14 PARKING

- 1.14.1 All parking by the Contractor is his responsibility. The Owner makes no representation that parking will be available. Under no circumstances shall vehicles impede or block access to the existing building.

1.15 HOISTS AND LIFTING FACILITIES

- 1.15.1 Install and operate an adequate number of elevators or hoists which shall be available for use by all trades and subcontractors. Hoists or elevators shall be properly positioned so as not to interfere with the construction, and if located outside the building, the exterior walls shall be protected against damage.

1.16 DUST NUISANCE

- 1.16.1 Prevent nuisance to adjacent properties near the work from dust, by taking appropriate anti-dust measures at such times as found necessary, and in response to complaints of dust received from the public.

1.17 SNOW AND ICE

- 1.17.1 Remove all accumulations of ice and snow from the property and sidewalks and access to the property. Ensure that access is provided at all times for all emergency vehicles.

1.18 REMOVAL OF TEMPORARY FACILITIES

- 1.18.1 Remove temporary facilities from the site when directed by the Consultant.

1.19 TRAFFIC CONTROL

- 1.19.1 Do not block roads or impede traffic. Keep construction traffic to designated roads only. Provide flag-person to direct traffic as required.
- 1.19.2 Provide a hard surface area at the Place of the Work for cleaning down trucks prior to entry onto municipal roads or private roads outside of the Place of the Work.
- 1.19.3 Keep public and private roads free of dust, mud and debris resulting from truck, machinery and vehicular traffic related specifically to this Project, for the duration of Work.
- 1.19.4 Clean roads regularly, public or private. Wash down and scrape flush roads at least daily when earth moving operations take place. Maintain public property in accordance with requirements of authorities having jurisdiction.

1.20 ENVIRONMENTAL/POLLUTION CONTROL/SITE CLEANING

- 1.20.1 Prevent the escape of untreated effluent, be it liquid or gaseous substance or any liquid or solid wastes, being objectionable or detrimental to adjoining areas of the construction site.
- 1.20.2 Burning or burying of rubbish, waste, and the like is not permitted on construction site.
- 1.20.3 Only fires for heating bitumen and temporary heaters as specified are permitted on site.
- 1.20.4 Take care to prevent staining or smoke damage to structure or materials. Replace stained or damaged work.
- 1.20.5 Make every effort to provide environmental protection, take precautionary measures to prevent excessive noise, sounds, vibrations, dust, air pollution, smoke, etc., which may become objectionable to people occupying adjacent areas.
- 1.20.6 Keep building site clean and free of unsightly collection of waste materials and debris. Provide for temporary storage and collection of waste materials, and dispose to local authorities having jurisdiction recommendations at intervals to maintain a clean site condition.
- 1.20.7 Confine apparatus, the storage of materials and the operations of workers to the site. Do not unreasonably encumber the premises with construction materials.

END OF SECTION

PART 1 - GENERAL

1.1 PRODUCT QUALITY

1.1.1 Products supplied for work shall be new and as far as possible and unless otherwise specified, of Canadian manufacture.

1.2 STANDARDS

1.2.1 The work of each trade shall be carried out by skilled, experienced personnel who have been certified to carry out the work by various trade associations and in accordance with the Apprenticeship and Trades Qualifications Act and applicable regulations.

1.2.2 Where reference is made to specification standards produced by various organizations, conform to the latest edition of the standards specified as amended and revised to the date of the Contract.

1.2.3 Each subcontractor must possess and be familiar with the specified standards which affect their work.

1.2.4 Generally, materials and workmanship shall meet or exceed the requirements of CAN/CSA, ASTM, CGSB, CAN/UL and manufacturer's printed instructions.

1.2.5 Where required, conform to the requirements of LEED® Certification.

1.3 SUBSTITUTIONS

1.3.1 The Contractor shall base his Tender Price upon the Tender Documents.

1.3.2 Prior to the Close of Tenders, the Owner and the Consultant may consider requests for substitutions from that specified in the Tender Documents, providing the requests are submitted in writing describing such substitutions in full detail, the type of material, equipment or method and reasons for deviating from the Tender Documents. In addition, submit any increase or decrease in price of any substitution.

1.3.3 In making a request for a substitution, confirm in writing that:

- .1 The Contractor has investigated the proposed product and method and determined it to be equal or superior in all respects to that specified.
- .2 The same guarantee is given for the proposed substitution as for the product and method originally specified.
- .3 The installation of the proposed substitution will be coordinated into the Work, and such changes in the Work will be made as required to accept the substitution and to ensure the Work is complete in all respects. The cost of changes in the Work necessary to incorporate a proposed substitution is to be included in any proposed increase or decrease to the Contract Price associated with the proposed substitution.
- .4 Do not substitute materials, equipment or methods unless such substitutions have been specifically approved in writing prior to the close of tenders by the Consultant.
- .5 The Owner reserves the right to accept or reject, at its sole discretion, any proposed substitution.

1.4 WORKMANSHIP

- 1.4.1 All work shall be carried out in accordance with the best trade practice, by mechanics skilled in the type of work concerned.
- 1.4.2 Products, materials, systems and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the applicable manufacturer's printed directions.
- 1.4.3 Where specified requirements are in conflict with manufacturer's written directions, follow manufacturer's directions, but inform the Consultant in writing prior to proceeding with affected work. Where specified requirements are more stringent than manufacturer's directions, comply with specified requirements.

END OF SECTION

PART 1 - GENERAL

- 1.1 SUBSTITUTIONS - MATERIALS AND PRODUCTS
- 1.1.1 Work of the Project shall be based upon using new materials and products specified or indicated by reference to standards, codes, specifications, to a manufacturer's name, by trade name or by catalogue reference, except where a material or product is indicated as being reused. Where two or more trade names are specified the choice shall be optional with the Contractor.
- 1.1.2 Contract Price shall be based on the materials and products specified, whether available or not at the time of bidding.
- 1.1.3 Requests for substitutions prior to Bid Date may not be accepted.
- 1.1.4 Materials and products specified without the "or other approved manufacture" / "or approved alternate" clause following the name of the material or product shall be supplied without substitution.
- 1.1.5 Where the Specifications include the "or other approved manufacture" / "or approved alternate" clause substitutions will be considered by the Consultant if:
- .1 products specified are not available, or
 - .2 substitute products to those specified, which are brought to the attention of, and considered by the Consultant as equivalent to those specified will result in a credit to the Contract Price, or
 - .3 substitute products to those specified, which are brought to the attention of, and considered by the Consultant as superior to those specified will not result in a change to the Contract Price and Contract Time.
- 1.1.6 Substitutions may be proposed by the Contractor under the following conditions:
- .1 Submission of proposed substitutions shall show the material and product names and complete specifications and shall state what difference, if any, will be made in the Contract Price and Contract Time for each substitution, should it be accepted.
 - .2 Indicate name and manufacturer of product specified, for which substitute is requested and where in Specification product is specified.
 - .3 Respective costs of items originally specified and the proposed substitution.
 - .4 Confirmation of proposed substitution delivery, in writing by Product manufacturer.
 - .5 Compliance with the building codes and requirements of authorities having jurisdiction.
 - .6 Affect concerning compatibility and interface with adjacent building materials and components.
 - .7 Compliance with the intent of the Contract Documents.
 - .8 Reasons for the request.
- 1.1.7 Should proposed substitution be accepted either in part or in whole the Contractor shall assume full responsibility when the substitution affects any other work. Any Contract Document changes required as a result of the substitution shall be executed by the Consultant at the Contractor's expense.
- 1.1.8 Proposed substitutions shall satisfy all design conditions and other specified requirements. Properties included but not limited to the following, as applicable, will be considered:
- .1 Physical dimension requirements to satisfy the space limitations, static and dynamic weight limitations, structural properties, audible noise levels, vibration generation, interchangeability of parts or components, accessibility for maintenance, possible removal or replacement, colours, textures and compatibility with other materials,

products, assemblies and components.

- 1.1.9 Cost of all changes in work of other Sections necessitated by use of proposed material and product substitutions shall be borne by the Contractor.
- 1.1.10 Bring to the attention of Owner and Consultant, in writing, the effect of all changes in the work of other Sections necessitated by use of proposed material and product substitutions. Should the contractor fail to bring to the attention of the Owner and the Consultant, the effect of any and all changes, due to the use of proposed materials or product substitutions, then cost of changes in the work of other Sections shall be borne by the Contractor.
- 1.1.11 Substitutions submitted on shop drawings without following requirements of this section prior to submission of the affected shop drawings will cause the shop drawings to be rejected.

1.2 SUBSTITUTIONS - METHODS OR PROCESSES

- 1.2.1 Contractor may suggest for consideration of the Consultant, substitutions to methods or processes described in the Specifications and/or shown on the Drawings and other Contract Documents. Any application for such substitutions shall indicate how such substitutions are advantageous to the Owner or to the better fulfilment of the Contract. There shall be no obligation on the parties concerned to accept any such suggestions.
- 1.2.2 Contractor shall be responsible for substitutions to methods or processes concerning such work, and the warranty covering all parts of the work shall not be affected.
- 1.2.3 Cost of all changes in work of other Sections, necessitated by the use of substituted methods or processes, shall be borne by the Contractor. Contract Document changes required as a result of the substitution shall be executed by the Consultant, at Contractor's expense.
- 1.2.4 Substituted methods or processes shall be accommodated by space allotted for the specified methods or processes.

1.3 CREDITS ARISING FROM SUBSTITUTIONS

- 1.3.1 Any and all credits arising from accepted substitutions shall be credited to the Contract in such sums as may be assessed by the Consultant and Contract Price will be adjusted accordingly. No substitutions will be permitted without prior written approval of the Consultant.

1.4 CODE REQUIREMENTS SUBSTITUTIONS

- 1.4.1 All proposed substitutions for materials, products, methods and processes shall meet the requirements of the National Building Code, Ontario Building Code, and the requirements of authorities having jurisdiction.
- 1.4.2 Proposed substitute materials, products, methods and processes shall not negate the compliance of adjacent materials, products and constructions with the requirements of the National Building Code, Ontario Building Code, and the requirements of authorities having jurisdiction, to which the proposed substitutions may be applied or attached.
- 1.4.3 Contractor shall obtain written approval of proposed substitutions from authority having jurisdiction and shall submit approval with the proposed substitution for the Consultant's consideration.

END OF SECTION

PART 1 - GENERAL

1.1 CLEAN UP DURING CONSTRUCTION

- 1.1.1 During construction, maintain the work in a tidy condition and free from accumulation of waste products, debris, snow and ice other than that caused by the Owner, Other Contractors or their employees.
- 1.1.2 At reasonable intervals during progress of the Work, clean-up site, building and access, and dispose of waste materials, rubbish and debris. Provide containers and locate on site for collection of waste materials, rubbish and debris. Do not allow waste materials, rubbish and debris to accumulate and become unsightly or hazardous.
- 1.1.3 Move waste materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights. Fog spray dusty debris with water.
- 1.1.4 Conduct clean up and disposal operations to comply with local ordinances and anti-pollution laws. Burning or burying of rubbish and waste materials on the Project site is not permitted. Do not dispose of volatile fluid wastes (such as mineral spirits, oil or paint thinner) in storm or sanitary sewer systems or into streams or waterways. Remove waste materials, rubbish and debris from the site and legally dispose of at public or private dumping areas off the Owner's property.
- 1.1.5 Vacuum clean interior building areas when ready to receive finish painting and continue vacuum cleaning on an as-needed basis until building is ready for acceptance or occupancy.
- 1.1.6 Wash down exterior exposed aluminum surfaces using a solution of mild domestic detergent in warm water, applied with soft clean wiping cloths. Take special care to remove all dirt from corners. Wipe interior surfaces clean when curtain wall work is completed.
- 1.1.7 Remove excess sealant by moderate use of mineral spirits or other solvent acceptable by the sealant manufacturer and the metal fabricator.
- 1.1.8 Where the accumulation of dirt does not respond to the washing or cleaning, refer the condition to the Consultant, with recommendations as to the remedial action required; but, do not undertake any cleaning procedure of a more severe nature without the written approval of the Consultant.
- 1.1.9 Remove concrete and alkali wash-offs on surfaces to prevent etching of glass and/or metal.
- 1.1.10 Remove temporary protective materials and coatings.
- 1.1.11 Clean exterior glass during construction, every 3 months or more frequently, to prevent the glass from being etched by alkaline water.

1.2 CLEANING AT SUBSTANTIAL PERFORMANCE

- 1.2.1 Upon attaining Substantial Performance of the Work, remove surplus products, tools, construction machinery and equipment not required for the performance of the remaining work. Also remove waste products and debris and leave the work clean and suitable for occupancy by the Owner unless otherwise specified.
- 1.2.2 All final cleaning shall be carried out under this Section and the building shall be left in condition to meet the approval of the Consultant. The final cleaning shall not commence until authorized by the Consultant. This work shall include, without being limited to, the cleaning of floors, walls,

windows, ceilings, fixtures and equipment, the removal of debris and all work required on the interior and exterior to complete the building and site cleaning.

- 1.2.3 All floors shall be cleaned in a manner acceptable to the Consultant.
- 1.2.4 Stains, paint, grease, oil, temporary protection and covers, plaster, mortar droppings, labels, caulking and sealant compounds, and dirt shall be removed. Damaged painted areas shall be touched up. All surfaces and items, including without being limited to, walls, ceilings, doors, windows, glass, partitions, fixtures, hardware, mechanical and electrical equipment shall be dusted and/or polished.
- 1.2.5 Replace broken and scratched glass.
- 1.2.6 Remove debris off roofs. Sweep and wash clean paved areas outside the building. Rake clean landscaped areas.
- 1.2.7 Replace heating, ventilating and air conditioning filters if units were used during construction. Vacuum clean ducts, fans, blowers and coils if units were used without filters during construction.
- 1.2.8 Ensure that the inside of all air handling systems are clean and free from dust, and debris when building is turned over to Owner.
- 1.2.9 Vacuum out and wipe clean all electrical and signal panels, switchboards, transformers and other electrical equipment.
- 1.2.10 Use experienced workmen or professional cleaners for final cleaning. Use only cleaning materials recommended by manufacturer of surface to be cleaned. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.
- 1.2.11 Completion of the Contract shall not be attained until the Contractor has removed surplus products, tools, construction machinery and equipment. Removed waste products and debris, other than that caused by the Owner, other Contractors or their employees.
- 1.3 HAZARD CONTROL
 - 1.3.1 Conduct cleaning and disposal operations in strict accordance with all applicable codes, ordinances and anti-pollution laws.
 - 1.3.2 Store volatile matters in covered metal containers and remove from site at end of each working day. Do not dispose of volatile and toxic wastes in storm or sanitary drains, streams or waterways.

END OF SECTION

1 GENERAL

1.1 Definition

1.1.1 Warranty = guarantee dated from date of Substantial completion.

1.2 Submission Requirements

1.2.1 Submit warranties as part of "Operating and Maintenance Manuals" in accord with requirements of Section 01 77 00.

1.2.2 Arrange warranties in systematic order matching Specification format. Include a table of contents listing warranties in same order.

1.2.3 Each warranty must show:

- .1 Name and address of project.
- .2 Name of Owner
- .3 Section Number and Title

1.2.4 All warranties issued by the manufacturer must be presented under the Contractor's letterhead, seal and signature and must bear the wording specified in Contract Documents.

1.3 List of Warranties

1.3.1 The following list of extended warranties is shown here for convenience only.

Item	Period
Entire Building, General Contract	1 year
Miscellaneous Metals	2 years
Finish Carpentry and Millwork	2 years
Caulking and Sealants	2 years
Windows	5 years
Doors	3 years
Finish Hardware	3 years
Glass and Glazing	2 years
Acoustic Ceilings	2 years
Resilient Flooring and Accessories	5 years
Paint and Finishing	2 years
Solid Surface Countertops	10 years
Mechanical	As specified under respective section
Electrical	As specified under respective section
Security	As specified under respective section

1.3.2 Refer to Divisions 15 and 16 for Mechanical and Electrical warranty requirements.

END OF SECTION

PART 1 - GENERAL

1.1 CONTRACT COMMISSIONING

- 1.1.1 Expedite and complete deficiencies and defects identified by the Consultant.
- 1.1.2 Submit required administrative and technical documentation, such as Statutory Declarations, Worker's Compensation Certificate, warranties, certificates of approval or acceptance from regulating bodies.
- 1.1.3 Review inspection and testing reports to verify conformation to the intent of the Documents and that changes, repairs or replacements have been completed.

1.2 AS BUILT-DRAWINGS

- 1.2.1 Prior to application for Substantial Performance, allowing sufficient time for review, clearly, neatly, and accurately transfer information from marked up white prints to diskettes. Print lettering and numbers in size to match original. Lines may be drawn freehand but shall be neat and accurate. Add "AS-BUILT" at each drawing title block. Should extensive changes and deviations to a drawing make the information illegible, re draft the drawing. Submit email copy for consultant's review and comments.
Once the consultant confirmed, submit two (2) USB key of entire final closeout documents including As-builts CAD files and PDFs and (2) hard copy sets of entire close-out documents including As-builts drawings to Client Office.

***GC is responsible for producing the CAD As-built Drawings.**

1.3 MAINTENANCE INSTRUCTIONS AND DATA BOOK

- 1.3.1 Provide one electronic copy and three sets of maintenance instructions and data books, together with the record drawings as specified in the preceding Article, to the Owner prior to the date of Substantial Performance.
- 1.3.2 Submit one email copy of the book for the Consultant's review prior to submitting the books to the Owner.
- 1.3.3 The books shall contain the name of the Contractor and the date of Substantial Performance for the Project. Supply the following data:
 - .1 Complete listing of materials, products, and equipment including serial numbers, manufacturer's names, and sources of supply.
 - .2 Description of each system, with the description of each major component of the systems.
 - .3 Operation and installation instructions for each assembly, component and system.
 - .4 Complete maintenance instructions for each assembly, component and system. Include warnings of harmful practices.
 - .5 Lists of spare parts for each assembly, component and system complete with names and addresses of suppliers.
 - .6 Cleaning, maintaining and preserving instructions for all materials, products and surfaces. Include warnings of harmful cleaning, maintaining and preserving practices.
 - .7 A lubrication schedule of all equipment.
 - .8 Final reviewed shop drawings.
 - .9 Copies of all warranties.

- .10 Operating curves of mechanical and electrical equipment.
- .11 Page-size Valve Tag Schedule and Flow diagrams.
- .12 Water treatment procedures and tests.
- .13 Final balancing reports for the mechanical systems.
- .15 Copies of all warranties.
- .16 **Once the consultant confirmed, submit two (2) USB key of entire final closeout documents including As-builts CAD files and PDFs and (2) hard copy sets of entire close-out documents including As-builts drawings to Client Office.**

1.3.4 Books shall be three-ring hard cover loose-leaf binders, indexed as to contents and identified on the binding edges as "Maintenance Instructions and Data Book", with name of project. The binders shall contain the name of the Contractor and the date of Substantial Performance for the Project.

1.3.5 Terminology used in the various indexed sections of the books shall be consistent.

1.4 MAINTENANCE MATERIALS

1.4.1 Deliver to the site, unload and store where directed, maintenance materials specified in the various Sections of the Specifications. Obtain receipt from the Owner for delivered materials.

1.4.2 Package materials so that they are protected from mechanical damage and loss of essential properties.

1.4.3 Label packaged materials for proper identification of contents. If applicable give colour and finish, room number or area where material is used.

1.5 DISTRIBUTION SYSTEM DIAGRAMS

1.5.1 Prior to application for Substantial Performance, submit framed single line diagrams of the electrical distribution systems.

1.6 TRIAL USAGE AND INSTRUCTIONS – MECHANICAL

1.6.1 Thoroughly instruct the Owner's authorized representative in the safe operation of the systems and equipment.

1.6.2 Arrange and pay for the services of qualified manufacturer's representatives to instruct Owner on specialized portions of the installation; such as, refrigeration machines, boilers, automatic controls, and water treatment.

1.6.3 Submit a complete record of instructions as part of the maintenance instructions and data book given to the Owner. For each instruction period, supply the following data:

- .1 Date.
- .2 System or equipment involved.
- .3 Names of persons giving instructions.
- .4 Names of persons being instructed.
- .5 Other persons present.

1.6.4 Instructional period shall be carried out during a continuous period of 30 days.

1.6.5 The Owner shall be permitted trial usage of systems or parts of system for the purpose of testing and learning operational procedures. Trial usage shall not affect the warranties, not be construed as acceptance thereof; and no claim for damage shall be made against the Owner for any injury or breakage to any part or parts of such systems due to the aforementioned tests, where such injuries and/or breakage are caused, directly or indirectly, by a weakness or inadequacy of parts, or by defective materials or workmanship of any kind whatsoever.

1.7 TRIAL USAGE AND INSTRUCTIONS – ELECTRICAL

1.7.1 Provide services of manufacturer's specialized representatives to instruct Owner in operation of systems and equipment.

1.7.2 Permit the Owner's representatives, in order to familiarize themselves with the equipment, to operate systems for a reasonable period of time, as may be arranged.

1.7.3 Trial usage of any equipment by the Owner shall not affect the warranties, nor be construed as acceptance of the equipment or system, and no claim for damage shall be made against the Owner for injury or breakage to any part or parts of the aforementioned system or systems due to any such test, where such injuries or breakage are caused, in whole or in part, directly or indirectly, by a weakness or inadequacy of parts, or by defective materials or workmanship of any kind whatsoever.

1.7.4 Review information provided in maintenance instructions and data book with the Owner's representatives to ensure the Owner has a complete understanding of the electrical equipment and systems and their operation.

1.8 WARRANTIES

1.8.1 Extended warranties (warranties of more than two years duration) where specified in the Contract Documents, shall be provided by the Contractor and shall be in a form acceptable to the Consultant.

1.8.2 Where manufacturers offer, as a general policy, extended warranties on their products or other greater benefits than those called for in the specifications, the Contractor shall obtain the benefit of such extended warranties for the Owner and shall certify that he has done so before making the final claim for payment.

1.8.3 Upon completion of the Contract by the Contractor, or upon other termination of this Contract, the Contractor hereby agrees and covenants to assign to the Owner all warranties and guarantees which the Contractor has received from the sub trades employed by him on the Project.

1.8.4 Specified warranty periods shall not be construed as limiting the provisions of the General Conditions.

1.8.5 The carrying out of replacement work and making good of defects shall be executed at times convenient to the Owner and this may require work outside of normal working hours at the Contractor's expense.

1.9 SUBSTANTIAL PERFORMANCE OF THE WORK

1.9.1 Deficiency review:

.1 Neither Owner nor Consultant will be responsible for preparation or issuance of extensive lists of deficiencies. Contractor assumes prime responsibility for ensuring that items

- shown and described in the Contract Documents are complete. Any reviews to approve the certificate of Substantial Performance of the Work will be immediately cancelled if it becomes obvious to the Consultant that extensive deficiencies are outstanding.
- .2 The Contractor shall conduct an inspection of the Work to identify deficiencies and defects, which shall be repaired. When the Contractor considers that the Work is substantially performed, the Contractor shall prepare and submit to the Consultant a comprehensive list of items to be completed or corrected and apply for a review of the Work by the Consultant to determine if Substantial Performance of the Work has been achieved.
 - .3 The Contractor's request described above shall include a statement by Contractor that the Work to be reviewed by Consultant for deficiencies is, to the best of the Contractor's knowledge, in compliance with Contract Documents, reviewed shop drawings, and samples, and that deficiencies and defects previously noted by Consultant have been repaired.
 - .4 No later than fifteen (15) working days after the receipt of the Contractor's request described above, but contingent upon the prior receipt, by the Consultant, of the closeout submittals in the manner and form specified in this section, the Consultant and the Contractor will review the Work to identify any defects or deficiencies. If necessary, the Contractor shall tabulate a list of deficiencies to be corrected prior to Substantial Performance of the Work being certified by the Consultant.
 - .5 During review, the Consultant and the Contractor will decide which deficiencies or defects must be rectified before Substantial Performance of the Work can be certified, and which defects are to be treated as warranty items.
 - .6 Provide a schedule of planned deficiency review having regard to the foregoing.

1.9.2 Certification of Substantial Performance of the Work:

- .1 When the Consultant considers that the deficiencies and defects have been completed and that it appears that the requirements of the Contract Documents have been substantially performed, the Consultant shall issue a certificate of Substantial Performance of the Work to the Contractor, stating the date of Substantial Performance of the Work.
- .2 The certificate of Substantial Performance of the Work shall be prepared in form required by Construction Lien Act.

1.9.3 Final Inspection for completion of the Contract:

- .1 Deficiencies and defects shall be made good before the Contractor submits a written request for final review of the Work and before the Contract is considered complete.
- .2 When Contractor is satisfied that the Work is complete, and after the Contractor has reviewed the Work to verify its completion in accordance with the requirements of the Contract Documents, the Contractor shall submit a written request for a final review by the Consultant, who in turn will notify the Owner.
- .3 If there are any deficiencies identified as a result of this review, they shall be listed by the Consultant and submitted to the Contractor. This list shall be recognized as the final deficiency list for purposes of acceptance of the Work under the Contract.
- .4 Such deficiencies shall be corrected by a date mutually agreed upon between Consultant and the Contractor, unless a specific date is required by Contract, and a further review by the Consultant shall be called for by the Contractor following his own review to take place within seven (7) days from date of request.
- .5 Contractor shall thereafter submit invoice for final payment.
- .6 Money shall be withheld for deficiency work and will be released only when all deficiencies have been completed. No partial payment to be recognized until all work is completed.

- 1.9.4 If the Contractor needs to return to the Place of the Work to complete deficiencies after the Owner has taken possession, the Contractor shall provide the Owner with a minimum of one (1) week's prior notice of such requirement.

END OF SECTION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.1.2 Related Specification Sections:

1.1.3 Division 22: Plumbing

1.1.4 Division 23: HVAC, HVAC Controls, Testing and Balancing, and Air Distribution

1.1.5 Division 25: Building Automation and Controls

1.1.6 Division 26: Electrical

1.2 SUMMARY

1.2.1 Section includes requirements and procedures for conducting equipment and system commissioning, including the following:

1. Completion of commissioning procedures on specific equipment and systems as indicated under "Related Sections" below.
2. Verification of operational and functional performance of specific equipment and systems for compliance with the Owner's Project Requirements as described in the "Related Sections" below.
3. This project is pursuing LEED certification under LEED ID+C Version 4.
4. Fundamental Commissioning of all commissioned systems shall be accomplished through the review of owner's project requirements and basis of design, review of construction documents, designation of the commissioning team, incorporating commissioning requirements into construction documents, implementing a commissioning plan, prefunctional system tests, functional performance tests and writing a summary commissioning report.
5. The commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning product.

1.3 DEFINITIONS

1.3.1 BOD: Basis of Design

1.3.2 Commissioning: The systematic process of ensuring that building's energy related systems are installed, calibrated and perform appropriately in accordance with the Owner's Project Requirements (OPR), engineer's basis of design (BOD), and as represented in the construction documents and specifications.

1.3.3 Commissioning Authority (CxA): Independent entity responsible for overseeing the specified commissioning procedures and under contract directly with the Owner or Owner's Representative.

1.3.4 Commissioning Report: Report prepared by the Commissioning Authority, detailing the commissioning procedures performed, inspection and testing results and the current version of the Issues Log indicating the process to resolve any outstanding issues.

1.3.5 Functional Performance Testing: The process of testing and documenting system parameters under simulated or actual operating conditions.

- 1.3.6 Installation and Startup Checklists: Installation and start-up items to be completed by the appropriate party prior to Functional Performance Testing.
- 1.3.7 Issues Log: List of noted deficiencies discovered and corrective actions taken as a result of commissioning process.
- 1.3.8 O&M: Operations and Maintenance
- 1.3.9 OPR: Owner's Project Requirements
- 1.3.10 Physical Inspection Process: On-site inspection and review of related system components for conformance to the specifications.
- 1.4 COORDINATION
 - 1.4.1 Commissioning Team (Abbreviations):
 - .1 Architect and Design Engineers – Design Team (A/E)
 - .2 Controls Contractor (CC)
 - .3 Commissioning Authority (CxA)
 - .4 Electrical Contractor (EC)
 - .5 General Contractor (GC)
 - .6 Mechanical, Electrical and Plumbing Subcontractors (MEP)
 - .7 Owner / Owner's Technical Staff (OS)
 - .8 Owner's designated Project Manager (PM)
 - .9 Testing and Balancing Contractor (TAB)
 - 1.4.2 Management: The CxA is hired by the Owner or owner's representative. The CxA directs and coordinates the commissioning activities. All members work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents. The CxA's responsibilities are the same regardless of who hired the CxA.
 - 1.4.3 Scheduling: The CxA will work with and provide sufficient notice to the PM and GC to schedule commissioning activities. The GC will integrate all commissioning activities into the master schedule. All parties will address scheduling on an ongoing basis and make necessary notifications in a timely manner in order to expedite the commissioning process.
- 1.5 COMMISSIONING TEAM RESPONSIBILITIES
 - 1.5.1 The responsibilities of various parties in the commissioning process are provided in this section. It is noted that the services for the Project Manager, Construction Manager, Architect, HVAC mechanical and electrical designers/engineers are not provided for in this contract. That is, the Contractor is not responsible for providing their services. Their responsibilities are listed here to clarify the commissioning process.
 - .1 Design Team Responsibilities:
 - .1 Attend commissioning scoping meeting, controls integration meeting and additional meetings, as necessary.
 - .2 Complete the Basis of Design (BOD) documentation, assist with development of the Owner's Project Requirements (OPR) document and sequence of operation documentation as required by CxA.
 - .3 Perform normal submittal review, construction observation, as-built drawing preparation, etc., as contracted.

- .4 Assist in resolution of system deficiencies identified during commissioning.
 - .5 Review and approve operations and maintenance manuals (O&M).
- .2 Commissioning Authority (CxA) Responsibilities:
- .1 Design, Construction and Acceptance Phase:
 - 1. Develop and coordinate execution of testing plan and commissioning activities to verify and document systems are functioning in accordance with design intent and Contract Documents.
 - 2. May assist with problem-solving of deficiencies, but ultimately that responsibility lies with the contractors and design engineer of record.
 - 3. Not responsible for design concept, design criteria, code compliance, general construction scheduling, cost estimating, or construction management.
 - 4. Plan and conduct a commissioning scoping meeting and other commissioning meetings.
 - 5. Coordinate the commissioning work and, with the GC and PM, ensure that commissioning activities are being scheduled into the master schedule.
 - 6. Request and review additional information required to perform commissioning tasks, including contractor submittals, O&M materials, contractor start-up and checkout procedures.
 - 7. Perform site visits to observe component and system installations.
 - 8. Develop start-up and initial systems checkout plan with Subcontractors.
 - 9. Approve systems installation by reviewing Installation Checklists completed by the Contractor and subcontractors.
 - 10. Approve systems startup by reviewing start-up reports and by selected site observation.
 - 11. Review TAB execution plan.
 - 12. With necessary assistance and review from installing contractors, write the functional performance test procedures for equipment and systems. Submit to PM for review, and for approval if required.
 - 13. Coordinate, witness, document and approve functional performance tests performed by installing contractors. Coordinate retesting as necessary.
 - 14. With the GC and Subcontractors, maintain master deficiency and resolution record and provide Owner with written progress reports and recommended actions. Additional costs to oversee, retest and correct deficiencies shall be paid by the GC.
 - 15. Review the O&M manuals.
 - 16. Prepare and deliver the systems manual to the owner's operating staff.
 - 17. Prepare a final commissioning report.
- .3 General Contractor Responsibilities:
- .1 Construction and Acceptance Phase:
 - 1. Facilitate coordination of commissioning work by CxA and integrate commissioning activities into the master schedule.
 - 2. Attend commissioning scoping meeting and additional meetings, as necessary.
 - 3. Furnish copies of construction documents, addenda, change orders, RFI, submittals and shop drawings related to commissioned equipment and systems to CxA.
 - 4. Ensure Subcontractors execute their commissioning responsibilities according to the contract documents, specifications and Commissioning Plan.
 - 5. Work with Subcontractors to prepare O&M manuals, according to specifications, including updating original sequences of operation and plans to Record conditions.
 - 6. Provide all documentation requested by the commissioning authority relating to the preparation of the Systems Manual.

7. Assist in resolution of system deficiencies identified during commissioning. Correlate the resolution of all deficiencies with final payment to associated contractor less warranty retention.
- .4 Mechanical, Electrical, Controls and TAB Subcontractor Responsibilities:
- .1 Construction and Acceptance Phase:
 1. Attend commissioning kick-off meeting, additional commissioning coordination meetings and deficiency resolution meetings, as necessary.
 2. Provide additional requested documentation, prior to normal O&M manual submittals, to CxA for development and review of start-up and functional testing procedures.
 3. Assist in clarification of operation and control of commissioned equipment as necessary for writing detailed testing procedures.
 4. Develop start-up and checkout plan for commissioned equipment based on manufacturer's recommendations and vendor's in-house checklists. Submit to CxA for review and approval prior to start-up.
 5. During startup and checkout process, execute pre-functional checklists for commissioned equipment. Perform and document completed startup and system operational checkout procedures. Be present on the job site to review pre-functional checklists results with the CxA as requested.
 6. Resolve A/E punch list items before implementation of functional testing.
 7. Air and water TAB to be completed with discrepancies and problems resolved before functional testing.
 8. Perform functional testing, under direction of CxA, for commissioned equipment.
 9. Resolve equipment or system deficiencies by making hardware or software changes necessary to satisfy project plans and specifications and retest as required.
 10. Prepare O&M manuals according to specifications, including updating original sequences of operation and plans to Record conditions.
 11. Coordinate with equipment manufacturers to determine requirements to maintain validity of warranties.
 12. Provide all necessary handheld instruments in order to perform startup, checkout, pre-functional testing, functional testing and deficiency resolution.
 13. TAB to provide test and balance plan to CxA for approval 3 weeks before balancing begins.
 14. TAB to maintain a deficiency log (including air, water & controls issues) provided to the CxA on a weekly basis.
 15. TAB to submit final test and balance data to CxA for review.
 - .5 Controls Contractor Responsibilities:
 - .1 Sequences of Operation Submittals: Controls submittals to include complete and detailed sequences of operation for each piece of equipment.
 - .2 Control Drawings Submittal shall include:
 1. Graphic schematic depictions of systems and individual components associated with the control system, including equipment primarily controlled by packaged controls. All control interfaces to embedded controls within packaged systems will be fully detailed.
 2. Full points list including for each point, system name, point abbreviation and description, point type, and display unit.

- .3 Controls Contractor to prepare and submit to the CxA a written plan that will be followed to test, checkout and adjust control system prior to functional performance testing. Plan shall include verification of all installations of end devices, wiring between device and controller, calibration of analog inputs, point-to-point verification, and controller software configuration. Control system checkout is a component of prefunctional testing and all specifications requirements of prefunctional checklists shall apply.
- .4 Controls Contractor to be present as necessary to manipulate control system and record results of calibration process and enter results into control system software or equipment software.
- .5 Signed and dated certification to CxA and Owner upon completion of control system checkout.
- .6 Record Drawing version of control drawings and sequences of operation to be included in final controls O&M manual submittal.

.6 Owner's Technical Staff Responsibilities:

- .1 Design, Construction and Acceptance Phase:
 - 1. Provide Owner's Project Requirements (OPR)
 - 2. Provide final acceptance of building contingent upon the resolution of all deficiencies identified during the commissioning process.

.7 Manufacturer's Representative and Equipment Suppliers Responsibilities:

- .1 Provide requested submittal data, including detailed start-up procedures, installation and operation manuals, controls wiring diagrams and specific responsibilities of Owner to keep warranties in effect.
- .2 Provide information requested by CxA regarding equipment sequence of operation and testing procedures.
- .3 Assist in equipment testing per agreements with contractors.

1.6 COMMISSIONING PROCESS

- 1.6.1 Commissioning Plan. The commissioning plan is developed by the CxA to provide guidance to the team in execution of the commissioning process.
- 1.6.2 Kick-Off Meeting. Members of design and construction team involved in the commissioning process meet and discuss scope of work, tasks, schedules, deliverables, and responsibilities for implementation of Commissioning Plan.
- 1.6.3 Submittals. The General Contractor submits commissioning documents to the CxA during regular submittals. The commissioning documents to be submitted as part of regular submittals include manufacturer's installation instructions, startup and test procedures, operation and maintenance instructions, performance data and control drawings.
- 1.6.4 Installation and Startup. The subcontractors, under their own direction, execute and document equipment installation and startup using the pre-functional checklists and perform startup and initial checkout. Completed checklists are provided to the CxA as documentation of the commissioning progress. In some cases, the CxA may elect to witness the completion of installation and startup procedures.
- 1.6.5 Functional Performance Tests. The functional test procedures will be developed by the CxA. Functional testing will not begin until all startup/prefunctional tests have been received and accepted by the CxA and the Owner. The functional performance tests will be executed by the contractor owning the work. The CxA will direct and witness the tests and collect documentation confirming that the tests were completed. Deferred testing is conducted, as specified or required.

- 1.6.6 Deficiencies and Non-conformance. Commissioned systems which fail to meet the requirements of Installation, Startup or Functional Performance Tests will be corrected at the subcontractor's expense and the system will be retested. An ongoing Issues Log, maintained by the CxA, will be provided to owner and Design Team.
- 1.6.7 O&M Manuals. The CxA will review the O&M documentation for completeness.
- 1.6.8 Systems Manual. The CxA will prepare and deliver the Systems Manual.
- 1.6.9 Commissioning Report. The CxA compiles final commissioning report which summarizes tasks, findings, and documentation of commissioning process. The report addresses actual performance of building systems in reference to design intent and contract documents and includes an executive summary of the process and results of the commissioning program, including observations, conclusions and any outstanding items, a history of any system deficiencies identified and how they were resolved, including any outstanding issues or seasonal testing scheduled for a later date and systems performance test results and evaluation.

1.7 SYSTEMS TO BE COMMISSIONED

The following new systems will be commissioned as part of this project.

- 1.7.1 Heating, ventilation, air conditioning, and refrigeration (HVAC&R) and associated controls, including, but not limited to:
 - .1 Air distribution system
 - .2 Variable Air Volume Terminal Units
 - .3 Air Conditioning Units
 - .4 Exhaust Fans
 - .5 Radiant Heaters
 - .6 Building Automation System
- 1.7.2 Plumbing, including domestic hot water systems, pumps, and controls
- 1.7.3 Electrical, including service, distribution, lighting, and controls, including daylighting controls

PART 2 – PRODUCTS

2.1 TEST EQUIPMENT

- 2.1.1 The General Contractor and Manufacturers shall provide all equipment required to conduct the tests specified. The General Contractor shall advise the commissioning team of instrumentation to be used and the dates the instruments were calibrated.
- 2.1.2 All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

PART 3 – EXECUTION

3.1 MEETINGS

- 3.1.1 Commissioning Kick-off. The CxA will conduct a Commissioning Kick-off Meeting to ensure that the roles and responsibilities are understood by all commissioning team members.

3.1.2 Commissioning Progress. The CxA will facilitate commissioning progress meetings as necessary to review commissioning progress and to identify any outstanding issues to the commissioning team.

3.2 SUBMITTALS

3.2.1 The General Contractor will provide commissioning submittals to the CxA for systems to be commissioned as defined in Part 1, Section 1.7, Systems to be Commissioned. Systems that are not within the commissioning scope do not require commissioning submittals. Commissioning submittals must include equipment manufacturer and model number, the manufacturer's printed installation and detailed start-up procedures, full sequences of operation, O&M data, performance data, any performance test procedures and control drawings. The submittals should also include the installation and checkout materials that are actually shipped with the equipment and the actual field checkout sheet forms to be used by the factory or field technicians.

3.2.2 The General Contractor will provide all documentation requested by the CxA relating to the preparation of the Systems Manual.

3.2.3 After the Submittal is approved by the designer the CxA will request additional information from design team, contractors and Subcontractors such as O & M and installation literature or other technical data in order to facilitate the commissioning process.

3.2.4 CxA may request additional design and operations narrative from Subcontractors and A/E.

3.3 STARTUP, PRE-FUNCTIONAL INSPECTION CHECKLISTS

3.3.1 Prefunctional checklists are important to ensure that the equipment and systems are properly installed and operational and to ensure that functional testing may proceed without unnecessary delays. Each piece of equipment receives full prefunctional checkout by the responsible contractor. Only individuals that have direct knowledge and witnessed that a line item task on the prefunctional checklist was actually performed shall initial or check that item. The prefunctional testing for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system.

3.3.2 Development. The General Contractor will develop prefunctional checklists and startup plan during submittal reviews. All vendor information must be submitted to the CxA for review at least four weeks prior to arrival of the equipment on site. The checklists should include, at minimum, all manufacturer or vendor Installation and Startup instructions. The CxA will review and approve the procedures in the prefunctional and startup checklists. The CxA will also note any procedures that must be added to the checklists.

3.3.3 Pre-functional checklists: Pre-functional checklists shall verify all aspects of equipment including but not limited to equipment manufacturer, model, capacity, efficiency, accuracy, status, full modulation capability, type, ratings, accessories, compatibility, installation methods and other project specification requirements.

3.3.4 Completion. The General Contractor or appropriate sub-contractor designated by the GC will complete prefunctional checklists and startup procedures for equipment to be commissioned, as defined in Part 1, Section 1.7, Systems to be Commissioned. Contractors schedule pre-functional testing activities and inform CxA of the schedule to enable the CxA to attend if desired. Prefunctional and Startup checks must be completed by the GC or sub-contractor and approved by the CxA prior to commencing Functional Performance Testing. GC completes all pre-functional tests in their entirety and submits completed pre-functional test reports to the CxA for review. Subcontractors and vendors execute startup and checkout and provide CxA with signed and dated copy of completed startup reports. The CxA will witness some, but not all equipment start-up.

3.4 FUNCTIONAL PERFORMANCE TESTING

- 3.4.1 Before Functional Performance Testing procedures are executed the GC must have submitted all commissioning submittals to the CxA and completed Pre-functional and Startup Checklists and TAB is completed for the given system being commissioned. Controls system and equipment it controls are not functionally tested until points have been calibrated and pre-functional checklists are completed. Lighting control system or lighting control component prefunctional checklists must be complete before functional testing is scheduled for lighting controls.
- 3.4.2 Objectives and Scope. Demonstrate each system is operating according to documented design intent, construction documents, and/or bidder design package. Functional testing verifies components, equipment, systems, and interfaces between systems operate correctly and include operating modes, interlocks, control sequences, and responses to emergency/life safety conditions. Verification procedures are reviewed, witnessed, and documented by the CxA.
- 3.4.3 Forms. The CxA will develop functional test procedures and forms based on project plans and specifications, contractor approved submittals and contractor submitted installation, operation & maintenance manuals for each piece of equipment being commissioned. IO&M manuals will be required to be submitted to the CxA during pre-functional test development. The GC or appropriate sub-contractor will review the tests for feasibility, safety, equipment and warranty protection prior to execution.
- 3.4.4 Development of Forms. Test procedure forms, developed by the CxA, to include the following information:
- .1 System and equipment or component name(s).
 - .2 Equipment location and ID number.
 - .3 Date.
 - .4 Participating parties.
 - .5 Instructions for setting up test, including special cautions and limits.
 - .6 Specific procedures to execute test.
 - .7 Acceptance criteria of proper performance with date passed and initials boxes.
 - .8 Section for comments or notes.
 - .9 Approval of Forms. The CxA may submit to the Owner or Design Team (A/E) the test forms for review.
 - .10 Test Methods. Functional Performance Testing, depending on equipment, may be achieved by direct manipulation of system inputs such as temperature sensors, setpoints, or short-term monitoring of parameters using stand-alone data loggers or DDC controls system (trend logging). A combination of methods may be required to test complete sequence of operations. The testing method to be used will be specified on the forms developed by the CxA.
 - .11 Schedule. The GC or sub-contractor shall keep the CxA informed of progress with pre-functional checklists and startup of equipment and systems. Functional testing will not be scheduled until all control system start-up and checkout plans, TAB reports and prefunctional checklists have been completed and submitted to the CxA for review and approval. The CxA will schedule the Functional Performance Testing through the Owner, GC and appropriate sub-contractors.
 - .12 Dry Run Tests. CxA will provide the contractor Functional Test forms for dry run testing by the contractor. The contractor will execute all functional tests in advance of formal functional testing with the CxA, owner and construction team. In addition the contractor will review their associated approved submittal to ensure that the installed system meets the requirements of the approved submittal prior to functional testing.

- .13 Test Completion. The sub-contractor responsible for installing the equipment will perform the Functional Performance Tests. Each test procedure is performed under conditions that simulate normal building operating conditions as closely as possible. The sub-contractor performing the tests shall provide all necessary materials and system modifications to measure performance and produce testing conditions described on the forms. The CxA will witness and document the tests. If damage to equipment or system results from the implementation of a functional performance test that was sent to the contractors for review, it is the contractor's responsibility to provide all equipment and labor necessary to make repairs.
- .14 Sampling. The CxA, at their discretion, may use a quality based sampling strategy to verify Functional Performance Testing for multiple identical pieces of equipment. When sampling is used, the CxA will witness and document Functional Performance Testing for a representative cross section of identical equipment.
- .15 Problem Solving. The CxA may recommend solutions to problems or deficiencies found, however the burden of responsibility to solve, correct and retest problems is with the GC, Subcontractors and A/E.
- .16 Deferred Testing. Deferred testing may be required due to seasonal variation in operations of equipment or due to inappropriate occupancy condition. Control strategies may require additional testing during opposite season to verify performance of HVAC system and controls.

3.5 DOCUMENTATION, ISSUES LOG, AND APPROVAL OF TESTS

- 3.5.1 Documentation. The CxA will witness and document the results of Functional Performance Testing using the forms developed for that purpose. The completed forms will be included in the Final Commissioning Report and the O&M Manuals.
- 3.5.2 Non-Conformance. Minor deficiencies identified during Functional Performance Testing may be corrected immediately and retested with resolution documented on procedure form. Larger deficiencies which cannot be resolved on-site will be rescheduled for testing at a later date. In all cases the CxA will make note of non-compliance and corrections made on the forms.
- 3.5.3 Issues Log. Deficiencies identified during Functional Performance Tests that cannot be corrected during the testing will be documented by the CxA in the Issues Log. The Issues Log shall include details of components or systems found to be non-compliant with parameters of test plans or project documents and attempts to identify responsible party. The log will be provided to all commissioning team members.
- 3.5.4 Cost of Retesting. Cost to conduct retesting will be covered by the sub-contractor, unless the deficiencies are due to manufacturer defect.
- 3.5.5 The cost to retest a prefunctional or functional test beyond 10% of the total number of tests will be back-charged to the responsible Sub.
- 3.5.6 For a deficiency identified, not related to any prefunctional checklist or start-up fault, the following shall apply: The CxA and PM will direct the retesting of the equipment once at no "charge" to the GC for their time. However, the CxA's time for a second retest will be charged to the GC, who may choose to recover costs from the responsible Sub.
- 3.5.7 The time for the CxA to execute any re-testing required because a specific prefunctional checklist or start-up test item, reported to have been successfully completed, but determined during functional testing to be faulty, will be back-charged to the GC, who may choose to recover costs from the party responsible for executing the faulty prefunctional test.
- 3.5.8 Approval. The CxA will document each completed Functional Performance Test on the forms.

- 3.5.9 Where Functional Performance Tests indicate systems are functioning normally, the CxA will formally provide approval of Functional Performance Tests after review.
- 3.5.10 CxA recommends acceptance of each test to Owner or Owner's Project Manager.
- 3.5.11 Owner gives final approval on each test.
- 3.5.12 CxA and owners final approval of all tests and resolution of all deficiencies is necessary before the owner will accept the building and turnover of the building to the owner can take place. Final payment to GC and all contractors may be withheld by the owner subject to the prerequisite of final acceptance of the building by the owner.

3.6 OPERATIONS AND MAINTENANCE MANUALS

3.6.1 Contents. The O&M Manual will be provided by the GC and will include the following items, at a minimum:

- .1 A narrative describing the system, including:
- .2 Startup, normal operations, shutdown, unoccupied operation, seasonal changeover and manual operation;
- .3 Contact information of equipment manufacturer or vendor;
- .4 Control drawings and schematics;
- .5 Installation, operating and maintenance instructions;
- .6 Maintenance schedules;
- .7 Parts list, including suppliers for parts;
- .8 List of special tools required for maintenance;
- .9 Performance and warranty data;
- .10 Troubleshooting & alarms.
- .11 Format. The O&M Manual must be provided in a format which will allow for efficient and easy access. An electronic copy shall be provided in a widely supported format. If a physical copy is provided, the O&M Manual must be bound in labeled binders and be divided with tabs.
- .12 The specific content and format requirements for the standard O&M manuals are detailed in the specifications.
- .13 Review and Approval. Prior to substantial completion the contractors submit to the CxA for review the O&M manuals, documentation and redline as-builts *for systems that were commissioned* to verify compliance with the specifications and project requirements. The CxA will communicate deficiencies in the manuals to the PM or A/E, as requested. The CxA also reviews each equipment warranty and verifies that all requirements to keep the warranty valid are clearly stated. Upon successful review of the manuals, the CxA will recommend approval and acceptance of the O&M Manuals to the Design Team. This work does not supersede the A/E's review of the O&M manuals according to the A/E's contract.

3.7 SYSTEMS MANUALS

3.7.1 Contents. The Systems Manual will be developed and prepared by the CxA with the assistance of the General Contractor, and will include the following items, at a minimum:

- .1 Executive Summary
- .2 Owner's Project Requirements
- .3 Basis of Design
- .4 System single-line diagrams
- .5 Construction record documents and specifications
- .6 Approved submittals
- .7 As-built sequences of operations
- .8 Original setpoints for all commissioned systems
- .9 Recommended schedule for recommissioning
- .10 Recommended schedule for sensor recalibration
- .11 Equipment operations and maintenance manuals
- .12 Equipment preventative maintenance schedules

- .13 Confirmation of completed training for the owner and occupants
- .14 Ongoing system optimization procedures
- .15 Final commissioning report

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

- 1.1.1 Comply with Division 1, General Requirements and all documents referred to therein.
- 1.1.2 Provide labour, materials, products, equipment and services required to complete the selective demolition work required and/or indicated on the Drawings and specified herein.
- 1.1.3 Visit site to establish extent of demolition to be carried out.
- 1.1.4 If suspected hazardous or contaminated materials are encountered, advise Consultant and await instructions regarding removal and disposal of such contaminants which may be considered hazardous to health, prior to demolition.

1.2 RELATED WORK

- 1.2.1 Refer to Asbestos Report by Pinchin (Appendix 'A') - removal of contaminated materials, friable asbestos containing materials, and PCB's.
- 1.2.2 Removal and relocation of mechanical and electrical items indicated as relocated and reused are specified under respective Mechanical and Electrical Drawings. Co-ordinate the removal and relocation of these items.

1.3 REFERENCE STANDARDS

1.3.1 American National Standards Institute (ANSI):

- .1 ANSI A10.8-2011, Scaffolding Safety Requirements

1.3.2 National Fire Protection Association (NFPA):

- .1 NFPA 241-09, Standard for Safeguarding Construction, Alteration, and Demolition Operations

1.3.3 Provincial Legislation:

- .1 Legislation specific to Authority Having Jurisdiction for work governed by this Section

1.4 DEFINITIONS

- 1.4.1 Demolish: Detach items from existing construction and legally dispose of them off site, unless indicated to be removed and salvaged or removed and reinstalled.
- 1.4.2 Remove and Salvage: Detach items from existing construction and deliver them to Owner ready for reuse.
- 1.4.3 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- 1.4.4 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed, removed and salvaged, or removed and reinstalled.

1.5 EXAMINATION

- 1.5.1 Visit and examine the site and note all characteristics and irregularities affecting Work of this Section. Submit a pre-demolition inspection report. Ensure the Owner of premises being inspected is represented at inspection.
- 1.5.2 Where appropriate prepare a photographic or video record of existing conditions, particularly of existing work scheduled to remain.
- 1.5.3 Where applicable, examine adjacent tenancies not part of the scope of work. Determine extent of protection required to areas and related components not subject to demolition.
- 1.6 PROTECTION
- 1.6.1 Do not commence demolition until all personnel and Owner's equipment are removed from the area being demolished.

PART 2 - PRODUCTS

2.1 SALVAGE MATERIALS

- 2.1.1 Salvage materials, products, and equipment indicated. Carefully remove items to be salvaged, protect during alteration and reinstall in locations indicated.
- 2.1.2 Refer to sprinkler, mechanical and electrical Drawings and specifications for sprinkler, mechanical and electrical work to be reused.
- 2.1.3 Salvage the following items for reuse and return to the Owner in an adequately preserved and usable condition on date of Substantial Performance or other mutually agreed date:
 - .1 Millwork, fire extinguishers, lockers, lights, clocks, bells and plumbing fixtures.
 - .2 Remove existing ceiling and light fixtures, as indicated for reuse or return to the owner.
- 2.1.4 All materials and products from the demolition except noted otherwise shall become the property of the Contractor. Remove all material and debris from the site as quickly as possible and dispose of legally. Burning of debris on the site will not be permitted.
- 2.1.5 Salvage materials, products, and/or equipment as directed by the Consultant. Remove carefully items to be salvaged to the locations designated. Protect during demolition and store above items. Materials and/or equipment directed to be salvaged shall remain the property of the Owner.

2.2 REPAIR MATERIALS

- 2.2.1 Use repair materials identical to existing materials:
 - .1 If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
 - .2 Use a material whose installed performance equals or surpasses that of existing material.
 - .3 Comply with material and installation requirements specified in individual Specification Sections.

- 2.2.2 Floor Patching and Levelling Compounds: Cement based, trowelable, self-levelling compounds compatible with specified floor finishes; gypsum based products are not acceptable for work of this Section.
- 2.2.3 Concrete Unit Masonry: Lightweight concrete masonry units, and mortar, cut and trimmed to fit existing opening to be filled. Provide standard hollow core units, square end units and bond beam units as indicated on drawings.
- 2.2.4 Brick: Install brick and mortar, cut and trimmed to fit existing opening to be filled, once demolition of hollow metal door and frame is completed. Match brick and mortar to existing adjacent materials as approved by the Consultant. Provide ties and accessories as required to complete the installation.
- 2.2.5 Gypsum Board Patching Compounds: Joint compound to ASTM C475, bedding and finishing types thinned to provide skim coat consistency to patch and prepare existing gypsum board walls ready for new finishes in accordance with Section 09 21 16 – Gypsum Board Systems.
- 2.2.6 Fireproofing: Patch and repair all fireproofing damaged during demolition of adjacent surfaces with compatible fireproofing materials. Provide test reports from fireproofing manufacture warranting installation, adhesion and compatibility between existing and new fireproofing materials.
- 2.2.7 Roofing: Remove no more existing roofing than can be covered in one day by new roofing. Refer to Division 7 for new roofing requirements.

PART 3 - EXECUTION

- 3.1 SEQUENCE OF ALTERATIONS
 - 3.1.1 Schedule sequence of alterations and demolition as indicated on Drawings.
- 3.2 SCREENS
 - 3.2.1 Provide temporary barriers, guard rails, protective covers, screens, enclosures, tarpaulins etc., as may be required to enclose work areas from other areas of the building, to maintain security, to confine dust, noise and workmen to the work area, and to give full protection to the public, building occupants, workmen employed for demolition and to adjoining property, in compliance with authorities having jurisdiction. Locate screens as directed by the Consultant.
 - 3.2.2 It is essential that the existing building be maintained weathertight at all times. Provide temporary protection, enclosures, tarpaulins, etc., as may be required to weatherproof any openings made in the Work.
 - 3.2.3 Construct dustproof and windproof screens as required to completely enclose the work areas and the access passages to the work areas from the other areas of the existing building. Locate partitions as directed by the Consultant.
 - 3.2.4 Build screens of 90 mm (3-5/8") metal studs at 400 mm (16") centres sheathed with sheets of 16 mm (5/8") gypsum board on both sides with close joints. Where exposed to the weather, fully cover screens with a heavy waterproof and dustproof paper with lapped and sealed joints. Fill spaces between studs with 100 mm (4") fibrous glass or mineral wool insulation batts to deaden sound.

- 3.2.5 Thoroughly pack framing at junctions of screens with floors, walls and ceilings with batt insulation in a manner to prevent infiltration of dust, dirt, etc. Over all junctions of screens with floors, walls and ceilings, apply continuous 40 mm (1-1/2") wide strips of masking tape both sides of screen to ensure that rooms within closed off areas which are not being altered are kept dust free.
- 3.2.6 Remove screens and make good damaged or blemished adjoining work when directed.
- 3.3 EXISTING SERVICES
 - 3.3.1 Arrange and pay for the disconnection, capping and for plugging of all gas, water, hydro, telephone and other services to the structures.
 - 3.3.2 Notify in advance each utility company involved and obtain approvals before commencing work.
- 3.4 DEMOLITION WORK
 - 3.4.1 Refer to Drawings for extent of selective demolition work. Do all demolition work not specified to be done under other Sections.
 - 3.4.2 Carry out selective demolition in strict accordance with provincial and municipal authorities having jurisdiction.
 - 3.4.3 Take precautions to guard against movement of existing building and structures and displacement of elements of the building to remain. If at any time the safety of such elements appear to be in danger, suspend operations and notify the Consultant promptly. Take measures to support such elements. Do not resume demolition until the Consultant issues instructions.
 - 3.4.4 The work shown on the Drawings, Schedules and Specifications may or may not be all the work required, do all demolition, make good all finishes and execute all necessary work including incidentals to make a complete job of the alterations.
 - 3.4.5 Cut off, cap, divert, or remove existing water, gas, electric and other services in areas being altered which are affected by the changes as required or as directed by the municipal authorities and the utility company concerned, and the Consultant. Protect and maintain active services to the existing building.
 - 3.4.6 Perform the Work in such a manner so as to cause a minimum of noise or interference to the use of the existing building.
 - 3.4.7 Whenever it becomes necessary to cut or interfere in any manner with existing apparatus for short periods of time, Do work at such times as agreed upon between the Owner, Consultant, and the Contractor.
 - 3.4.8 Where new work connects with existing and where existing work is altered, all necessary cutting and fitting required to make satisfactory connections with the existing work shall be performed under this Contract, so as to leave the entire work in a finished and workmanlike condition.
 - 3.4.9 Make good materials and finishes which are damaged or disturbed during the process of additions and reconstruction under the Contract.
 - 3.4.10 Where existing work is to be made good, the new work shall match exactly the old work in material, form, construction and finish unless otherwise noted or specified.
 - 3.4.11 Perform drilling of existing work carefully, leaving a clean hole no larger than required.

- 3.4.12 Provide, throughout the entire construction period, proper and safe means of fire exit from all zones of the existing building at all times to the approval of the authorities having jurisdiction.
- 3.4.13 Protect work in the existing buildings, such as floors, finishes, trim, etc., as completely as possible to hold the replacing of damaged work by each Section to a minimum.
- 3.4.14 Properly co-ordinate the various Sections taking into account also the existing installations to assure the best arrangement of pipes, conduits, ducts and mechanical, electrical and other equipment, in the available space. Under no circumstances will any extra cost be allowed due to the failure by the Contractor to co-ordinate the work. If required, in critical locations, interference and/or installation drawings shall be prepared showing the work of the various Sections as well as the existing installation, and these drawings shall be submitted to the Consultant for review before the commencement of work.
- 3.4.15 Remove existing finishes as indicated on the Drawings to neat, straight lines and leave substrate clean and even, suitable for new finishes indicated.
- 3.4.16 At the end of each work shift leave work in a safe condition so that no part of the building or its finishes are in danger of toppling, collapsing or falling.

END OF SECTION

1. GENERAL

1.1 Work Included

Comply with Division 1, General Requirements and all documents referred to therein.

- .1 All plain and reinforced cast-in-place concrete shown on drawings.
- .2 Setting anchors, inserts, frames, sleeves and other items supplied by other Sections.
- .3 Repairing concrete imperfections.
- .4 Finishing formed concrete surfaces.
- .5 Concrete sidewalk.

1.2 Related Work

- .1 Concrete Formwork: Section 03 10 00
- .2 Concrete Reinforcement: Section 03 20 00

1.3 Quality Assurance

- .1 Cast-in-place concrete to conform to CSA CAN3-A23.1-04.

1.4 Design Standards

The latest issue of the following standards, Codes and by-laws shall govern the work except as specifically varied herein:

- .1 Canadian Standards Associations (CSA)
 - CAN3-A5 Specifications for Portland Cement
 - CAN3-A23 Series Standards for Concrete and Reinforced Concrete Structures
 - G-30 Series Specifications for Concrete Reinforcing Materials
 - S269.1 Falsework for Construction Purposes
 - W186 Welding of Reinforcing Bars in Reinforced Concrete Construction
 - CAN3-A266.1 Air Entraining Admixtures for Concrete
 - CAN3-A266.2 Chemical Admixtures for Concrete
 - CAN3-A266.4 Guidelines for the Use of the Admixtures in Concrete
 - CAN3-A266.5 Guidelines for the use of Super-Plasticizing Admixtures
in Concrete
 - CSA 086 Code for Engineering Design of Wood
- .2 American Concrete Institute (ACI)
 - 304 Recommended Practice for Measuring, Mixing, Transporting and
Placing Concrete
 - 305 Recommended Practice for Hot Weather Concreting
 - 306 Recommended Practice for Cold Weather Concreting
 - 309 Recommended Practice for Consolidation of Concrete
 - 315 Standard Practice for Detailing Reinforced Concrete Structures
 - 347 Recommended Practice for Concrete Formwork

- .3 American Society for Testing and Materials (ASTM)
 - C171 Specification for Sheet Materials for Curing Concrete
 - C309 Liquid Membrane - Curing Compounds for Curing concrete
 - C494 Standard Specifications for Chemical Admixtures in Concrete
- .4 Concrete Reinforcing Steel Institute (CRSI)
 - CRSI-WCRSI Placing Reinforcing Bars

1.5 Inspection and Testing

- .1 Notify Engineer at least 24 hours before complete formwork and concrete reinforcement will be ready for inspection.
- .2 Allow ample time for inspection and corrective work, if required, before scheduling concrete placement.
- .3 Concrete sampling, inspection and testing is to be performed by an Inspection and Testing Firm appointed by the Architect and paid by the Cash Allowance.
- .4 Provide free access to all portions of work and co-operate with appointed firm.
- .5 Submit proposed mix design of each class of concrete to Engineer and Inspection and Testing Firm for review prior to commencement of work.
- .6 Tests of cement and aggregates may be required to be performed to ensure conformance with requirements stated herein.
- .7 Notify Inspection and Testing Firm 24 hours before placing concrete to permit scheduling.
- .8 Three concrete test cylinders will be taken for every 50 m³ or less of each class of concrete placed.
- .9 At least three test cylinders will be taken daily for each class of concrete placed. Record atmospheric and concrete temperatures.
- .10 One additional test cylinder will be taken during cold weather concreting, and be cured on job site under same conditions as concrete it represents.
- .11 One slump test and one air content test will be taken for each set of test cylinders taken.
- .12 Additional slump tests may be taken as necessary to verify quality of concrete.
- .13 Testing of concrete will be performed in accordance with CSA CAN3-A23.2-04. Test results will be issued to Contractor, Engineer and Owner.
- .14 Retesting is required due to defective materials of workmanship.

2. PRODUCTS

2.1 Concrete Materials

- .1 Cement: normal type 10, Portland type, conforming to CSA CAN3-A5.
- .2 Fine Aggregate: conforming to Normal Density Fine Aggregate, CSA CAN3-A23.1-04.
- .3 Coarse Aggregate: conforming to Normal Density Coarse Aggregate, CSA CAN3-A23.1-04, Group 1, normal size 20mm to 5mm.
- .4 Water: clean and free from injurious amounts of oil, alkali, organic matter or other deleterious material.

2.2 Admixtures

- .1 Air Entrainment: conforming to CSA CAN3-A266.1.
- .2 Chemical: conforming to CSA CAN3-A266.2; "Anti-Hydro" concrete waterproofing by Anti-Hydro of Canada Sales Ltd.
- .3 Pozzolanic Mineral: conforming to CSA CAN3-A266.3; Type N - raw or calcined or F - fly ash.

2.3 Accessories

- .1 Epoxy Bonding Agent: two component epoxy resin, Sika Sikadur Hi-Mod or approved equal.
- .2 Non-Ferrous Grout: pre-mixed, non-shrink, Master Builders 713, or approved equal, minimum 35 MPa compressive strength.
- .3 Curing Compound: Conforming to ASTM C309 Type 1 - Clear or translucent. Ensure compound is compatible with all proposed materials to be placed on concrete surfaces.
- .4 Moisture Retention Film: Master Builders Confirm or approved equal.

2.4 Concrete Mixes

- .1 Provide concrete mix in accordance with requirement of CSA CAN 3-A23.1-04.
- .2 Concrete compressive strength at 28 days:

Footings	25 MPa
Slab	25 MPa min.
Concrete Piers	25 MPa
Walls	25 MPa min.
Slab-on-grade	25 MPa

Maximum size of aggregate in the mix to be 20 mm.

.3 Slump:

	Maximum (mm)	Minimum (mm)
Concrete Piers	75	25
Footings	80	20
Slabs	75	25
Slab-On-Grade	55	25
Other Concrete	80	20

.4 All concrete exposed to weather and exterior foundations: maximum water/cement ratio = 0.45; air content = 6% + 1%; minimum cement content = 340 kg/m³.

.5 Interior Air Entrained Concrete: maximum water/cement ratio = 0.53; air content 5% + 2%; minimum cement content = 300 kg/m³.

.6 Do not use Calcium Chloride in any concrete.

.7 No admixtures other than air entraining agents and water reducing admixtures or water proofers will be permitted in concrete without prior approval by Engineer.

.8 Do not use super-plasticizers and water proofers in same mixes.

.9 Use accelerating admixtures in cold weather only when approved by Engineer. If approved, the use of admixtures will not relax cold weather placement requirements.

.10 Use set-retarding admixtures during hot weather only when approved by Engineer.

3. EXECUTION

3.1 Examination

- .1 Before starting this work, examine work done by others which affects this work.
- .2 Notify the Engineer of any conditions which would prejudice proper completion of this work.
- .3 Commencement of work implies acceptance of existing conditions.

3.2 Placing Concrete

- .1 Place concrete in accordance with requirements of CSA CAN3-A23.1-04 and as indicated on drawings.
- .2 Notify Engineer and Inspection and Testing Firm minimum 24 hours prior to commencement of concrete operations.
- .3 Ensure all anchors, seats, plates and other items to be cast into concrete are securely placed, and will not interfere with concrete placement.
- .4 Maintain accurate records of cast-in-place concrete items. Record date, location of pour, quantity, air temperature and test samples taken.

- .5 Ensure reinforcement, inserts, embedded parts, formed expansion and control joints, are not disturbed during concrete placement.
- .6 Prepare set concrete by removing all laitance and loose materials and applying bonding agent. Apply bonding agent in accordance with manufacturer's recommendations.
- .7 Place concrete continuously between preset construction and control joints.
- .8 Honeycomb or embedded debris in concrete is not acceptable.
- .9 Remove and replace defective concrete.

3.3 Joints and Embedded Items

- .1 Provide construction joints at locations indicated and/or in accordance with CAN3-A23.1-04. Joint in slab-on-grade shall be made using an approved joint form.
- .2 Remove laitance and concrete fines where necessary from surfaces of horizontal construction joints to partially expose coarse aggregate.
- .3 Continue reinforcement through joints in normal position. Add additional reinforcement across joints as indicated or directed.
- .4 Use vertical construction joints in slabs, beams or continuous grade beams unless indicated otherwise. Locate construction joints at midspan between points of support in slabs, beams or similar members.
- .5 Provide horizontal construction joints in walls or columns only at underside of beams or slabs unless indicated otherwise.
- .6 Provide a shear key in construction joints unless indicated otherwise.
- .7 Beam haunches or column capitals shall be considered monolithically part of floor systems. Brackets shall be monolithic with columns.
- .8 Install continuous waterstops in locations indicated, fixed rigidly in forms. Waterstop splices to be heat-welded in such a manner that water stopping action will not be impaired.
- .9 Provide reglets in joints as required.
- .10 Before depositing new concrete on set concrete, retighten forms, clean surfaces of set concrete, reinforcing steel and forms of foreign matter, adhering concrete or laitance. Saturate items with water.
- .11 Surfaces of concrete at joints shall be thoroughly cleaned of laitance.
- .12 Expansion and Control Joints:
 - .1 Reinforcement or other embedded metal items bonded to concrete (except dowels in floors bonded on only one side of joints) shall not extend continuously through expansion joints.
 - .2 Construct joints as detailed at locations indicated.
 - .3 Where specific locations of control joints are not shown, locate as directed.

- .4 Mark locations of control joints on first form face erected to assist in accurately positioning break in horizontal reinforcement.
- .5 Construct expansion joints clean, free of foreign material likely to impair proper operation of joint.
- 6 Install joint filler in expansion joints for full area between adjacent concrete members. Anchor filler material to one of adjacent members or between concrete members and adjacent members of other materials
- .13 Waterstops:
 - .1 Install in construction joints exposed to earth and weather.
 - .2 Make waterstops continuous for the full length of joint. Joints shall be heat welded.
 - .3 Install in accordance with the manufacturer's instructions so that water stopping action is not impaired.
 - .4 Rigidly fix waterstops in forms to maintain position during concreting.
- .14 Embedded Items:
 - .1 Install sleeves, inserts, anchors and embedded items required by other trades.
 - .2 Position expansion joint material, waterstops, and other embedded items accurately and prevent displacement. Fill voids in sleeves, inserts, and anchor slots temporarily with readily removable material to prevent entry of concrete.

3.4 Slabs on Fill

- .1 Seal punctures and damaged areas of vapour barrier before placing concrete. Use vapour barrier material, lapped over punctures and damaged areas minimum 150 mm in all directions. Seal with tape.
- .2 Carefully place concrete to required elevations indicated on drawings.
- .3 Saw cut control joints to straight lines with true, square edges within 24 hrs after finishing. Use 5 mm thick blade, cut 1/3 depth of slab.

3.5 Curing and Protection

- .1 Protect freshly deposited concrete from premature drying and extremes of temperature, and maintain minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening.
- .2 Initial Curing: Maintain concrete surface continuously moist until temperature from hydration of cement has peaked and dropped several degrees.
- .3 Final curing: Immediately following initial curing and before concrete has dried, maintain additional curing to attain specified strength and quality. Maintain temperature of surfaces minimum 10 C for five (5) days after placing. Keep above freezing temperature for seven (7) days. Where high early strength cement is used protection period can be reduced to two thirds (2/3).

- .4 Methods, Material and Application:
 - .1 Methods: Do curing as specified using one or more of the following:
 - .1 Continuous sprinkling.
 - .2 Curing compounds whose type and method shall be approved by the engineer.
 - .3 Other approved moisture retaining methods.
 - .4 Do not use curing compounds which are not compatible with applied finishes, specified in other Sections.
 - .2 Application: Apply curing compounds to form complete unbroken film on surface and remain intact for entire curing period, at rate recommended by manufacturer.
- .5 Protection of Freshly Placed Concrete:
 - .1 Protect freshly placed concrete from harmful effects of sunshine, drying winds, rain, cold or running water with adequate tarpaulins or other suitable materials.
 - .2 Protect concrete from damaging mechanical disturbances particularly load stresses, heavy shock and excessive vibration.
 - .3 Protect freshly placed concrete from defacement due to building operations.
- .6 Protection of Completed Work:
 - .1 Protect exposed members, with polyethylene sheets, from staining or concrete leakage from continuing concreting operations. Rectify coated defective work.
 - .2 Protect exposed concrete from rust staining of reinforcement projecting beyond construction joints.
 - .3 Take suitable measures to prevent spalling and cracking damage in structure from water freezing at expansion joints, small holes, slots and depressions.
- .7 Cold Weather Concreting:
 - .1 Conform to CAN3-A23.1-04 and ACI 306 except as specified herein.
 - .2 Provide on hand and ready for use, equipment for protection and curing.
 - .3 Concrete Temperature at which protection is required: when the air temperature is at or below 5 C, or when there is a probability of its falling below 5 C within 24hr of placing (as forecast by the nearest official meteorological office), the temperature of the concrete as placed shall be within the limits shown in Table 14 in CAN3-A23.1-04.
 - .4 Placing:

Remove ice, snow and frost and raise temperature of surfaces in contact with concrete above 5 C. Calcium chloride or other de-icing salts shall not be used as a deicing agent in the forms. Concrete shall not be placed on, or against, any surface that will lower the temperature of concrete in place below 10 C.

.5 Protection:

Protection shall be provided for newly placed concrete by means of heated enclosures, coverings, insulation, on a suitable combination of these methods.

For outside temperature falls below - 12 C during placing or during protection period, provide suitable enclosure plus supplementary heat.

For outside temperature falls below -5 C but not below -12 C provide enclosures of concrete work with insulation. Supplementary heat shall be used as directed.

For outside temperature falls to -5 C, provide adequate enclosure of concrete work with insulation. Ensure supplementary heat is available.

.6 Heating of Enclosures:

.1 Supply heat to the enclosure by live steam, forced hot air, stationery heaters, or other heaters of various types.

.2 At the time of placing and curing, concrete surfaces shall be protected by formwork or an impermeable membrane from direct exposure to combustion gases or drying from heaters.

.7 Protection by insulation:

The amount of insulation required to cure concrete properly shall be determined on the basis of the expected air temperature and wind velocity (wind chill factor), the size and shape of concrete structure, and the amount of cement in the concrete mix.

.8 Cooling after Protection:

To avoid cracking of the concrete due to sudden temperature change near the end of the curing period, the protection shall not be completely removed until the concrete has cooled to the temperature differential in Table 15 in CAN3-A23.1-04.

.9 Temperature Records:

Record the date, hour, outside air temperature and weather. Record temperatures of enclosure and on concrete surface in sufficient number to show highest and lowest temperatures of concrete.

10. Hot Weather Concreting:

.1 Conform to CAN3-A23.1-04 and ACI 305. Use set retarding admixture only as directed.

.2 Place concrete in thin layers and small areas so compaction of concrete will ensure adequate union of adjacent portions.

.3 When the air temperature is at or above 27 C, continuously moist cure by water spray or by using saturated absorptive fabric during first few hours after placement. Prevent alternate wetting and drying during remainder of curing period.

3.6 Formed Concrete

Inspect concrete surfaces immediately upon removal of forms. Modify or replace concrete not conforming to qualities, lines, details and elevations specified herein or indicated on drawings

3.7 Finishing

All slabs shall be floated and then steel trowel finished. Exterior slabs and stairs shall receive a light broomed non-slip finish. Slabs shall be sloped at 1% to drain and stair risers formed with a 1" (25mm) backslope to create a nosing.

End of Section

PART 1 - GENERAL

1.1 WORK INCLUDED

1.1.1 Comply with Division 1, General Requirements and all documents referred to therein.

1.1.2 Provide all labour, materials, products, equipment and services to finish and cure concrete floors, concrete toppings, floating slabs and horizontal surfaces required and/or indicated on the Drawings and specified herein.

1.2 RELATED WORK UNDER OTHER SECTIONS

1.2.1 Cast-In-Place Concrete: Section 03 30 00.

1.3 REFERENCES

1.3.1 ACI 117-2010 Standard Tolerances for Concrete Construction and Materials.

1.3.2 ACI 308R-01 Guide to Curing Concrete.

1.3.3 ASTM C309-11 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

1.3.4 ASTM C494/C494M-15 Standard Specification for Chemical Admixtures for Concrete

1.3.5 ASTM C1315-11 Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete

1.3.6 CSA A23.1-14/A23.2-14 Concrete materials and methods of concrete construction/Test methods and standard practices for concrete

1.4 ADMINISTRATION REQUIREMENTS

1.4.1 Coordination: Coordinate a meeting between the Contractor, Subcontractor responsible for concrete placement, and the Consultant to determine Site Quality Control testing section borders and sample measurement line locations, method of measurement, and accuracy requirements of the measuring devices.

1.4.2 Pre-Construction Meetings: Arrange meeting with Contractor, Subcontractor for work of this Section and other Subcontractors affected by work of this Section to discuss effects and issues governing installation of concrete finishing materials; prepare an outline agenda for meeting in accordance with Division 1.

1.5 QUALIFICATION

1.5.1 Work of this Section shall be performed by an approved, established floor finishing company having a proven record of satisfactory workmanship for a period of at least 5 years. Submit proof of this requirement to the Consultant well in advance of concrete finishing operations.

1.6 SUBMITTALS

1.6.1 Submit maintenance instructions for finishes supplied under this Section.

- 1.6.2 Product Data: Submit manufacturers product data for each materials specified including recommended application rates and methods of installation.
- 1.6.3 Minimum four weeks prior to placing of any cover slabs over waterproofing membranes, submit drawings showing proposed locations of control joints in cover slab.
- 1.6.4 Minimum two weeks prior to starting concrete work, submit proposed quality control procedures for Consultant's review for finishing, curing and protection.
- 1.6.5 LEED Projects: Submit product data for sealers and coatings, including printed statement of VOC content and chemical composition showing compliance with SCAQMD rule #1168. Include statement indicating the amount of materials used on the Project. Contractor and/or Subcontractor shall provide completed forms in accordance with Section 01 35 00.
- 1.7 JOB MOCK UP
 - 1.7.1 At location on site as directed by the Consultant, provide a completely finished sample area, 1.2 m x 1.2 m (4' x 4,) of integrally coloured and sealed, steel trowelled concrete floor for his approval.
 - 1.7.2 For accurate colour, the quantity of concrete mix to produce the sample shall not be less than 3 cu yds. Excess material shall be discarded according to local regulations.
 - 1.7.3 Remove mock-ups that are designated by the Consultant as unsuitable for incorporation in the Work.
 - 1.7.4 If finishing is unacceptable, provide additional mock-ups until workmanship is approved.
 - 1.7.5 Approved mock-up will serve as a standard by which subsequent Work will be judged acceptable.
- 1.8 JOB CONDITIONS
 - 1.8.1 Environmental Requirements:
 - .1 Perform Work only when environmental conditions are as specified in Section 03300.
 - .2 Ensure that adequate temporary heating is provided as required for cold weather work.
 - .3 Provide adequate moisture, sun shades and wind barriers to prevent too rapid drying of concrete during hot weather.
- 1.9 PROTECTION
 - 1.9.1 Keep traffic which would affect or disturb the curing procedures off the finished surfaces for a period of 7 days minimum.
 - 1.9.2 Protect exposed concrete finishes against damage until the building is accepted by the Owner.
 - 1.9.3 Protect floors which are to receive an architectural finish or traffic membrane system against contamination by oil, paint or other deleterious materials.
 - 1.9.4 Protect items set into floors from damage; ensure that alignment is not disturbed.

PART 2 - PRODUCTS

2.1 MATERIALS

- 2.1.1 Unless specified otherwise, materials shall meet requirements of Section 03 30 00.
- 2.1.2 Ensure that concrete supplied for slabs contain no admixtures which would be incompatible with floor hardener materials or other applied finishes.
- 2.1.3 Curing materials shall be compatible with finish to be applied to concrete, and comply with ASTM C308.
- 2.1.4 Curing compound: Dissipating, liquid membrane forming curing compound.
 - .1 Basis of Design Materials:
 - .1 Kurez DR Vox by The Euclid Chemical Company, or other approved manufacture.
- 2.1.5 Combination curing and sealing compound shall meet requirements of ASTM C1315 and EPA regulation for maximum allowable VOC content.
- 2.1.6 Curing compound shall meet requirements of ASTM C309, and ASTM C1315 and EPA regulation for maximum allowable VOC content.
- 2.1.7 Combination Curing and Sealing Compound:
 - .1 Chlorinated rubber based compound, conforming to ASTM C309, Type 1; Class B, water based acrylic curing and sealing compound, compatible with surface hardener where hardener is used, when temperature permits:
 - .1 Florseal WB 25 by Sika Canada Inc.
 - .2 Aqua-Cure VOX by Euclid Chemical Company.
 - .3 VOCOMP-20 by W.R. Meadows of Canada Ltd., or other approved manufacture.
 - .2 Solvent based when required due to application temperature:
 - .1 Super Floor Coat by Euclid Chemical Canada Inc., or other approved manufacture.
 - .3 If product listed exceeds VOC limits replace with product that meets VOC limits and is acceptable to the Consultant.
- 2.1.8 Laminated waterproof paper consisting of laminations of kraft paper and water resistant materials capable of retaining the moisture in the concrete and tough enough to remain intact for the specified curing time.
- 2.1.9 Curing blanket for moist curing: Burlap sheet, or proprietary blanket fabricated for moist curing..
- 2.1.10 Plastic sheet for moist curing: Polyethylene sheet not less than [0.102 mm|4 mils] thick, clear for interior, white for exterior applications.
- 2.1.11 Non-metallic hardener: Premixed, selected natural grades of mineral aggregates including emery particles, having a Mohs Hardness 8 or better, pre-blended wetting and densifying agents and Portland cement.
 - .1 Diamag 7 by Sika Canada Inc.
 - .2 MasterTop 100 by BASF,
 - .3 Floor Hardener Pre-Mix by CPD Construction Products, or other approved manufacture.

- 2.1.12 Coloured admix for coloured concrete floor slabs: Colour as selected by Consultant. Admixture shall be a coloured, water-reducing, admixture containing no calcium chloride with colouring agents that are limeproof and ultra-violet resistant.
- .1 Chromix P Admixture and Chromix L by L.M. Scofield Company or other approved manufacture.
- 2.1.13 Curing and sealer for use with coloured concrete finish: Complying with ASTM C309 and be of the same manufacture as coloured admixture. Sealing and curing compound:
- .1 Cureseal-S Matte by L.M. Scofield Company or other approved manufacturer.
- 2.1.14 Integral colour mix:
- .1 Interstar Liquid Color by Interstar Materials Inc., or other approved manufacture.
- 2.1.15 Liquid chemical hardener:
- .1 Surfhard by Euclid Admixtures Canada Inc., or other approved manufacture.
- 2.1.16 Premixed, coloured, non-metallic hardener:
- .1 Colorplete by Sika Canada Inc., or other approved manufacture.
- 2.1.17 Stain for concrete floor slabs: Chemically reactive chemical stain:
- .1 Lithochrome Chemical Stain by L.M. Scofield Company or other approved manufacture. Colour as selected by Consultant.
- 2.1.18 Sealer for use with stained concrete finish:
- .1 Cementone Clear Sealer by L.M. Scofield Company, or other approved manufacture.
- 2.1.19 Admix for colour-conditioned concrete floor slabs: Single component, coloured, water-reducing, set-controlling admixture, complying with ASTM C494:
- .1 Chromix Admixture by L.M. Scofield Company, or other approved manufacture. Colour as selected by Consultant.
- 2.1.20 Joint filler: Self-levelling, 2-component, solvent free, moisture insensitive epoxy resin:
- .1 Sikadur 51/SL by Sika Canada Inc., or other approved manufacture.
- 2.1.21 Joint filler for control joints in floors which will be covered by an architectural finish: same as specified for exposed control joints, or use sand, cement, and additive grout mixture, mixed 2 parts sand, 1 part cement, 1 part additive.
- 2.1.22 Joint filler for control joints: Load bearing, epoxy-urethane filler:
- .1 Loadflex by Sika Canada Inc.
.2 Eco 700 by Euclid Admixture Canada Inc., or other approved manufacture.

- 2.1.23 Grout: For filling cracks and control joints: 1 part cement to 2 parts fine concrete sand wetted with additive/water solution to manufacturer's directions to provide suitable mix. Colour, texture and strength to match adjacent surfaces.
- 2.1.24 Non-slip inserts: Contractor's choice of either slot blocked-out during forming and pouring procedures or rout-out after concrete has cured and filled with aluminum-oxide and epoxy abrasive fill.
- 2.1.25 Non-slip aggregate: Aluminum oxide aggregate:
- .1 A-H Emerundum, by Anti-Hydro Canada Inc., or other approved manufacture.
- 2.1.26 Non-slip aggregate: Alumdum aggregate. No. 00 [0.4 mm to 2.4 mm|1/64" to 3/32"], grey, by the Norton Co. Ltd., or other approved manufacture.
- 2.1.27 Non-slip inserts:
- .1 Type 610 aluminum Super Grit by Wooster Products Inc.
 - .2 CT-22/138A by K.N. Crowder Mfg. Ltd., or other approved manufacture.
- 2.1.28 Non-slip stair nosings:
- .1 Type WP-3C (WP-3-SP with lip) Sure-Hold by Wooster Products Inc.,
 - .2 CT-20/3A (CT-21/3A with lip) by K.N. Crowder Mfg. Ltd., or other approved manufacture.
- 2.1.29 Sealer for exterior Concrete: 50:50 mixture of boiled linseed oil conforming to CAN/CGSB 1.2 cut back with kerosene.
- 2.1.30 Sealer:
- .1 Prothane urethane sealer by Proseal Concrete Floor Care Systems Inc.
- 2.1.31 LEED PROJECTS: Provide sealers and coatings with VOC content limits less than stated for the State of California's South Coast Air Quality Management District (SCAQMD) Rule #1106, current edition.

PART 3 - EXECUTION

- 3.1 LEVELLING AND FLOATING
- 3.1.1 Strike off concrete after it is placed, level and flush and then level and consolidate with a wooden darby or bullfloat. Complete levelling and consolidation before free moisture (bleeding) rises to surface.
- 3.1.2 When concrete has stiffened sufficiently to sustain foot pressure and after removing free bleed water, float concrete with hand or power float.
- 3.1.3 Co-ordinate work of this Section with work of Section 07145, Capillary Concrete Waterproofing for areas where capillary waterproofing is required to be floated into slabs.
- 3.1.4 Depress slabs where required to receive finishes.
- 3.1.5 Slope floors uniformly to floor drains where indicated. At isolated floor drains, depress level floor 6 mm locally, slope uniformly to drain.

3.2 CONTROL JOINTS

- 3.2.1 Provide sawcut control joints in concrete slabs and toppings, located on column centre lines, unless closer spacing is indicated. Saw-cut as soon as it is practicable to work the slab without tearing out course aggregate.
- 3.2.2 Cut joints in slabs on grade 5 mm (3/16") wide x 1/4 the depth of the slab.
- 3.2.3 Within four weeks, grout control joints.
- 3.2.4 Fill control joints with epoxy type filler where exposed; fill control joints to be covered with architectural finish using either epoxy joint filler as for exposed locations, or the sand/cement/grout mixture specified under Materials.
- 3.2.5 Rake out dirt in joints with an appropriate tool. Blow dirt out of joints with compressed air. Clean the floor surface by vacuuming with industrial type vacuum cleaner.
- 3.2.6 Apply filler in accordance with manufacturer's instructions, using the recommended application method.
- 3.2.7 Provide expansion joints in concrete walks, sidewalks and curbs spaced [4600mm | 15'-0"] o.c., and provide v-groove control joints in walks and sidewalks spaced [1500mm | 5'-0"] o.c.

3.3 CONTROL JOINTS IN SLABS ON GRADE

- 3.3.1 Refer to Section 03 30 00 - Cast-In-Place Concrete.
- 3.3.2 Use [3 mm|1/8"] "Soff-Cut" saw. Commence saw cutting within 2 hours of final surface finishing or when slab surface can support weight of saw and operator without disturbing the final finish.
- 3.3.3 Saw cut unreinforced slabs to a depth of [40 mm|1-1/2"].
- 3.3.4 For slabs that will be covered with architectural finish which will conceal joint, prepare the joints as follows:
 - .1 Clean residue from the joint.
 - .2 Fill joint with latex/sand/cement grout mixture and work into joint, or place fine silica sand in bottom of joint and fill top [25 mm|1"] of joint with epoxy joint filler to flush with top surface, do not overfill.
- 3.3.5 For slabs that will remain as exposed concrete, prepare and fill joints as follows:
 - .1 Clean saw cut residue from floor.
 - .2 Clean residue from joint by power washing with an [8 Mpa\1200 psi] water jet and allow to dry.
 - .3 Install polyethylene sealant backer rod of diameter sized 25% greater than joint width, flush with top of floor, to exclude dirt. Leave to receive final preparation and joint sealant under Section 07 90 00.

3.4 NON-SLIP INSERTS AND AGGREGATE

- 3.4.1 Install non-slip inserts in concrete and concrete-filled steel stairs, at nosings of landings and treads unless they are shown to have architectural applied finish.

- 3.4.2 Install non-slip inserts in concrete pedestrian ramp, at [300 mm|12"] o.c. Finish inserts slightly above adjacent surfaces.
- 3.4.3 Stop inserts [75 mm|3"] short of each side.
- 3.4.4 Install non-slip aggregate to concrete-filled steel stair treads and landings where no architectural applied finish will be applied. Apply aggregate in accordance with manufacturer's instructions.
- 3.5 STEEL TROWEL FINISH
 - 3.5.1 After floating, trowel surface with steel hand or float trowel keeping blade flat at first and raising blade angle little more on subsequent passes. Leave surface smooth, dense, of fine uniform texture without a swirl.
- 3.6 SWIRL FINISH
 - 3.6.1 In the final trowelling of Steel Trowel Finish, where swirled finish is scheduled, impart a slightly textured surface to the concrete by spin trowelling, moving the trowel in a "swirling" or circular motion, in such a way as to produce a spin trowelled (swirled) texture or pattern on the surface.
- 3.7 BROOM FINISH FOR BOND
 - 3.7.1 After floating, broom the substrate with a stiff bristle broom in one direction.
- 3.8 BROOM FINISH FOR NON-SLIP
 - 3.8.1 After steel trowelling, lightly broom the surface with a bristle push broom to obtain a fine even texture finish.
- 3.9 MOIST CURING
 - 3.9.1 Cover the concrete with non-staining burlap or canvas coverings. Keep surface continuously wet. When concrete has hardened sufficiently, it may be covered with sand which shall be kept moist. Keep concrete moist for a minimum period of seven consecutive days.
- 3.10 PLASTIC FILM CURING
 - 3.10.1 Cover concrete with polyethylene sheets.
 - 3.10.2 Lap all edges [100 mm|4"] minimum and seal all laps.
 - 3.10.3 Leave in place for a minimum of seven consecutive days.
- 3.11 COMBINATION CURING AND SEALING COMPOUND
 - 3.11.1 Apply combination curing and sealing compounds in strict accordance with manufacturers' specifications and as required to properly cure and seal the surfaces.
 - 3.11.2 After application of combination curing and sealing compound, protect surface with laminated waterproof paper or plywood or other approved protection.
 - 3.11.3 Apply one coat at completion of floor finishing. Apply second coat immediately prior to take-over, after proper cleaning of concrete floor.

3.12 INTEGRAL COLOUR MIX

- 3.12.1 Apply integral colour mix into plastic concrete in accordance with manufacturer's written instructions.
- 3.12.2 After levelling and floating, shake apply 1/2 of the colour mix as soon as concrete is firm enough to support weight and equipment and no standing water is present on the surface. Apply mix evenly over the floor surface in one direction commencing along walls, forms, doorways, columns and the like.
- 3.12.3 Machine float just enough to bring moisture completely through the mix and embed and compact the mix into the base concrete.
- 3.12.4 Immediately following the floating of the first mix apply the balance of the mix. Spread evenly and in a direction perpendicular to the first mix. Float as specified for the first mix.
- 3.12.5 Additional floating to further compact the surface may be done depending on time and setting characteristics of the concrete.

3.13 STAINED CONCRETE

- 3.13.1 Apply chemically reactive concrete stain to concrete slabs, where shown on Drawings, in accordance with manufacturer's instructions.
- 3.13.2 Apply sealer in matching colour to stained concrete.
- 3.13.3 Provide colours and saw-cut patterns in stained concrete as shown.

3.14 SHAKE HARDENED CONCRETE FINISH/INTEGRAL COLOUR MIX

- 3.14.1 After levelling and floating, shake apply 1/2 of the hardener as soon as concrete is firm enough to support weight and equipment and no standing water is present on the surface. Apply hardener evenly over the floor surface in one direction commencing along walls, forms, doorways, columns and the like.
- 3.14.2 Machine float just enough to bring moisture completely through the shake and to embed and compact the shake into the base concrete.
- 3.14.3 Immediately following the floating of the first shake apply the balance of the hardener. Spread evenly and in a direction perpendicular to the first shake. Float as specified for the first shake.
- 3.14.4 Additional floating to further compact the surface may be done depending on time and setting characteristics of the concrete.
- 3.14.5 After floating, steel trowel floor to non-slip swirl finish.
- 3.14.6 Apply premixed coloured, non-metallic hardener at the rate of:
 - .1 [5 kg/m²|1 lb/ft²] in change rooms
 - .2 [7 kg/m²|1.4 lb/ft²] in garage and service bays
 - .3 [9 kg/m²|1.8 lb/ft²] in roller rinks
- 3.14.7 Apply natural mineral, non-metallic hardener at the rate of:

- .1 [2.5 kg/m²|0.5 lb/sq.ft.] in stair treads, pedestrian ramps
- .2 [3.6 kg/m²|0.74 lb/ft²] in warehouse floors

3.14.8 Apply non-metallic hardener at the rate of:

- .1 [3 kg/m²|0.6 lb/ft²] in change rooms, store rooms
- .2 [5 kg/m²|1 lb/ft²] in manufacturing areas
- .3 [8 kg/m²|1.64 lb/ft²] in roller rinks

3.14.9 Moist cure apply curing compound as soon after trowelling and the surface will not be damaged by applicator and equipment.

3.15 NON-METALLIC HARDENED CONCRETE FINISH

3.15.1 After levelling and floating apply hardener as soon as concrete is firm enough to support weight and equipment and no standing water is present on the surface.

3.15.2 Spread material evenly by sprinkling at right angles in two passes close to floor level.

3.15.3 Float shake application promptly. Work wall, column and door areas first. Avoid excessive floating, but ensure that the shake application is completely wetted and incorporated into the base slab.

3.15.4 Immediately following the floating of the first shake apply the balance of the hardener. Spread evenly and in a direction perpendicular to the first shake. Float as specified for the first shake.

3.15.5 Additional floating to further compact the surface may be done depending on time and setting characteristics of the concrete.

3.15.6 After floating, steel trowel floor to non-slip swirl finish.

3.15.7 Apply premixed, non-metallic hardener at the rate of [3.6 kg/m²|75 lb/100 ft²].

3.15.8 Apply curing compound, complying with ASTM C309, as soon after trowelling and the surface will not be damaged by applicator and equipment.

3.16 CHEMICALLY HARDENED CONCRETE FINISH

3.16.1 Apply 2 coats of chemical hardener, not sooner than 28 days after concrete has been allowed to cure, unless otherwise recommended by manufacturer of chemical hardener. Application may be delayed provided sufficient time is allowed for hardener to dry before application of subsequent finish.

3.16.2 Ensure that surfaces are thoroughly cured, dry, and free from dust, and other foreign substances which would inhibit proper application of liquid compound, and have been moist cured.

3.16.3 Remove oil, grease, dirt and other foreign substances on surfaces. Apply chemical hardener as directed by manufacturer, spread evenly, avoiding puddles, allow to dry.

3.16.4 Check application of first coat for accumulation of surplus hardener in low spots.dry.

3.16.5 Apply second coat.

3.17 CHEMICAL HARDENER

- 3.17.1 Apply chemical hardener, not sooner than 28 days after concrete has cured, unless otherwise recommended by manufacturer of chemical hardener. Allow sufficient time per manufacturer's directions, for hardener to dry before application of subsequent finish.
- 3.17.2 Ensure that surfaces are thoroughly cured, dry, and free from dust, and has been moist cured.
- 3.17.3 Remove oil, grease, dirt and other foreign substances on surfaces. Apply chemical hardener as directed by manufacturer.
- 3.18 REMEDIAL WORK
- 3.18.1 Grind floor levels which do not comply with specified tolerances to the tolerances required, or level with epoxy or latex compound.
- 3.18.2 Obtain approval of method for correcting tolerances before proceeding.
- 3.18.3 Immediately prior to installation of applied floor finishes but not sooner than 28 days after concrete has been placed, examine concrete floor surfaces and repair cracks. Rout cracks which exceed [0.8 mm|1/32"] in width with mechanical router to [13 mm|1/2"] square cross section. Clean and fill cracks as specified for control joints.
- 3.18.4 Grinding of hardened concrete surfaces is to be avoided.
- 3.19 TOLERANCES
- 3.19.1 Levels of finished concrete floors and floors under finished flooring applications shall be to CAN/CSA A23.1 standards. Under waterproofing, traffic topping resilient and seamless flooring, finish levels shall not vary more than [1.6 mm|1/16"] in any running [300 mm|1'-0"].
- 3.19.2 Levels of finished concrete floors and floors under finishing applications shall be to ACI 117 standards. Under waterproofing, resilient and seamless flooring, finish levels shall not vary more than [1.6 mm|1/16"] in any running [300 mm|1'-0"]
- 3.19.3 Finish slab for specialized operations (i.e. narrow aisle warehouses, television studios, and air-pallet systems) 'super flat', with flatness number F_f exceeding 100 and levelness F_l number exceeding 50, when tested in accordance with ASTM E1155.
- 3.19.4 Levels of finished concrete floors and floors under finished flooring applications shall be finished to surface tolerances as listed in Table 16 of CAN/CSA A23.1, Class A, and Appendix D and E, when tested in accordance with CAN/CSA A23.2-10B.
- 3.19.5 Completed surfaces shall not vary more than [6 mm in 3 m|1/4" in 10'-0"] from dead level, F_f 25, F_l 20. Except where slopes and slopes to drains are required.
- 3.20 URETHANE SEALER
- 3.20.1 Allow concrete floors to receive urethane sealer to cure 2 to 3 weeks.
- 3.20.2 Acid etch, rinse and allow to dry.
- 3.20.3 Prime with water borne epoxy and apply 2 coats of Prothane at the site of [6.2 sq.m|1|300 sq.ft./gal] per application, giving a [1.5 mm|6 mil] thickness.

3.21 SLIP RESISTANT FILL

3.21.1 Form or rout cast-in-place concrete to provide two rows of grooves at stair treads and landings of cast-in-place and concrete filled stairs, unless they are shown to have architectural applied finish, other than paint or similar thin coating.

3.21.2 Terminate grooves [75 mm|3"] short of each side.

3.21.3 Fill with non-slip abrasive aggregate mix, finish slightly above adjacent surface in neat, straight line.

3.22 SCHEDULE

3.16.2 The following curing methods and finishes shall be applied to the corresponding surfaces:

SURFACE	CURING METHODS	FINISH
Exposed concrete floors and toppings	Combination curing and sealing	Steel trowel
Polished concrete floors	Combination curing and chemical hardener	Steel trowel, phenolic diamond grinding
Concrete to accept resilient flooring	Combination curing and sealing	Steel trowel
Concrete to accept stone / brick paving and ceramic tile applied using thin bed or adhesive method	Moist cure	Steel trowel
Concrete to accept marble tile and brick paving applied using mortar bed system	Moist cure	Wire broomed for bond after floating
Concrete to accept special flooring, seamless flooring, or similar thin, fluid applied finishes	Moist cure	Steel trowel
Carpet, including areas scheduled to receive carpet by tenants.	Moist cure or cure and seal	Steel trowel
Concrete to accept wood flooring	Combination curing and sealing	Steel trowel
Waterproofing and roofing membranes	Moist cure	Steel trowel
Parking garage floors and ramps	Moist cure	Steel trowel
Exposed concrete stair treads and landings	Combination curing and sealing compound	Swirl or coarse non-bristle slipbrush broomed
Concrete stairs and landings		Add silica sand to final coat
Concrete to receive traffic topping	Moist cure	Steel trowel
Concrete to receive urethane sealer	Moist cure	Steel trowel
Loading dock and other areas	Moist cure	Hardened with non-metallic

SECTION 03 35 00
CONCRETE FLOOR CURES AND FINISHES

scheduled to receive shake
hardened concrete finish

shake during float finish
followed by swirl steel trowel

Concrete to receive capillary
waterproofing

Moist cure

Wood float

Concrete sidewalks and curbs

Combination curing and
sealing compound

Finish to City of Toronto
standards

Concrete sidewalks and curbs

Exterior sealer

Wood float and broomed

Concourse area

Moist cure primer epoxy
sealer

Steel trowel

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

1.1.1 Comply with Division 1, General Requirements and all documents referred to therein.

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

- .1 Veneer Brick
- .2 Architectural Concrete Masonry Units (CMUs)
- .3 Mortar, and Grout
- .4 Reinforcing steel
- .5 Masonry joint reinforcement
- .6 Ties and anchors
- .7 Miscellaneous masonry accessories

1.2 REFERENCES

- 1.2.1 ASTM C216 Standard SW Severe Weather (Cold Climate)
- 1.2.2 ASTM A82-02 Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
- 1.2.3 ASTM A116-11 Standard Specification for Metallic-Coated, Steel Woven Wire Fence Fabric.
- 1.2.4 ASTM A123/A123M-13 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- 1.2.5 ASTM A153/A153M-09 Standard Specification for Zinc Coated (Hot-Dip) on Iron and Steel Hardware.
- 1.2.6 ASTM A167-99 (2009) Standard Specification for Stainless and Heat-Resistant Chromium-Nickel Steel Plate, Sheet and Strip.
- 1.2.7 ASTM A580/A580M-15 Standard Specification for Stainless Steel Wire.
- 1.2.8 ASTM C207-06(2011) Standard Specification for Hydrated Lime for Masonry Purposes.
- 1.2.9 ASTM C331/C331M-14 Standard Specification for Lightweight Aggregates for Concrete Masonry Units.
- 1.2.10 CSA A23.1-09/A23.2-09 Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
- 1.2.11 CAN/CSA G164-M92 (R2003) Hot Dip Galvanizing of Irregularly Shaped Articles.
- 1.2.12 CSA A-82 EG Exterior Grade Masonry Unit
- 1.2.13 CSA S304-14 Design of Masonry Structures.

- 1.2.14 CSA A82.56-M1976 Aggregate for Masonry Mortar.
- 1.2.15 CSA A165 Series-14 CSA Standards on Concrete Masonry Units.
- 1.2.16 1 CSA A179-14 Mortar and Grout for Unit Masonry.
- 1.2.17 CSA A370-14 Connectors for Masonry.
- 1.2.18 CSA A371-14 Masonry Construction for Buildings.
- 1.2.19 CSA G30.3-M1983(R1998) Cold Drawn Steel Wire for Concrete Reinforcement.
- 1.3 DEFINITIONS
 - 1.3.1 Solid block: A masonry unit with a net cross sectional area of at least 75% of its gross sectional area in any plane parallel to its bearing surface.
 - 1.3.2 One hundred percent (100%) solid block: A masonry unit with plain flat ends and without cores.
 - 1.3.3 Administrative Requirements - Pre-Construction Conference: Arrange a site meeting attended by the contractor's superintendent, the Subcontractor's representative and foreman for this project, the Consultant, materials supplier(s), and other relevant personal before commencement of work for this Section; agenda for meeting will include; but not be limited to, the following:
 - .1 Confirmation of specifications and details for the project
 - .2 Required mortar, grout and concrete testing, batch control and grouting procedures
 - .3 Installation requirements of air/vapour membranes and insulation and coordination with other components of the Work
 - .4 Confirmation of cavity compartmentalization and drainage requirements
 - .5 Confirmation of appearance of exposed block lintels
 - .6 Confirmation of reinforcement at corners and wall intersections
 - .7 Coordination of interior and exterior crack control measures
 - .8 Confirmation of trowelled or tooled joints to concealed and exposed masonry faces
 - .9 Confirmation of methods for keeping mortar out of cavity space
 - .10 Confirmation of methods for controlling efflorescence during construction
 - .11 Confirmation of membranes and membrane flashing materials and details used for construction
 - .12 Review of submitted masonry unit samples
 - .13 Review of hot and cold weather requirements
 - 1.3.4 Coordination: Coordinate components of the work of this Section with work performed by other Sections including; but not limited to, the following:
 - .1 Rain Screen Wall Construction: Masonry veneer forms a part of the exterior rain screen and protective facing. Construct assembly to allow for ventilation, drainage and pressure equalization of the voids between the veneer and the insulation with the outside pressures. Construct cavity space divided into separate compartments as a means of controlling these pressure differences within the building envelope.
 - .2 Steel Support Angles and Brackets: Coordinate requirements for structural steel support angles and brackets supplied and installed onto the building structure by Section 05 50 00.
- 1.4 DESIGN REQUIREMENTS

- 1.4.1 Fire and smoke separations: Where masonry walls, partitions and furring are required to act as fire and smoke separations or barriers or as fire protection for structural steel, they shall conform to Supplementary Guidelines to the latest OBC, with respect to equivalent thickness and type of concrete and to requirements of authorities having jurisdiction.
- 1.4.2 Comply with CSA A370, CSA A371, CSA S304, local building codes, authorities having jurisdiction and these Specifications. Should conflict occur, the more strict shall govern.
- 1.4.3 Comply with CAN3-A371 for construction tolerances. Tolerances shall not accumulate.
- 1.4.4 Irregularity in mortar joints of wall faces exposed or painted in the completed work shall not be noticeable when viewed from a distance of 15'.
- 1.5 SOURCE QUALITY CONTROL
 - 1.5.1 The Consultant may appoint an independent testing company to test each type of masonry unit and mortar. Tests for masonry units shall be in accordance with CSA S304, and CSA A165 as appropriate. Submit products selected at random in presence of Consultant to the testing company for testing when directed.
 - 1.5.2 Submit unit compression test and net area and absorption tests to Consultant prior to delivery of materials to the site.
 - 1.5.3 Include testing cost as part of this Section.
- 1.6 FIELD QUALITY CONTROL
 - 1.6.1 Perform field quality control tests as part of work of this Section.
 - 1.6.2 Perform site tests to determine moisture content of unit at time of delivery to site.
 - 1.6.3 Submit three test reports for each type of mortar and grout in accordance with CSA A179 .
 - 1.6.4 Site test clay masonry units to determine initial rate of absorption in accordance with CSA A179.
- 1.7 SUBMITTALS
 - 1.7.1 Submit two samples of each type of masonry unit, reinforcing, ties, anchors, accessories and cured coloured mortar for approval before delivery of materials to the site.
 - 1.7.2 Submit two brick samples, each consisting of 6 bricks, showing range of colours and texture, stacked with simulated joints.
 - 1.7.3 Submit layout of cavity wall locations for approval.
 - 1.7.4 Products on site shall match approved samples.
 - 1.7.5 Shop Drawings: Submit shop drawings indicating the following:
 - .1 Indicate sizes, profiles, coursing, and locations of special shapes for concrete masonry units.
 - .2 Indicate sizes, profiles, and locations of each stone trim unit required.
 - .3 Detail corner units, end dam units, and other special applications for fabricated flashings.

- 1.7.6 Informational Submittals: Provide the following submittals when requested by the Consultant: Submit ULC Assembly Listings and Materials cut sheets for fire rated assemblies as follows:
- .1 Not later than 30 working days following Award of Contract, submit copies of ULC Assembly and Materials Listing for indicating ULC Number and how assembly meets the rating criteria for assemblies listed on drawings or meets requirements of Supplementary Standard SB-3 of Ontario Building Code
 - .2 Use the same system and material as would be required for a tested assembly for the project; ULC Listings are tested with the specific materials indicated; substitutions will not be permitted unless evidence of equivalency is confirmed.
 - .3 Submit manufacturer's product data for materials and prefabricated devices, providing descriptions are sufficient for identification at job site; include manufacturer's printed instructions for installation.
- 1.8 MOCK-UP
- 1.8.1 Prior to commencement of work, construct a 1000 mm (40") high and 1500 mm (60") long sample wall for each type of masonry wall on site at locations on the building approved by the Consultant.
- 1.8.2 Allow Consultant to inspect sample wall during the various stages of its construction.
- 1.8.3 Sample wall shall show the specified mortar, bond, joint treatment, back-up masonry, cast-in-place concrete and metal stud, reinforcement, insulation, vapour barrier, and flashing where applicable. Remove rejected sample walls from site. Approved sample wall may form part of the completed work. All work shall match approved sample wall.
- 1.8.4 Co-ordinate erection of sample wall with Sections providing back up construction.
- 1.9 PRODUCT DELIVERY, STORAGE AND HANDLING
- 1.9.1 Deliver and store masonry units, palletized, level and under protective covering. Do not overload structure.
- 1.9.2 Protect materials and products from deterioration by weather, mechanical damage and other causes, and from soiling.
- 1.9.3 Keep masonry materials and products completely free from frost, snow and ice.
- 1.10 COLD WEATHER WORK
- 1.10.1 Comply with CSA A371 and the following:
- .1 Where possible, deliver materials required to the site in advance of freezing temperatures.
 - .2 Use dry, unfrozen masonry units.
 - .3 Building on frozen work is prohibited. Remove sections of masonry deemed frozen and damaged before continuing construction of that section.
 - .4 Do not use scorched sand, salts, or anti-freeze admixtures.

1.10.2 Cold Weather Construction Requirements

.1 Provisions for work in progress:

Condition	Requirement
Ambient temperature above 40°F (4.5°C)	Normal construction practice. Cover stored materials.
Ambient temperature below 40°F (4.5°C) or temperature of units below 40°F (4.5°C)	Heat mortar materials to produce mortar temperatures between 40°F (4.5°C) and 120°F (49°C) at time of mixing. Maintain mortar above freezing until used in masonry. If units have a temperature below 20°F (-7°C), heat to above 20°F (-7°C). Remove visible ice from units.

Condition	Requirement
Ambient temperature is between 25°F (-4°C) and 20°F (-7°C)	Heat masonry under construction from both sides. Install wind breaks when wind velocities reach 15 mph (24 km/h).
Ambient temperature is below 20°F (-7°C)	Provide heat enclosure for masonry under construction and maintain temperature above 32°F (0°C) within that enclosure.

2. Protection of newly completed work:

Condition	Requirement
Mean daily temperature above 40°F (4.5°C)	Normal construction practice. Cover top of unfinished masonry work to protect it from weather.
Mean daily temperature between 40°F (4.5°C) and 25°F (-4°C)	Cover completed masonry with weather resistive membrane to protect from rain or snow for 24 hours after construction.
Mean daily temperature between 25°F (-4°C) and 20°F (-7°C)	Cover masonry with insulating blankets or equivalent protection for 24 hours after construction.
Mean daily temperature below 20°F (-7°C)	Maintain temperature of masonry above 32°F (0°C) for 24 hours after construction.

1.11 HOT WEATHER PROTECTION

- 1.11.1 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.

PART 2 - PRODUCTS

2.1 MATERIAL

- 2.1.1 Concrete block: CSA A165.1, autoclaved, low pressure steam or bubble cured. All interior walls and partitions corners to be bullnose unit.

- .1 Classification: S/15/A/M, 75% solid for all locations where structural members bear on concrete block.
- .2 H/15/A/M, for all other block work.
- .3 Fire Resistant Concrete Masonry Units: Manufactured in accordance with CSA A165:
 - .1 2 Hour Fire Rating: H/15/C/O
 - .2 1 Hour Fire Rating: H/15/A/O
- .4 Size: Modular imperial to sizes indicated on Drawings.
- .5 Special shapes:
 - .1 Provide square units for exposed corners.
 - .2 Provide purpose made shapes for lintels and bond beams.
 - .3 Provide additional special shapes required for project.
 - .4 Manufacture special shapes at same time and with the same batch as standard concrete block to be used.

- 2.1.2 Metric Brick: ASTM C216 Standard and CSA A-82 exterior grade masonry unit, Modular, Architectural series type FBX by Brampton Brick or equivalent, texture and colour to be confirmed by Architect.

- .1 Special shapes: Provide special sizes and shapes as shown on drawings and as required including but not limited to, plain ends, halves, jambs, sash, lintel, bullnose, and other shapes. Special shapes shall be manufactured to shape, not cut.
- .2 Notwithstanding the appearance requirements of the above mentioned CSA Standards, block shall be free from all surface indentations, surface cracks and other defects detrimental to the appearance of the finished surface. Block having visual defects shall be rejected for exposed areas but may be used for concealed or unfinished areas.
- .3 Efflorescence: When testing in accordance with CSA A82.2, concrete blocks shall be efflorescence free.
- .4 Freeze/thaw resistance: Free of disintegration, weight loss, delamination, and pop outs when tested in accordance with CSA A165.3.
- .5 Load bearing, hollow, normal weight units: H/15/A/M.
- .6 Walls and partitions exposed to weather, normal weight: H/15/A/M.
- .7 Load bearing, solid normal weight units: S/15/A/M.
- .8 Load bearing, solid, lightweight units: S/15/B/M.
- .9 Load bearing, hollow, lightweight units: H/15/B/M.
- .10 Non load bearing, hollow, normal weight units: H/15/A/M.
- .11 Non load bearing, solid, normal weight units: S/15/A/M.
- .12 Non load bearing, hollow, lightweight units: H/15/B/M.
- .13 Non load bearing, solid, lightweight units: S/15/B/M.
- .14 Fire ratings: Provide concrete blocks having void to solid ratios and aggregate as required to achieve required fire ratings for width of fire rated walls shown. Use concrete block units as specified above and of special aggregate type L1 as required to obtain fire

- ratings of walls, which cannot be achieved with concrete block units of standard type S or N aggregates.
- .15 Aggregates for light weight concrete blocks: ASTM C331.
 - .16 Aggregates for normal weight concrete blocks: CSA A23.1.
 - .17 Architectural concrete block: 2-Rib, Split-Face,.
 - .18 Supply masonry units in compliance with "Intended Use of Different Types of Masonry Units as listed in Appendix 'C' of CSA A165.1..
- 2.1.3 Architectural Block: Architectural Block series by Brampton Brick or equivalent, texture and colour to be confirmed by Architect.
- 2.1.4 Portland cement: Type 10.
- 2.1.5 Masonry cement: Type H or Type L.
- 2.1.6 Sand: CSA A82.56M, as amended by CSA A179.
- 2.1.7 Lime: ASTM C207, hydrated lime.
- 2.1.8 Water: Clear and free from injurious amounts of deleterious substances.
- 2.1.9 Colour pigments: Pure mineral pigment, mineral oxide content minimum 70%. Fillers; inert. Maximum carbon black content; 1% water soluble matter. Colours to be selected by Consultant to match existing mortar at exterior brick.
- .1 Extra Strong Colour by Elementis Pigments Inc.,
 - .2 Staybrite by Sternson Limited, or other approved manufacture.
- 2.1.10 Non-shrink grout: Minimum compressive strength of 35 Mpa (5000 psi) at 28 days. Include non-ferrous expansion agents where exposed to view or weather.
- .1 Sika Grout 212 By Sika,
 - .2 Sealtight CG-86 by W.R. Meadows of Canada Ltd.,
 - .3 Thoro Multigrout by Harris Specialty Chemicals, or other approved manufacture
- 2.1.11 Parging mortar: Type N, having a compressive strength of 5.0 Mpa (759 psi) minimum, 1 part Portland cement to not less than 2 1/2 nor more than 3 1/2 parts sand by volume.
- 2.1.12 Control joint material:
- .1 Rapid Control Joint by Dur O Wal Limited,
 - .2 Titewall BL-A by Blok lok Ltd., or other approved manufacture.
- 2.1.13 Premoulded filler: 100% over sized:
- .1 Rodofoam PR grade by Sternson Limited,
 - .2 Sealtight Rescor by W.R. Meadows of Canada Ltd., or other approved manufacture.
- 2.1.14 Mineral wool filler: Mineral fibre batt insulation by Roxul Company, or other acceptable equivalents.
- 2.1.15 Through-wall flashing material: Modified bitumen, glass scrim reinforced elastomeric, 0.9 mm (35 mils) thick, Blueskin TWF by Henry Company, or other approved manufacture.

2.1.16 Flexible anchors and adjustable ties: 9 gauge galvanized rods.

2.1.17 Horizontal reinforcing:

- .1 Reinforcing: Truss type, consisting of 9 ga. wire complying with CSA G30.3, two side rods welded to a continuous diagonal formed cross rod forming a truss design with alternating welds not exceeding 8". Width of reinforcing unit shall be 1 1/2" less than nominal thickness of wall, BL 30 Blok Truss by Blok Lok or other approved manufacture.
- .2 Galvanizing: ASTM A116 Class 3 mill galvanized for interior walls and ASTM A153 Class B2 hot dipped galvanized after fabrication for exterior walls.

2.1.18 Masonry Unit Veneer/Concrete or Concrete Masonry Unit Substrate Tie Systems:

- .1 Backer Plate: Fabricated from stainless steel meeting requirements of CSA A370-04(R2009) and ASTM A1011/A101aM-12; designed to transfer wind loads to steel stud framing; length to suit total cavity, insulation and sheathing thickness, as detailed on Drawings.
- .2 Ties: Wire ties fabricated from stainless steel wire in accordance with CSA G30.18-09; length to allow for cavity width and to extend minimum 2" into masonry unit joint.
- .3 Fasteners: Self tapping metal screws to metal stud backup as recommended by tie manufacturer consisting of close tolerance bits for use in percussion drills, and hammer driven anchors with pullout strengths of 5.4 kN for 20 MPa concrete and 3.75 kN for hollow concrete masonry unit with a 1" embedment:
 - .1 Fero Holdings Ltd., Rap-Tie System
 - .2 Blok-Lok, BL-407

2.1.19 Insulation fasteners: Wedge Lok by Block Lok Limited.

2.1.20 Interior and Exterior Single Wythe Concrete Block Walls:

- .1 Single wythe interior and exterior concrete block walls: Horizontal reinforcement shall be ladder type or truss type having two parallel side rods 3/16" diam. welded to 3/16" cross rods forming a ladder or truss design. Side rods shall be notched or knurled. Design ladder or truss reinforcement to allow placement of side rods at center-line of both face shells of concrete block.

2.1.21 Minimum corrosion protection for masonry connectors and horizontal reinforcing, as outlined in CSA A370:

- .1 Interior masonry not subjected to moisture; Mill galvanized carbon steel.
- .2 Interior masonry subject to moisture, below grade masonry in contact with ground, and above grade exterior masonry in buildings less than 32'-0" in height (measured from the floor level of the first storey); Hot-dipped galvanized after fabrication with minimum zinc coating in accordance with ASTM A153, Class B wire ties/reinforcing 1.5 oz/ft² and ASTM A123 plates/strips/sheets 2 oz/ft², on each face.

2.1.22 Masonry connectors shall meet the following performance tolerance requirements as outlined in CSA A370:

- .1 Deflection; Maximum 3/32" including free play when acted upon by a lateral load of 0.05 ton force in all possible positions.
- .2 Linkage preventing separation of components i.e. brick tie/connector reinforcing, etc.
- .3 Free play of multi-part connectors; not more than 0.048" when assembled in all possible configurations and not subject to a load.

2.1.23 All steel anchors, reinforcement and other accessories: Stainless steel conforming to ASTM A167 or hot dip galvanized, complying with CSA G164, as herein specified.

2.1.24 Trim Units: Manufactured in accordance with CSA A165, and as follows:

- .1 Architectural Sill Profile:
 - .1 Size: 5-1/2" deep, complete with drip edge, 3-1/2" high, and angled to 3-1/4" high, with beveled edges.
 - .2 At locations requiring sills to wrap a corner, provide corner sill unit as a one (1) piece unit completed with beveled profile to match adjacent sill units. Miter joints are not permitted, unless prior written approved by the Consultant is obtained.
 - .3 Colour: As indicated on the Drawings.
 - .4 Basis of Cambridge Series, Architectural Sills Model R24/3.5 Angled, by Richvale York Block Inc.

2.2 MORTAR TYPES

2.2.1 Mortar types in parts by volume, complying with CSA A179-M shall be as follows:

TYPE	PORTLAND CEMENT	HYDRATED LIME OR LIME PUTTY	MASONRY CEMENT TYPE H	AGGREGATE LOOSE DAMP CONDITION	28 DAY COMPRESSIVE STRENGTH
S	1	1/2	0	4-1/2	12.5 MPa (1800 psi)
	1/2	0	1	4-1/2	
N	1	1	0	6	5 MPa (750 psi)
	0	0	1	3	

2.2.2 Use premixed masonry mortars prepared with Betomix 1.1.6 and Betomix Plus, by Daubois Inc., or other approved manufacture, for exterior face work.

2.2.3 Other masonry cement may be used only on interior masonry.

2.2.4 Add colouring pigment to mortar for face work if required. Colours shall be as later directed to match existing mortar at exterior brickwork. Under no circumstances shall colour pigment loading exceed 6% per 55 lb. of dry mixed mortar. Mix colouring pigment into mortar in accordance with manufacturer's written instructions and as required to ensure colour uniformity and consistency.

2.3 MORTAR LOCATIONS

2.3.1 Type SW hard burned clay face brick with initial rate of absorption range of 10 to 20 grams: Type N.

2.3.2 Back up masonry to exterior walls: Type S.

- 2.3.3 Bearing courses: Type S. Rake joints back 1/2" if such courses are to be exposed and point to match remainder of wall.
- 2.3.4 Non load bearing partitions: Type N.
- 2.3.5 Grout in around all beams, joists, truss bearing plates bearing on masonry work: Type S.

2.4 MORTAR PREPARATION

- 2.4.1 Measure and mix mortar products accurately according to CSA A179. Proportion products by either the property specifications or the proportion specifications of CSA A179.
- 2.4.2 Mortar of the products and proportions used shall be mixed to an initial flow of 100% to 115% and shall have a flow after suction of not less than 70% of original flow.
- 2.4.3 Do not mix different types of mortar in the same mixer unless the mixer is thoroughly cleaned first.
- 2.4.4 When air temperature is 27°C or higher, use and place mortar in its final position within two hours of mixing it. When air temperature is less than 27°C use and place mortar in its final position within 2 1/2 hours of mixing it. Discard mortar not used within above times.
- 2.4.5 Mortars which have stiffened within mix/use time limits due to moisture evaporation may be re tempered by adding enough water as is necessary to produce proper workability consistent with the initial rate of absorption of the masonry units.

2.5 GROUTS

- 2.5.1 Measure and mix grout products accurately according to CSA A179M.
- 2.5.2 Do not mix different types of grout in same mixer or mixer used for mixing of mortar unless mixer is thoroughly cleaned.
- 2.5.3 Use and place grout in its final position within 2 1/2 hours of mixing it. Discard grout not used within 2 1/2 hours.
- 2.5.4 Grout types by volume shall be as follows:

TYPE	PORTLAND CEMENT	HYDRATED LIME OR LIME PUTTY	AGGREGATE MEASURED IN LOOSE DAMP STATE
<hr/>			
Fine			
Grout	1	0 to 1/10	2-1/4 to 3 times the sum of the cementitious materials
<hr/>			
Coarse			
Grout	1	0 to 1/10	1 to 2 times the sum of the cementitious materials
<hr/>			

- 2.5.5 Use coarse grout where required, in spaces 2" or more in least horizontal dimension. Use fine grout in spaces less than 2" in horizontal dimension.

2.6 ACCESSORIES

2.6.1 Weepholes: PVC 'T' shaped brick vents by Goodco Limited, or cadmium plated airplane type 'Weep Holes-343' by Blok-Lok Limited, set 32" O.C. for architectural block in the following locations:

- .1 Bottom course of manufactured stone masonry units throughout;
- .2 Top courses of manufactured stone masonry units throughout.

2.6.2 Mortar Dropping Control Devices:

- .1 High density, polyethylene or nylon woven mesh type mortar dropping control devices with trapezoidal "zigzag" shaped top edge, designed to allow moisture/water to flow/drain downward in cavity/collar joints to the weepholes, thicknesses to suit cavities and collar joints, 'The Mortar Net' by Mortar Net USA Ltd., and distributed by JV Building Supply, division of Consolidated Materials Corporation, or approved equal.

PART 3 - EXECUTION

3.1 LINES AND LEVELS

3.1.1 Provide general lines and levels. Be responsible for accurate dimensions, lines and levels of work of this Section. Make work plumb and true.

3.2 CUTTING AND PATCHING

3.2.1 Do all cutting, fitting and patching of masonry to receive work of other trades, to make work properly come together and to make good to match adjacent masonry.

3.3 BUILT INS

3.3.1 Install items supplied by other trades to be built into masonry walls, plumb, level, properly aligned, rigid and secure. Build in miscellaneous metal work, loose lintels, bearing plates, sleeves, anchor bolts, anchors, wood nailers and all other items which required attachment or building into the masonry.

3.3.2 Set access doors and panels with front face flush with final wall finish. Such fittings shall be located precisely as directed.

3.3.3 Anchor steel door frames in place and build masonry around them. Do not attach door frames to walls by fastening to wood nailers. Use steel anchors. Solidly grout voids between masonry and steel frames for doors full with masonry mortar or fine grout. Keep exposed faces of frames free from mortar. Remove droppings promptly.

3.4 PROVISIONS FOR OTHER TRADES

3.4.1 Provide openings in masonry walls where required or indicated.

3.4.2 Accurately locate chases and opening and neatly finish to required sizes.

3.4.3 Where masonry encloses conduit or piping, bring to proper level indicated and as directed. Do not cover any pipe or conduit chases or enclosures until advised that work has been inspected and tested.

3.5 ERECTION – GENERAL

- 3.5.1 Erect masonry to correct dimensions, plumb, true and with level courses.
- 3.5.2 Maintain joints vertical in alternate courses or as broken by bond pattern in line, throughout the entire height.
- 3.5.3 Reinforce masonry as required, to support wall mounted equipment, building components and fixtures provided under other Sections.
- 3.5.4 Verify the loads to be supported and the arrangement and type of fastenings with the appropriate Section.
- 3.5.5 Lay masonry exposed to view or to receive a brushed or sprayed finish carefully with even joint widths, and with exposed faces flush and even throughout. Broken corners and spoiled units are not acceptable. Do not use units which are too contrasting in appearance. Provide satisfactory blending of tones and textures.
- 3.5.6 Where resilient base is indicated, tool joints to within 4" of the floor. Strike joints at base flush.
- 3.5.7 Lay block to receive adhesive-applied gypsum board plumb, with joints finished flush.
- 3.5.8 Level, align and plumb masonry for application of thin set applied ceramic tile to requirements of 09 30 00 - Ceramic Tile, with joints struck flush.
- 3.5.9 The corners of concrete masonry units projecting into habitable areas and exposed or painted in the finished work shall be single or double bullnosed as required to suit the particular location. Lay specially shaped masonry units required or shown on Drawings.
- 3.5.10 Completely fill and tool head and bed joints to provide support for vapour barrier adhesive.
- 3.5.11 Completely fill joints in solid block masonry with mortar. Fully cover the end areas and bearing areas of the face shells of hollow units with mortar.
- 3.5.12 Provide anchors, ties, crimps, and other mason's iron work required for the construction of the work.
- 3.5.13 Build in anchors, nailers, accessories, flashings and other items required as the masonry work progresses. Solidly fill with non-shrink grout all voids in masonry into which anchor bolts or other connection materials are built.
- 3.5.14 Fill hollow metal door and borrowed light frames occurring in masonry with grout.
- 3.5.15 Provide grout setting bed for flashing under window sills.
- 3.5.16 Determine the location and size of openings to be left in masonry walls for heating, ventilating, plumbing, electrical fixtures, ducts, boxes and other items. Pass conduits and piping through hollow cells of blocks or build around them and split blocks. Build chases and openings as required accurately located and neatly finished, as the work progresses. Cut block for electrical boxes and recessed equipment accurately using a carborundum saw. Provide square clean edges.
- 3.5.17 Tooth new masonry into existing, where existing openings are to be filled in. necessary for construction purposes to "stop-off" a horizontal run of masonry, rake back 1/2-block length in each course. Tothing is not permitted, except with the written approval of the Consultant.

- 3.5.18 Tool joints in exposed masonry to a neat concave finish using 5/8" diameter non staining tool. Before tooling, ensure that surface of mortar is thumb print hard and has lost water sheen. Strike joints flush in concealed locations. Rake alternate joints back 1/2" where masonry is to receive plaster directly. Do not rake back joints containing reinforcing.
- 3.5.19 Where fresh masonry joins masonry that is partially or totally set, clean and lightly wet the exposed surface of the set masonry so as to obtain the best possible bond with the new work.
- 3.5.20 Where the joints in interior masonry will be apparent in the completed building, start interior walls and the back-up masonry for exterior walls with a 4" starter course, or as necessary to achieve a neat appearance at the door head/lintel condition.
- 3.5.21 Where insulation and vapour barrier are to be built into masonry walls. Co-ordinate the erection of the masonry with the installation of insulation under Section 07 21 00, Building Insulation. Strike joints flush on exterior face of interior wythes and parge this surface with a 1/4" thick coating of cement mortar. Trowel surface smooth to receive vapour barrier adhesive. Build exterior wythe tight to completed insulation.
- 3.5.22 Provide light weight aggregate as required for fire rated partitions.
- 3.5.23 Lay all joint 3/8" thick unless otherwise specified or indicated on Drawings.
- 3.5.24 Use lightweight aggregate units for concrete masonry visible or painted in the finished work.
- 3.5.25 Other masonry units shall be of lightweight aggregate or of regular sand and gravel aggregates.
- 3.6 COMPOSITE EXTERIOR WALLS
- 3.6.1 Construct exterior brick masonry using brick to match existing brick. Use only clean, sound brick. Brickwork shall match adjacent existing brickwork in coursing, bonding, colouring of brick and mortar and shall blend into existing, to approval of Consultant.
- 3.6.2 Tooth new brickwork into existing.
- 3.6.3 Supply insulation fasteners to Section 07 21 00 for installation.
- 3.7 PARTITIONS
- 3.7.1 Unless otherwise shown or specified, lay concrete block masonry in running bond.
- 3.7.2 Build up non load bearing walls to within 1" of underside of structure unless shown otherwise. Obtain lateral support anchors from Section 05 10 00. Secure lateral support anchors to structure along wall. Perform necessary drilling of concrete. Where junction of wall and structure will be visible in the completed building, lay sash block so that grooves engage in legs of metal anchors such that anchorage is concealed. Where junction of wall and structure will be concealed, lay top course to engage lateral support angles. Install mineral wool filler in void between top of wall and underside of structure. Cut filler around legs of concealed anchors. Leave ready for caulking.
- 3.7.3 Use concrete aggregate block for walls and partitions on slabs on grade. At all other locations use light weight block.
- 3.7.4 Carry partitions up through ceiling to slab or metal deck above.

3.7.5 Where walls and partitions are pierced by structural members, ducts, pipes, fill voids with mortar to within 1" of such members flush with wall face. Fill spaces between partition and structural members, ducts and pipes with glass fibre or mineral wool insulation compressed 50% completely from one side of wall to other.

3.8 REINFORCING AND ANCHORING

3.8.1 Reinforce and anchor masonry as required by local by laws when greater requirements are not specified or shown.

3.8.2 Unless otherwise shown, tie walls at corners in masonry bond, alternate courses.

3.8.3 At wall intersections, terminate one wall at the face of the other and build in prefabricated sections of truss type connectors at 16" o.c. vertically.

3.8.4 Provide horizontal reinforcing above first block course above floors slab and in first block course below floor slab, with box ties to anchor face masonry to back up.

3.8.5 Reinforce hollow concrete masonry walls with truss reinforcing every 16" o.c. to suit wall thickness.

3.8.6 Cut alternate continuous reinforcing at control joints in straight walls. Lap splices in continuous length reinforcing 6".

3.8.7 Install masonry reinforcing in two consecutive courses above and below openings in walls, extending not less than 3' 0" on both sides of opening.

3.8.8 Use adjustable wall ties where the horizontal joints in adjacent wythes of masonry walls requiring reinforcing are not in vertical alignment. Install ties 12" o.c. horizontally and 16" vertically.

3.8.9 Solidly fill with mortar all voids in masonry into which anchor bolts, reinforcing steel or other connection materials are built.

3.9 LINTELS

3.9.1 Lintels over openings in masonry shall have a minimum bearing of 8" on each side of opening. Provide building paper bond barrier at ends and under bearing parts of lintels.

3.9.2 Install loose steel lintels and bearing plates. Grout under lintels and/or bearing plates at each jamb with full bed of mortar.

3.9.3 Provide reinforced concrete block lintels of same thickness as wall for block walls of less than 8" thickness and for other block walls where units are to be painted or visible in the completed work. Construct lintels with special concrete lintel units. Supervise the filling of voids of units with concrete and their reinforcing with deformed steel bars. Cure before applying loads. Provide temporary support for lintels consisting of a level platform, true to the proper elevation and of sufficient strength to support the load without visible deflection. Maintain supports in place for a minimum of 7 days and for a period sufficient to permit the concrete to cure and gain sufficient strength to safely support all loads. Lay masonry units with full mortar coverage on all abutting edges with joints shoved tight. Where masonry construction is continued above the lintel, place the first course of masonry units on the lintel in a full mortar bed.

3.10 BEARING AND ANCHORAGE

3.10.1 Provide at least 16" of 100% solid masonry under bearing of beams, girders, trusses and lintels extending 8" beyond each side of bearing, at least 8" of 100% solid masonry under joists and under slabs. Hollow units filled with concrete are not acceptable. Provide a concrete distribution pad in lieu of solid masonry specified above for bearing plates anchored with bolts. Solid masonry in locations visible in the completed work shall be of same material and appearance as adjacent wall surface.

3.11 INSTALLATION DAMPPROOF COURSES

3.11.1 At walls having grout fill, turn dampproof course material up at least 8" on the face of the back-up masonry and terminate in a reglet.

3.11.2 In all cases extend dampproof course material through full thickness of face masonry.

3.11.3 Make 100% watertight seal between dampproof course material strips with waterproof adhesive. Make 100% watertight seal between dampproof course material and items passing through it.

3.12 REPOINTING

3.12.1 Cut back defective joints 1/2" taking care not to damage units. Remove dust and loose materials by brushing or by water jet. If water jet is used, allow excess water to drain before repointing.

3.12.2 Repoint with mortar similar to original mortar mix. Pre hydrate mortar by mixing with only a portion of required water, two hours before use. At end of curing period, rework mortar, adding remaining water.

3.12.3 Pack mortar tightly in thin layers and tool to required joint finish.

3.13 CLEANING

3.13.1 Clean masonry according to masonry unit manufacturer's written instructions.

3.13.2 Where mortar or stains cannot be removed as specified above, propose other methods to the Consultant for approval. Employ methods approved by the Consultant and remove mortar and stains.

3.14 PROTECTION

3.14.1 Provide and maintain protection against entry of moisture into masonry whenever work is interrupted. Use non staining water repellent paper, polyethylene sheet or tarpaulins overhanging walls 2' 0" minimum and secured in place to prevent wind uplift. Similarly protect exposed ledges to be covered by flashing or other material until such materials are installed.

3.14.2 Provide and maintain protective non staining boards to external corners which may be damaged by construction activities. Secure protection without damaging the work.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

- 1.1.1 Comply with Division 1, General Requirements and all documents referred to therein.
- 1.1.2 Provide all labour, materials, products, equipment and services required to complete the metal fabrications work necessary and/or indicated on the Drawings and specified herein including all metal work which is not specified elsewhere.

1.2 REFERENCES

- 1.2.1 ASTM A53/A53M-12: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- 1.2.2 ASTM A123/A123M-13 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- 1.2.3 ASTM A143/A143M-07(2014) Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedures for Detecting Embrittlement.
- 1.2.4 ASTM A153 / A53M-09 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- 1.2.5 ASTM A167-99(2009) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate.
- 1.2.6 ASTM A307-14 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
- 1.2.7 ASTM A325-14 Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- 1.2.8 ASTM A394-08(2015) Standard Specification for Steel Transmission Tower Bolts, Zinc-Coated and Bare.
- 1.2.9 ASTM A563-15 Standard Specification for Carbon and Alloy Steel Nuts.
- 1.2.10 ASTM A653/A653M-15 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- 1.2.11 ASTM A780/A780M-09(2015) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
- 1.2.12 ASTM 1011/A1011M-14 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength, Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra High-Strength.
- 1.2.13 ASTM C939-10 Standard Test Method for Flow of Grout for preplaced-aggregate Concrete (Flow Cone Method)

- 1.2.14 ASTM C1107/1107M-14a Standard Specification for Packaged Dry Hydraulic-Cement Grout (Nonshrink)
- 1.2.15 CAN/CGSB 1.108-M89 Bituminous Solvent Type Paint.
- 1.2.16 CAN/CGSB 1.171-98 Inorganic Zinc Coating.
- 1.2.17 CAN/CGSB 1.181-99 Organic, Ready Mixed, Zinc Rich Coating.
- 1.2.18 CAN/CSA-G40.20-04(R2009) General Requirements for Rolled or Welded Structural Quality Steel.
- 1.2.19 CAN/CSA-G40.21-04(R2009) Structural Quality Steel.
- 1.2.20 CAN/CSA G164-M92 (R2003) Hot Dip Galvanizing of Irregularly Shaped Articles.
- 1.2.21 CISC/CPMA 2-75 Quick-Drying Primer For Use on Structural Steel.
- 1.2.22 CSA W47.1-09(R2014) Certification of Companies for Fusion Welding of Steel Structures.
- 1.2.23 CSA W47.2-11 Certification of Companies for Fusion Welding of Aluminum.
- 1.2.24 CSA W59-13 Welded Steel Construction (Metal Arc Welding).
- 1.2.25 CAN/CSA W117.2-12 Safety in Welding, Cutting and Allied Processes.
- 1.3 QUALIFICATIONS OF WELDING
 - 1.3.1 Welding of steel and aluminum shall be undertaken only by a fabricator fully approved by the Canadian Welding Bureau and CSA W47.1 and CSA W47.2, as may be applicable.
 - 1.3.2 Conform to safety requirements of CAN/CSA W117.2 for welding operations.
- 1.4 DESIGN
 - 1.4.1 Design the work of this Section in accordance with the Ontario Building Code and the by-laws of the local municipality.
 - 1.4.2 Maximum deflection for individual members shall not exceed 1/360th, of the span.
 - 1.4.3 Work of this Section which will support other items or will be required to support structural loads of any nature shall be designed by a Professional Structural Engineer registered in Ontario and who shall affix his/her professional seal and signature to the shop drawings for such items.
 - 1.4.4 Work of this Section to be executed by firm thoroughly conversant with laws, by-laws and regulations which govern, and capable of workmanship of best grade of modern shop and field practice known to recognized manufacturer's specializing in this work.
- 1.5 SUBMITTALS
 - 1.5.1 Shop drawings:

- .1 Make thorough examination of drawings and details, determine the intent, extent, and materials, and be fully cognizant of requirements when preparing shop drawings.
 - .2 Submit shop drawings showing and describing in detail all work of this Section including large scale detail of members and materials, of connection and interfacing with work of other Sections, jointing details, and of anchorage devices, dimension, gauges, thicknesses, description of materials, metal finishing, as well as other pertinent data and information.
 - .3 Digital files of design drawings shall not be used in the preparation of shop drawings.
- 1.5.2 Submit necessary templates and instructions where fastenings or anchors have to be built in by other trades.
- 1.5.3 Work designed by a Professional Engineer shall bear signature and stamp of the engineer.
- 1.5.4 Submit adequate written instructions for protection of completed work, and proper methods and materials to be used in cleaning.
- 1.6 **STORAGE, DELIVERY, HANDLING AND PROTECTION**
- 1.6.1 Coordinate deliveries to comply with construction schedule and arrange ahead for strategic off the ground, under cover storage locations. Do not load any area beyond the design limits.
- 1.6.2 Adequately protect and crate all components against damage, dirt, disfigurement and weather during delivery and storage. Damaged materials shall not be used and shall be replaced by approved material.
- 1.6.3 Cover and protect the work of other Sections in the area of work from damage. Make good all damage to the satisfaction of the Consultant.
- Protect the installed work of this Section and on completion the work shall be examined and damage shall be remedied to the complete satisfaction of the Consultant.
- 1.7 **WARRANTY**
- 1.7.1 Warrant Miscellaneous metals work of this Section against defects in materials and workmanship in accordance with General Conditions but for an extended period of two (2) years and agree to repair or replace faulty materials or work which appears during warranty period, without cost to the Owner/Tenant. Defects shall include, but not limited to, deflection, opening of joints, or deterioration of metal.

PART 2 - PRODUCTS

- 2.1 **MATERIALS**
- 2.1.1 Structural Steel Sections and Steel Plate: New stock (not weathered or rusted); to conform to CAN/CSA-G40.21, Grade 300W (44W) and Grade 350W (50W) for wide flange shapes.
- 2.1.2 Hollow Structural Sections (HSS): New stock; to conform to CAN/CSA-G40.21, Grade 350W (50W), Class C, stress relieved.
- 2.1.3 Sheet Steel (Structural Quality): Conforms to ASTM A1011/A1011M.
- 2.1.4 Sheet Steel (Commercial Quality): Conforms to ASTM A653/A653M, stretcher levelled or temper rolled.

- 2.1.5 Tube: Conforms to ASTM A53.
- 2.1.6 Welding materials: Complying with CSA W59.
- 2.1.7 Interior primer: Complying with CISC/CPMA 2-75, oil alkyd type.
- 2.1.8 Stainless steel: Type 302 or 304 alloy, complying with ASTM A167.
- 2.1.9 Aluminum sheet: 1100 alloy, H14 temper, anodizing quality.
- 2.1.10 Aluminum extrusions: Alcan 6063 alloy, T5 temper.
- 2.1.11 Steel members, fabrications and assemblies shall be galvanized after fabrication by the hot dip process in accordance with CAN/CSA G-164 or ASTM A123.
- 2.1.12 Bolts, nuts and washers and iron and steel hardware components shall be galvanized in accordance with CAN/CSA G-164 or ASTM A153. Nuts and bolts shall be supplied in accordance with ASTM A307, A325, A394 and A563 as applicable.
- 2.1.13 Products shall be safeguarded against embrittlement in conformance with ASTM A143.
- 2.1.14 Organic zinc rich primer: Complying with CAN/CGSB 1.181 "Galvafruid SB Grade" by W.R. Meadows of Canada Ltd., "Kem Organic Zinc Rich Primer No. 6430" by Sherwin-Williams Company of Canada Ltd., "Glid-Guard Glid-Zinc Organic Line 5526 Line" by the Glidden Company Limited, or other approved manufacture.
- 2.1.15 Inorganic zinc coating: Complying with CAN/CGSB 1.171, "Glid-Guard Glid-Zinc No. 5535 Line" by Glidden Company Limited, or other approved manufacture.
- 2.1.16 Interior primer for steel: Complying with CISC/CPMA 2-75a.
- 2.1.17 Bituminous paint: Complying with CAN/CGSB 1.108.
- 2.1.18 Non-Shrink Grout: Premixed, high strength, maximum bearing, impact resistant, non-shrink non-metallic aggregate grout having minimum 76 Mpa 28 day compressive strength and conforms to ASTM C939 and ASTM C1107/C1107M, 'Embeco Premixed Grout' by Master Builders Technologies Ltd., or 'Tartan Grout Iron' by Webster & Sons Ltd., or 'Sika Grout 212 HP' by Sika Canada Inc.
- 2.2 FABRICATION
 - 2.2.1 Verify all dimensions on the site before preparing Drawings or proceeding with shop work.
 - 2.2.2 Insofar as practical, execute fitting and assembly in the shop with various parts of assemblies ready for erection at the building site.
 - 2.2.3 Fabricate the work true to dimensions and square. Accurately fit members with hairline joints, and join using adequate fastening.
 - 2.2.4 Construct finished work free from distortion and defects detrimental to appearance and performance.
 - 2.2.5 File or grind exposed welds smooth and flush. Do not leave grinding marks. Construct internal and external corners with sharp lines. Provide continuous welds unless otherwise approved by the Consultant in writing.

- 2.2.6 Fabricate metal work complete with all components required for anchoring to concrete; bolting or welding to structural frames; standing free; or resting in frames or sockets in a safe and secure manner.
- 2.2.7 Weld all connections unless approved otherwise in writing by the Consultant.
- 2.2.8 Execute exposed fastenings neatly where approved and of the same material, colour and finish as the base metal, on which they occur.
- 2.2.9 Counter sink exposed fastenings, where such are approved in writing, and make as inconspicuous as possible with bolts cut off flush with nuts. Construct fastenings of the same material and finish as the base material on which they occur.
- 2.2.10 Insulate contact surfaces to prevent electrolysis due to metal to metal contact or between metal and masonry or concrete. Use bituminous paint, butyl tape, building paper or other approved means.
- 2.2.11 Thoroughly de-scale steel work before delivery to project site. Remove roughness and irregularities, clean with a wire brush, remove oil and grease and prime with one shop coat of paint to a 2 mil thickness.
- 2.2.12 Primer interior steel work supplied under this Section with one shop coat of interior primer.
- 2.2.13 Do not prime the following surfaces:
- .1 steel to be encased in concrete;
 - .2 non-ferrous metals;
 - .3 surfaces and edges to be field welded. If painted, remove paint for field welding for a distance of at least 2" in all sides of the paint.
- 2.2.14 Hot-dip galvanize steel, where specified, in accordance with CAN/CSA G164 (coating weight as prescribed for type of article), or ASTM A653/G90 (coating weight; 1.25 oz./sq.ft.) as applicable. Galvanize after fabrication where possible. Follow recommended precautions to avoid embrittlement of the base metal by overpickling, overheating or during galvanizing.
- 2.2.15 Touch-up galvanized steel where galvanizing is damaged during installation with zinc rich primer, in accordance with ASTM A780.
- 2.2.16 Stainless steel shall be finished in No. 4 bright, brush finish, unless otherwise noted.
- 2.3 ANCHOR BOLTS AND OTHER MEANS OF ANCHORAGE
- 2.3.1 Provide all anchor bolts and expansion bolts or other means of anchorage required for building into floors, walls and ceilings, where it is necessary to secure metal and wood to concrete, masonry or steel work. Supply anchor bolts, nuts and similar hardware to the respective Sections for fastening.
- 2.4 MISCELLANEOUS STEEL SECTIONS
- 2.4.1 Supply and install all steel items not indicated to be supplied under other Sections.
- 2.4.2 Where sections are required to be built into masonry or concrete supply such members to the respective Sections.

2.5 CONCEALED SUPPORT ELEMENTS AND FRAMING

- 2.5.1 Supply and install all support elements and framing as shown on the Drawings for the items listed herein. Construct supports from rolled steel sections assembled by welding.
- 2.5.2 Design supports to withstand, within acceptable deflection limitations, their own weight, the weight of the items to be supported, loads imposed by the motion of supported items, where applicable, and all live loads, static and dynamic which might be applied to the supported items in the course of their normal function. Design supports with a safety factor of 3. Design supports further as required to accommodate structural deflection.
- 2.5.3 Provide all accessories, inserts and fixings necessary for attachment of supports to building structure. Drill supports as required to receive attachment of supported items. Arrange supports to avoid conflicts with pipes, ducts, precast concrete connections, thermal and vapour barrier construction, framing provided under other sections, and such that supports and their fixings are fully concealed from view within the finished work.
- 2.5.4 Paint all supports unless galvanizing is specified.
- 2.5.5 Provide concealed support elements or framing as required for the following items:
 - .1 Vanities.
 - .2 Grab bars occurring on gypsum board partitions.

2.6 LINTELS

- 2.6.1 Supply loose steel lintels to other Sections where required for building into the work. Fabricate lintels as shown on the Drawings. Galvanize lintels which will be exposed to the exterior.
- 2.6.2 Lintels for wall of less than 8" nominal thickness shall be masonry lintels supplied and installed under Section 04200.

PART 3 - EXECUTION

3.1 INSTALLATION

- 3.1.1 Install miscellaneous metals work in the correct locations and positions, plumb, level, structurally sound, securely fastened, free from defects detrimental to finished appearance and to the approval of the Consultant.
- 3.1.2 Install the work of this Section using skilled craftsmen and in accordance with manufacturer's recommendations where applicable.
- 3.1.3 After installation, spot prime field bolt heads and nuts, field rivets, welds and any abrasions or damage to the shop coat of the primer.
- 3.1.4 Perform drilling of steel and/or concrete masonry to fasten the work of this Section.
- 3.1.5 All surfaces prime painted under the Section shall be free from runs, sags, crawls and other defects. This Section shall repair any such defects to the satisfaction of the Consultant.

END OF SECTION

- 1.5.1 All trades must examine practices, as outlined in the related sections, to assist the team in achieving these results.
- 1.5.2 Related Sections:
- .1 01 35 20 General LEED® Requirements
 - .2 01 35 50 Waste Management Disposal
 - .3 01 35 90 Indoor Air Quality Management
 - .4 01 61 10 LEED® Product Requirements
 - .5 31 25 00 Construction Pollution Prevention.
- 1.5.3 Materials used for Work in this section are to include, but are not limited to the following criteria:
- .1 All materials under Work of this Section, including but not limited to, coatings, sealants, primers and adhesives to have low VOC contents in accordance with Section 01 35 90.
 - .2 Composite wood must contain no added urea-formaldehyde resins.
 - .3 Laminate adhesives to contain no urea-formaldehyde.
 - .4 All wood materials used in work of this Section are to be FSC Certified in accordance with Section 01 61 10.
- 1.5.4 The following must be submitted as appropriate for Consultant's review and approval:
- .1 Submit an MSDS or product data sheet stating the VOC and urea-formaldehyde content, along with Schedule A of Section 01 35 90A LEED Product Requirements Schedules following the measures outlined in Section 01 35 90, for all applicable products.
 - .2 Submit Schedules A and D, as appropriate, of Section 01 61 10A LEED Product Requirements Schedules following the measures outlined in Section 01 61 10, for all applicable products.
 - .3 Submit Schedules C and D from Section 01 61 10A LEED Product Requirements Schedules for all FSC certified wood, and Schedule D for all wood, including wood contained in products/assemblies, following the measures outlined in Section 01 61 10.

2 PART 2 - PRODUCTS

2.1 MATERIALS

- 2.1.1 Wood materials: Straight, sawn square, true, dressed four sides, properly sized and shaped to correct dimensions from nominal sizes indicated or specified.
- 2.1.2 Lumber grade and moisture content: Comply with official grading rules of NLGA for the particular lumber and grade, and structurally complying with the latest requirements of the NBC. Use only grade marked lumber.
- 2.1.3 Maximum moisture content of lumber: 7% for interior work, 19% for exterior work.
- 2.1.4 Softwood lumber: Comply with CSA O141-05.
- 2.1.5 Douglas Fir Plywood: Complying with CSA O121-08, COFI Exterior.
- 2.1.6 Framing lumber: Lumber for structural components shall be of species and grade specified, well seasoned, processed and stamped at same mill with appropriate grade markings. Conform to requirements of Standard Grading Rules for Canadian Lumber of National Lumber Grades Authority the (NLGA) with latest supplements, approved by the Canadian Lumber Standards Administrative Board.

- .1 No. 1 Construction grade, Spruce, Balsam Fir, Lodgepole Pine or Ponderosa Pine.
- 2.1.7 All wood materials: Well seasoned, free from defects that would impair strength or durability.
- 2.1.8 Wood curbs: Vacuum/pressure impregnated in accordance with CAN/CSA O80.1 to an average net retention of [6.0 kg/m³][0.40 lb./ft³]. Wolman CCA preservative or other approved manufacture. Species shall be southern pine, ponderosa pine, fir, western hemlock or jack pine.
- 2.1.9 Blocking, concealed framing, cant strips, grounds, nailing strips: No. 2 Ontario White Pine, No. 2 Red Pine, or Construction No. 1 Jack Pine, all complying with the grading rules of NLGA, or Construction Douglas Fir complying with COFI standard grading and dressing rules.
- 2.2 PRESSURE PRESERVATIVE TREATED MATERIALS FOR ALL EXTERIOR APPLICATIONS / FRAMING
 - 2.2.1 Pressure Preservative Treated Lumber: Lumber graded and stamped in accordance with applicable grading rules and standards of associations or agencies approved to grade lumber by Canadian Lumber Standards Accreditation Board in accordance with CAN/CSA O80 Series.
 - .1 Species: Pine or Spruce-Pine
 - .2 Grade: No.2 or better structural posts and lumber, pieces may be grade stamped or shipment certified by letter of compliance.
 - .3 Grading authority: NLGA, paragraph 131CC
 - .4 Material having twisted grain or structural defects affecting integrity of lumber will not be acceptable for this project.
 - .5 Use only material with radius edges, minimum 6 mm.
 - .6 Kiln dry lumber materials to 8% moisture content or less.
 - 2.2.2 Pressure Preservative Treated Plywood: Treated in accordance with CAN/CSA O80 Series, using water-borne preservative to obtain minimum net retention of 4 kg/m³ of wood. Plywood or laminated materials shall be manufactured with exterior grade adhesives. After treatment, plywood shall be kiln dried to moisture content of 8% or less.
- 2.3 PRESSURE FIRE RETARDANT TREATED MATERIALS
 - 2.3.1 Treat by pressure impregnation with fire-retardant chemicals in accordance with CAN/CSA O80 Series to provide classification for flame spread of not more than 25, smoke developed of not more than 75 in accordance with CAN/ULC S102.
 - 2.3.2 All fire retardant wood must comply with the requirements in AWPA Standard C20 for lumber and C27 for plywood.
 - .1 AWPA C20: Structural Lumber, Fire-Retardant Pressure Treatment, lumber materials shall only be of species listed. After treatment, lumber 50 mm or less in thickness shall be kiln dried to moisture content of 8% or less.
 - .2 AWPA C27: Plywood, Fire-Retardant Pressure Treatment, plywood or laminated materials shall be manufactured with exterior grade adhesives. After treatment, plywood shall be kiln dried to moisture content of 8% or less.
 - .3 All species to comply with CAN/ULC S102 for surface-burning characteristics and shall bear identification showing classification and type of fire retardant.
 - 2.3.3 Each piece or bundle of fire-retardant treated material or panel to bear ULC inspection label or stamp attesting to FRS rating indicating flame spread, smoke developed, and fuel contributed classification meeting AWPA standard C20 and C27 for Type A Use.

- 2.3.4 Fire retardant chemicals used to treat lumber must comply with FR-1 of AWPA Standard P17 and shall be free of halogens, sulphates and ammonium phosphate.
- 2.3.5 Acceptable materials: Plywood and lumber materials treated by licensed applicators with fire retardant materials from the following:
 - .1 Hickson Corporation – Dricon FRTW
 - .2 Hoover Treated Wood Products Inc. – Pyro-Guard
 - .3 Chemical Specialties Inc. – D-Blaze
- 2.3.6 Rough hardware: Nails, screws, bolts, lag screws, anchors, special fastening devices and supports as required for the erection of all rough carpentry items.
- 2.3.7 Fastenings, nails, bolts, screws, lag screws, anchors, special fastening devices and supports as required for the erection of all rough carpentry items: Complying with CSA B111.
- 2.4 **FABRICATION**
 - 2.4.1 Comply with CAN/CSA-O86 for all fabrication and assembly of structural components off site, or on site.
 - 2.4.2 Treat wood in contact with masonry, or concrete, with wood preservative before setting in place. Apply preservatives in accordance with the manufacturer's written instructions.
 - 2.4.3 Design construction details for expansion and contraction of materials.
 - 2.4.4 Machine sand surfaces exposed in the finished work. Hand sand to an even smooth surface free from scratches.
 - 2.4.5 Refer to structural drawings for sizes and structural requirements.
- 2.5 **FABRICATION - FIRE RETARDANT TREATMENT**
 - 2.5.1 Pressure fire retardant treat lumber prior to final milling. Each piece shall bear the mark of Underwriters' Laboratories of Canada indicating conformance to Standard CAN/ULC-S102.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

- 3.1.1 Supply all labour, materials, equipment, services and perform all operations required to complete all rough carpentry work to the full intent of the drawings and as herein specified.
- 3.1.2 Consult with and co-operate with other Sections in advance and build-in or make provisions for installation of other work.
- 3.1.3 Provide running members of the longest lengths obtainable.
- 3.1.4 Slowly feed machine-dressed members using sharp cutters. Provide finished members free from drag, feathers, slivers or roughness of any kind. Remove machine marks by sanding.
- 3.1.5 Properly frame material with tight joints and rigidly secure in place. Use glue-blocks where necessary.

- 3.1.6 Design construction methods for expansion and contraction of the materials.
- 3.1.7 Conceal joints and connections wherever possible. Locate prominent joints only where directed.
- 3.1.8 Erect work plumb, level, square and to the required lines.
- 3.1.9 Do not regard blocking, strapping and other rough carpentry indicated as complete or exact. Provide rough carpentry items required for the installation of the work of other Sections. Blocking shall be through-bolted to structure.
- 3.1.10 Set and secure wood level, plumb and to correct locations indicated on Drawings. Ensure horizontal bowing is kept to a minimum.
- 3.1.11 Provide temporary bracing and anchorage required to hold members in place until permanently secured. Ensure member ends have sufficient bearing area.
- 3.2 **INSTALLATION - GROUNDS, STRAPPING AND FURRING**
 - 3.2.1 Install grounds of a thickness required for the application of finishes. Install roomside surfaces of grounds plumb and in true plane throughout. Secure grounds to metal furring with 16 ga. galvanized soft annealed tie wire.
 - 3.2.2 Provide wood furring and strapping for applied facings, cupboards, caseworks, lockers, cubicles etc.
 - 3.2.3 Provide 1" x 2" strapping at 16" o.c. to suit details. Secure to nailing strips.
 - 3.2.4 Furring generally shall be 2" x 2" at 16" o.c. erected to suit job conditions, where indicated.
 - 3.2.5 Shim members as required to provide a true and plumb surface.
- 3.3 **INSTALLATION - CANT STRIPS, BLOCKING AND CURBS**
 - 3.3.1 Apply wood preservative to all surfaces of wood cant strips and blocking to be covered with flashing.
 - 3.3.2 Provide wood blocking as indicated. Provide curbs around roof openings wider than 10" in any direction. Build up curbs of 2" x 6" members to 12" minimum above finished roof level. Bolt or anchor curbs securely in place at 2'-0" o.c. Provide blocking under cants equal to insulation thickness.
 - 3.3.3 Provide 3/4" thick, fire retardant treated, plywood mounting boards as required for mechanical and electrical equipment. Securely fasten to concrete, masonry or gypsum wallboard framing.
 - 3.3.4 Immediately apply, in instance where primed work is cut, a coat of wood preservative to the resulting raw surfaces.
 - 3.3.5 Provide wood blocking for anchoring of window frames.
 - 3.3.6 Provide double studs or wood blocking and bolts in stud partitions for fastening of handrails, grab bars, to be capable of supporting 230 kg (500 lb) downward pull. Provide double studs and blocking for anchoring of door frames, and other items anchored to stud partitions.
 - 3.3.7 Provide 5/8" thick fire retardant treated plywood fastened to metal stud framing, at washroom mirrors. Provide 5/8" thick plywood backing for mirrors fastened to block.

3.3.8 Co-ordinate with Section 09 29 00 - Gypsum Board, the installation of wood blocking for fastening of wall mounted accessories and casework

3.4 INSTALLATION - ROUGH HARDWARE

3.4.1 Supply and install rough hardware, including hardware for temporary enclosures.

3.4.2 Provide fasteners long enough so that at least half their length penetrates into the second member and as recommended by COFI. Minimize splitting of wood members by staggering the fasteners in the direction of the grain and by keeping fasteners well in from edges. Use spiral, annular or resin coated nails for plywood.

3.4.3 Fasten to hollow masonry units with toggle bolt, to solid masonry or concrete with lead expansion shields and lag screws. Do not use organic fibre or wood plugs.

3.5 INSTALLATION - PRESSED STEEL FRAMES

3.5.1 Set frames plumb and square in their exact location. Firmly block and brace to prevent shifting. Shim up where required to ensure proper alignment dimensions from finished floor to head of frame. Install temporary wood spreaders at midheight.

3.5.2 Where pressed steel frames are installed in concrete walls, secure frames to concrete using lead expansion shields and anchor bolts. Perform drilling of concrete as required. Fill recessed bolt heads flush to frame face with approved metal filler and sand smooth.

3.5.3 Install fire rated door frames in accordance with requirements of authorities having jurisdiction to provide the required rating.

3.5.4 Install fire rated door frames in accordance with requirements of National Fire Protection Association and authorities having jurisdiction to provide the required rating.

3.6 PRESSURE PRESERVATIVE TREADED WOOD INSTALLATION

3.6.1 Comply with AWPA M4.

3.6.2 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation. Allow first coating to fully soak into grain before applying second coating in accordance with manufacturer's instructions.

3.6.3 Remove with fine sandpaper, chemical deposits on treated wood to receive applied finish.

3.6.4 Use only hot-dipped galvanized, corrosion resistant nail or screw fasteners. Staples are not acceptable for installation of preservative treated materials.

3.6.5 Use water-borne preservative treated wood for:

- .1 Wood in contact with masonry or concrete,
- .2 Wood within 450 mm of grade,
- .3 Wood decking and fence boards,
- .4 Wood in contact with flashings,
- .5 Wood in contact with waterproofing membranes, confirm compatibility with membrane manufacturer prior to application.

3.6.6 Use oil-borne preservative treated wood for:

- .1 Wood in contact with the ground,
- .2 Wood in contact with freshwater,
- .3 Landscaping timbers,
- .4 Retaining walls,
- .5 Piers or docks,
- .6 Pilings,
- .7 Bases of utility poles,
- .8 Bases of fence posts.

3.7 PRESSURE FIRE RETARDANT TREATED WOOD INSTALLATION

3.7.1 Field Cuts:

- .1 Do not rip, mill or conduct extensive surfacing of fire retardant treated lumber, label will be voided.
- .2 Only end cuts, drilling holes and joining cuts are permitted.
- .3 All cuts on plywood will be considered end cuts.
- .4 Fire-retardant lumber and plywood can be given a light sanding for cosmetic cleaning after treatment.
- .5 Pre-cut to the greatest extent possible before treating.

3.7.2 Fire retardant treated plywood used in structural applications shall be graded or span-rated material.

3.7.3 Use only hot-dipped galvanized, corrosion resistant nail or screw fasteners. Staples are not acceptable for installation of fire resistant treated materials.

3.7.4 Where humidity conditions are such that moisture may condense between hardware and treated wood, hardware shall be back-primed with a corrosive-inhibitive paint.

3.7.5 Back-prime at contact points and fasteners to prevent electrolysis when fire retardant framing members are used in metal buildings.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

- 1.1.1 Comply with Division 1, General Requirements and all documents referred to therein.
- 1.1.2 Provide all labour, materials, products, equipment and services to complete the finish carpentry and millwork necessary and/or indicated on the Drawings and specified herein.

1.2 RELATED WORK UNDER OTHER SECTIONS

- 1.2.1 Section 06 10 00 Rough Carpentry.
- 1.2.2 Section 08 71 00 Finishing Hardware.

1.3 REFERENCES

- 1.3.1 ANSI/NPA A208 2009 Medium Density Fiberboard for Interior Use.
- 1.3.2 ASTM D1037-12 Standard Test Method of Evaluating the Properties of Wood-Based Fiber and Particle Panel Materials.
- 1.3.3 NEMA LD3-2005 High Pressure Paper Base, Decorative Laminates.
- 1.3.4 CAN3-O188.0-M78 Standard Test Methods for Mat Formed Wood Particleboard and Waferboard.
- 1.3.5 CAN3 O188.1-M78 Interior Mat Formed Wood Particleboard.
- 1.3.6 CSA O112 Series-(R2014) Evaluation of Adhesives for Structural Wood Products
- 1.3.7 CSA O121-08(R2013) Douglas Fir Plywood.
- 1.3.8 CAN/CSA O141-05(R2014) Softwood Lumber.
- 1.3.9 CSA 0151-09(R2014) Canadian Softwood Plywood.
- 1.3.10 NFPA 80-2013 Fire Doors and Other Opening Protectives.

1.4 QUALITY ASSURANCE

- 1.4.1 The work of this Section shall be executed by fully equipped, expert craftsmen, highly skilled in millwork fabrication, having a minimum of five (5) years continuous Canadian experience in successful manufacture/fabrication and installation of work of type and quality shown and specified. Submit proof of experience upon Consultant's request.
- 1.4.2 Unless otherwise specified herein comply with the requirements for Custom grade work as set out in the Quality Standards for Architectural Millwork published by the AWI/AWMAC.
- 1.4.3 Supplements and modifications to the above standards as indicated on the drawings or as specified herein shall govern work of this section.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- 1.5.1 Accept delivery of cabinet work and doors.
- 1.5.2 Inspect millwork, cabinet work and doors for damage, upon delivery to the site. Items which cannot be readily corrected by sanding, or do not have primer or sealer applied shall be promptly returned to the manufacturer.
- 1.5.3 Store millwork, casework, and doors in a dry and clean location. If required, store in a temperature and humidity controlled area.
- 1.5.4 Arrange for proper sequence and scheduling of millwork delivery so as not to delay the progress of the work. Prevent materials not reasonably required from accumulating.
- 1.5.5 Be responsible for any damage to doors from time of delivery until accepted by Owner after installation.
- 1.5.6 Provide dry storage areas. Stack materials with 150 mm (6") clearance off the floor.
- 1.5.7 Accept delivery of finishing hardware. Store hardware in a dry, locked and supervised area.
- 1.5.8 Protect installed hardware from damage and blemishes.
- 1.5.9 Protect fire-retardant materials against humidity and moisture.
- 1.5.10 Protect counter tops with 6 mm (1/4") plywood or other suitable sheet material.
- 1.6 SUBMITTALS
 - 1.6.1 Submit shop Drawings for all items showing large scale details of construction. Indicate profiles of members, jointing, fastenings, strapping, cut-outs for mechanical and electrical services and related items.
 - 1.6.2 Submit three 300 mm x 300 mm (12" x 12") samples of wood and plastic laminate veneers, and three 300 mm (12") long samples of wood trim, to be supplied to the project, before proceeding. Samples shall show colours, profiles, edging and construction.
- 1.7 ADMINISTRATIVE REQUIREMENTS
 - 1.7.1 Coordination: Coordinate sizes and locations of framing, blocking, furring, and reinforcements provided by work that is specified in other Sections is complete before starting work of this Section.
 - 1.7.2 Pre-Construction Meeting: Arrange a preconstruction meeting attended by Contractors personnel, Consultant, finish carpentry Subcontractor to discuss:
 - .1 Installation requirements
 - .2 Special surface effects and finishing
 - .3 Coordination of work with adjacent finishes
 - .4 Protection of finishes
 - .5 Acceptability of substrates and quality of materials being used for the project
- 1.8 SITE CONDITIONS
 - 1.8.1 Site Measurements: Verify dimensions by site measurements before fabrication and indicate measurements on Shop Drawings where casework is indicated to fit walls and other construction;

coordinate fabrication schedule with construction progress to avoid delaying the Work; locate concealed framing, blocking, and reinforcements that support woodwork by site measurements before being enclosed and indicate measurements on Shop Drawings.

- 1.8.2 Established Dimensions: Establish dimensions and proceed with fabricating casework without confirmed site measurements where site measurements cannot be made without delaying the Work; coordinate with the construction to ensure that actual dimensions correspond to established dimensions; allow for trimming and fitting.
- 1.8.3 Ambient Conditions: Maintain area or room in which casework is being installed at a uniform temperature and humidity for 24 hours prior to, during and after installation in accordance with AWS for relative humidity and moisture content; provide additional lighting to maintain a minimum of 430 lx on surfaces and areas where casework is being installed.
- 1.9 WARRANTY
 - 1.9.1 Warrant plastic laminate work of this Section against defects in materials and workmanship in accordance with General Conditions but for an extended period of two (2) years and agree to repair or replace faulty materials or work which appears during warranty period, without cost to the Owner/Tenant. Defects shall include but not be limited to, opening of joints, cracking, shrinkage, warpage, delamination of plastic laminate.

PART 2 - PRODUCTS

- 2.1 MATERIALS
 - 2.1.1 Wood members: Clean, seasoned, straight, square and true on all four sides. Comply with minimum size and tolerances of CSA O141. Grade-mark all wood materials. Kiln dry wood materials for interior use to a moisture content of 4% to 8%.
 - 2.1.2 Douglas Fir plywood: Comply with CSA O121. Western Softwood Plywood: Comply with CSA O151. Exposed two sides shall be Grade G2S, and exposed one side shall be Grade G/Solid. Consider fitment doors exposed on both sides.
 - 2.1.3 Lumber grading - Complying with official grading rules of NLGA.
 - 2.1.4 Lumber species, Group D Balsam Fir or Spruce, complying with CAN/CSA 3-086, unless noted otherwise.
 - 2.1.5 Hardwood for paint finish: Paint grade Birch.
 - 2.1.6 Hardwood Plywood: Comply with CSA O115 Type II, Exposed faces shall be Architectural Grade, selected veneers and unexposed faces shall be sound grade. Exposed faces and edges shall be belt sanded other faces regular sanded.
 - 2.1.7 Wood veneer: Of species specified to match approved sample, minimum 0.8 mm (1/32") thick, architectural quality selected for uniformity of colour, figure and grain. Piece veneers shall be parallel clipped, jointed by tapeless splicer and edge glued. Face veneers shall not contain open joints, face depressions, glue stain, patches, plastic repair or any other manufacturing irregularities or defects.
 - 2.1.8 Medium Density Fibreboard (MDF): Premium grade, 770 kg m³ (48 lbs/ft³), complying with ANSI A208.2, as tested in accordance with ASTM D1037 methods.

- 2.1.9 High Density Fibreboard (HDF): Premium grade, 882 kg/m³ (55 lbs/ft³), complying with ANSI A208.2, as tested in accordance with ASTM D1037 methods.
- 2.1.10 Exposed framing solid members and trim: quarter sawn, architectural grade, matched for compatibility of grain and colour.
- 2.1.11 Concealed framing: Comply with NLGA, S-Dry No. 1 grade Ontario White Pine or Douglas Fir; comply with BCLMA construction grade.
- 2.1.12 Sealer: Water-repellent penetrating wood preservative, LePage's Wood Preservative, distributed by LePage's Ltd., Solignum distributed by Sturgeons Ltd., or other approved manufacture.
- 2.1.13 Fire retardant treatment of plywood and particle board: Conforming to CAN/CSA O80.27-M to provide a flame spread rating of 25 or less, in accordance with test method CAN/ULC-S102 of Underwriter's Laboratories of Canada.
- 2.1.14 Glue for wood assemblies: Comply with CSA O112.4, polyvinyl adhesive.
- 2.1.15 Adhesive for decorative laminate fabrication: Formulated for decorative laminate and to suit application without failure.
- 2.1.16 Plastic laminate facing sheet: High pressure decorative laminated plastic sheet complying with NEMA Publication LD3-2000, Class 1:
- .1 Grade:
 - .1 Laboratory Grade 840/LGP
 - .2 General Purpose (HGL and VGL)
 - .3 Post Forming (PF)
 - .4 Backing Grade (BK)
 - .2 Type:
 - .1 Heavy Duty (HD) 2.0 mm (0.08") thick.
 - .2 Standard Duty (S) 1.2 mm (0.048") thick.
 - .3 Light Duty (LD) 0.75 mm (.03" thick).
- 2.1.17 Melamine: Melamine resin impregnated paper, thermally fused to particle board, Formica MCP by Cyanamide Canada Limited, Arborite Cladboard by Domtar Construction Materials, or other approved manufacture. Furniture finish in colour to be selected by Consultant.
- .1 P601 - Blanc/White by Sublime Collection
 - .2 M2015(Y) – Après-Ski, Butternut wood species by Tafisa
- 2.1.18 Closet doors: Melamine faced hollow core wood doors complying with CAN/CSA O132.2, provided with lock blocks and intermediate stiles and rails to provide adequate support for fastening and hardware.
- 2.1.19 Plastic laminate for General Millwork to be GP HGL, Pattern Series by Wilsonarrt- Daintree 8235K-05 or approved equal.
- 2.1.20 Magnetic hooks: N40 Grade Neodymium-Iron-Boron magnets with 3 layer coating of Nickel-Copper-Nickel coating, minimum 0.0015" thick, with stainless steel dowel, mounted with three #6 stainless steel screws, Henkelhook as manufactured by Henkel Diversified Inc. or approved equal.
- 2.2 CABINET HARDWARE

2.2.1 Hafele and Accuride products and other product names and numbers listed in this article are a representative quality standard for hinges, handles, shelving pilasters and clips, drawer slides, elbow catches, locks, deadbolts, furniture glides, cupboard locks, door pulls, etc. Products of other manufacturers meeting or exceeding the quality herein specified shall be subject to approval by the Consultant.

2.2.2 For 19 mm (3/4") thick cabinet doors, drawers and shelving;

Swing-Up Fitting, Free Flap 1.7, Set
Hinge 165D 3903 FULL SC DOW MOD14
Hinge 165D 3904 HALF SC DOW MOD6
MPL F.W. SCREW MOD 1 3000/4000
MPL PRE/11MM MOD 1 3000/4000
Chrome Plated Polished 124.02.220
Handle BR Satin CHR 8/32 CTC 96MM
Shelf Support Strip ST.NIP 16X6X3500
Shelf Support ST. ZIP. 16X28MM
ACCURIDE C3832-C10 ST. ZIP. 100LB
ACCURIDE C3832-C12 ST. ZIP. 100LB
ACCURIDE C3832-C14 ST. ZIP. 100LB
ACCURIDE C3832-C16 ST. ZIP. 100LB
ACCURIDE C3832-C18 ST. ZIP. 100LB
ACCURIDE C3832-C20 ST. ZIP. 100LB
Elbow Catch Solid Brass CHR.PL
Lock Core ZN.NI.MATT KEY DIFF TA
Deadbolt Lock Body RD.R.H./L.H.
Deadbolt Lock Body RD.DR.
Strike Plate ANGLED ST. BL.
Cyl. ROSETTE BR.NI.MATT 17.4/24MM
Furniture Glide PL. WH. DIA. 16MM

2.2.3 For 35 mm (1-3/8") thick cabinet doors:

Hinges	F179 76 x 76 Stanley C15
Roller Catches	504N Onward C26
Surface Bolt	043-4 X Angle Strike C15
Door Pulls	CBH245 - 4-1/2" C32D
Cabinet Locks	"Best" cylinder and core

2.2.4 Closet rods and flanges:

Rods:	Chrome finish, 33 mm diam.
Flanges:	Chrome finish, Closed flanges at both ends of rod.

2.2.5 Shelf and rod: Steel, white enamel, Model No. 1797 by Hager.

2.2.6 Cabinet keying: Key all cabinets and drawer locks alike for each room, except teachers' closets, which shall be keyed to match classroom door.

2.2.7 Provide accessories such as rubber door silencers (2 per drawer or door), and other items necessary for completion of the cabinet work.

2.3 FABRICATION - GENERAL

- 2.3.1 Check job dimensions and conditions and notify the Owner in writing of unacceptable conditions. Do not proceed until remedial instructions are received.
- 2.3.2 As far as practical, assemble work at the shop and deliver to the job ready for installation. Leave ample allowance for fitting and scribing on the job.
- 2.3.3 Fabricate work square and to the required lines. Recess and conceal fasteners and anchor heads. Fill with matching wood plugs.
- 2.3.4 Provide wood members free from bruises. Blemishes, mineral marks, knots, shake and other defects. Select for colour, grain and texture. Machine and hand sand surfaces exposed in finished work to even smooth surface free from defects detrimental to appearance.
- 2.3.5 Provide running members in the maximum lengths obtainable. Provide thickness of members in maximum dressed size of standard lumber. Where thickness or width indicated is not available in hardwoods, use glue laminations to obtain sizes required. Spline or key solid boards 6" and wider and glue under pressure. Provide unexposed backs of veneers having the same physical characteristics as the face veneer.
- 2.3.6 Design construction details for expansion and contraction of materials. Unless otherwise specified work shall be glued, and blind nailed. Properly frame material with tight, hairline joints and hold rigidly in place. Use glue blocks where necessary. Conceal joints and connections wherever possible. Locate prominent joints where directed. Glue and pin mortise and tenon joints. Intermediate joints between supports will not be permitted. Set and fill surface nails. Prevent opening-up of glue lines in the finished work.
- 2.3.7 Comply with glue manufacturer's recommendations for lumber moisture content, glue shelf life, pot life, working life, mixing, spreading, assembly time, time under pressure and ambient temperature.
- 2.3.8 Provide exposed end grain of solid members and edges of exposed plywood with matching solid edging at least 6 mm (1/4") thick.
- 2.3.9 Seal finish carpentry items before they leave the fabricating shop. For surfaces to receive natural or stain finish ensure that sealer is compatible with the final finish. Co-operate with
- 2.3.10 Section 09 90 00 and obtain written approval of proposed sealer.
- 2.4 FABRICATION - TRIM
 - 2.4.1 Trim members shall be of sizes and profiles indicated. Trim members shall be slow-fed work, free from chatter and other machine marks.
 - 2.4.2 Provide trim over 63 mm (2 ½") wide with backs ploughed or kerfed. Mitre all joints. Carefully machine drum-sand exposed flat surface. Minimize sanding on the job.
- 2.5 FABRICATION - CABINET WORK
 - 2.5.1 Check job dimensions and conditions and notify Consultant in writing of unacceptable conditions. Do not proceed until remedial instructions are received.
 - 2.5.2 As far as practical, assemble work at the shop and deliver to the job site ready for installation. Leave ample allowance for fitting and scribing on the site.

- 2.5.3 Unit bodies shall be minimum 19 mm (3/4") thick plywood. All bodies shall have backs.
- 2.5.4 Use HGL, HD plastic laminate for horizontal working surfaces. Use VGL, S for exposed vertical surfaces.
- 2.5.5 Provide melamine on interior exposed surfaces.
- 2.5.6 Vanities and counters containing sinks shall have waterproof plywood backing for Corian and quartz countertop.
- 2.5.7 Other surfaces shall be HGL and VGL, LD. Colour and sheen to approval of Consultant.
- 2.5.8 Install metal supports supplied under Section 05 99 90 - Miscellaneous Metals, for support of vanities.
- 2.6 FABRICATION - PLASTIC LAMINATE FACED WORK
 - 2.6.1 Comply with NEMA , Publication LD3-2000, Class 1, High Pressure, Paper Base, Decorative Laminates.
 - 2.6.2 Provide cores of not less than 19 mm (3/4") nominal thickness solid face Douglas Fir or Western Softwood Plywood.
 - 2.6.3 Apply backing sheet to laminated flatwork. Apply uniform coating of sealer on exposed edges. Provide backing sheet of sufficient thickness to compensate stresses caused by the facing sheet.
 - 2.6.4 Self-edge straight-line-edging with 1.2 mm (0.048") standard material and radius corners with post-forming material; apply with same adhesive as facing sheet. Chamfer edges uniformly at approximately 20° using machine router.
 - 2.6.5 Locate joints at 2400 mm to 3000 mm (8'-0" to 10'-0") o.c. At L-shaped corners mitre plastic laminate, to the outside corner. Accurately fit members together to provide tight and flush butt joints, in true planes. Provide 6 mm (1/4") blind spline and approved type draw bolts; one draw bolt at maximum 450 mm (18") centres. Colour-match adjoining units.
 - 2.6.6 Provide cut-outs as required for inserts, fixtures and fittings. Use radiused corners and chamfer edges around cut-outs to avoid chipping laminate.
 - 2.6.7 Post-form laminate work to details indicated. Provide same core and laminate profiles to provide continuous support and bond for the entire surface.
 - 2.6.8 Assemble work, true and square. Arrange adjacent parts of continuous laminate work to match in colour and pattern.
- 2.7 FABRICATION - VENEERED PANELS
 - 2.7.1 Fabricate wood veneered panels from fire retardant wood particle board cores, minimum 13 mm (1/2") thick with backing sheet, solid edge strips, and face veneer of species indicated.
 - 2.7.2 Book matching panels.
 - 2.7.3 Apply uniform coating of sealer on exposed edges. Provide backing sheet of sufficient thickness to compensate stresses caused by facing sheet.

- 2.7.4 Provide cut-outs as required for inserts, fixtures and fittings. Use radius corners and chamfer edges around cut-outs to avoid chipping laminate / veneer.

PART 3 - EXECUTION

3.1 INSTALLATION - MILLWORK

- 3.1.1 Deliver millwork to the site. Provide units of such size as will not present difficult of entry to the place of installation.
- 3.1.2 Provide cutting and fitting required to install millwork in place.
- 3.1.3 Install units plumb and level without distortion. Shim as necessary with concealed shims. Accurately scribe and closely fit face plates, filler strips and trim to irregularities of adjacent surfaces.
- 3.1.4 Secure trim members into proper position with blind nailing where possible or heads of exposed nailing neatly set.

3.2 INSTALLATION - CABINETWORK

- 3.2.1 Counters, vanities, kitchen counters and cupboards may be delivered in assembled or knock-down form. Provide cutting and fitting and assemble as required to install these units properly in place.
- 3.2.2 Where dimensions are incorrect and alterations are required to the main structure of unit, return unit to the manufacturer for corrections.
- 3.2.3 Prepare cut-outs for fittings as required. Co-operate with the trades concerned.
- 3.2.4 Install units plumb, square, true, rigid, and level without distortion. Shim as necessary with concealed shims. Accurately scribe and closely fit face plates, filler strips and trim to irregularities of adjacent surfaces.
- 3.2.5 Secure trim members into proper position with blind nailing where possible or heads of exposed nailing neatly set.

3.3 INSTALLATION - PANELLING

- 3.3.1 Install panelling with concealed fastening.
- 3.3.2 Install work, true and square. Arrange adjacent panels to match in colour and pattern.

3.4 INSTALLATION - DOORS

- 3.4.1 Install hollow metal doors supplied under Section 08 10 00.
- 3.4.2 Check doors for correct size. If improperly sized return to manufacturer for corrections.
- 3.4.3 Prepare doors to receive hardware. Check each hardware item before installation. Drill pilot holes of suitable diameter.
- 3.4.4 Install doors. Maintain an even clearance, not exceeding 1/8", between door and frame and 19 mm (3/4"), at floor to allow free action of door. Allow for proper clearance where carpet is

scheduled.

- 3.4.5 Install doors with warp age not to exceed 2 mm (3/32") measured diagonally across door.
- 3.4.6 Install door grilles where required.
- 3.4.7 Install fire rated doors in accordance with requirements of authorities having jurisdiction to provide the required rating. Install fire rated doors and frames according to NFPA 80.

3.5 INSTALLATION - FINISHING HARDWARE

- 3.5.1 Install finish hardware in accordance with manufacturer's written instructions. Do not modify finish hardware without manufacturer's written approval.
 - 3.5.2 Install finish hardware secure, plumb, level, and true to line.
 - 3.5.3 Install finish hardware to template.
 - 3.5.4 Cut and fit to substrate avoid damage and weakening. Reinforce attachment substrate as necessary for installation and operation.
 - 3.5.5 Completely cover cut-outs with hardware item.
 - 3.5.6 Mortise work to correct location and size without gouging, splintering, and causing irregularities in exposed finish work.
 - 3.5.7 Surfaces for Paint or Other Finish:
 - .1 Where cutting and fitting is required on substrata to be painted or similarly finished, install, fit, and adjust hardware prior to finishing.
 - .2 Remove hardware and place in original packaging.
 - .3 Re-install hardware after finishing operation is complete.
 - 3.5.8 Install hardware items affixed to concrete with machine screws and threaded metal expansion shields.
 - 3.5.9 Set, fit, adjust and clean hardware according to manufacturer's written instructions.
 - 3.5.10 Lubricate moving parts as recommended by hardware manufacturer. Use graphite type lubrication if no other is recommended.
 - 3.5.11 After installation of hardware under this section, check opening units for correct fit and uniformity of space around perimeter of units, or between units. Provide smoothly operating opening units free from binding.
- ### 3.6 HARDWARE MOUNTING HEIGHTS
- 3.6.1 Mortise lock strike: 990 mm (39") from centre of knob to finished floor.
 - 3.6.2 Deadlock strike: 1270 mm (50") from centre of cylinder to finished floor.
 - 3.6.3 Mortised night latches: 1270 mm (50") from centre of cross bar to finished floor.
 - 3.6.4 Panic sets: 1020 mm (40") from centre to finished floor.

- 3.6.5 Door pulls: 1020 mm (40") from centre to finished floor.
- 3.6.6 Push plates: 1120 mm (44") from centre to finished floor.
- 3.6.7 Blank strikes: 1270 mm (50") from centre to finished floor.
- 3.6.8 Blank fronts: 1270 mm (50") from centre to finished floor.
- 3.6.9 Door closer arms: To allow maximum degree of swing.
- 3.6.10 Floor stops: To allow maximum degree of swing.
- 3.7 ADJUSTING AND CLEANING - HARDWARE
 - 3.7.1 Check and adjust each operating hardware item to ensure proper operation and function of unit.
 - 3.7.2 Lubricate moving parts as recommended by hardware manufacturer. Use graphite type lubricant if no other is recommended.
 - 3.7.3 Repair or replace defective materials and units which cannot be adjusted and lubricated to operate freely and smoothly. Re-install items found improperly installed.
 - 3.7.4 Prior to date of Substantial Performance, re-adjust and re-lubricate as necessary.
 - 3.7.5 Instruct Owner's designated personnel in the proper adjustment and maintenance of hardware and finishes at time of final hardware adjustment.
- 3.8 CLEANING
 - 3.8.1 On completion, remove manufacturer's identification markings and clean plastic laminate surfaces.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

- 1.1.1 Comply with Division 1, General Requirements and all documents referred to therein.
- 1.1.2 Provide all labour, materials, products, equipment and services required to complete the building insulation and vapour barrier work indicated on the Drawings and/or specified herein.
- 1.1.3 All thermal insulation and vapour barrier work throughout the entire project not specified under other Sections is the work of this Section.
- 1.1.4 Comply with applicable code requirements, where combustible insulation or vapour retarder materials are used, including supply and installation of approved non-combustible backing and independently supported, non-combustible insulation covering except where these provisions are expressly specified as the work of other Sections.
- 1.1.5 Continuity of the vapour and air retarder within the construction specified herein and with adjacent retarder construction is the responsibility of this Section.

1.2 RELATED WORK SPECIFIED UNDER OTHER SECTIONS

- 1.2.1 Air/Vapour Barriers: Section 07 27 13.
- 1.2.2 Fire stopping and smoke seals: Section 07 84 00.

1.3 REFERENCES

- 1.3.1 ASTM C165-07(2012) Standard Test Method for Measuring Compressive Properties of Thermal Insulations.
- 1.3.2 ASTM C272/C272M-12 Standard Test Method for Water Absorption of Core Materials for Sandwich Constructions.
- 1.3.3 ASTM C612-14 Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
- 1.3.4 ASTM D1621-10 Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
- 1.3.5 ASTM E84-15a Standard Test Method for Surface Burning Characteristics of Building Materials.
- 1.3.6 ASTM E96/E96M-14 Standard Test Method for Water Vapor Transmission of Materials.
- 1.3.7 CAN/ULC S701-11 Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- 1.3.8 CAN/ULC S702-14 Standards for Mineral Fibre Thermal Insulation for Buildings.
- 1.3.9 CAN/ULC-S101 Standard Method of Fire Endurance Tests Of Building Construction And Materials

1.4 QUALITY ASSURANCE

- 1.4.1 Perform the work of this Section by an insulation subcontractor of recognized standing having not fewer than 5 years proven experience in this type of work.
- 1.4.2 Employ only skilled mechanics having experience in the work specified, and having an understanding of the design principles of the thermal and vapour barriers which they are providing.
- 1.4.3 Submit proof of the above requirements to the Consultant upon request.
- 1.4.4 Apply insulation and vapour barrier provisions as specified to sample panels of masonry cavity wall erected under Section 04 20 00 - Unit Masonry. Sample shall show co-ordination of this work with masonry reinforcement.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- 1.5.1 Store packaged materials and products in their original wrappings or containers with manufacturer's labels and seals intact. Store flammable materials outside the building, protect from all-weather hazards and open flame. Abide by all fire protection regulations imposed by authorities having jurisdiction, and take precautionary measures to avoid fire.
- 1.5.2 Do not store insulation in direct contact with the earth, road surface, or floors. Place suitable forms or skids under the insulation upon delivery to protect the insulation from absorbing dampness from the surrounding terrain or floor. Cover material with approved tarpaulins and secure.
- 1.5.3 In cold weather, provide warm storage for adhesives such that their consistency is suitable for ease of application.

1.6 SITE CONDITIONS

- 1.6.1 Protect surfaces, and in particular the building cladding finish, from being marred or contaminated by the materials, by means of protective covers, boards, tapes and other approved means.
- 1.6.2 Supervise the work of other Sections where such work is closely associated with the work of this Section and report any damage done to the work of this Section.
- 1.6.3 Protect the work of this Section from damage due to high velocity winds until the building cladding or other permanent protection is in place.

1.7 WARRANTY

- 1.7.1 Submit 2-year warranty against defects in materials, products and workmanship in the work of this Section. Warranty shall extend to the integrity and continuity of the air/vapour barrier and thermal barrier.

PART 2 - PRODUCTS

2.1 MATERIALS – INSULATION

- 2.1.1 Rigid Insulation Board for EIFS System & Composite Wall Panel:
 - .1 Insulation Boards supplied by EIFS Manufacturer shall be ROCKBOARD 80 mineral wool insulation board made from basalt rock and slag, a non-combustible product with fire resistance properties and a melting point of approximately 2150°F (1177°C).
 - .2 Mineral wool insulation board properties to include low thermal conductivity, high compression resistance and able to repel water. Mineral wool fibre insulation board must

have a minimum actually density of 128 kg/m³ (8 lb/ft³) and an RSI Value @ 25.4mm @ 24oC of 0.70m²K/W (R-Value @ 75oF of 4.0hr.ft²/Btu). Minimum insulation thickness to be not less than 75 mm (3 inches) maximum insulation thickness to be not greater than 127 mm (5 inches) and have the following Fire Performance properties:

1. ASTM E 136 Behaviour of Materials at 750°C (1382°F) Non-Combustible.
2. CAN/ULC-S114 Test for Non-Combustibility Non-Combustible
3. ASTM E 84 (UL 723) Surface Burning Characteristics Flame Spread = 0, Smoke Developed = 0
4. CAN/ULC-S102 Surface Burning Characteristics Flame Spread = 0, Smoke Developed = 0

- 2.1.2 Mineral Wool board insulation: Conforming to ASTM C612, Type 1B, "A.F. 530" by Owens-Corning Canada Inc., "ROCKBOARD 40" by Roxul Inc., or other approved manufacture. Insulation shall have a "k" factor of 0.25 BTU/hr/sq ft/°F/1" thickness at a mean temperature of 24°C, and a nominal density of 4 lbs/cu ft. Deformation of fibrous glass rigid board shall not exceed 10% when tested at 25 lbs/sq ft. in accordance with ASTM C165.
- 2.1.3 Fibrous glass board insulation: Conforming to ASTM C612, Type 1B, "A.F. 530" by Owens-Corning Canada Inc., "RXL 40" by Roxul Inc., or other approved manufacture. Insulation shall have a "k" factor of 0.25 BTU/hr/sq ft/°F/1" thickness at a mean temperature of 24°C, and a nominal density of 3 lbs/cu ft. Deformation of fibrous glass rigid board shall not exceed 10% when tested at 25 lbs/sq ft. in accordance with ASTM C165.
- 2.1.4 Masonry cavity wall Insulation: Expanded polystyrene complying with CAN/ULC S701, Type 3 R-5 per 1" thickness (RSI 0.87 / 25mm) and a minimum compressive strength of 25 psi (172 kPa); shiplapped edges; "Styrofoam CavityMate CS" by Dow Chemical of Canada Ltd., or other approved manufacture, thickness as indicated on drawings.
- 2.1.5 Steel/wood stud Insulated Sheathing: Extruded polystyrene insulation conforming to CAN/ULC S701 Type 2 having a minimum R value of R5 per 1" (RSI 0.87 / 25mm) and a minimum compressive strength of 30 psi (210 kPa). "Styrofoam Cladmate or Cladmate XL" by Dow Chemical of Canada Ltd., or other approved manufacture, thickness as indicated on drawings.
- 2.1.6 Perimeter/below slab insulation: Extruded polystyrene insulation conforming to CAN/ULC S701 Type 4 having a minimum R value of R5 per 1" (RSI 0.87 / 25mm) and a minimum compressive strength of 30 psi (210 kPa). "Styrofoam SM" by Dow Chemical of Canada Ltd., or other approved manufacture, thickness as indicated on drawings.
- 2.1.7 Semi-rigid board insulation: Fibrous glass "A.F. 110" by Owens-Corning (Schuller International) Canada Inc., "RXL 20" by Roxul Inc., or other approved manufacture. Insulation shall have a "k" factor of 0.262 BTU/hr/sq ft/°F/1" thickness at a mean temperature of 24°C and a nominal density of 1.1 lbs/cu ft.
- 2.1.8 Batt insulation: Lightweight, resilient, inorganic fibrous batts (blankets) complying with CAN/ULC S702, Type 1, fibrous glass by Owens-Corning (Schuller International) Canada Inc., fibrous mineral by Roxul Inc., or other approved manufacture.
- 2.1.9 Non-encapsulated 2" thick glass fibre roof insulation with a density of at least 0.75 lb/ft³ shall be inverted in the deck webs.
- 2.1.10 High Density Underslab Insulation Board: Closed-cell, cellular, foamed, smooth skin, extruded expanded polystyrene, having 100 psi compressive strength, thicknesses as indicated on drawings and specified herein, conforming to CAN/ULC S701, Type IV.

- .1 Basis of Design Materials:
 - .1 Styrofoam HI-100 by Dow Chemical Canada Inc.
 - .2 Foamular 1000 by Owens-Corning Canada Inc.
- 2.1.11 Foamed-In-Place Insulation: Two component polyurethane froth/spray kit, UL Class I (flame spread of 25 or less), Great Stuff by Dow Building Solutions Inc., or approved equal.
- 2.2 MATERIALS - VAPOUR BARRIERS
 - 2.2.1 Polyethylene vapour barrier: 6 mil sheet, suitable for Class 1 Construction and approved by Underwriters' Laboratories of Canada and having a perm rating of 0.09, by Dupont Canada Limited, or other approved manufacture.
- 2.3 MATERIALS - ADHESIVES
 - 2.3.1 Insulation adhesive: Fire retardant vapour barrier type compatible with polystyrene foam: "Air-Bloc 21" by Henry Company, or other approved manufacture.
- 2.4 MATERIALS - MECHANICAL FASTENERS
 - 2.4.1 Insulation fasteners for application to air/vapour barrier membrane: Perforated plates with special anchors for insulation, "Soprseal Clips" by Soprema Waterproofing Inc., perforated base, spindle-type "Insul-Anchors" by Continental Studwelding Ltd.
 - 2.4.2 Stick clips: By Eckel Industries of Canada Limited, Morrisburg, Ontario, or other approved manufacture. Clip size and type shall suit application and insulation thickness.
 - 2.4.3 Split clips: 14 gauge galvanized clips of sufficient length to allow 1" to be bent over the gypsum lath, by Eckel Industries of Canada Limited, Morrisburg, Ontario, Canadian Hilti Limited or other approved manufacture.
 - 2.4.4 Adhesive for applying clips: High strength, resilient adhesive having a drying time of 0 to 30 minutes (rapid initial set), and 24 hours final set. Adhesive shall be compatible with insulation adhesive, insulation, vapour barrier and substrate and shall be non-corrosive to galvanized steel and polyvinyl chloride. Where used in conjunction with a vapour barrier insulation adhesive, its permeability shall not exceed that of insulation adhesive.
 - 2.4.5 Z-section strapping: Roll-formed from 25 gauge electro-galvanized sheet steel and having a 1-1/4" minimum wide flanges and web depth to suit insulation thickness. Provide flanges knurled to facilitate acceptance of screws, and with rolled lips at outer edges for added stiffness.
 - 2.4.6 Galvanized screw type fasteners with 1" galvanized washers. Fasteners shall be at least 1/2" longer than the thickness of the insulation.
- 2.5 MATERIALS - MISCELLANEOUS
 - 2.5.1 Tape: Laminated aluminum foil/fibreglass scrim/fire resistance kraft paper tape, 2" minimum wide, and with a perm rating of 0.03.
 - 2.5.2 Tape for use with exterior insulation sheathing and vapour barrier: Contractor's Sheathing Tape 3M-Y-8086.
 - 2.5.3 Unless otherwise specified, the numerical values required herein for material characteristics shall be as determined by the latest editions of the test procedures of standards listed below:

- .1 Permeability: ASTM E96/E96M;
- .2 Deformation: ASTM C165;
- .3 Compressive strength: ASTM D1621;
- .4 Flame spread: ASTM E84;
- .5 Water absorption: ASTM C272/C272M.

PART 3 - EXECUTION

3.1 INSPECTION

- 3.1.1 Ensure that surfaces to receive air/vapour barrier (adhesive) or insulation are dry, firm, straight, slightly textured for bond, and free from loose material, projections, ice, frost, slick, grease, oil or other matter detrimental to bond of the air/vapour barrier (adhesive) or uniform bedding of the insulation.
- 3.1.2 Maintain surface and ambient temperatures constantly between 38°C and 10°C during application and curing of adhesive except as permitted otherwise by the Consultant in writing.
- 3.1.3 Report surfaces left unacceptable by other trades to the Consultant.

3.2 INSTALLATION - GENERAL

- 3.2.1 Allow new concrete to cure a minimum of 2 weeks.
- 3.2.2 Fill any spalled concrete or open mortar joints to provide an even plane.
- 3.2.3 Joints in drywall shall have been taped.
- 3.2.4 Install insulation to thicknesses shown on the Drawings.
- 3.2.5 Install all materials in accordance with the manufacturers' printed directions unless otherwise specified herein.
- 3.2.6 In construction separating interior from exterior, locate vapour barrier on the warm-in-winter side of the insulation.
- 3.2.7 Ensure a uniform, continuous thermal and vapour barrier effect. Where insulation and vapour barriers are to be provided under other Sections, co-ordinate the work such that thermal and vapour barrier continuity is achieved.
- 3.2.8 Pay the cost of repair satisfactory to the Consultant of precast or in situ concrete chipped, spalled or otherwise damaged by the use of powder activated or pneumatic fixings in connection with the work of this Section and for resulting delays. The Consultant reserves the right to restrict the use of such fixings where substrates are damaged. Powder activated fixing devices, where approved, shall be the low-velocity type having a double guidance system.
- 3.2.9 Where insulation and vapour barrier are fixed to the inside face of exterior wall components or cladding units, arrange insulation such that joints in insulation boards are coincident with the joints in the exterior wall components. Butt insulation board joints tightly. Provide a 1/2" fold in the vapour barrier over these joints.
- 3.2.10 Where hangers for suspended ceilings and where supports for heating units pass through insulation and vapour barrier construction, butter apertures liberally with vapour barrier adhesive and ensure continuity of thermal and vapour barrier provisions.

3.3 INSTALLATION - MECHANICAL FASTENERS

- 3.3.1 Install clips to supplement all adhesive attachment of rigid cellular and fibrous glass board insulation and elsewhere, where specified. Apply clips to substrate using adhesive or, where approved by the Consultant and the precast concrete fabricator using powder-activated or pneumatic fixings.
- 3.3.2 Support adhesive-applied clips in place until adhesive has set. Where insulation adhesive is to form a vapour barrier, extend clip adhesive over substrate a distance of 6" around clip so that it becomes integral with subsequently applied vapour barrier adhesive coating.
- 3.3.3 Where insulation adhesive is to form a vapour barrier, and clips are applied using powder-activated or pneumatic fixings, embed clips in adhesive and butter clip with adhesive after fixing such that vapour barrier continuity is ensured.
- 3.3.4 Provide insulation fasteners generally at 1'-0" centres both ways with 2 fasteners minimum for each full board width and 4 fasteners minimum for each full board length.
- 3.3.5 Where no finishing or protective material is to be applied directly to insulation and vapour barrier assembly, use stick clips. Arrange clips generally at 1'-0" centres both ways with 2 clips minimum for each full board width and 4 clips minimum for each full board length. Where insulation occurs on the undersides of horizontal construction, provide each clip with a 2" diameter 28 gauge galvanized steel washer before applying retainer.
- 3.3.6 Where gypsum wallboard, or other board finish is to be installed directly over insulation vapour barrier assembly, apply the specified z-section strapping to the substrate using powder-activated or pneumatic fasteners. Arrange strapping to suit the fixing requirements of the board to be applied.
- 3.3.7 Where rigid insulation is to be applied to interior face of exterior walls, apply z-section strapping to substrate using powder-activated or pneumatic fasteners. Arrange strapping to suit the fixing requirements of the board to be applied.
- 3.3.8 Where gypsum board ceiling finish is to be applied over insulation, apply Z-section strapping fastened through first lay in of gypsum board to furring members. Arrange strapping to suit fixing requirements of gypsum board.
- 3.3.9 Where anchors and supports pass through insulation and air/vapour barrier construction, ensure continuity of thermal and air/vapour barrier provisions.
- 3.3.10 Tape all joints of insulation sheathing with sheathing tape. Solidly tape around anchors and other protrusions through insulation sheathing.
- 3.3.11 Where insulation is applied directly to concrete substrates, install insulation fasteners tightly into drilled holes, with head of fastener snug to face of insulation board.
- 3.3.12 When gypsum wallboard finish is to be applied directly over insulation, i.e. exterior basement walls, and elsewhere as shown, install z-section strapping to the substrate using powder-activated or pneumatic fasteners. Arrange strapping to suit fixing requirements of the board insulation.

3.4 INSTALLATION - INSULATION

- 3.4.1 Install insulation on exterior walls, where shown. Cut and fit insulation snugly around anchors, penetrations, obstructions, openings, corners, around door frames, electrical receptacles, etc. Carry insulation above ceiling, full height of exterior walls.
- 3.4.2 Press insulation boards firmly to substrate impaling them on clips without bending clips. Bevel board edges abutting sloping surfaces.
- 3.4.3 Butt insulation boards tightly and stagger joints. Cut out back of board insulation as required to accommodate substrate irregularities and build up over cut out areas on the other side as required to ensure thermal barrier uniformity.
- 3.4.4 Individual insulation boards shall be arranged so that 12" minimum widths are provided.
- 3.4.5 Where more than one layer of insulation is required, stagger successive layer joints with the joints of the preceding layer and bed in adhesive trowelled solidly over the preceding layer.
- 3.4.6 Where board insulation has an integral vapour barrier facing, tape all board facing joints and the junctions of board facings with adjacent construction. Seal tape in a full-width continuous coating of adhesive. Lap joints in tape 4" and seal with adhesive. Where clips pierce vapour barrier, butter the puncture liberally with the specified vapour barrier adhesive.

3.5 INSTALLATION - INSULATION OVER AIR/BARRIER MEMBRANE

- 3.5.1 Where insulation is applied to air/vapour barrier membrane, install insulation fasteners onto membrane to ensure adequate bond without penetrating the membrane and supplement adhesive bond with a small power activated fastener applied through fastener base to structure. Press insulation boards firmly to substrate and fasten to anchors.
- 3.5.2 Provide insulation fasteners generally at 1'-0" centres both ways with 2 fasteners minimum for each full board width and 4 fasteners minimum for each full board length.
- 3.5.3 Where anchors and supports pass through insulation and air/vapour barrier construction, ensure continuity of thermal and air/vapour barrier provisions.

3.6 INSTALLATION - BATT INSULATION

- 3.6.1 Friction fit insulation between studs.
- 3.6.2 Butt batts tightly and tape joints at batt ends and at junctions of batt installations with adjacent vapour barrier construction. Bed tape in a full-width continuous coating of adhesive. Lap joints in tape 4" and seal with adhesive.
- 3.6.3 Tear apart batt insulation and pack tightly into spaces where shown and generally into miscellaneous building cavities as required to ensure a continuous thermal barrier where such provision is not specified under other Sections.
- 3.6.4 Pack batt insulation into cavity between concrete columns and precast concrete facings.

3.7 METAL AIR/VAPOUR BARRIER

- 3.7.1 Brake form barriers from sheet metal to permit assembly using self-tapping screws, and attachment using powder activated or pneumatic fixings or other means of secure fastening.

- 3.7.2 Make provision in barrier design to accommodate movement resulting from thermal change and structural deflection.
- 3.7.3 Form edges to 45° to permit peripheral and joint sealing.
- 3.7.4 Cut, fit and form metal air/vapour barriers as required to accommodate conflicting framing, granite panel connections and other obstructions.
- 3.7.5 Fabricate supplementary framing from rolled steel sections as may be required.
- 3.7.6 Ensure the continuity of the air, vapour and thermal barriers within the construction specified herein and with adjacent construction.
- 3.8 PATCHING
 - 3.8.1 Perform cutting and patching necessary to accommodate irregularities in the work of this Section caused by appurtenances of the work of other Sections including piping, ductwork and electrical conduit projecting through the thermal or vapour barriers.
 - 3.8.2 Ensure the continuity of the thermal and vapour barriers where such items project through the barriers. Allow for expansion and contraction and linear movement of these items.
 - 3.8.3 Where there is a possibility of heat loss through ductwork or conduit which passes through the thermal and vapour barrier, extend insulation around the duct or conduit a distance of 1'-0" minimum on both sides of the barrier unless otherwise shown on the Drawings.
 - 3.8.4 After installation under other Sections of heating equipment and other construction adjacent to the work of this Section, inspect the work of this Section and perform such reasonable taping and patching of vapour barriers and replacing of insulation as necessitated by unavoidable minor damage caused in the course of the work of the other Sections.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

1.1.1 General Conditions, Supplementary Conditions and Division 01 apply to this section.

1.2 SUMMARY

1.2.1 This Section includes requirements for supply and installation of self-adhered air and vapour membranes that prevent exfiltration and infiltration between interior and exterior of building through wall and roof transition construction.

1.3 RELATED REQUIREMENTS

1.3.1 Section 04 20 00: Masonry

1.3.2 Section 06 10 00: Rough Carpentry

1.3.3 Section 07 42 00: Aluminum Cladding Panel Dry Joint

1.3.4 Section 07 42 13: Metal Siding

1.3.5 Section 08 44 00: Curtain Wall

1.3.6 Section 09 29 00: Gypsum Board

1.4 REFERENCE STANDARDS

1.4.1 American Society for Testing of Materials (ASTM):

- .1 ASTM E96/E96M-15, Standard Test Methods for Water Vapor Transmission of Materials
- .2 ASTM E2178-13, Standard Test Method for Air Permeance of Building Materials

1.5 ADMINISTRATIVE REQUIREMENTS

1.5.1 Pre-Installation Conference:

- .1 Convene a pre-installation conference two (2) weeks prior to commencing work of this section. Require attendance of parties directly affecting work of this section, including, but not limited to, the Owner's representative, Consultant, General Contractor, air and vapour barrier membrane contractor, air and vapour barrier membrane manufacturer's representative and substrate installer.
- .2 Contact Consultant two (2) weeks prior to pre-installation conference to confirm schedule.
- .3 Review preparation and installation procedures and co-ordinating and scheduling required with related work.
- .4 Record discussions of conference and decisions and agreements (or disagreements) reached, and furnish copy of record to each party attending. Review foreseeable methods and procedures related to the vapour permeable air barrier membrane, including the following:
 - .1 Tour, inspect and discuss condition of substrate, penetrations and preparatory work performed by other trades.
 - .2 Review surface preparation, minimum curing period and installation procedures.
 - .3 Review special details and flashings.
 - .4 Review required submittals, both completed and yet to be completed.
 - .5 Review and finalize construction schedule related to work and verify availability

SELF-ADHERED AIR AND VAPOUR BARRIER MEMBRANE

of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.

- .6 Review required inspections, testing, protection and repair procedures.
- .7 Review weather and forecasted weather conditions, and procedures for coping with unfavourable conditions.

1.5.2 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.

1.6 SUBMITTALS

1.6.1 Submit submittals in accordance with the General Conditions and Section 01 33 00.

1.6.2 Action Submittals:

- .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, etc.
- .2 Samples: Submit representative sample of air and vapour membrane minimum 305mm x 305mm (12" x 12") with factory applied identification clearly visible.

1.6.3 Safety Data Sheets:

- .1 Submit WHMIS safety data sheets for inclusion with project record documents. Keep one copy of WHMIS safety data sheets on site for reference by workers.

1.7 QUALITY ASSURANCE

1.7.1 Qualifications: Provide proof of qualifications when requested by Consultant:

- .1 Manufacturer: Obtain air and vapour membrane materials through one source from a single manufacturer or using materials from a secondary source that are acceptable to the manufacturer.
- .2 Installer: Use an installation company that is acceptable to the manufacturer, using workers who are trained and approved by the membrane manufacturer having experience with projects of similar complexity and area.
- .3 Installer must have minimum five (5) years of experience.

1.8 ENVIRONMENTAL CONDITIONS

1.8.1 Air and vapour barrier is not to be applied to surfaces that are either wet, oily, frosted, dirty or contaminated in any way.

1.8.2 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.

1.8.3 Air and vapour barrier is not to be applied over lightweight cast-in-place concrete containing high moisture or certain curing compounds. Cast-in-place concrete should be cured for a minimum of two weeks prior to application of air barrier membrane.

SELF-ADHERED AIR AND VAPOUR BARRIER MEMBRANE**1.9 DELIVERY, STORAGE, HANDLING AND PROTECTION**

- 1.9.1 Coordinate deliveries with construction schedule and arrange for proper storage areas.
- 1.9.2 All materials are to be stored in a clean, dry and protected area in their original containers sealed and undamaged. Manufacturer's labels are to be easily visible and undamaged.
- 1.9.3 Care and precaution are to be exercised by the applicator so as not to damage the work of other trades. Applicator is responsible to take all necessary precautions to protect work of other trades during application.
- 1.9.4 In addition to the above, store modified bituminous sheet type air and vapour barrier membrane as follows:
 - .1 Store rolls of membrane on end, in vertical position without leaning with selvage end up.
 - .2 Store materials away from direct heat or open flame.
 - .3 For installation in cold weather, store rolls of membrane in heated storage trailer for minimum of 24 hours with the temperature kept at 21 deg C and remove for application with as little exposure as possible to low ambient temperatures.
- 1.9.5 Provide portable fire extinguishers within easy access of torching applications.

1.10 WARRANTY

- 1.10.1 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.
- 1.10.2 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.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- 2.1.1 Basis-of-Design products are named in this Section; form the basis-of-design materials 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 they submit requests a minimum of five (5) days in advance of Bid Closing.
- 2.1.2 Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- .1 Henry Company
- .2 Soprema Inc.
- .3 Tremco

2.2 MATERIALS

- 2.2.1 Self adhering SBS modified bitumen reinforced membrane; having low temperature formulation appropriate for installation requirements; tested in accordance with ASTM E96 and ASTM E2178, and having the following nominal properties:

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- .1 Low Temperature Flexibility: Less than -10°C
- .2 Basis of Design Products:
 - .1 Blueskin SA by Henry Company.
 - .2 Sopraseal Stick 1100-T by Soprema Inc.
 - .3 ExoAir 110LT by Tremco
 - .4 ExoAir 230 by Tremco, Fluid-Applied, Synthetic Air & Vapor Permeable Membrane
- 2.2.2 Primers and Undercoats: Manufacturer's recommended primer or surface conditioner to improve bond between membranes to substrates.
- 2.2.3 Accessories:
 - .1 Waterproofing Mastic: Manufacturer's recommended trowel applied waterproofing mastic containing compatible modified bitumen, fibres and mineral fillers.
 - .2 Roof-to-Wall Transition Membranes: Manufacturer's recommended reinforced self-adhesive, compatible with roofing air and vapour membranes and wall materials specified in this Section.
 - .3 Opening Transition Membranes: Tremco 'Proglaze' engineered transition membrane, adhered to adjacent air/vapour barrier using manufacturer's recommended joint sealant.
 - .4 Through Wall Membranes: Manufacturer's recommended reinforced self-adhesive, compatible with air and vapour membrane

PART 3 - EXECUTION

- 3.1 EXAMINATION
 - 3.1.1 Ensure that surfaces to receive air barrier membrane are dry, firm, suitable for bond, and free from dust, dirt, loose material, projections, ice, frost, slick, grease, oil or other matter detrimental to bond of sheet type air barrier membrane.
 - 3.1.2 Report surfaces left unacceptable by other trades in writing to the Consultant before commencing installation.
 - 3.1.3 Co-ordinate work of this section with the work of other sections.
 - 3.1.4 Commencement of work of this section implies acceptance of surfaces and conditions.
- 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.
 - 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:
 - .1 Transition Membranes: Connect air and vapour membranes to adjacent assemblies having pre-installed transition membranes; install transition membranes where required

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- to maintain continuity of building envelope.
- .2 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 Cut and tightly seal air barrier membrane around penetrations and protrusions to provide a continuous air barrier.
- 3.3.4 Lap joints in air barrier membrane minimum of 75mm (3").
- 3.3.5 Where masonry anchors and supports pass through air barrier construction, ensure continuity of air barrier by applying air barrier mastic all around/over masonry anchors.
- 3.3.6 Prior to masonry being installed by section 04 20 00, inspect air barrier membrane for punctures, misaligned seams and fishmouths. Apply additional layer of air barrier membrane over damaged/affected areas, extending membrane minimum of 6" beyond damage in all directions.
- 3.4 SITE QUALITY CONTROL
- 3.4.1 Allow access for review and inspection and testing of installed air and vapour membranes, and repair of deficiencies before placement of insulation materials.
- 3.4.2 Manufacturer's Site Services: Arrange for air and vapour membrane manufacturer's technical personnel to review building envelope during installation.
- 3.4.3 Owner reserves the right to engage a testing firm to perform air and vapour retarder testing to confirm performance of installed membranes and insulation systems in accordance with Section 01 45 00; testing will be performed when the building mechanical systems are balanced and operating; when building is occupied and climatic conditions are suitable for infrared thermographic scan of the building.
- 3.4.4 Cooperate with testing agency; repair or replace air and vapour membrane system as directed by testing agency, at no additional cost to the Owner.
- 3.5 CLEANING AND PROTECTION
- 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

PART 1 - GENERAL

1.1 WORK INCLUDED

1.1.1 Comply with Division 1, General Requirements and documents referred to therein.

1.1.2 Provide labour, materials, products, equipment and services required to complete the fire stopping and smoke seals work.

1.2 RELATED WORK SPECIFIED UNDER OTHER SECTIONS

1.2.1 Section 07 84 00 Fire Stopping and Smoke Seals.

1.2.2 Section 09 90 00 Caulking and Sealants

1.2.3 Division 21 – Fire Suppression: Coordination of pipes and pipe fittings and other materials penetrating fire resistance rated assemblies.

1.2.4 Division 22 – Plumbing: Coordination of pipes and pipe fittings and other materials penetrating fire resistance rated assemblies.

1.2.5 Division 23 – Heating, Ventilation and Air Conditioning: Coordination of ductwork and other materials penetrating fire resistance rated assemblies.

1.2.6 Division 25 – Integrated Automation: Coordination conduit, wiring, communications cabling, cable trays and other materials penetrating fire resistance rated assemblies.

1.2.7 Division 26 – Electrical: Coordination conduit, wiring, communications cabling, cable trays and other materials penetrating fire resistance rated assemblies.

1.2.8 Division 27 – Communications: Coordination conduit, wiring, communications cabling, cable trays and other materials penetrating fire resistance rated assemblies.

1.2.9 Division 28 – Electronic Safety and Security: Coordination conduit, wiring, communications cabling, cable trays and other materials penetrating fire resistance rated assemblies.

1.3 REFERENCES

1.3.1 ASTM A653/A653M-11 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.3.2 ASTM A1008/A1008M-13 Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.

1.3.3 ASTM E119-12a Standard Test Methods for Fire Tests of Building Construction and Materials

1.3.4 ASTM E814-11a Standard Test Method for Fire Tests of Penetration Firestop Systems

1.3.5 ASTM E1966-07(2011) Standard Test Method for Fire-Resistive Joint Systems

- 1.3.6 ASTM E2174-10ae1 Standard Practice for On-Site Inspection of Installed Fire Stops
- 1.3.7 ASTM E2307-10 Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus
- 1.3.8 ASTM E2393-10a Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers
- 1.3.9 ULC Firestop Systems and Components, 2013 Edition
- 1.3.10 CAN/ULC S101-07 Fire Endurance Tests of Building Construction and Materials
- 1.3.11 CAN/ULC S114-05 Test for Determination of Non-Combustibility in Building Materials
- 1.3.12 CAN/ULC S115-11 Fire Tests of Firestop Systems
- 1.3.13 CAN/ULC S702-09 Mineral Fibre Thermal Building Insulation
- 1.3.14 ANSI/UL 1479 May-2003 Standard for Fire Tests of Through-Penetration Firestops
- 1.3.15 NFPA 251-2006 Standard Methods of Tests of Fire Endurance Building Construction and Materials

1.4 SYSTEM DESCRIPTION

- 1.4.1 Work of this Section comprises fire stopping and smoke seal materials and/or systems to provide closures to fire and smoke at openings around penetrations, at unpenetrated openings, at projecting or recessed items, and at openings and joints within fire separations and assemblies having a fire-resistance rating, including openings and spaces at perimeter edge conditions.
- 1.4.2 Provide seals to form draft tight barriers to retard the passage of flame and smoke.
- 1.4.3 The installed seal shall provide and maintain a fire resistance rating equivalent to the rating of the adjacent floor, wall or other fire separation assembly to the requirements of and as acceptable to the authorities having jurisdiction and the Consultant.
- 1.4.4 Fire stopping and smoke seals within mechanical (i.e. inside ducts, dampers) shall be provided as part of the work of Division 15. Fire stopping and smoke seals around the outside of such mechanical assemblies where they penetrate rated fire separations shall be part of the work of this Section.

1.5 QUALITY ASSURANCE

- 1.5.1 Provide the work of this Section using experienced and competent installers, approved, trained and licensed by the material or system manufacturer.
- 1.5.2 Fire stopping and smoke seal materials shall conform to the temperature and flame rating, and fire hose rating of CAN/ULC S115 and ASTM E814, and other requirements of authorities having jurisdiction.

1.6 SUBMITTALS

- 1.6.1 Submit shop drawings indicating the ULC assembly number, the required temperature and flame rating, thickness, installation methods and materials of fire stopping and smoke seals, damming materials, anchorages and fastenings.
- 1.6.2 Submit manufacturer's product data for materials and prefabricated devices, providing descriptions sufficient for identification at the Project site. Include manufacturer's printed instructions for installation.
- 1.6.3 Submit samples of each type of fire stopping and smoke seal material.
- 1.6.4 Submit manufacturer's certification that installed fire stopping and smoke seal materials comply with specified requirements.
- 1.7 **MOCK-UP**
 - 1.7.1 Apply one sample installation on representative substrate of each type of installation and required fire rating.
 - 1.7.2 Sample shall comply with requirements as to thickness and density of application to achieve fire rating required.
 - 1.7.3 Acceptable mock-up may remain as part of completed work.
- 1.8 **DELIVERY, STORAGE AND HANDLING**
 - 1.8.1 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels intact. Protect from damage and environmental conditions in accordance with manufacturer's recommendations.
- 1.9 **SITE CONDITIONS**
 - 1.9.1 Comply with manufacturer's recommended requirements for temperature, relative humidity, and substrate moisture content during application and curing of materials.

PART 2 - PRODUCTS

- 2.1 **ACCEPTABLE MANUFACTURERS**
 - 2.1.1 Fire stopping and smoke seal materials of the following manufacturers complying with these specifications are acceptable:
 - .1 Canadian General Electric Company Limited.
 - .2 Electrovert Ltd.
 - .3 Firestop Systems Inc.
 - .4 M.W. McGill and Associates.
 - .5 Tremco Ltd.
 - .6 Hilti (Canada) Corporation.
 - .7 or other approved manufacture.
- 2.2 **MATERIALS**
 - 2.2.1 Fire stopping and smoke seals: Asbestos free materials and systems complying with standards specified herein, by one or more of the specified acceptable manufacturers, installed in

- accordance with tested assemblies acceptable to authorities having jurisdiction to provide an effective barrier against the passage of fire, smoke and gases, and to provide a fire resistance rating not less than the fire resistance rating of the surrounding floor, wall or other assembly.
- 2.2.2 Products shall be manufactured under ULC Follow-up Program and each package/container shall bear ULC label or listing mark.
 - 2.2.3 Service penetration assemblies: Certified by ULC in accordance with CAN/ULC S115 and listed in ULC Guide No. 40 U19.
 - 2.2.4 Service penetration firestop components: Certified by ULC in accordance with CAN/ULC S115 and listed in ULC Guide No. 40 U19.13 under the Label Service of ULC.
 - 2.2.5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: An elastomeric seal; do not use a cementitious or rigid seal at such locations.
 - 2.2.6 Firestopping and smoke seals at openings around penetrations for pipes, duct work and other mechanical items requiring round and vibration control: Elastomeric, do not use cementitious or rigid seal at such locations.
 - 2.2.7 Primers: To manufacturer's recommendation for specific material, substrate, and end use.
 - 2.2.8 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
 - 2.2.9 Damming and backup materials, supports and anchoring devices: To manufacturer's recommendations, and in accordance with the tested assembly being installed as acceptable to authorities having jurisdiction.
 - 2.2.10 Sealants for vertical joints: Non-sagging.

PART 3 - FABRICATION

- 3.1 FIRESTOPS
 - 3.1.1 Supply and install mineral wool firestop material at all suspended slabs, between edge of slabs and exterior cladding and in vertical positions at air shafts. Place firestop material under permanent 35% compression. Use impaling clips or metal trims to hold insulation in place.
 - 3.1.2 Supply and install stick clips at maximum [300 mm|1'-0"] o.c. secured to concrete in an approved manner, to support firestop material in place.
 - 3.1.3 Supply and install continuous steel angles, hot dipped, galvanized, minimum [10 mm|3/8"] thick for firestopping where shown and as required.

PART 4 – EXECUTION

- 4.1 PREPARATION
 - 4.1.1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials. Ensure that substrates and surfaces are dry and frost free.
 - 4.1.2 Clean bonding surfaces to remove deleterious substances including dust, paint, rust, oil, grease and other foreign matter which may otherwise impair effective bonding.
 - 4.1.3 Do not apply fire stopping and smoke seals to substrates and surfaces previously painted or

- treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
- 4.1.4 Remove insulation from insulated pipe and duct where such pipes or ducts penetrate a fire separation unless ULC certified assembly permits such insulation to remain within the assembly.
- 4.1.5 Beginning of installation shall indicate acceptance of existing conditions.
- 4.1.6 Prepare surfaces and prime in accordance with manufacturer's directions.
- 4.1.7 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.
- 4.2 MIXING
- 4.2.1 Mix components in a mixer clean and free of used and set materials and surface contaminants.
- 4.2.2 Thoroughly mix components in accurate proportions.
- 4.2.3 Apply mixed materials within time limit recommended by the manufacturer.
- 4.3 APPLICATIONS
- 4.3.1 Apply fire stopping and smoke seals in strict accordance with manufacturer's instructions and tested designs to provide the required temperature and flame rated seal, and to prevent the passage of smoke.
- 4.3.2 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
- 4.3.3 Completely fill and seal voids with fire stopping and smoke seal materials.
- 4.3.4 Tool or trowel exposed surfaces.
- 4.3.5 Remove excess compound promptly as work progresses and upon completion.
- 4.3.6 Allow materials to cure. Do not cover up materials until full curing has taken place.
- 4.3.7 Notify Consultant when completed installations are ready for inspection and prior to concealing or enclosing fire stopping and smoke seals.
- 4.4 SCHEDULE OF LOCATIONS
- 4.4.1 Provide fire stopping and smoke seal materials at openings and penetrations in fire resistance rated assemblies, including but not limited to, the following locations:
- .1 Penetrations through fire resistance rated masonry, concrete, and gypsum board partitions and walls.
 - .2 Top of fire resistance rated masonry and gypsum board partitions.
 - .3 Intersection of fire resistance rated masonry and gypsum board partitions.
- 4.5 CLEAN UP
- 4.5.1 Remove excess materials and debris and clean adjacent surfaces immediately after application.

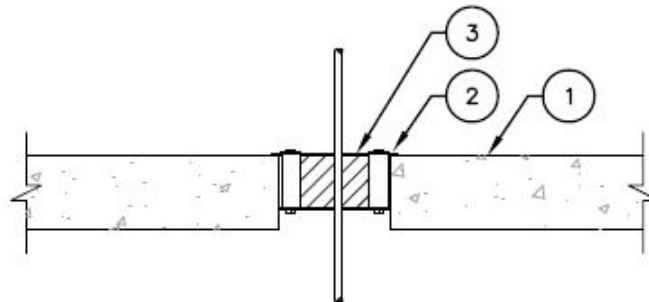
4.5.2 Remove temporary dams after initial set of fire stopping and smoke seal materials.

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E-2 PREFORMED, RE-ENTERABLE CABLE PENETRATION FOR WALL OR FLOOR

(BASED ON MATERIALS MANUFACTURED BY ROXTEC)

TOP/FRONT VIEW



1. FIRE-RATED (1-HR. OR 2-HR) CONCRETE FLOOR OR WALL ASSEMBLY OR ULC FIRE-RATED CONCRETE BLOCK WALL ASSEMBLY.

2. PREFORMED, RE-ENTERABLE FIRE-RATED FRAME AND SEAL ASSEMBLY, MINIMUM 70mm DIAMETER, MAXIMUM 200mm DIAMETER; SIZED TO SUIT NUMBER OF CABLE PENETRATIONS IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

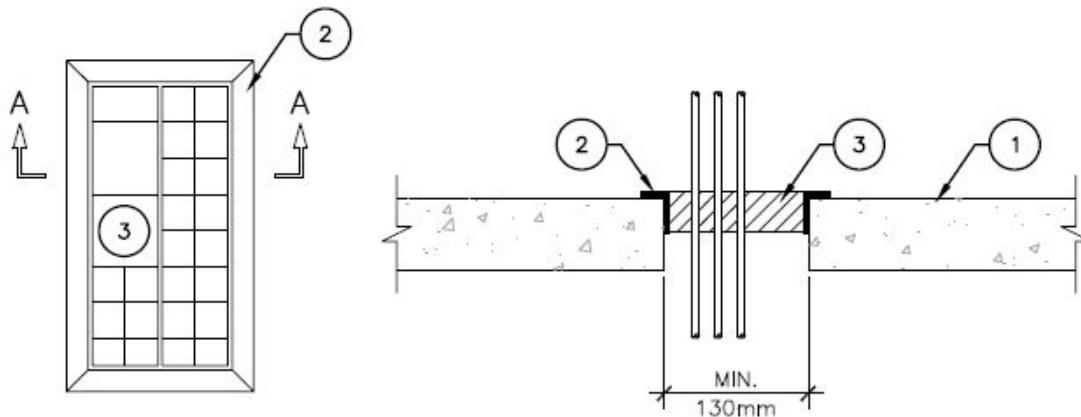
3. PREFORMED FIRE-RATED CABLE MODULES OR COMPENSATION BLOCKS SIZED TO SUIT NUMBER AND DIAMETER OF CABLE PENETRATIONS IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

E-3 PREFORMED, RE-ENTERABLE CABLE PENETRATION FOR WALL OR FLOOR

(BASED ON MATERIALS MANUFACTURED BY ROXTEC)

TOP/FRONT VIEW

SECTION A-A



1. FIRE-RATED (1-HR. OR 2-HR) CONCRETE FLOOR OR WALL ASSEMBLY OR ULC FIRE-RATED CONCRETE BLOCK WALL ASSEMBLY.

2. WELDED, BOLTED OR CAST ANGLE FRAME MINIMUM 130 x 110mm OPENING SIZE; MAXIMUM 865 x 870mm OPENING SIZE; SIZED TO SUIT NUMBER OF CABLE PENETRATIONS IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

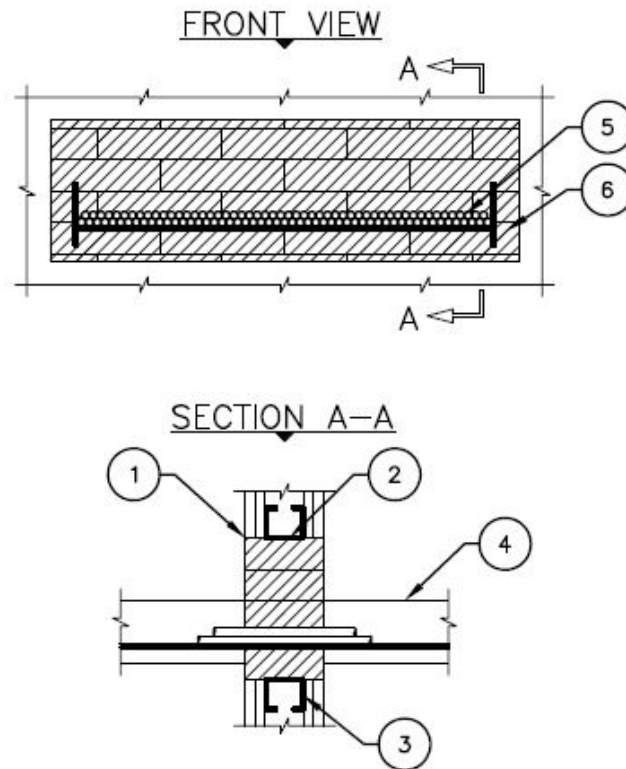
3. PREFORMED FIRE-RATED CABLE MODULES AND WEDGES SIZED TO SUIT NUMBER AND DIAMETER OF CABLE PENETRATIONS, HAVING 20% SPARE CAPACITY, ASSEMBLED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

4. COORDINATE OPENING SIZES PRIOR TO PLACEMENT OF CONCRETE OR CONSTRUCTION OF CONCRETE BLOCK.

E-4 CABLE TRAY THROUGH 1-HR. OR 2-HR. GYPSUM WALL ASSEMBLY

F RATING = 1-HR. OR 2-HR.

T RATING = 0-HR.

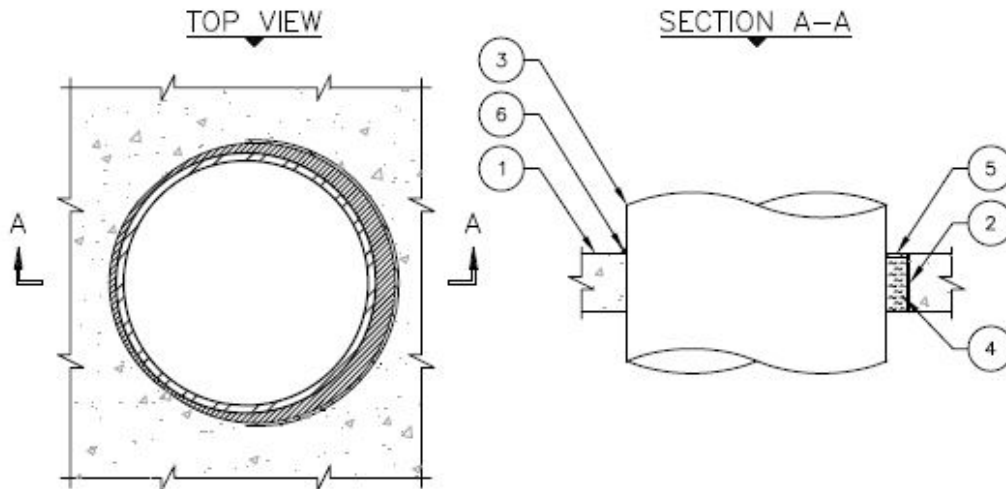


1. GYPSUM WALL ASSEMBLY: 1-HR. OR 2-HR. FIRE- RATING (2-HR. SHOWN).
2. WOOD STUDS NOMINAL 38 x 89mm OR MINIMUM 65mm STEEL STUDS.
3. FRAME OUT OPENING WITH METAL STUDS.
4. OPEN LADDER CABLE TRAY (MAXIMUM 610 x 100mm, STEEL OR ALUMINUM).
5. CABLES HAVING A COMBINATION NO GREATER THAN THE FOLLOWING :
 - A. MAXIMUM 300 PAIR NO. 24 AWG TELEPHONE CABLE.
 - B. MAXIMUM 500 KCMIL SINGLE CONDUCTOR POWER CABLE.
 - C. MAXIMUM 13mm DIAMETER FIBER-OPTIC CABLE (24 FIBER).
 - D. MAXIMUM 3/C NO. 12 AWG METAL CLAD CABLE.
6. FIRE BLOCKS AND SEALANT AS RECOMMENDED BY MANUFACTURER.

NOTES : 1. MAXIMUM SIZE OF OPENING = 225 x 760mm.
2. ANNULAR SPACE = MINIMUM 25mm, MAXIMUM 100mm.
3. MAXIMUM AREA OF CABLES EQUALS 40% OF CROSS-SECTIONAL AREA OF CABLE TRAY.
4. APPLY INTUMESCENT FIRE STOP INTO INTERSTICES OF CABLES, BETWEEN CABLES AND CABLE TRAY, AND ANY VOIDS TO MAXIMUM EXTENT POSSIBLE.

M-1 METAL PIPE THROUGH A SLEEVE IN CONCRETE FLOOR/WALL OR BLOCK WALL

F RATING = 3-HR.
T RATING = 0-HR.



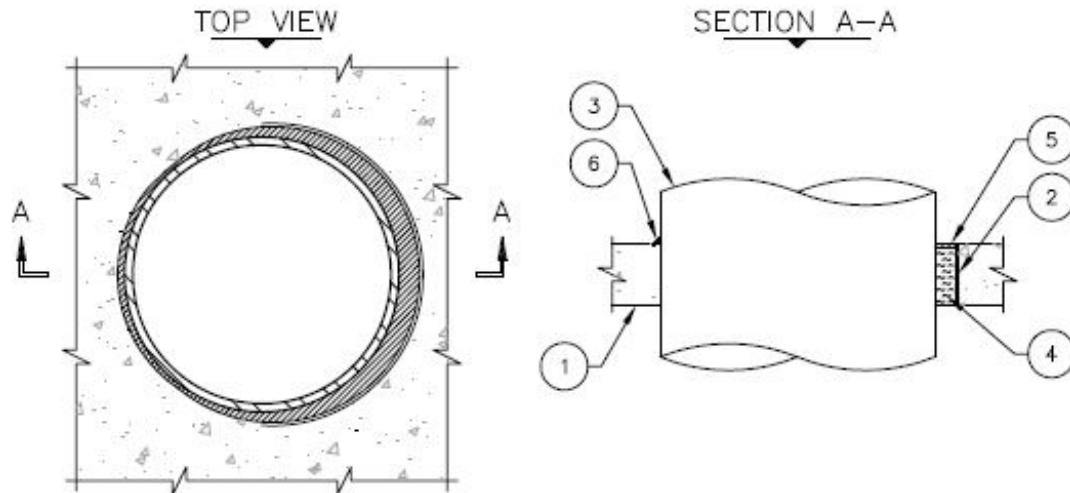
1. CONCRETE FLOOR OR WALL ASSEMBLY: 3-HR FIRE-RATING
 - A. LIGHTWEIGHT OR NORMAL WEIGHT CONCRETE FLOOR OR WALL (MIN. 114mm THICK).
 - B. ANY ULC CLASSIFIED CONCRETE BLOCK WALL.
2. OPTIONAL: MAXIMUM 800mm NOMINAL DIAMETER STEEL PIPE SLEEVE (SCHEDULE 40 OR HEAVIER).
3. PENETRATING ITEM NO GREATER THAN ONE OF THE FOLLOWING:
 - A. MAXIMUM 760mm NOMINAL DIAMETER STEEL PIPE (SCHEDULE 10 OR HEAVIER).
 - B. MAXIMUM 760mm NOMINAL DIAMETER CAST IRON PIPE.
 - C. MAXIMUM 150mm NOMINAL DIAMETER COPPER PIPE.
 - D. MAXIMUM 150mm NOMINAL DIAMETER STEEL CONDUIT.
 - E. MAXIMUM 100mm NOMINAL DIAMETER EMT.
4. MINIMUM 100mm THICKNESS MINERAL WOOL (MIN. 64kg/m³ DENSITY) TIGHTLY PACKED.
5. INTUMESCENT FIRE STOP SEALANT AS RECOMMENDED BY MANUFACTURER FOR FIRE RATING INDICATED
6. INTUMESCENT FIRE STOP SEALANT APPLIED AT POINT OF CONTACT.

NOTES : 1. MAXIMUM DIAMETER OF OPENING = 800mm.
2. ANNULAR SPACE = MINIMUM 0mm, MAXIMUM 47mm.
3. MINIMUM INTUMESCENT FIRE STOP SEALANT IS REQUIRED ON BOTH SIDES OF A WALL ASSEMBLY IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATION.

E-6 METAL PIPE THROUGH A SLEEVE IN CONCRETE FLOOR/WALL OR BLOCK WALL

F RATING = 3-HR.

T RATING = 0-HR.



1. CONCRETE FLOOR OR WALL ASSEMBLY: 3-HR FIRE-RATING
 - A. LIGHTWEIGHT OR NORMAL WEIGHT CONCRETE FLOOR OR WALL (MIN. 114mm THICK).
 - B. ANY ULC CLASSIFIED CONCRETE BLOCK WALL.
2. OPTIONAL: MAXIMUM 810mm NOMINAL DIAMETER STEEL PIPE SLEEVE (SCHEDULE 40 OR HEAVIER).
3. PENETRATING ITEM NO GREATER THAN ONE OF THE FOLLOWING:
 - A. MAXIMUM 760mm NOMINAL DIAMETER STEEL PIPE (SCHEDULE 10 OR HEAVIER).
 - B. MAXIMUM 760mm NOMINAL DIAMETER CAST IRON PIPE.
 - C. MAXIMUM 150mm NOMINAL DIAMETER COPPER PIPE.
 - D. MAXIMUM 150mm NOMINAL DIAMETER STEEL CONDUIT.
 - E. MAXIMUM 100mm NOMINAL DIAMETER EMT.
4. MINIMUM 100mm THICKNESS MINERAL WOOL (MIN. 64kg/m³ DENSITY) TIGHTLY PACKED.
5. INTUMESCENT FIRE STOP SEALANT AS RECOMMENDED BY MANUFACTURER FOR FIRE-RATING INDICATED.
6. INTUMESCENT FIRE STOP SEALANT APPLIED AT POINT OF CONTACT AS RECOMMENDED BY MANUFACTURER FOR FIRE-RATING INDICATED.

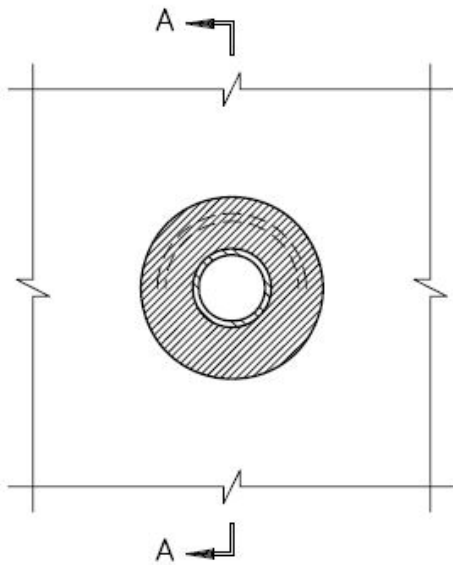
NOTES : 1. MAXIMUM DIAMETER OF OPENING = 810mm.
2. ANNULAR SPACE = MINIMUM 0mm, MAXIMUM 47mm.
3. INTUMESCENT FIRE STOP SEALANT IS REQUIRED ON BOTH SIDES OF A WALL ASSEMBLY AS RECOMMENDED BY MANUFACTURER FOR FIRE-RATING INDICATED.

E-7 ENT THROUGH 1-HR. OR 2-HR. GYPSUM WALL ASSEMBLY

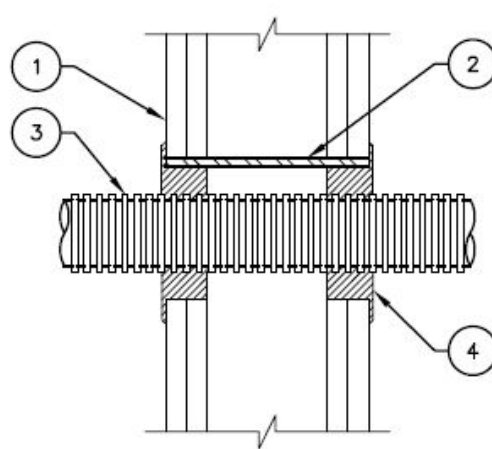
F AND FH RATING = 1-HR. AND 2-HR.

FT AND FTH RATING = 0-HR. AND 2-HR. (FOR 1-HR. AND 2-HR. WALLS, RESPECTIVELY)

FRONT VIEW



SECTION A-A



1. GYPSUM WALL ASSEMBLY: 1-HR OR 2-HR FIRE-RATING (2-HR SHOWN).
2. MAXIMUM 100mm NOMINAL DIAMETER STEEL PIPE SLEEVE (SCHEDULE 40 OR THINNER).
3. MAXIMUM 50mm NOMINAL DIAMETER ENT.
4. INTUMESCENT FIRE STOP SEALANT AS RECOMMENDED BY MANUFACTURER FOR FIRE-RATING INDICATED.

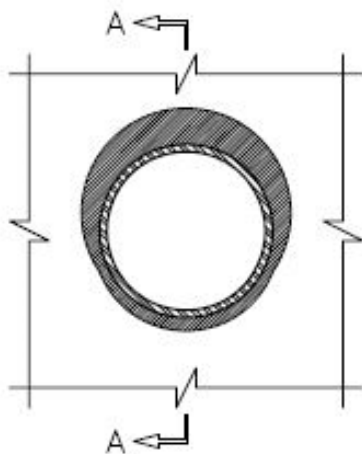
NOTES : 1. MAXIMUM DIAMETER OF OPENING = 100mm.
2. ANNULAR SPACE = 19mm.

E-8 METAL PIPE THROUGH 1-HR. OR 2-HR. GYPSUM WALL ASSEMBLY

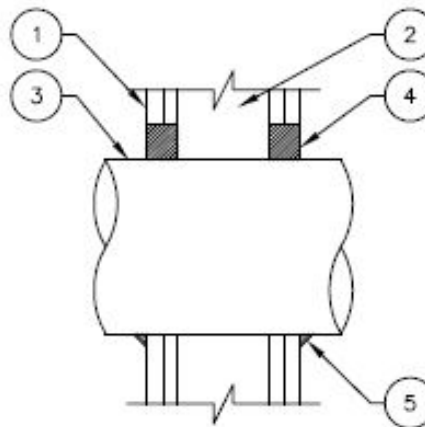
F RATING = 1-HR OR 2-HR.

T RATING = 0-HR.

FRONT VIEW



SECTION A-A

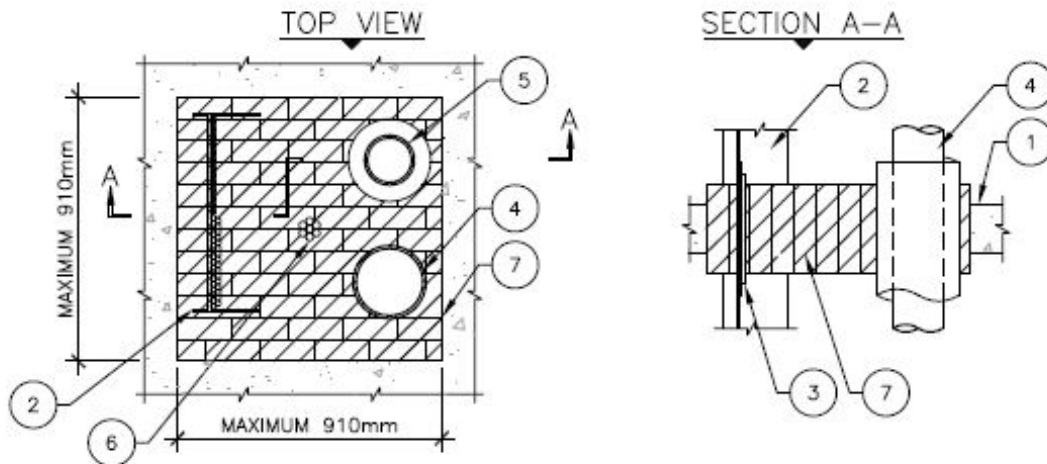


1. GYPSUM WALL ASSEMBLY: 1-HR. OR 2-HR. FIRE-RATING (2-HR. SHOWN).
2. WOOD STUDS NOMINAL 38 x 89mm OR MINIMUM 65mm STEEL STUDS.
3. PENETRATING ITEM NO GREATER THAN ONE OF THE FOLLOWING :
 - A. MAXIMUM 760mm DIAMETER STEEL PIPE (SCHEDULE 10 OR HEAVIER).
 - B. MAXIMUM 760mm DIAMETER CAST IRON PIPE.
 - C. MAXIMUM 150mm NOMINAL DIAMETER COPPER PIPE.
 - D. MAXIMUM 150mm NOMINAL DIAMETER STEEL CONDUIT.
 - E. MAXIMUM 100mm NOMINAL DIAMETER EMT.
4. INTUMESCENT FIRE STOP SEALANT AS RECOMMENDED BY MANUFACTURER FOR FIRE-RATING INDICATED.
5. INTUMESCENT FIRE STOP SEALANT AT POINT OF CONTACT AS RECOMMENDED BY MANUFACTURER FOR FIRE-RATING INDICATED.

NOTES : 1. MAXIMUM DIAMETER OF OPENING :
A. 820mm FOR STEEL STUD WALLS.
B. 370mm FOR WOOD STUD WALLS.
2. ANNULAR SPACE = MINIMUM 0mm, MAXIMUM 65mm.

E-10 MULTIPLE PENETRATING ITEMS THROUGH CONCRETE FLOOR/WALL OR BLOCK WALL

F RATING = 3-HR.
T RATING = 0-HR.

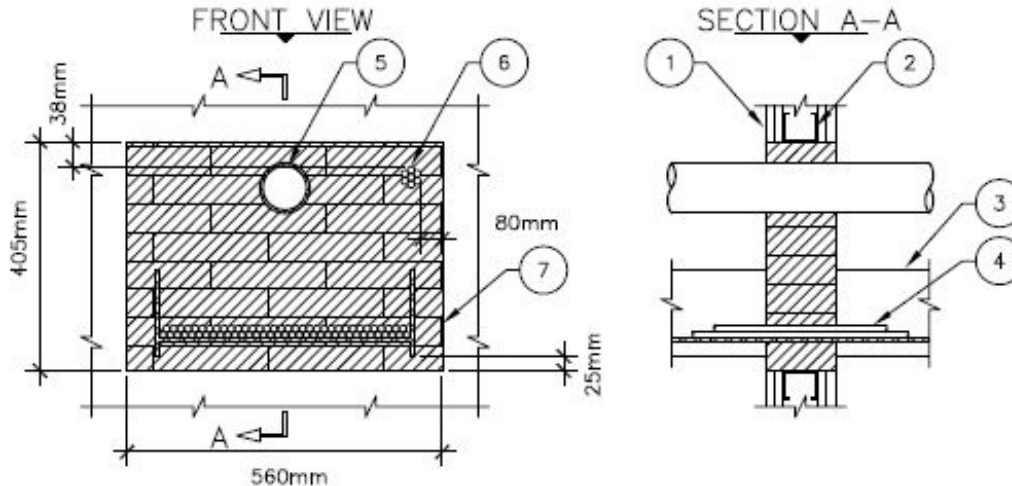


1. CONCRETE FLOOR OR WALL ASSEMBLY: 3-HR FIRE-RATING.
 - A. LIGHTWEIGHT OR NORMAL WEIGHT CONCRETE FLOOR OR WALL (MIN. 114mm THICK).
 - B. ANY ULC CLASSIFIED CONCRETE BLOCK WALL.
2. MAXIMUM 450 x 150mm ALUMINUM OR STEEL OPEN LADDER CABLE TRAY.
3. ANY COMBINATION OF THE FOLLOWING CABLES MAY BE USED WITHIN THE CABLE TRAY (SEE NOTE NO. 4 BELOW):
 - A. 7/C NO. 12 AWG COPPER CONDUCTOR CABLE.
 - B. MAX. 500 KCMIL SINGLE CONDUCTOR CABLE.
 - C. MAX. 300 PAIR NO. 24 AWG TELEPHONE CABLE.
 - D. 24 FIBER-OPTIC CABLE (MAX. 13mm DIAMETER).
4. PENETRATING ITEMS MAY BE ANY OF THE FOLLOWING: MAXIMUM 6" NOMINAL DIAMETER STEEL PIPE OR STEEL CONDUIT; MAXIMUM 6" NOMINAL DIAMETER CAST IRON PIPE; OR MAXIMUM 4" NOMINAL DIAMETER COPPER PIPE OR EMT.
5. MAXIMUM 38mm GLASS FIBER INSULATION.
6. MAXIMUM 50mm CABLE BUNDLE TO BE A COMBINATION OF ANY OF THE FOLLOWING:
 - A. 7/C NO. 12 AWG CABLE.
 - B. 25 PAIR NO. 24 AWG TELEPHONE CABLE.
 - C. ROMEX (2/C NO. 10 +GRND).
 - D. 3/C NO. 8 ALUMINUM CLAD CABLE.
 - E. RG 62A COAXIAL CABLE.
 - F. 24 FIBER-OPTIC CABLE (MAX. 13mm DIA.).
7. FIRE BLOCK AS RECOMMENDED BY MANUFACTURER FOR FIRE-RATING INDICATED.

NOTES : 1. MAXIMUM AREA OF OPENING = 0.835m², WITH MAXIMUM DIMENSION OF 915mm.
2. ANNULAR SPACE FOR CABLE TRAY = MINIMUM 38mm, MAXIMUM 114mm.
3. ANNULAR SPACE FOR PIPE AND CABLE PENETRATIONS = MINIMUM 25mm, MAXIMUM 114mm.
4. MAXIMUM AREA OF CABLES EQUALS 30% OF CROSS-SECTIONAL AREA OF CABLE TRAY.
5. APPLY INTUMESCENT FIRE STOP SEALANT INTO INTERSTICES OF CABLES, BETWEEN CABLES AND CABLE TRAY, AND ANY VOIDS TO MAXIMUM EXTENT POSSIBLE.
6. WIRE MESH (NOT SHOWN). WHEN THE ANNULAR SPACE EXCEEDS 114mm, USE A NOMINAL 50mm SQ., NO. 16 SWG WIRE MESH TO KEEP THE FIRE BLOCKS IN PLACE.

E-11 MULTIPLE PENETRATIONS THROUGH 1-HR. OR 2-HR. GYPSUM WALL ASSEMBLY

F RATING = 1-HR OR 2-HR.
T RATING = 0-HR.

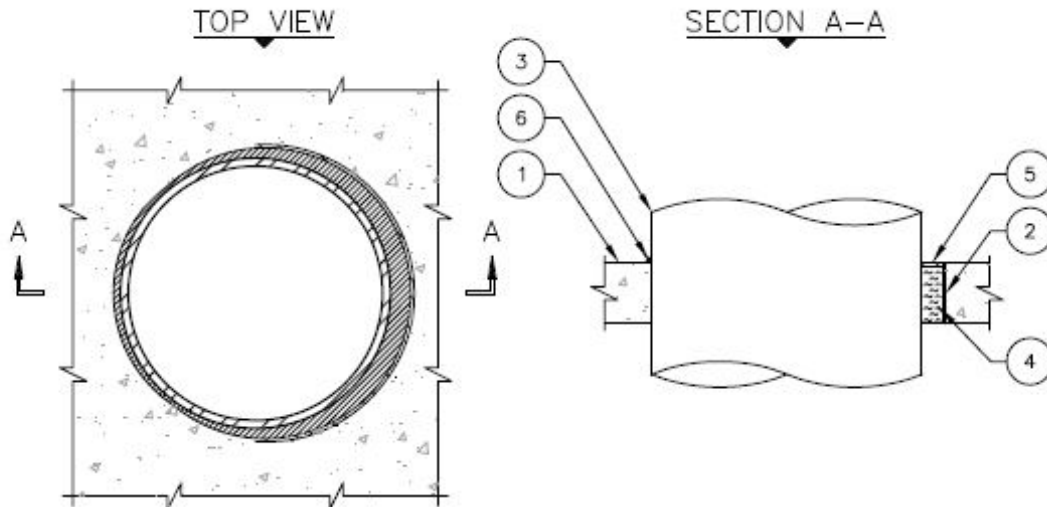


1. GYPSUM WALL ASSEMBLY: 1-HR. OR 2-HR. FIRE-RATING (2-HR. SHOWN).
2. WOOD STUDS NOMINAL 38 x 89mm OR MINIMUM 65mm STEEL STUDS.
3. OPEN LADDER CABLE TRAY (MAXIMUM 450 x 150mm, STEEL OR ALUMINUM).
4. ANY OF THE FOLLOWING CABLES MAY BE USED WITH MAXIMUM 30% FILL OF CABLE TRAY :
 - A. MAXIMUM 350 KCMIL SINGLE CONDUCTOR POWER CABLE.
 - B. MAXIMUM 7/C NO. 12 AWG COPPER CONDUCTOR CABLE.
 - C. MAXIMUM 100 PAIR NO. 24 AWG TELEPHONE CABLE.
5. MAX. 75mm NOMINAL DIAMETER PVC PLASTIC PIPE (SCHEDULE 40) (CLOSED OR VENTED PIPING SYSTEM) (SEE NOTE NO. 1 BELOW).
6. MAXIMUM 38mm DIAMETER CABLE BUNDLE CONSISTING OF ANY OF THE FOLLOWING :
 - A. FIBER-OPTIC CABLE (24 FIBER).
 - B. RG 59 COAXIAL CABLE.
 - C. MAX. 25 PAIR NO. 24 AWG TELEPHONE CABLE.
 - D. MAX. 7/C NO. 12 AWG COPPER CONDUCTOR.
7. FIRE BLOCKS AS RECOMMENDED BY MANUFACTURER FOR FIRE-RATING INDICATED.

NOTES: 1. PENETRATING ITEMS MAY ALSO INCLUDE A MAX. 150mm NOM. DIA. STEEL PIPE, MAX. 150mm NOM. DIA. STEEL CONDUIT; MAX. 100mm NOM. DIA. COPPER PIPE, OR MAX. 100mm NOM. DIA. EMT.
 2. MAX. 38mm GLASS-FIBER INSULATION MAY BE USED ON ANY OR ALL METALLIC PIPES.
 3. ANNULAR SPACE = MINIMUM 25mm, MAXIMUM 235mm.
 4. APPLY INTUMESCENT FIRE STOP SEALANT IN ANY VOID THAT MAY EXIST (AROUND PENETRANTS, INTO INTERSTICES OF CABLES, BETWEEN CABLES AND CABLE TRAY, OR BETWEEN FIRE BLOCKS) TO MAXIMUM EXTENT POSSIBLE.

M-1 METAL PIPE THROUGH A SLEEVE IN CONCRETE FLOOR/WALL OR BLOCK WALL

F RATING = 3-HR.
T RATING = 0-HR.

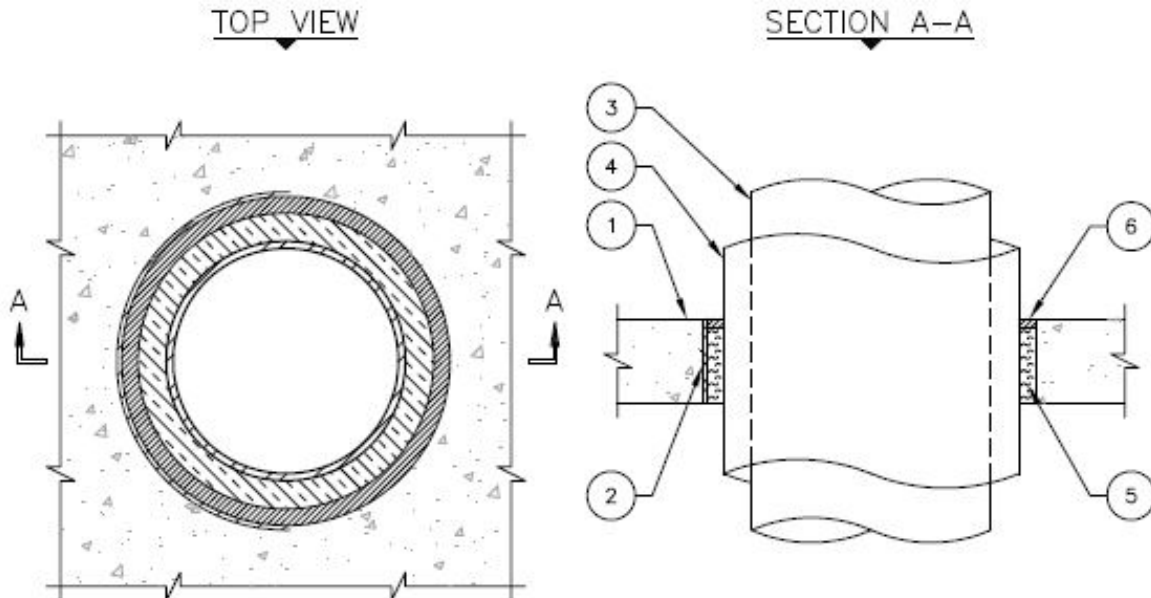


1. CONCRETE FLOOR OR WALL ASSEMBLY: 3-HR FIRE-RATING
 - A. LIGHTWEIGHT OR NORMAL WEIGHT CONCRETE FLOOR OR WALL (MIN. 114mm THICK).
 - B. ANY ULC CLASSIFIED CONCRETE BLOCK WALL.
2. OPTIONAL: MAXIMUM 800mm NOMINAL DIAMETER STEEL PIPE SLEEVE (SCHEDULE 40 OR HEAVIER).
3. PENETRATING ITEM NO GREATER THAN ONE OF THE FOLLOWING:
 - A. MAXIMUM 760mm NOMINAL DIAMETER STEEL PIPE (SCHEDULE 10 OR HEAVIER).
 - B. MAXIMUM 760mm NOMINAL DIAMETER CAST IRON PIPE.
 - C. MAXIMUM 150mm NOMINAL DIAMETER COPPER PIPE.
 - D. MAXIMUM 150mm NOMINAL DIAMETER STEEL CONDUIT.
 - E. MAXIMUM 100mm NOMINAL DIAMETER EMT.
4. MINIMUM 100mm THICKNESS MINERAL WOOL (MIN. 64kg/m³ DENSITY) TIGHTLY PACKED.
5. INTUMESCENT FIRE STOP SEALANT AS RECOMMENDED BY MANUFACTURER FOR FIRE RATING INDICATED
6. INTUMESCENT FIRE STOP SEALANT APPLIED AT POINT OF CONTACT.

NOTES : 1. MAXIMUM DIAMETER OF OPENING = 800mm.
2. ANNULAR SPACE = MINIMUM 0mm, MAXIMUM 47mm.
3. MINIMUM INTUMESCENT FIRE STOP SEALANT IS REQUIRED ON BOTH SIDES OF A WALL ASSEMBLY IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATION.

M-2 INSULATED METAL PIPE THROUGH CONCRETE FLOOR/WALL OR BLOCK WALL

F RATING = 2-HR.
T RATING = 1-HR.



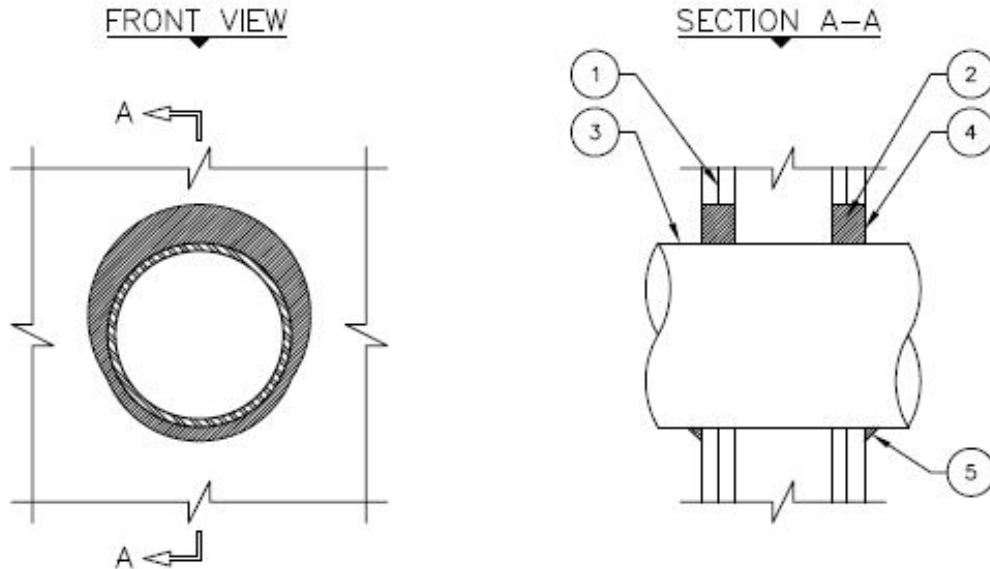
1. CONCRETE FLOOR OR WALL ASSEMBLY: 2-HR FIRE-RATING
 - A. LIGHTWEIGHT OR NORMAL WEIGHT CONCRETE FLOOR OR WALL (MINIMUM 114mm THICK).
 - B. ANY ULC CLASSIFIED CONCRETE BLOCK WALL ASSEMBLY.
2. OPTIONAL: MAXIMUM 500mm NOMINAL DIAMETER STEEL PIPE SLEEVE (SCHEDULE 10 OR HEAVIER).
3. PENETRATING ITEM NOT GREATER THAN ONE OF THE FOLLOWING:
 - A. MAXIMUM 300mm NOMINAL DIAMETER STEEL PIPE (SCHEDULE 10 OR HEAVIER).
 - B. MAXIMUM 150mm NOMINAL DIAMETER COPPER PIPE.
4. MAXIMUM 50mm THICK GLASS FIBER INSULATION.
5. MINIMUM 100mm THICKNESS MINERAL WOOL (MIN. 64kg/m³ DENSITY) TIGHTLY PACKED.
6. INTUMESCENT FIRE STOP SEALANT AS RECOMMENDED BY MANUFACTURER.

NOTES : 1. MAXIMUM DIAMETER OF OPENING = 500mm.
2. ANNULAR SPACE = MINIMUM 13mm, MAXIMUM 57mm.
3. APPLY FIRE STOP SEALANT TO BOTH SIDES OF WALL ASSEMBLY.

M-3 METAL PIPE THROUGH 1-HR. OR 2-HR. GYPSUM WALL ASSEMBLY

F RATING = 1-HR. OR 2-HR.

T RATING = 0-HR.



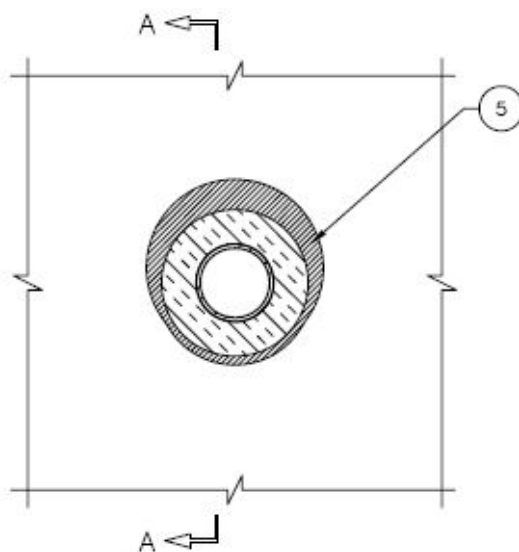
1. GYPSUM WALL: 1-HR. OR 2-HR. FIRE-RATING (2-HR. SHOWN).
2. WOOD STUDS NOMINAL 38 x 89mm OR MINIMUM 65mm WIDE STEEL STUDS.
3. PENETRATING ITEM NOT GREATER THAN ONE OF THE FOLLOWING :
 - A. MAXIMUM 760mm DIAMETER STEEL PIPE (SCHEDULE 10 OR HEAVIER).
 - B. MAXIMUM 760mm DIAMETER CAST IRON PIPE.
 - C. MAXIMUM 150mm NOMINAL DIAMETER COPPER PIPE.
 - D. MAXIMUM 150mm NOMINAL DIAMETER STEEL CONDUIT.
 - E. MAXIMUM 100mm NOMINAL DIAMETER EMT.
4. INTUMESCENT FIRE STOP SEALANT AS RECOMMENDED BY MANUFACTURER FOR FIRE RATING INDICATED
5. APPLY FIRE STOP SEALANT AT POINT OF CONTACT.

NOTES : 1. MAXIMUM DIAMETER OF OPENING :
A. 820mm FOR STEEL STUD WALLS.
B. 370mm FOR WOOD STUD WALLS.
2. ANNULAR SPACE = MINIMUM 0mm, MAXIMUM 65mm.

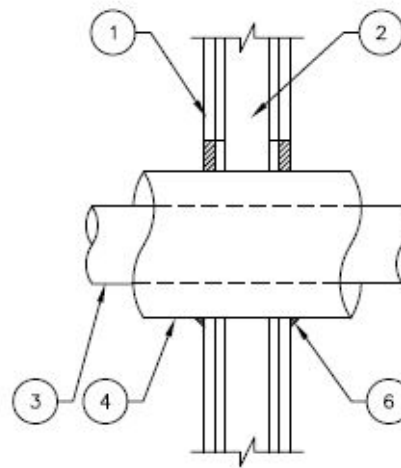
M-5 INSULATED METAL PIPE THROUGH 1-HR. OR 2-HR. GYPSUM WALL ASSEMBLY

F RATING = 1-HR. AND 2-HR.
T-RATING = 1/2-HR., 3/4-HR., 1-HR., AND 1-3/4 HR.

FRONT VIEW



SECTION A-A

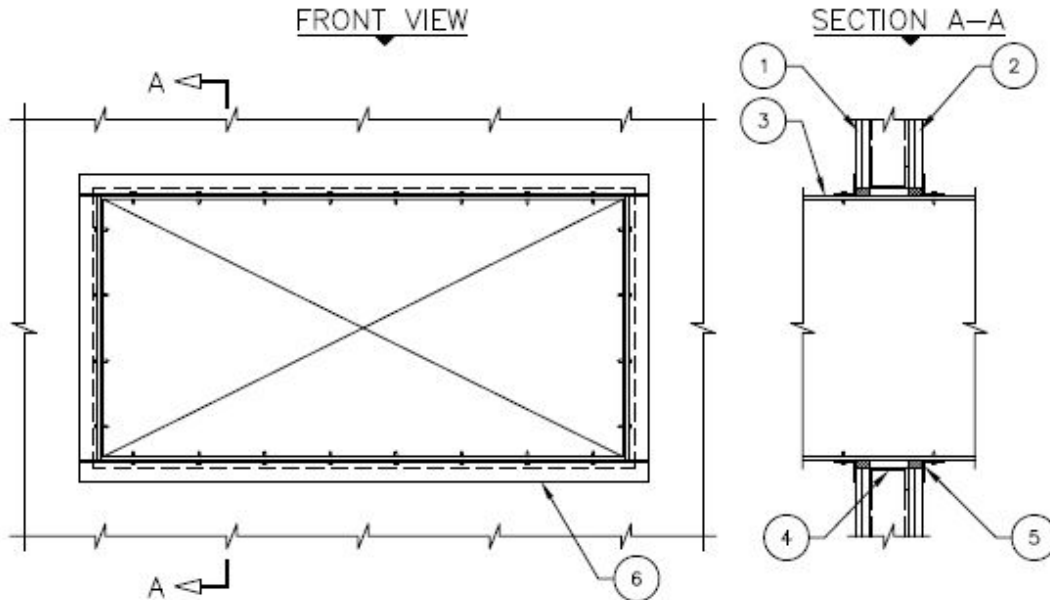


1. GYPSUM WALL ASSEMBLY: 1-HR. OR 2-HR. FIRE-RATING. (2-HR. SHOWN)
2. WOOD STUDS NOMINAL 38 x 89mm OR MINIMUM 65mm WIDE STEEL STUDS.
3. PENETRATING ITEM NO GREATER THAN ONE OF THE FOLLOWING :
 - A. MAXIMUM 300mm NOMINAL DIAMETER STEEL PIPE (SCHEDULE 20 OR HEAVIER).
 - B. MAXIMUM 150mm NOMINAL DIAMETER COPPER PIPE.
 - C. MAXIMUM 100mm NOMINAL DIAMETER STEEL CONDUIT.
 - D. MAXIMUM 100mm NOMINAL DIAMETER EMT.
4. MAXIMUM 50mm THICK GLASS-FIBER PIPE INSULATION.
5. INTUMESCENT FIRESTOP SEALANT AS RECOMMENDED BY MANUFACTURER FOR FIRE-RATING INDICATED
6. INTUMESCENT FIRE STOP SEALANT AT POINT OF CONTACT AS RECOMMENDED BY MANUFACTURER.

NOTES : 1. MAXIMUM DIAMETER OF OPENING = 450mm.
2. ANNULAR SPACE = MINIMUM 0mm, MAXIMUM 47mm.

M-6 METAL DUCT (WITHOUT DAMPER) THROUGH 1-HR. OR 2-HR. GYPSUM WALL ASSEMBLY

F RATING = 1-HR. OR 2-HR.
T RATING = 0-HR.

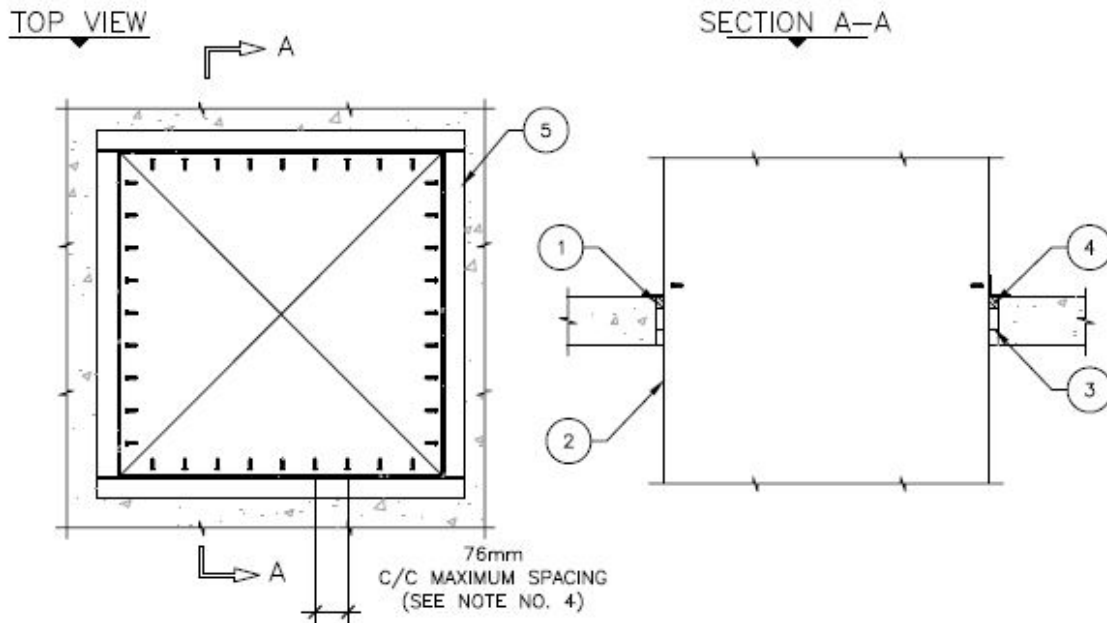


1. GYPSUM WALL ASSEMBLY: 1-HR. OR 2-HR. FIRE-RATING. (2-HR. SHOWN)
2. WOOD STUDS NOMINAL 38 x 89mm OR MINIMUM 65mm WIDE STEEL STUDS.
3. RECTANGULAR SHEET METAL DUCT (MAXIMUM SIZE : 610mm x 1220mm, MINIMUM 0.61mm. THICKNESS).
4. FRAMED OUT OPENING WITH METAL STUDS.
5. INTUMESCENT FIRE STOP SEALANT AS RECOMMENDED BY MANUFACTURER FOR FIRE-RATING INDICATED.
6. AFTER SEALING SPACE BETWEEN DUCT AND GYPSUM WALL ASSEMBLY WITH FIRE STOP SEALANT, FASTEN STEEL ANGLE (MINIMUM 38 x 38 x 1.5mm.) TO DUCT WITH MINIMUM NO. 8 x 19mm" LONG SHEET METAL SCREWS; ANGLE DOES NOT HAVE TO BE FASTENED TO THE WALL ASSEMBLY.

NOTES : 1. MAX. AREA OF OPENING = .800mm² WITH A MAXIMUM DIMENSION OF 1250mm.
2. ANNULAR SPACE = MINIMUM 6mm, MAXIMUM 25mm.
3. NOT FOR USE IN DUCT SYSTEMS CONTAINING A FIRE DAMPER.

M-7 METAL DUCT (WITHOUT DAMPER) THROUGH CONCRETE FLOOR/WALL OR BLOCK WALL

F RATING = 3-HR.
T RATING = 0-HR.



1. CONCRETE FLOOR OR WALL ASSEMBLY: 3-HR FIRE-RATING.
 - A. LIGHTWEIGHT OR NORMAL WEIGHT CONCRETE FLOOR (MIN. 114mm THICK).
 - B. LIGHTWEIGHT OR NORMAL WEIGHT CONCRETE WALL (MIN. 135mm THICK).
 - C. ANY ULC CLASSIFIED CONCRETE BLOCKWALL.
2. MAXIMUM 800 x 800mm RECTANGULAR STEEL DUCT (MINIMUM 0.61mm THICK).
3. MINIMUM 89mm THICKNESS MINERAL WOOL (MIN. 64kg/m³ DENSITY) TIGHTLY PACKED.
4. FIRE STOP SEALANT AS RECOMMENDED BY MANUFACTURER FOR FIRE-RATING INDICATED.
5. AFTER SEALING SPACE BETWEEN DUCT AND CONCRETE FLOOR/WALL ASSEMBLY WITH FIRE STOP SEALANT, FASTEN STEEL ANGLE (50 x 50 x 1.5mm THICK.) TO DUCT WITH NO. 8 (OR LARGER) STEEL SHEET METAL SCREWS; ANGLE DOES NOT HAVE TO BE FASTENED TO CONCRETE FLOOR/WALL ASSEMBLY.

NOTES : 1. MAXIMUM AREA OF OPENING = .735mm² WITH A MAXIMUM DIMENSION OF 857mm.
2. ANNULAR SPACE = MINIMUM 6mm, MAXIMUM 38mm.
3. ELASTOMERIC FIRE STOP SEALANT IS REQUIRED ON BOTH SIDES OF A WALL ASSEMBLY.
4. NOT FOR USE IN DUCT SYSTEMS CONTAINING A DAMPER.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

- 1.1.1 Comply with Division 1, General Requirements and all documents referred to therein.
- 1.1.2 All labour, materials, products, equipment and services to complete the joint caulking and sealants work necessary and/or indicated on the Drawings and specified herein.
- 1.1.3 All caulking and sealing required to make the building sealed tightly from the exterior and caulked from the interior to withstand the action of the elements and to complete the building vapour barrier and not specified under other Sections, shall be the work of this Section.

1.2 WORK INCLUDED UNDER OTHER SECTIONS

- 1.2.1 Section 03 01 30 Rehabilitation of Cast-in-Place Concrete
- 1.2.2 Section 07 84 00 Fire stopping and smoke seals
- 1.2.3 Section 09 29 00 Gypsum Board

1.3 REFERENCES

1.3.1 AMERICAN SOCIETY FOR TESTING AND MATERIALS INTERNATIONAL, (ASTM)

- 1.3.1.1 ASTM C919-[02], Standard Practice for Use of Sealants in Acoustical Applications.

1.3.2 CANADIAN GENERAL STANDARDS BOARD (CGSB)

- 1.3.2.1 CGSB 19-GP-5M-[1984] Sealing Compound, One Component, Acrylic Base, Solvent Curing (Issue of 1976 reaffirmed, incorporating Amendment No. 1).
- 1.3.2.2 CAN/CGSB-19.13-[M87] Sealing Compound, One-component, Elastomeric, Chemical Curing.
- 1.3.2.3 CGSB 19-GP-5M-[1984] Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing (Reaffirmation of April 1976).
- 1.3.2.4 CAN/CGSB-19.17-[M90] One-Component Acrylic Emulsion Base Sealing Compound.
- 1.3.2.5 CAN/CGSB-19.24-[M90] Multi-component, Chemical Curing Sealing Compound.

1.4 QUALITY ASSURANCE

- 1.4.1 Perform the work by a recognized established caulking and sealing contractor having at least five years experience and skilled mechanics thoroughly trained and competent in the use of caulking and sealing equipment and the specified materials.
- 1.4.2 Arrange with the caulking and sealant manufacturers for visit at the job site by one of their technical representatives before beginning the caulking and sealing installation to discuss with the Contractor and the Consultant the procedures to be adopted, to analyze site conditions and inspect the surfaces and joints to be sealed, in order that recommendations may be made.

1.4.3 Discuss the following items:

- .1 Weather condition under which work will be done;
- .2 Anticipated frequency and extent of joint movement;
- .3 Joint design;
- .4 Suitability of Durometer hardness and other properties of material to be used.

1.4.4 Technical representative shall randomly inspect preparation of substrate and perform random testing of installed work at at least ten(10) locations.

1. Cut tests locations to be 150mm long.
2. Certify thickness, hardness and surface finish conforms to intended design.
3. Report to consultant.

1.5 SUBMITTALS

1.5.1 Submit a signed letter from the sealant and caulking manufacturers prior to commencement of work of this Section which states:

- .1 Sealants and caulking materials selected for use from those specified;
- .2 Surface preparation requirements;
- .3 Priming and application procedures;
- .4 Verification that sealant and caulking are suitable for purposes intended and joint design;
- .5 Sealants and caulking are compatible with other materials and products with which they come in contact including but not limited to sealants provided under other Sections, insulation adhesives, bitumen, block, concrete, metals and metal finishes;
- .6 Verification that sealants and caulking are suitable for temperature and humidity conditions at time of application.

1.6 ENVIRONMENTAL CONDITIONS

1.6.1 Ambient and substrate surface temperatures shall be above 5°C during application and during the work of this Section.

1.7 WARRANTY

1.7.1 Submit a five year warranty of the materials and workmanship for the sealing work. Under the warranty, the materials shall not breakdown, decompose, lose their resiliency, crack, or lose bond with sides of joints.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 All caulking and sealants: Non-bleeding and capable of supporting their own weight except for the self-levelling type sealant for horizontal surfaces.

2.1.2 Caulking: One component acrylic base (solvent release type) complying with CGSB 19-GP-5M.

2.1.3 Caulking for horizontal surfaces: Self-levelling pourable grade, Shore "A" hardness of 25-35, fully water resistant for continuous wet conditions, grey in colour, Duoflex SL by Sika, or other approved manufacture.

2.1.4 Sealant: Multi-component chemical curing, complying with CAN/CGSB 19.24-M Type 2, Dymeric 240FC by Tremco Manufacturing Company (Canada) Ltd., or other approved manufacture.

- 2.1.5 Sealant for saw-cut horizontal surfaces: Multi-component, self-levelling, conforming to ASTM D2240 Tremco Control Joint Sealant, BASF Masterfill 300, or Sika Loadflex.
- 2.1.6 Sealant for Joints around Interior Door Frames, Windows and Under Exterior Thresholds: One-part, low or medium modulus, neutral curing 100% silicone joint sealant, conforming to ASTM C920-11, Type S, Grade NS, Class 35.
- .1 DC CWS by Dow Corning.
 - .2 SWS by GE
 - .3 SikaSil WS-305CN by Sika
- 2.1.7 Sealant for Exterior Wall Joints: Air-seal sealant: One part, silicone, shore A hardness 15-25, conforming to CGSB 19-GP-13M, classification C-1-40-B-N and C-1-25-B-N and ASTM C920-11, Type S, Grade NS, Class 25. Use NT, M, G, A and O:
- .1 DC 791 by Dow Corning
 - .2 UltraPruf II SCS 2902 by GE
 - .3 Spectrum 3 by Tremco
 - .4 SikaSil N-Plus by Sika
- 2.1.8 Sealant for vanity and kitchen counter splash-backs and washroom fixtures: Mould and mildew resistant, Shore A Hardness 15-25, conforming to ASTM C920, Type S, Grade NS, Class 25, use NT, G, and A.; colour white.
- .1 SCS1700 by GE
 - .2 DC 786 by Dow Corning
 - .3 Tremsil 200 by Tremco
 - .4 Omni Plus by Sonneborn
 - .5 SikaSil –GP by Sika
- 2.1.9 Exterior Metal To Wood, Masonry, Stone Or Porous Surfaces:
- 2.1.9.1 One-part elastomeric, non-sag urethane based sealant. Accepted products:
- .1 “Dymonic” as manufactured by Tremco
 - .2 “Sikaflex 1-A” as manufactured by Sika Canada
 - .3 “Vulkem 931” by Mameco as manufactured by Tremco
 - .4 “SK-1 Structural Sealant” as supplied by Chemlink
- 2.1.10 Exterior And Interior Metal To Metal And Metal To Glass Joints:
- 2.1.10.1 One-part Silicone based sealant. Accepted Products:
- .1 “Spectrum 2” as manufactured by Tremco DC 786 by Dow Corning
 - .2 “Contractors SCS 1000 Sealant” as manufactured by GE Silicones Canada
 - .3 “DC 999-A Silicone Building & Glazing Sealant” as manufactured by Dow Corning Canada.
- 2.1.11 All caulking, sealants, cleaning solvents, fillers and primers: Compatible with each other.
- 2.1.12 Colours for caulking and sealants: As selected later by the Consultant and not necessarily standard colours.

- 2.1.13 Joint backing: White non-absorbent open cell foam polyethylene, Sof Rod, by Tremco, or other approved manufacture. Filler diameter shall be 50% greater than joint width before installation.
- 2.1.14 Bond breaker: Tape of type supplied or recommended by sealant or caulking manufacturer.
- 2.1.15 Primers: As recommended by the caulking and sealant manufacturer. Primers shall suit the various job conditions.
- 2.1.16 Cleaning material: Xylol, Methyl-ethyl-ketone, Toluol or as recommended by the caulking and sealant manufacturer.

PART 3 - EXECUTION

3.1 GENERAL

- 3.1.1 Apply in accordance with the drawings, specifications and requirements of the jurisdictional authorities and the Canadian Roofing Contractors Association's Roofing Manual.
- 3.1.2 Regard the manufacturer's printed recommendations and specifications as a minimum requirement for materials, methods and quality of work not otherwise specified herein.
- 3.1.3 Make adjustments to the specified procedures caused by weather and site conditions only with the Consultants approval.
- 3.1.4 Conform to the details.
- 3.1.5 Examine joints before caulking to ensure that the configuration, surface and widths are suitable for the sealant and service, and that the execution of caulking and performance of sealants will not be adversely affected.
- 3.1.6 Verify, before commencing the work, that the joint size, depth and substrate will not adversely affect the execution, performance or quality of the completed work; and that joints can be sealed in an acceptable condition by means of the preparation specified in this section. Verify the site conditions together with the sealant manufacturer's representative.
- 3.1.7 Defective work resulting from the application to unsatisfactory joint conditions will be rejected.

3.2 PREPARATION

- 3.2.1 Remove the existing sealant and backing material and all deleterious material from the joint. Use the method of surface preparation suitable for substrate that does not damage adjacent surfaces, as recommended by the sealant manufacturer.
- 3.2.2 Brush, scrub, scrape or grind the inner face surfaces to remove loose mortar, dust, oil, grease, oxidation, mill scale, and other materials which will affect the adhesion and integrity of the sealant.
- 3.2.3 Wipe down metal surfaces with clean cellulose sponges or rags soaked in solvent compatible with the sealant, and dry with clean cloths.
- 3.2.4 Ensure that surfaces have not been coated with release agents, coating or other treatments, or that, if present, they are entirely removed.
- 3.2.5 Protect adjacent finishes from damage, where heavy abrasive cleaning is required such as sandblasting, grinding or wire brushing.

3.2.6 Cleaning procedures:

- .1 Metal:
 - .1 Blast cleaning: Sandblast or iron shot blast surfaces requiring heavy cleaning to bright metal. Remove loose matter by compressed air or commercial vacuum cleaner.
 - .1 Power tool cleaning: Clean surfaces by wire brush, impact tools, abrasive wheels or by buffing. Remove loose matter by compressed air or vacuum cleaner.
 - .3 Solvent cleaning: Clean with solvent applied by spray or brush. Wipe with clean wiping cloth. Remove paints with paint remover and wipe with solvent. Remove residue.
- .2 Concrete and Masonry:
 - .1 Remove all friable material with wire brush or chipping, until surfaces are sound. Remove surface residue with a stiff brush, vacuum cleaner or compressed air.
 - .2 Concrete surfaces shall be cured for at least 28 days. Acid etch joint surfaces to remove alkaline salts and neutralize acid with a solution of trisodium phosphate, followed by rinsing with clean, cold water.
 - .3 Allow joints to dry thoroughly.
 - .4 Completely remove resinous products used as curing compounds and form release agents.
- .3 Glass, Ceramics and Porcelain:
 - .1 Brush with solvent and wipe with clean wiping cloths. Remove residue.
- .4 Wood:
 - .1 Remove foreign matter such as soil, paint, grease, asphalt, resin with solvents, abrasives and paint removers; make surfaces clean and dry.

3.2.7 Do not exceed shelf life, and pot life of the materials and installation times, as stated by the manufacturers.

3.2.8 Become familiar with the work life of the sealant to be used. Do not mix two part materials until required for use.

3.2.9 Mix sealants thoroughly with a mechanical mixer capable of mixing at 80-100 rpm without mixing air into the materials. Continue mixing until the material is a uniform colour and free from streaks of unmixed material.

3.2.10 Mask areas adjacent to the joints as required. Prevent contamination of adjacent surfaces. Remove masking promptly after the joint has been completed.

3.3 JOINT DEPTH

3.3.1 Provide the following Depth To Width Ratios:

- .1 Masonry:
 - .1 6mm (1/4") deep, up to 13mm (1/2") wide
 - .2 10mm (3/8") deep, up to 19mm (3/4") wide.
 - .3 13mm (1/2") deep, up to 25mm (1") wide
 - .4 19mm (3/4") deep, up to 51mm (2") wide.
- .2 Non Porous Materials:
 - .1 Joint depth and width to not be less than 6mm (1/4").
- .3 Maintain a minimum of a 2:1 width of depth ration or what is listed above in 3.3.1.1 and 3.3.1.2, whichever is more stringent.

3.4 PRIMING

3.4.1 Prime the inner face surfaces of joints as necessary for the substrate, in accordance with the sealant manufacturer's specification, to provide full adhesion and to prevent staining of the face surface at the joint.

3.4.2 Prime surfaces prior to installing the joint backing rod.

3.5 JOINT FILLING AND BACKING

3.5.1 Install joint backing where required to maintain the joint depth.

3.5.2 Pack joints tightly with sealant in accordance with the manufacturer's specifications using pressure guns. Fill joints completely to the required depths with sealant compound. Use sufficient pressure to fill all voids and joints. Sealant is to bond to both sides of the joint.

3.5.3 Finish joints smooth, free of wrinkles, ridges, air pockets and imbedded foreign materials. Tool joints to a slight concave surface using a soap/water mixture.

3.5.4 Cure sealants in accordance with the sealant manufacturer's instructions.

3.5.5 Do not cover up sealants until proper curing has taken place.

3.5.6 Do not allow sealants to cover or spot surfaces outside of joints. Use masking tape on all surfaces adjacent to joints which may become coated with sealant during the caulking process.

3.6 CLEAN UP

3.6.1 Cut out damaged caulking and sealing, re-prepare and prime joints and install new material as specified to the Consultant's satisfaction.

3.6.2 Clean surfaces soiled by work of this Section. Do not use chemicals, scrapers, or other tools in cleaning which will damage surfaces. Make good other work.

END OF SECTION

1 PART 1 - GENERAL

1.1 WORK INCLUDED

1.1.1 Comply with Division 1, General Requirements and all documents referred to therein.

1.1.2 All labour, materials, equipment and services to supply the hollow metal door, and steel door and screen frame work necessary and/or indicated on the Drawings and specified herein.

1.2 RELATED WORK UNDER OTHER SECTION

1.2.1 Section 06 10 00 Rough Carpentry.

1.2.2 Section 07 90 00 Caulking and Sealants.

1.2.3 Section 08 71 00 Finishing Hardware.

1.2.4 Section 08 80 00 Glass and glazing.

1.2.5 Section 09 90 00 Painting.

1.2.6

1.2.7 Door, Frame and Hardware Schedule on Drawings – Drawing Schedule: Door and frame types and sizes, fire ratings, glass requirements and hardware groups.

1.3 REFERENCES

1.3.1 ANSI/SDI A250.7-1997 (R2002) Nomenclature for Standard Steel Doors and Steel Frames.

1.3.2 ANSI/SDI A250.11-2001 Recommended Erection Instructions for Steel Frames.

1.3.3 ASTM A653/A653M-11 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.3.4 ASTM A879/A879M-06 Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface.

1.3.5 ASTM A924/A924M-09 Standard Specification for General Requirements for Sheet Steel, Metallic Coated by the Hot-Dip Process.

1.3.6 ASTM E90-09 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.

1.3.7 ASTM E413-04 Classification for Determination of Sound Transmission Class.

1.3.8 E1425-07 Standard Practice for Determining the Acoustical Performance of Windows, Doors, Skylight, and Glazed Wall Systems.

- 1.3.9 CAN/CGSB 1.132-M90 Primer, Zinc Chromate, Low Moisture Sensitivity.
- 1.3.10 CAN/CGSB 41-GP-19Ma-78 (1984) Rigid Vinyl Extrusions for Windows and Doors.
- 1.3.11 CAN/CGSB 82.5-M88 Insulated Steel Doors.
- 1.3.12 CSA W59-03 (R2008) Welded Steel Construction (Metal Arc Welding).
- 1.3.13 Recommended Dimensional Standards for Commercial Steel Doors and Frames, 2009.
- 1.3.14 Fire Labelling Guide, 2009.
- 1.3.15 NFPA 80-2010 Fire Doors and Windows.
- 1.3.16 NFPA 252-2008 Fire Tests of Door Assemblies.
- 1.3.17 CAN/ULC S104-10 Standard Method for Fire Tests of Door Assemblies.
- 1.3.18 CAN/ULC S105-09 Standard Specification for Fire Door Frames Meeting the Performance Required by CAN/ULC S104.
- 1.3.19 CAN4 S106-1980 (R1985) Standard Method for Fire Tests of Window and Glass Block Assemblies.
- 1.3.20 CAN/ULC S701-11 Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- 1.3.21 CAN/ULC S702-09 Standard for Thermal Insulation Mineral Fibre for Buildings.
- 1.3.22 CAN/ULC S705.1-01 Standard for Thermal Insulation, Spray Applied Rigid Polyurethane Foam, Medium Density.
- 1.3.23 CAN/ULC S705.2-05 Standard for Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density, Installer's Responsibilities - Specification.
- 1.3.24 Fire Rating Services, Building Materials and Equipment, Listings.

- 1.4 SUBMITTALS
 - 1.4.1 Shop drawings: Provide shop drawings in accordance with Section 01 33 00 - Submittals. Show, in as large a scale as practical, components, construction, methods of joining, welds, fastening and sleeving, type of metal, gauges and finishes, door swing, location of hardware and all other pertinent data. Clearly locate visible fixings on shop drawings.
 - 1.4.2 Door and frame schedule: Identify each door and frame with a symbol listed in the schedule and place legibly on the unit at the time of manufacture. Co-ordinate symbol with architectural drawing symbols and indications.
 - 1.4.3 Certificate: Substantiate design and construction of fire doors and frames, if required by the Consultant.

- 1.4.4 Submit full size hollow metal door and frame for approval, before production.
- 1.4.5 Upon Substantial Completion, provide Owner with a written Warranty, identifying both supplier and manufacturer, on materials and workmanship, for a period of one (1) year following date of completion. Deficiency correction during the period of warranty is the mutual responsibility of the General Contractor and the supplier.
- 1.4.6 Informational Submittals: Provide the following submittals when requested by the Consultant:
Source Quality Control Submittals: Submit information on zinc coating treatment and primer spot treatment, including instructions for surface treatment before site painting and any restrictions or special coating requirements.
- 1.5 QUALITY ASSURANCE
- 1.5.1 Acceptable manufacturers listed below are members of The Canadian Steel Door & Frame Manufacturers' Association:
- All Steel Doors Ltd.
- Daybar Industries Ltd.
- Fleming Steel Doors
- Metal Door Ltd.
- 1.5.2 Reference standards: Unless otherwise specified, meet requirements of "Canadian Manufacturing Specification for Steel Doors and Frames" published by the Canadian Steel Door & Frame Manufacturers' Association.
- 1.5.3 Fire protection requirements: fire rated doors; frames and sidelights shall bear ULC labels.
- 1.5.4 Frames shall be welded type; knockdown frames will not be acceptable.
- 1.5.5 Manufacturer: Obtain hollow metal doors and frames from single source of supply and from a single manufacturer, and as follows:
- .1 Fabricate work of this Section to meet the requirements of the Canadian Steel Door and Frame Manufacturer's Association, Manufacturing Specification for Doors and Frames as a minimum, and as further modified in this section.
 - .2 Fabricator shall be a member in good standing of the Canadian Steel Door and Frame Manufacturer's Association.
- 1.5.6 Supplier: Obtain hollow metal doors and frames from single source of supply and from a single manufacturer.
- 1.5.7 Installer: Use installers who have experience with the installation of hollow metal doors and frames of similar complexity and extent to that required for the Project.
- 1.5.8 Testing Agencies: Provide doors produced under label service program of a testing agency acceptable to Authorities Having Jurisdiction, and as follows:
- .1 Steel Fire Rated Doors and Frames: Labelled and listed by an organization accredited by Standards Council of Canada for ratings specified or indicated.
 - .2 Provide fire labelled frame products for those openings requiring fire protection ratings, as scheduled:

- .1 List by nationally recognized agency having factory inspection service and construct as detailed in Follow-up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.
- .2 Fabricate all rated doors, frames and screens to labelling authority standard.
- .3 Fire rated frame construction shall conform to can4 s105-m

1.6 INSPECTION AND TESTING

1.6.1 One door will be selected at random by the Consultant and shall be submitted for deconstructive testing by the inspection and testing company appointed by the Consultant to verify conformance with the requirements of these specifications.

1.6.2 Door testing shall include:

- .1 Verification that the door is internally reinforced with the specified core, steel sheet thickness, and other specified requirements.
- .2 The cost of door inspection and testing shall be paid by the Owner. Replacement of tested door at no additional cost to the Contract.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

1.7.1 Carefully wrap doors and frames ensuring complete protection during shipping and storage.

1.7.2 Deliver units to the site in undamaged condition and store in a suitable location. Store units vertically.

1.7.3 Stockpile doors and frames inside the building with the identification symbol readily visible, and in the general order in which they will be required for installation and in such a way that the floor structure is not loaded beyond the capacity for which it was designed.

1.7.4 Touch-up damaged galvanized units promptly with zinc-rich primer. Touch-up prime coated units with primer.

1.7.5 Remove damaged units, installed or not, and install new units. Replace or make good adjacent work damaged on account of such replacements at no extra cost to the Owner.

1.8 SITE CONDITIONS

1.8.1 Site Measurements: Verify actual dimensions of openings by site measurements before fabrication and indicate measurements on shop drawings; coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.8.2 Established Measurements: Establish dimensions and proceed with fabricating doors and frames without site measurements where site measurements cannot be made without delaying the Work; coordinate construction to ensure that actual site dimensions correspond to established dimensions.

1.9 WARRANTIES

1.9.1 Submit a two (2) year warranty of the materials, products and labour of this Section and warranty that windows and panels are water and weather-tight, structurally sound and free from distortion; that aluminum finishes will not develop excessive fading or non-uniformity of colour, and will not crack, peel or otherwise corrode; that glazing splines and sealant will be free from deterioration from sunlight, weather and oxidation, and will be free from permanent deformation under load.

- 1.9.2 Submit a two (2) year warranty that aluminum finishes will not develop excessive fading, non-uniformity of colour, and will not crack, peel, delaminate, or otherwise corrode.
- 1.9.3 Submit a ten (10) year warranty of the insulating glass units and warranting that the insulating glass units shall be free from material obstruction of vision as a result of dust or film formation on the internal glass surfaces by any cause, under normal conditions, other than extrinsic glass breakage.
- 1.9.4 Upon Final Completion, provide Owner with a written Warranty, identifying both supplier and manufacturer, on materials and workmanship, for a period as listed above following date of completion. Deficiency correction during the period of warranty is the mutual responsibility of the General Contractor and the supplier.
- 1.9.5 Warranties shall include the prompt remedy of defect upon written notification from the Owner that defects exist. Remedy shall include labour, materials, equipment, and services required to make good defective areas of the work, and in case of the factory fabricated components, to supply and install new components, all at no cost to the Owner. Warranties shall also include making good other adjoining parts and finishes or other Owner's property damaged or disturbed in the process or remedying defects. Warranty period shall recommence on remedied work.
- 1.9.6 In the case of work performed by subcontractors and where warranties are specifically required or requested by the Consultant, secure such additional written warranties and deliver same to the Owner.
- 1.9.7 Warranties shall be in be in a form approved by the Owner.

PART 2 - PRODUCTS

MATERIALS

2.1.1 Sheet steel:

- .1 Exterior doors and frames galvanized steel sheet: commercial quality to ASTM A653, A653M. Hot dip coating to ASTM-A924/A924M, coating designation Z275 (G90) minimum steel thicknesses shall be in accordance with this specification. Finish painting of exterior frames and doors by others.
- .2 Interior Doors and frames galvanized steel sheet: commercial grade steel to ASTM A653, CS Type B, coating designation ZF75 (A60) minimum steel thickness shall be in accordance with this specification. Frames to be supplied with factory prime paint; H.M. doors supplied with a factory paint finish.

2.1.2 Wipe coat galvanized with a minimum zinc coating of 107 g/sq m (0.35 oz/sq.ft.) to ASTM A653/A653M Coating Class A01.

2.1.3 Hot dip galvanized: Minimum 183 g/sq m (0.60 oz/sq.ft.) and having a Rockwell B maximum of 65 and suitable for forming and bending without metal or coating fracture.

2.1.4 Minimum thicknesses (Gauges), uncoated and zinc wipe coat steel:

- | | | |
|----|---|------------------|
| .1 | Door frames | 1.34 mm (16 ga.) |
| | Frames for doors over 1068 mm (3'-6")
Wide | 1.70 mm (14 ga.) |
| .2 | High Traffic Doors (hollow steel) | |

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HOLLOW METAL DOORS AND FRAMES

construction stiffened) Door faces	1.34 mm (16 ga.)
Top and bottom end channels	1.34 mm (16 ga.)
Vertical stiffeners	0.81 mm (20 ga.)
.3 Door face sheets for interior doors	1.60 mm base metal thickness, galvannealed coating Z75 (A60)
.4 Door face sheets for exterior door	1.60 mm base metal thickness, galvanized ho dip coating Z275 (G90)
.5 Top and bottom end channels spot Welded to the door faces	1.34 mm (16 ga.)
.6 Provide all interior, hollow metal doors with factory applied finish to meet or exceed ANSI/SDI A250.3-2007. Test procedure and acceptance criteria for factory applied finish coatings for steel doors and frames. Colour to be chosen by Architect.	
.7 Provide all exterior hollow metal doors with factory applied prime finish to meet or exceed ANSI/SDI A250.10-1998. Test procedures and acceptance criteria for prime painted steel surfaces for steel doors and frames. Finish coats by Section 09900 – Painting.	
.8 Doors to be bevelled 3 mm (1/8") in 50 mm (2") on hinge and lock edges, and have welded seams at hinge and lock edges.	
.9 Doors shall have mortised hardware preparations and be adequately reinforced for all surface mounted hardware.	
.10 Doors shall contain fixed metal louvres and/or lights as indicated on the drawings.	
.11 Doors where shown or required shall be complete with approved fire labels.	
.12 Reinforcements Mortised template hinges	3.12 mm (10 ga.), with integral high-frequency angle, and integral field-conversion from standard-weight to heavy-weight hinges at all locations in both doors and frames.
.13 Continuous hinges	2.36 mm (12 ga.) continuous reinforcement in both doors and frames
Lock and Strike reinforcement	1.34mm (16 ga.)
Flush bolt reinforcement and Jamb floor anchors	1.34 mm (16 ga.)
Channel spreaders	1.34 mm (16 ga.)
Guard boxes	0.66 mm (22 ga.)
Hinge reinforcement	2.36 mm (12 ga.)
Anchors	
T anchors	1.34 mm (16 ga.)
L anchors	1.06 mm (18 ga.)
Closer	2.36 mm (12 ga.)
Surface mounted hardware	2.36 mm (12 ga.)

2.1.5 Door Cores:

- .1 Exterior doors (non-heated areas) and interior heavy duty (high-traffic) doors (stairs, vestibules, general purpose room, and main entrance): hollow steel, vertically stiffened with 20 ga. steel ribs spot welded or laminated to face sheets. Fill voids with polystyrene insulation or fibreglass insulation. Edge seams to be continuously welded the full height of the door, filled and ground smooth with no visible seams. Exterior H.M. doors to be supplied factory primed painted. Interior H.M. doors to be supplied factory painted.
- .2 Exterior doors (heated area): H.M. door stiffened and insulated with polyurethane or polyisocyanurate core. Edge seams to be continuously welded the full height of the door, filled and ground smooth with no visible seams. Exterior H.M. doors to be supplied factory primed painted.
- .3 Interior doors standard duty: honeycomb structural small cell 25.4 mm (1") maximum kraft paper 'honeycomb'. Weight: 36.3 kg (80 lb.) per ream minimum, density: 16.5 kg/m³, (1.03 PCF) minimum, sanded to required thickness. Lockseam edges to be tack welded, filled and ground smooth. Interior doors to be supplied with a factory applied finish paint.

2.1.6 Primer: CAN/CGSB 1.132-M, Zinc chromate rust inhibitive primer.

2.1.7 Zinc rich primer: Galvafruid SB grade by W.R. Meadows Ltd., Kem Organic Zinc Rich Primer No. 6430, by Sherwin Williams Co. of Canada Ltd., Glidden No. 16113 zinc rich primer by Glidden Co. Ltd., or other approved manufacture.

2.1.8 Phosphatizing: CGSB 31-GP-105M.

2.1.9 Double stud bumpers: Black #52, by Stanley Works of Canada Ltd., or other approved manufacture.

2.1.10 Glass stops: 0.037" C-shaped, 16 mm (5/8") high, flush screw applied.

2.1.11 Fasteners for stops: Cadmium plated, recessed, flat or oval head Phillips screws.

2.1.12 Temperature Rise Rated (TRR): Solid slab core of non-combustible, inorganic composite to limit temperature rise on the unexposed side of door to [250 deg C for [30] [60] minutes] [no limit] rating, in accordance with CAN4 S104.

2.1.13 Anchors: As required to suit condition.

2.1.14 Rubber Bumpers: 3 per door.

2.1.15 Insulation: CAN/ULC S702, Type 1, minimum density 24 kg/cu m (1.5 lb/cu.ft.) consisting of durable fibrous material processed from rock, slag or glass, bound with deterioration resistant binders.

2.1.16 Materials for fire-rated doors and frames: Complying with ULC requirements.

2.1.17 Sound and light seal: Drop seal mortise type 16 mm (5/8") neoprene insert by Pemko Mfg. Co., or mortise type drop seal #36H by Zero Weather-Stripping Co. Ltd., or other approved manufacture.

2.1.18 Gaskets: 16 mm (5/8") square neoprene rubber, closed cell extrusion.

2.2 FABRICATION – GENERAL

2.2.1 Assemble units by arc welding in accordance with CSA W59 to produce a finished unit square, true and free of distortion. Welding shall be continuous unless specified otherwise. Welding shall be undertaken only by a fabricator fully approved by the Canadian Welding Bureau to the requirements of CSA W47.1.

2.2.2 Permit access to an approved inspection and testing company for the purpose of inspecting at random, doors under construction for this project.

2.2.3 Make provisions in doors and frames to suit requirements of trade or Section providing security devices. Provide removable plates or knock-outs for electrical contacts. Provide conduit and fish wire to location of electric strike on concealed face of frames.

2.2.4 Provide all function holes for all latching and locking hardware, including those for through-bolted lever trim. (CSDFMA-08100, Article 2.3.5).

2.2.5 Factory mortise, reinforce, drill, and tap all preparations for mortise template hardware. Site-drill and tap for installation of surface-applied hardware, in accordance with hardware manufacturer's installation templates. (CSDFMA-08100, Article 2.3.4).

2.3 FABRICATION - FRAMES AND SCREENS

2.3.1 Interior frames shall be detailed on drawings and be made of 16 gauge A60 galvanized and have a minimum coating weight 0.6 oz/s.f. Frames to be supplied factory prime painted.

2.3.2 Exterior frames shall be as detailed on drawings and be made of 14 gauge G90 galvanized. Fill jambs with batt insulation or spray in place polyurethane foam. Insulation to provide by frame install sub. Frames to be supplied factory primed.

2.3.3 Frames shall be set up and arc welded continuously on the inside of the face and ground smooth. Spreader bars are to be attached at the bottom and supplied with 3 rubber bumpers installed on strike jamb after final coat of paint has been supplied.

2.3.4 Frames with electronic hardware preparations are to be shipped to site with junction boxes welded to the frame at all mortised electric hardware preparations. Electrical boxes are supplied by this section. Frames shipped to site without required junction boxes will be rejected and returned to the supplier to be rectified. Knockdown frames will not be acceptable.

2.3.5 Form frames accurately to profiles indicated. Construct frames straight and free from twist or warp.

2.3.6 Blank, drill, reinforce and tap frames to receive templated hardware. Reinforce frames for installation of closers. Install stiffener plates or two angle spreaders where required to prevent bending of frame and to maintain alignment when setting. Weld reinforcement in place.

2.3.7 Punch frame mitres accurately and weld on inside of frame face. Fill frame corners, exposed surface depressions and butted joints with air-drying paste filler. Sand to a smooth uniform finish. Apply one coat of primer.

- 2.3.8 Supply jamb and mullion extensions and anchors required to secure screens to the structure. Fabricate anchorage to prevent transfer of load from support framing to the screens when deflection of structure occurs.
- 2.3.9 For all existing frames being modified to accommodate new standard height doors, each opening will require to be site measured. Confirm existing frame profile in order to fabricate horizontal mullions to fit. Notch mullions on both sides and fully weld in place. Construct new fire rated HM panels with two layers of 12mm or 16mm fire rated drywall laminated to two sheets of 18 gauge A60 Galvanized steel. Fastened panels using standard 12mm x 16mm glazing bead and self-drilling, self-tapping #6 x 1" glazing bead screws.
- 2.3.10 Where frames terminate at finished floor, supply floor plates for anchorage to slab. Check depth of extension of finished floor to structural slab and provide jamb extension anchorage as required. Provide 50 mm (2") minimum adjustment.
- 2.3.11 Provide three adjustable "T" anchors per jamb or six "L" anchors per jamb for frames up to 2300 mm (7'-6"). Add one "T" anchor or two "L" anchors per jamb for additional 600 mm (2'-0") or fraction thereof in frame height.
- 2.3.12 Supply removable stop and frame, where required for the overhead concealed door closers, properly connected to frame and prepared for attachment to closer, prior to shipment.
- 2.3.13 Provide three double stud bumpers per single door, four bumpers per double door, except for exterior doors. Lowest bumper shall be 230 mm (9") minimum above bottom of door.
- 2.3.14 Reinforce door frame head if opening is wider than 1500 mm (5'-0"). Reinforce jambs and mullions at junction of heads.
- 2.3.15 Fabricate metal screens to sizes shown.
- 2.3.16 Knock-down frames will not be permitted unless it can be shown that preassembled frames are impossible to install.
- 2.3.17 Install gaskets into 6 mm x 6 mm (1/4" x 1/4") deep groove in jambs and head of door frames, as shown. Apply with approved adhesive.
- 2.3.18 Where openings to receive hollow metal frames have already been built, supply reverse channel bucks, one for each 600 mm (2'-0") or fraction thereof. Reinforce bucks where frame is to be fire rated.
- 2.3.19 Fire rated frames in fire separations: Constructed to ULC approval and bearing ULC, ULI or Warnock Hersey Professional Services label, as acceptable to authorities having jurisdiction and as specified for doors. Locate label on inside of hinge jamb, midway between top hinge and head of door frame, so that it is concealed when door is closed.
- .1 Frame System: Proprietary TRR framing system meeting the specified fire and resistive ratings and acceptable to fire rated glass systems installed under Section 08 80 00.
- 2.3.20 Where glass openings are indicated, provide integrally formed cutouts and sections with steel framed glass mouldings and glazing stop. Cutouts and moulded sections to allow for single snap in door glazing stop and double glazing stop. Aluminum mouldings will not be permitted.

2.4 FABRICATION - HOLLOW METAL DOORS

- 2.4.1 Fabricate doors 45 mm (1-3/4") thick, flush face, seamless and to conform to details and schedules.
- 2.4.2 Provide vertical steel stiffened core construction for all interior doors. Laminate steel stiffened core material to both inside faces of door, completely fill the inside hollow of the door with fiberglass insulation core material. Join door faces at vertical door edges by tack welding every 150mm (6"), filling, grinding and dressing smooth.
- 2.4.3 Provide insulated hollow steel construction for exterior doors and high traffic interior doors are required. Edge seams, continuously welded, filled and sanded flush. Weld recessed end channel closures to close top and bottom of door. Weld vertical stiffeners to face sheets at a maximum of 150 mm (6") o.c. Fill voids with insulation.
- 2.4.4 Equip fire labelled exterior doors with factory installed flush steel top caps.
- 2.4.5 Top and bottom of doors shall be provided with inverted, recessed, nominal 1.34 mm steel end channels [; nominal 2.74 mm steel end channels for acoustic doors], welded to each face sheet at 150mm on centre.
- 2.4.6 Mortise, reinforce, drill and tap doors to receive templated hardware and reinforce for surface mounted hardware. Check hardware list for details.
- 2.4.7 Provide both stiles of single doors bevelled 3 mm in 50 mm (1/8" in 2"). Fabricate doors with clearance of 3 mm (1/8") to the frame and 19 mm (3/4") to finished floor.
- 2.4.8 Provide flush top edge on exterior doors, with drip on exterior side.
- 2.4.9 Fill voids in stile and rail type doors, including stiles, transom head and bottom rail in glazed doors, with core material.
- 2.4.10 Where glass openings are indicated, provide integrally formed cutouts and sections with steel framed glass mouldings and glazing stop. Cutouts and moulded sections to allow for single snap in door glazing stop and double glazing stop. Aluminum mouldings will not be permitted.
- 2.4.11 Install sound and light gaskets using mortise type drop seal at bottom of door and gaskets at jamb and head of door. Set gaskets into a 6 mm x 6 mm (1/4" x 1/4") deep groove and fastened with approved adhesive.
- 2.4.12 Thermally broken doors shall be constructed in two sections, joined rigidly with thermal break material. Fabricate anchors for thermally broken frames to suit wall conditions; avoid cold transfer from exterior frame section to interior frame section.
- 2.4.13 Provide insulated sealed glazing kits to all exterior door with sidelight or glazed transom.
- 2.5 FABRICATION - FIRE RATED HOLLOW METAL DOORS
 - 2.5.1 Construct fire rated doors to ULC requirements, bearing ULC, ULI, or Warnock-Hersey International Ltd., label, and acceptable to authorities having jurisdiction. Provide fire protection ratings indicated and time/ temperature rise label to requirements or authorities having jurisdiction.
 - 2.5.2 Face sheets: Minimum nominal 1.34 mm (16 Ga.) base steel sheet thickness.

2.5.3 [Stiffened and sound deadened with vertical steel stiffeners laminated under pressure to each face sheet. Fill voids in between stiffeners with fiberglass insulation] [Stiffened, insulated and sound deadened with manufacturer's proprietary Temperature Rise Rated (TRR) core material.]

2.5.4 Locate labels on the inside of door at hinge jamb midway between the top hinge and door head.

2.5.5 Construct and reinforce for hardware, fire-rated doors similar to standard units.

2.6 ACOUSTICAL DOORS AND FRAMES

2.6.1 Acoustical doors: Sound reduction doors, Series S, 45 mm (1-3/4") thick, complete with door frames, acoustical seals, automatic mortised door bottom, and complete assembly to provide minimum 43 STC when installed, by Stanley-Bumeda Ltd., or other approved manufacture.

2.7 INSULATED EXTERIOR STEEL DOOR FRAMES

2.7.1 Thermally broken frames shall be constructed in two sections, joined rigidly with thermal break material. Fabricate anchors for thermally broken frames to suit wall conditions; avoid cold transfer from exterior frame section to interior frame section.

2.7.2 Separate interior and exterior frame sections by a polyvinyl chloride (PVC) thermal break. Do not connect sections to each other by screws welds, grommets or other fastening devices.

2.7.3 Design wall and floor anchors to suit wall conditions and not to permit thermal transfer from exterior to interior surfaces of frame sections.

2.8 HARDWARE PREPARATION

2.8.1 Prepare for template hardware in accordance with ANSI/DHI A115 Standards, unless noted otherwise herein. Locate hardware preparations vertically in accordance with CSDFMA Recommended Dimensional Standards, unless noted otherwise herein.

2.9 FINISHING

2.9.1 Doors and frames manufactured from zinc wipe coated steel or hot dipped galvanized: Factory-applied touch-up primer to areas where coating has been removed or abraded due to grinding or handling.

2.9.2 Doors and frames to exterior: G90 Hot dipped galvanized.

2.9.3 Doors and frames to all other areas: A60 Wipe coat galvanized.

3 **PART 3 - EXECUTION**

3.1 EXAMINATION

3.1.1 Examine substrates, door swing arcs, areas of installation and conditions affecting installation for compliance with requirements for manufacturers installation tolerances and other conditions affecting performance of work of this Section.

3.1.2 Verify roughing-in for embedded and built-in anchor locations before installing frames.

3.1.3 Verify door and frame size, door swing and ratings with door opening number before installing frames.

3.1.4 Installation of hollow metal doors and frames will denote acceptance of site conditions.

3.2 INSTALLATION

3.2.1 Supply doors and frames to Sections responsible for installation.

3.2.2 Door Frames:

- .1 Remove temporary spreaders before installing door frames, leaving exposed surfaces smooth and undamaged.
- .2 Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set; limit of acceptable frame distortion 1/16" out of plumb measured on face of frame, maximum twist corner to corner of 1/8"; align horizontal lines in final assembly.
- .3 Brace frames rigidly in position until adjacent construction is complete; install wooden spreaders at third points of frame rebate to maintain frame width, install centre brace to support head of frames 4' and wider in accordance with ANSI A250.1; do not use temporary metal spreaders for bracing of frames.
- .4 For frames over 1220mm (4') in width, provide vertical support at the centre of head.

3.2.3 Frame Tolerances: Install frames to tolerances listed in ANSI A250.11, and as follows:

- .1 Squareness: Maximum 0.8mm (1/32") measured across opening between hinge jamb and strike jamb.
- .2 Plumbness: Maximum 0.8mm (1/32") measured from bottom of frame to head level.
- .3 Alignment: Maximum 0.8mm (1/32") measured offset between face of hinge jamb and strike jamb relative to wall construction.
- .4 Twist: Maximum 0.8mm (1/32") measured from leading edge of outside frame rabbet to leading edge of inside frame rabbet.

3.2.4 Doors:

- .1 Fit hollow metal doors accurately in frames within clearances required for proper operation; shim as necessary for proper operation.
- .2 Install hardware in accordance with manufacturers' templates and instructions.
- .3 Adjust operable parts for correct clearances and function.
- .4 Install glazing materials and door silencers where required.
- .5 Install fire rated doors within clearances specified in NFPA 80.
- .6 Install louvers and vents.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

- 1.1.1 Comply with Division 1, General Requirements and all documents referred to therein.
- 1.1.2 Provide all labour, materials, equipment and services required to supply and install the overhead door indicated on the Drawings and specified herein.

1.2 REFERENCES

- 1.2.1 ASTM A653/A653M-15 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- 1.2.2 ASTM C165-07(2012) Standard Test Method for Measuring Compressive Properties of Thermal Insulation.
- 1.2.3 CSA S16-14 Design of Steel Structures.
- 1.2.4 CSA W47.1-09(2014) Certification of Companies for Fusion Welding of Steel.
- 1.2.5 CSA W59-13 Welded Steel Construction (Metal Arc Welding), Includes Update No. 1 (2014), Update No. 3 (2015), Update No. 4 (2015).
- 1.2.6 CAN/CGSB 1.121-93 Vinyl Pretreatment Coating for Metals (Vinyl Wash Primer).

1.3 QUALITY ASSURANCE

- 1.3.1 Welding: By welder certified by the Canadian Welding Bureau under CSA W47.1, and in compliance with CSA W59. File or grind exposed welds smooth and flush. Do not leave grinding marks.

1.4 SUBMITTALS

- 1.4.1 Shop drawings: Indicate materials, controls, hardware, connections, attachments, reinforcing, anchorage and location of exposed fastenings.
- 1.4.2 Operating and Maintenance Data: Provide operating and maintenance data for incorporation into the Operating and Maintenance Manual.

1.5 LEED™ STRATEGIES

- 1.5.1 All trades must examine practices, as outlined in the related sections, to assist the team in achieving these results.
- 1.5.2 Related Sections:
 - .1 01 35 20 General LEED® Requirements
 - .2 01 35 50 Waste Management Disposal
 - .3 01 35 90 Indoor Air Quality Management
 - .4 01 61 10LEED® Product Requirements
 - .5 31 25 00 Construction Pollution Prevention.

- 1.5.3 Materials used for Work in this section are to include, but are not limited to the following criteria:
- .1 Materials used in work of this Section are to contain high amounts of recycled content and are to be sourced regionally from within 800 km via truck or 2400 km via rail or ship from jobsite in accordance with Section 01 61 10.
- 1.5.4 The following must be submitted as appropriate for Consultant's review and approval:
- .1 Submit Schedules A and D, as appropriate, of Section 01 61 10A LEED Product Requirements Schedules following the measures outlined in Section 01 61 10, for all applicable products.

PART 2 - PRODUCTS

2.1 APPROVED PRODUCTS AND MANUFACTURERS

- 2.1.1 This specification is based on 'Thermatite 175' sectional steel, polyurethane laminated, overhead doors by Richards Wilcox Door Systems (Toronto) Limited. The following manufacturers shall also be accepted provided they conform in general with specified requirements:
- .1 Steel-Craft Door Products Ltd.
 - .2 Upwardor Corporation.

2.2 MATERIALS

- 2.2.1 Galvanized sheet steel: ASTM A653/A653M, coating weight 380g/ sq.m (1.25 oz/sq.ft) , door sections and stiles 1.6 mm (16 gauge); door tracks 3 mm (12 gauge); back panels 0.6 mm (26 gauge) .
- 2.2.2 Insulation: Rigid, fibrous glass board insulation, "AF-530" by Owens-Corning Limited or other approved manufacture. Insulation shall have a "k" factor of 1.4W/(sq m x °C (0.25 BTU/hr/sq ft/1" thickness) at a mean temperature of 24 °C and a nominal density of 48 kg/cu m (3 pcf) . Deformation of insulation board shall not exceed 10% when tested at 38 kg/m (25 psf) in accordance with ASTM C165.
- 2.2.3 Priming paint treatment for non-galvanized components: Vinyl pre-treatment and vinyl primer complying with CAN/CGSB 1.121 and 1.122, respectively.
- 2.2.4 Touch-up paint for galvanized surfaces: Sherwin Williams "Zinc Clad III HS 100", Wasser Coatings "MC-Zinc 100" or Benjamin Moore Super Spec HP Primers, or other approved zinc rich (95% content) coating.
- 2.2.5 Welding materials: CSA W59.

2.3 FABRICATION – GENERAL

- 2.3.1 Fabricate the work true to dimensions and square. Accurately fit joints and intersecting members with adequate fastenings.
- 2.3.2 Fabricate finished work free from distortion and defects detrimental to appearance and performance.
- 2.3.3 Unless otherwise specified, noted or approved, weld all connections.

- 2.3.4 Use shop and field connections as detailed. Where not detailed, connections shall comply with CSA S16.
- 2.3.5 Do not prime non-ferrous metals
- 2.3.6 Where work is not specified to be galvanized, thoroughly de-scale the work after fabrication, remove roughness and irregularities by grinding, clean with a wire brush, remove oil and grease and apply pre-treatment and primer.
- 2.4 FABRICATION – STEEL SECTIONAL OVERHEAD DOOR
- 2.4.1 Provide in locations shown on Drawings electrically operated insulated sectional steel overhead doors, complete with standard lift hardware, tracks, steel jamb and head channels, door guides, electrical operator and controls.
- 2.4.2 Form sections to produce a door not less than 50 mm (2") thick with a flush outside face. Roll door sections to provide a rebated weather joint. Make each section of the door equal in height. Form stiles from 50 mm (2") deep formed channels, cut accurately to fit the contour of the rolled sections and projection weld to the sections, forming a weld that does not destroy the exterior zinc coating.
- 2.4.3 Door sections shall be manufactured by a continuous foamed-in-place polyurethane lamination process resulting in a homogenous sandwich of even-textured polyurethane insulation of metal/foam/metal construction to form a section 1-13/16" thick. Sections shall be roll-formed to produce a thermal break. Sections shall have a thermal resistance of minimum RSI of 2.15. (R 12)
- 2.4.4 Weld back panels to door sections. Before applying the back panels, install 25 mm (1") rigid insulation cemented to the back of the face panels.
- 2.4.5 Roll form door tracks 75 mm (3") deep, heavy duty. Fabricate and install door such that maximum lift clearance is achieved. Reinforce tracks such that during door operation, deflection is limited to 1/240 of the span, and rotation of track is limited to 1°
- 2.4.6 Provide heavy duty hinges bolted to stiles, with case hardened double row ball bearing rollers for track.
- 2.4.7 Provide door counterbalances of minimum 100,000 cycle torsion springs coiled from oil tempered wire. Lift doors with 5 mm (3/16") diameter minimum galvanized steel airplane cable. Operate cast drums on a ball-mounted shaft. Provide extension springs for counterbalancing doors.
- 2.4.8 Weatherstrip the bottom door section with an extruded neoprene gasket to provide a tight, freeze- proof, seal between the door and the finished floor. Provide a rubber seal strip at head of door. Overlap door behind jamb frames and weatherstripped wood stops 75 mm x 25 mm (3" x 1") clad in galvanized sheet steel.
- 2.4.9 Provide door with a bolt surface-mounted on door interior at 900 mm (3'-0") above finished floor and arranged to engage jamb or a keeper welded to jamb and to lock using a padlock. Supply of padlocks not in contract.
- 2.5 TRACKS
- 2.5.1 Tracks shall be 3" heavy-duty gauge galvanized steel vertical lift track as indicated on drawings,

designed for clearances shown. Provide complete track assembly including brackets, bracing and reinforcing for rigid support of the track for the required door type and size. Slope tracks at proper angle from vertical to ensure tight closure at jambs when the door is closed. Weld or bolt to track supports.

- 2.5.2 Provide steel roll-formed track channel. Track channel shall be faced with polyvinyl chloride (PVC). Track channel shall allow temperature change movements of the door to take place when subjected to extreme temperature variance between inside and outside.

2.6 POWER OPERATOR

- 2.6.1 Supply and mount a disconnect switch for door, located on the wall adjacent to door jambs or elsewhere as shown on the Drawings. Provide necessary door operator wiring in rigid conduit and connect to the load side of the disconnect switch. Wiring and connection to the line side of the switch shall be provided under Division 26, Electrical.
- 2.6.2 Supply and securely mount a motor for the operation of door. Provide motor with a thermal overload device, a magnetic reversing starter and all necessary accessories. All equipment shall be CSA and EEMAC approved.
- 2.6.3 Provide power train components necessary to transmit motor action to door motion. Suspend all moving parts using sealed, pre-lubricated anti-friction bearings. Use end thrust bearings where required. Provide an override device, arrange to relieve the power train and motor if door is jammed.
- 2.6.4 Provide power operator with an integral locking mechanism, to be interfaced with the access control system.
- 2.6.5 Provide door with an emergency chain hoist with interlock switch for manual door operation in case of power failure.

2.7 CONTROLS

- 2.7.1 Provide timers, relays, travel limit switches, interlocks and other devices necessary for door control and to disconnect power when door is locked.
- 2.7.2 Provide input/output modules and any additional equipment to integrate and operate from access control system
- 2.7.3 Supply and install in rigid conduit all wiring necessary for control devices. Conduit may be surface mounted except as otherwise noted or embedded in the topping or surfacing.
- 2.7.4 All devices shall be CSA approved and manufactured by Parking Products Canada Ltd., Cincinnati Time Recorder, or other approved manufacture.

2.8 DOOR PROTECTION DEVICE

- 2.8.1 Equip door edge with a weathertight, resilient gasket containing a switch mechanism sensitive over the full door width to pressure applied as a point load. Gasket/switch shall be a Miller Safety Edge by Overhead Door Company or other approved manufacture.
- 2.8.2 Door shall be protected with a photo-electric cell and light source located as directed, and wired to prevent commencement of door closing, and if closing is underway, to cause door to reverse instantly and open fully.

SECTIONAL OVERHEAD INSULATED METAL DOORS

- 2.8.3 Door shall instantly reverse and re-open while closing in response to any of its "OPEN" controls and to activation of its protective device. Re-opened door shall close when obstruction is removed (after the pre-determined door-open period).
- 2.9 DOOR
- 2.9.1 Provide door with a lockable push-button switch station words "OPEN" AND "CLOSE" impressed on the appropriate buttons. Arrange control so that constant pressure on the "CLOSE" button shall cause the door to reverse instantly and open fully. Momentary pressure on the "OPEN" button shall cause the door to open fully.
- 2.9.2 Provide door with a Multi-Elmac radio control receiver having a keyed channel and three (3) portable, battery-operated Multi-Elmac transmitters. Adjust frequency of transmitter and receiver such that no interference is either caused or suffered by other electronic equipment existing with the range of the door control equipment. Radio signal shall cause door to open. Arrange signal from both inside and outside the building.
- 2.9.3 Entry and egress controlled from control panel located in cell custodian's office, and card reader/keypads. Provide input/output modules for the door to be controlled from an access control system.
- 2.9.4 Overhead door shall be interlocked with sally port access door. Provide input/output modules controls for the door to be interlocked
- 2.9.5 During emergency/maintenance door can be operated from the local door control panel
- 2.9.6 Door shall remain fully open for 30 seconds minimum after which it shall close automatically. Duration of door open interval shall be adjustable.
- 2.10 FINISHES
- 2.10.1 All exposed steel surfaces shall be suitably cleaned and pre-treated. Apply one coat of manufacturer's standard shop primer, and a second polyester finish coat, on interior and exterior of door. Colour to be selected by the Consultant, not necessarily from the manufacturer's standard range.

PART 3 - EXECUTION

- 3.1 INSTALLATION
- 3.1.1 Erect doors in accordance with manufacturer's instructions.
- 3.1.2 Install doors, tracks and operating equipment complete with necessary hardware, jamb and head mould stops, anchors, brackets and accessories.
- 3.1.3 Mount counterbalance mechanism with manufacturer's fully adjustable ball bearing brackets at each end of shaft. Furnish torsion shaft centre support bearings as required for size and weight of doors.
- 3.1.4 Fasten vertical track assembly to framing at maximum 24" O.C.
- 3.1.5 Install weather seals at heads, jambs and door bottoms as recommended by door manufacturer to form a continuous weathertight seal at door perimeter.
- 3.1.6 Doors shall fit snugly to all edges of jambs and heads of frames and shall operate smoothly and

freely under all conditions of operation. Door shall sit in any position in door opening and shall not drift upward or downward.

- 3.1.7 Install electrical motors, controller units, push-button stations, relays and other electrical equipment required for door operation.

3.2 ADJUSTMENT AND DEMONSTRATION

- 3.2.1 On completion, and when directed by the Consultant, adjust and lubricate overhead doors, check and adjust controls, ensure that all equipment and mechanisms are operating smoothly, and demonstrate the operation, control and safety features of each door to the Owner.

- 3.2.2 Supply three transmitter control devices to the Owner.

3.3 CLEANING AND CLEAN-UP

- 3.3.1 Clean and make good to the Consultant's approval, surfaces soiled or otherwise damaged in connection with the work of this section. Contractor shall pay the cost of replacing finishes or materials that cannot be satisfactorily cleaned.

- 3.3.2 On completion of the work of this section, remove all debris, equipment and excess material from the site that results from the work of this section.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

- 1.1.1 Comply with Division 1, General Requirements and all documents referred to therein.
- 1.1.2 Provide all labour, materials, products, equipment and services to replace existing windows with new aluminum windows indicated on the Drawings and specified herein.
- 1.1.3 Drawings contain details that suggest directions for solving some of the major design requirements; these details can be developed further by the Contractor provided that the final installation adheres to aesthetic criteria established by the drawings and specified dimensions with all elements in planes as drawn, maintaining their relationships with all other building elements.

1.2 RELATED WORK SPECIFIED UNDER OTHER SECTIONS

- 1.2.1 General Requirements for Building Envelope: Section 01 90 00
- 1.2.2 Self-Adhered Air and Vapour Barrier Sheet Membrane
- 1.2.3 Glass and Glazing: Section 08 80 00

1.3 REFERENCES

- 1.3.1 ASTM A167-99(2009) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip (Withdrawn 2014).
- 1.3.2 ASTM B37-08(2013) Standard Specification for Aluminum for Use in Iron and Steel Manufacture.
- 1.3.3 ASTM B244-09(2014) Standard Method of Measurement of Thickness of Anodic Coatings on Aluminum and of Other Nonconductive Coatings on Nonmagnetic Basis Metals with Eddy Current Instruments.
- 1.3.4 CGSB 1-GP-108 Bituminous Solvent Type Paint.
- 1.3.5 CAN/CGSB 12.1-M90 Tempered or Laminated Safety Glass.
- 1.3.6 CAN/CGSB 12.2-M91 Flat Clear Sheet Glass.
- 1.3.7 CAN/CGSB 12.3-M91 Flat, Clear Float Glass.
- 1.3.8 CAN/CGSB 12.8-97 Insulating Glass Units.
- 1.3.9 CAN/CGSB 12.20-M89 Structural Design of Glass for Buildings.
- 1.3.10 CAN/CGSB 19.13-M87 Sealing Compound, One-Component, Elastomeric, Chemical Curing.
- 1.3.11 CAN/CGSB 19.24-M90 Multicomponent, Chemical-Curing Sealing Compound.

- 1.3.12 CGSB 19-GP-14M Sealing Compound, One Component, ButylPolyisobutylene Polymer Base, Solvent Curing.
- 1.3.13 CGSB 31-GP-404a Blast Cleaning of Metal Surfaces.
- 1.3.14 CSA G40.20-13/G40.21-13 General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel, Includes Update No. 1 (2014).
- 1.3.15 CAN/CSA G164-M92(R2003) Hot Dip Galvanizing of Irregularly Shaped Articles.
- 1.3.16 CSA HA Series-M1980 CSA Standards for Aluminum and Aluminum Alloys.
- 1.3.17 CSA W47.1-09(2014) Certification of Companies for Fusion Welding of Steel.
- 1.3.18 CSA W59-13 Welded Steel Construction (Metal Arc Welding), Includes Update No. 1 (2014), Update No. 3 (2015), Update No. 4 (2015).
- 1.3.19 AAMA/WDMA/CSA 101/I.S.2/A440-08 North American Fenestration Standard/Specification for Windows, Doors, and Skylights.
- 1.3.20 AAMA/WDMA/CSA 101/I.S.2/A440SI-09 Canadian Supplement.
- 1.4 DESIGN
- 1.4.1 Design members to withstand within acceptable deflection limitations their own weight, the weight of their glass, and the minimum design loads due to the pressure and suction of wind as calculated in accordance with the NBC of Canada and the local Building Code.
- 1.4.2 Except where more specifically specified herein, glass shall meet or exceed requirements of CAN/CSA 12.20.
- 1.4.3 Design insulating glass units to minimize the possibility of thermal breakage.
- 1.4.4 Windows shall comply with CAN/CSA A440/A440.1 as specified hereafter.
- 1.5 QUALITY ASSURANCE
- 1.5.1 Work shall be executed by skilled mechanics, specifically trained and qualified for this work (i.e. written proof of minimum five (5) years employment/service with the window manufacturer. Individuals to be either employees of the manufacturer and/or workers approved by the manufacturer (i.e. Written proof of minimum five (5) years employment/service with the window manufacturer will be required if requested by the Owner / Consultant.
- 1.5.2 Provide one (1) thoroughly experienced, reliable, qualified and competent person in charge of the Work. Individual shall be designated for the duration of the Work of this Section. Any changes to the individual shall be by written approval of Owner / Consultant.
- 1.5.3 The supplier shall have adequate plant, equipment and skilled trades people, and is known to have satisfactorily manufactured similar windows for a minimum of five (5) years in the Province of Ontario.

- 1.5.4 Perform welding of structural components with fabricators certified by the Canadian Welding Bureau to CSA welding qualification codes.
- 1.5.5 Field Testing:
- .1 The Owner / Consultant will engage the services of an independent inspection and testing company to conduct testing of the installed work. Initial testing at any given location shall be paid for by the Owner. Cost of re-testing to verify corrected work shall be paid for by the Subcontractor for this Section.
 - .2 Field testing will include but not be limited to tests for static air infiltration and static water penetration to the same as the listed design criteria and performance parameters and pass/fail criteria as the laboratory testing.
 - .3 The Subcontractor is responsible for alterations, repairs, additions necessary to achieve acceptable performance at the test locations and similar adjustments to all completed work.
 - .4 Test locations and frequency will be determined by the Consultant. The Subcontractor shall provide access to the work necessary for the testing agency to conduct testing. The Subcontractor shall prepare framing as necessary during fabrication to allow air and water penetration field testing.
 - .5 The contractor, glazing sub-contractor and window manufacturer representative to be present for the window test to verify acceptance of the selected windows and to remove glazing stops or sealants at conclusion of the test for verification by the consultant as may be required.
 - .6 The contractor is to facilitate and accommodate the site requirements for testing including but not limited to: minimum 20psi water supply, swing stages/platforms if at upper floors, heated shelters when outdoor temperatures are below 5C, removal of furniture or window coverings for selected locations.
 - .7 Modifications made to the window(s) by the contractor prior to, or after, testing shall be made to all installed windows.
 - .8 Non-conforming work shall be corrected, removed, cleaned and re-installed at no cost to the Owner.
- 1.5.6 MOCK-UP
- 1.5.7 Construct mock-ups in accordance with Section 01 40 00.
- 1.5.8 Erect a full size assembly of a typical window.
- .1 Locate mock-ups in the location and of the size indicated or, if not indicated, as directed by Consultant.
 - .2 Notify Consultant seven (7) days in advance of the dates and times when mock-ups will be constructed.
 - .3 Demonstrate the proposed range of aesthetic effects and workmanship.
 - .4 Obtain Consultant's acceptance of mock-ups before proceeding with construction of window assembly.
 - .5 Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed Work.

- 1.5.9 Co-ordinate work of mock-up with related work of other Sections.
- 1.5.10 Adjust mock-up as required to gain acceptance. Accepted work may form a part of the final installation.
- 1.6 DESIGN - RAIN SCREEN PRINCIPLE
- 1.6.1 Base the design of the work of this Section on the "Rain Screen" principle as defined in Section 01 90 00 - General Requirements for Building Envelope. Design and reinforce rigid air/vapour barriers to withstand within acceptable deflection limitations, their own weight, the insulation weight, and the design loads.
- 1.6.2 The definition of the rain screen principle for the purpose of these specifications is "as advocated by the National Research Council of Canada." All voids between the assembly components as well as between the components and the structure shall have:
- .1 Gaskets, baffles, overlaps, and seals as required to provide a barrier "Rain Screen" to effectively prevent excessive rain water entry into any of the cavities but allow pressure equalization.
 - .2 Non-permeable air seals as required to exclude the entry of interior building air into the vertical skin cavities.
 - .3 Such provisions in the form of openings between cavities and the buildings exterior of sufficient cross section to provide adequate pressure equalization. In addition, all openings shall be baffled against direct rain water entry.
 - .4 Air seals placed to eliminate any contact between interior humid air and a cold surface or structural component to prevent condensation and ice build-up on such surfaces during cold weather.
- 1.7 SUBMITTALS
- 1.7.1 Submit shop drawings showing all components of the window assemblies in as large a scale as practical, and showing the construction, methods of joining, welding, bonding, fastening, sealing, gasketing and sleeving, as well as type of metal, material thickness, finishes and other pertinent data. Show paths of interior drainage and venting.
- 1.7.2 Submit test results from an accredited CSA testing company confirming that the individual window units being manufactured and installed for the project meet or exceed the specified criteria in CAN/CSA A440/A440.1, including all latest amendments.
- 1.7.3 The test results shall include data for all fixed, opening and combination windows indicated in the drawing details and windows specific to the project. Provide further test results for any window units which are more than 25% larger than the originally tested units.
- 1.7.4 If test results are not available for a particular configuration or combination or composite window, and providing that the individual component window units meet specified CAN/CSA A440/A440.1 criteria, submit further test results from a Professional Engineer practising in the Province of Ontario confirming that the mullions separating individual window units meet or exceed the wind load requirements specified in CAN/CSA A440/A440.1 and all air (A) and water (B) performance levels as specified, Costs of such test shall be borne by the contractor.
- 1.7.5 Submit reports of tests of the insulating glass units to be supplied as prescribed in CAN/CGSB 12.8 showing successful results. Tests shall be conducted and reports prepared by an approved, independent testing laboratory.

- 1.7.6 Shop drawings shall bear professional seal or stamp and signature of a professional Engineer licensed to design structures in the Province of Ontario.
- 1.7.7 Submit samples of all materials and products with their respective finish before fabrication. Samples shall fully represent the physical and chemical properties of the materials and products to be supplied.
- 1.7.8 Submit in duplicate, a set of two pieces 18" square for sheets, 18" long for extrusions, indicating the lightest and darkest colour to be furnished.
- 1.7.9 Submit a signed certificate from the sealant manufacturers prior to the commencement of this work which states:
 - .1 Sealant materials selected for use from those specified;
 - .2 Surface preparation requirements;
 - .3 Priming and application procedures;
 - .4 Verification that sealants are suitable for purposes intended and joint designs;
 - .5 Sealants are compatible with other materials and products with which they come in contact, including but not limited to sealants and caulking provided under other Sections, insulation adhesives, bitumens, waterproofing, metals and metal finishes and stone;
 - .6 Verification that sealant is suitable for temperature, humidity and weather conditions at the time of application.
- 1.7.10 Obtain review and acceptance of engineered stamped shop drawings before assembly of window units. All fastening patterns, embedment depths of fasteners, types of fasteners, substrate conditions shall be clearly shown on the shop drawings.
- 1.7.11 Submit a service manual and instructions for routine maintenance as specified in Section 01 30 00.
- 1.8 PRODUCT DELIVERY, STORAGE AND HANDLING
 - 1.8.1 Handle and store material in such a manner that no damage will be done to the materials or to the work of other Sections.
 - 1.8.2 Apply a temporary protective coating of the fabricator's choice to all finished surfaces. Remove coating at the most suitable time during erection. Do not use adhesive papers or sprayed coatings which will become firmly bonded when exposed to the sun. Do not leave coating residue on any surface.
 - 1.8.3 Do not use adhesive papers or sprayed coatings which will become bonded when exposed to the sun. Remove temporary protection after installation. Do not leave coating residue on any surface.
- 1.9 PROTECTION
 - 1.9.1 Do not apply mullion snap-on caps until the building is closed-in, until the roofing is installed and until no possibility of alkaline substances can be washed from the building onto the windows.
 - 1.9.2 Clean glass every 3 months or more frequently to prevent the glass from being etched by alkaline bearing water.
- 1.10 SITE CONDITIONS

- 1.10.1 Site Measurements: Verify actual locations of structural supports for aluminum windows by site measurements before fabrication and indicate measurements on Shop Drawings.
- 1.10.2 Established Dimensions: Establish dimensions and proceed with fabricating aluminum windows where site measurements cannot be made without delaying the Work; coordinate construction to ensure that actual dimensions correspond to established dimensions.
- 1.10.3 Ambient Conditions: Confirm installation requirements for ambient and surface temperatures of sealants with manufacturer and apply sealants when temperatures are greater than manufacturer's stated minimum from time of application until sealants have cured.
- 1.11 WARRANTIES
- 1.11.1 Submit a five (5) year warranty of the materials, products and labour of this Section and warranty that windows and panels are water and weather-tight, structurally sound and free from distortion; that aluminum finishes will not develop excessive fading or non-uniformity of colour, and will not crack, peel or otherwise corrode; that glazing splines and sealant will be free from deterioration from sunlight, weather and oxidation, and will be free from permanent deformation under load.
- 1.11.2 Submit a five (5) year warranty that aluminum finishes will not develop excessive fading, non-uniformity of colour, and will not crack, peel, delaminate, or otherwise corrode.
- 1.11.3 Submit a ten (10) year warranty of the insulating glass units and warranting that the insulating glass units shall be free from material obstruction of vision as a result of dust or film formation on the internal glass surfaces by any cause, under normal conditions, other than extrinsic glass breakage.
- 1.11.4 Warranties shall include the prompt remedy of defect upon written notification from the Owner / Consultant that defects exist. Remedy shall include labour, materials, equipment, and services required to make good defective areas of the work, and in case of the factory-fabricated components, to supply and install new components, all at no cost to the Owner. Warranties shall also include making good other adjoining parts and finishes or other Owner's property damaged or disturbed in the process or remedying defects. Warranty period shall recommence on remedied work.
- 1.11.5 In the case of work performed by subcontractors and where warranties are specifically required or requested by the Consultant, secure such additional written warranties and deliver same to the Owner.
- 1.11.6 Warranties shall be in be in a form approved by the Owner / Consultant.

PART 2 - PRODUCTS

- 2.1 DESIGN CRITERIA
- 2.1.1 Performance Requirements: Provide assemblies able to withstand positive and negative pressures normal to the plane of window in accordance with Building Code climatic requirements based on 1 in 30 year criteria.
- 2.1.2 Meet or exceed requirements of AAMA/WDMA/CSA 101/I.S.2/A440S1, and the following performance requirements:
- .1 Air Tightness Rating, Fixed Windows: Fixed.
 - .2 Air Tightness Rating, Operable Windows: A3.
 - .3 Water Tightness Rating: B7.

- .4 Wind Load Resistance Rating: C3.
 - .5 Forced Entry: F2, pass test for resistance to forced entry.
 - .6 Glazing: As indicated in Section 08 81 00.
- 2.1.3 Failure of performance requirements will be considered to include, but not be limited to, the following:
- .1 Deflection exceeding specified limits
 - .2 Thermal stresses transferred to building structure
 - .3 Framing members transferring stresses, including those caused by thermal and structural movements, to glazing
 - .4 Glazing-to-glazing contact in structural silicone glazed systems
 - .5 Noise or vibration created by wind and thermal and structural movements
 - .6 Sealant failure
 - .7 Loosening or weakening of fasteners, attachments, and other components
 - .8 Failure of operating units to function properly
- 2.1.4 All double-glazed Insulating Units to be nominal thickness 25mm to meet requirements of CGSB CAN2-12.8-97. Heat reflecting glass: Vitro Architectural Glass, Solarban 70XL on no. 2 surface with warm edge spacer at perimeter of glass units, with solar Control Low E glass, argon filled space between glass, as manufactured by VAG or equivalent approved by the Consultant.
- 2.2 MATERIALS
- 2.2.1 All aluminum work: Comply with CSA Standard HA series.
- 2.2.2 Aluminum: Extruded shapes of Alcan 6063 aluminum alloy "T5" temper for framing. Exposed sheet and plate aluminum: Alloy 1100-H14 anodizing quality..
- 2.2.3 Non-exposed sheet and plate aluminum: AA3003-H14 alloy and temper, mill finish.
- 2.2.4 Exposed anodized sheet and plate to AA5005-H14 alloy and temper or AA1100-H14 alloy and temper (anodizing quality, 1.6mm thickness)
- 2.2.5 Stainless steel: ASTM A167, Type 304 or 316, of one type throughout.
- 2.2.6 Bolts, screws, nuts, washers and other fasteners: Stainless steel of austenitic grade, 300 series for stainless steel connections; stainless steel or aluminum for aluminum connections; cadmium plated steel or galvanized steel elsewhere.
- 2.2.7 Thermal separator (thermal break): Of a size to conform to the extruded aluminum members, neoprene or polyvinyl chloride and having a minimum tensile strength of 2000 psi and minimum 70 ±5 Durometer Hardness.
- 2.2.8 Aluminum flashings: 1/32" utility grade.
- 2.2.9 Steel: Complying with CSA G40.20/G40.21, Grade 300W, hot dipped galvanized in accordance with current CSA G164-M. Thread dimensions shall be such that nuts will thread over bolts without re-threading or chasing galvanized threads.
- 2.2.10 Primer paint for ferrous metals: Zinc rich pain conforming to CSA G164-M.
- 2.2.11 Bituminous paint: Complying with CGSB 1-GP-108.

- 2.2.12 Touch-up primer for galvanized steel: Zinc rich primer, Galvafruid SB grade, by W.R. Meadows of Canada Ltd., Kem Organic Zinc Rich Primer No. 6430 by Sherwin-Williams Company of Canada Ltd., Glidden No. 16113 Zinc Rich Primer by the Glidden Company Ltd.
- 2.2.13 Glass: As indicated in Section 08 80 00.
.1 Bear manufacturer's labels, indicating quality and direction of draw marks. Labels shall be left in place until final cleaning.
- 2.2.14 Glazing stops: Aluminum extrusions.
- 2.2.15 Sills, condensation gutters: Extruded aluminum.
- 2.2.16 Weatherstripping: Extruded polypropylene type pile inserted in keyed grooves.
- 2.2.17 Spacers and glass setting blocks: 80 Durometer A hardness ± 5 , neoprene rubber. Gasketing, spacers and setting blocks shall be resistant to sunlight, weathering, oxidization and permanent deformation under load.
- 2.2.18 Gaskets and thermal barriers between metal components: Neoprene. Set gaskets in grooves and bond to the metal with adhesive. Gaskets: Sized so that they will be under compression when installed, and having a 2000 psi tensile strength and minimum 200% elongation. Thermal barriers: Sized to conform to the extruded aluminum members.
- 2.2.19 Shims (for wet glazing): 45 Durometer, pressure sensitive resilient extruded synthetic rubber or as recommended by the glass manufacturer.
- 2.2.20 Caulking and sealant: Non-bleeding and capable of supporting their own weight.
- 2.2.21 Caulking compound: One component butyl rubber caulking compound complying with CGSB 19-GP-14M.
- 2.2.22 Sealant: Multi-component chemical curing sealing complying with CAN/CGSB 19.24M. Dymeric by the Tremco Manufacturing Company or other approved manufacture.
- 2.2.23 Caulking, sealant, cleaning solvents, fillers and primers: Compatible with each other.
- 2.2.24 Colours for caulking and sealant: As later selected and not necessarily from standard colours.
- 2.2.25 Filler strips: Chemically compatible rod stock of butyl or neoprene, diameter sized 25% greater than joint width before application.
- 2.2.26 Primers: As recommended by the caulking and sealant manufacturer to suit the various job conditions.
- 2.2.27 Cleaning material: Xylol, Methyl-ethyl-ketone, Toluol or as recommended by the caulking and sealant manufacturer.
- 2.2.28 Vents: 1/4" to 3/8" diameter plastic tubes, length as required.
- 2.2.29 Insulation for packing into frame cavities: Foamed-in-place urethane insulation, Pre-froth urethane foam by H. L. Blachford Limited, stable maximum "K" factor of 0.14 BTU/hr/sq ft/°F/1" thickness, and a maximum density of 2.0 lbs/cu.ft. and shall be self-extinguishing type.
- 2.2.30 Membrane air/vapour barrier and primer: As indicated in Section 07 27 13.

2.2.31 Screws and Fasteners: Assembly screws - series 410 stainless steel, cadmium plated.

2.2.32 Insulated Spandrel Panels:

-
- Galvanized sheet steel to ASTM standard for zinc coating Z275 ASTM 525
- Aluminum sheet: AA110-H14 anodizing quality.
- Insulation: AF220 by Fibreglass.
- Sandwich panel, thickness as indicated, comprised of exterior face of 0.51 mm thick aluminum embossed sheet, Duranar XL finish laminated to 3 mm (1/8") hardboard substrate; interior face of 0.51 mm thick aluminum sheet.
- Insulation: rigid, polyisocyanurate; 28.8 kg/cu.m (1.8 lb/cu.ft) density.
- Insulation Clips: Type-N Sticklip and Type-S adhesive as manufactured by Eckel Industries Ltd., or equivalent.
- Adhesive: as recommended by manufacturer of material to be bonded.
- Hardboard: to CAN/CGSB-11.3-M, Type 2, tempered.
- Aluminum Finish: as indicated on drawings.

2.3 FABRICATION - GENERAL

2.3.1 Do not start fabrication until shop and erection drawings have been reviewed, and samples have been approved.

2.3.2 Insofar as practical, execute fitting and assembly of metal windows in the shop with the various parts or assemblies ready for erection at the building site.

2.3.3 Take field measurements and levels required to verify or supplement those shown on the Drawings for the proper layout and installation of the work. Co-ordinate dimensional tolerances in adjacent building elements and confirm prior to the commencement of the work.

2.3.4 Accurately machine file and fit and rigidly frame together all joints, corners and mitres. Match components carefully to produce perfect continuity of line and design. Make all joints and connections toward the exterior weather tight. Metal in contact shall have hairline joints unless otherwise shown on the final reviewed shop drawings. Location of all exposed joints shall be subject to the approval of the Consultant.

2.3.5 Weld aluminum with inert metal arc equipment and by methods recommended by the Aluminum Co. of Canada. Make exposed welds continuous and flush with adjacent surface. Space intermittent welds as shown on the final reviewed shop drawings. Do not mar with welds in back of exposed aluminum, the specified surface finishes. Do not deform the exposed metal and finish in any way by welding.

2.3.6 Weld steel in accordance with CSA W59. Welded joints shall be of adequate strength and durability with jointing tight and flush. Welders shall be fully approved by the Canadian Welding Bureau and shall comply with CSA W47.1.

2.3.7 Where it is necessary to weld components already galvanized, remove galvanizing for 2" around weld and paint over the welds where galvanizing is removed as specified hereinafter.

2.3.8 Reinforce all frames as necessary to meet the specified design requirements and as shown. All reinforcing shall be hot rolled mild steel and shall be securely anchored to horizontal and vertical members by positive mechanical means.

- 2.3.9 Clean and galvanize all reinforcing, brackets and other steel items supplied under this Section in accordance with CGSB 31-GP-404 (blast cleaning) and CSA G164-M, (coating weight; 1.25 oz./sq.ft.). Isolate galvanized steel from contact with aluminum with a heavy brush coat of bituminous paint.
- 2.3.10 Units shall be fabricated using two separate frames joined to thermal break. Neatly cope and butt any main frame joints in a weather tight manner and secure with screws into integral screw sleeves. Reinforce any member which is to receive hardware.
- 2.3.11 Internally seal all sash corners and make smooth all sharp milled edges and corners.
- 2.3.12 Sill members shall have a minimum seven (7) degree downward slope and an integral drip which extends a minimum of 1" (25 mm) from face of wall cladding.
- 2.3.13 Fabricate units such that they allow easy replacement of defective, worn or damaged components.
- 2.3.14 Provide extruded aluminum sills at windows. Sills shall have end caps, returned up one brick course. Sills shall be continuous, and all butt joints shall be capped (minimum 5" (125 mm) width and be aligned to exterior wall expansion and control joints and at all male/female/jamb locations of windows.
- 2.3.15 Exposed fasteners or use of pop rivets is not permitted.
- 2.3.16 Fabricate units to provide for expansion and contraction of components.
- 2.4 FABRICATION - WINDOWS
- 2.4.1 The following are acceptable manufacturers:
- .1 Alwind Industries Ltd.
 - .2 Alumicor Ltd.
 - .3 Windspec
 - .4 Aerloc Windows
- 2.5 FABRICATION - FIXED WINDOWS
- 2.5.1 Fixed windows shall have thermally broken framing with snap-in glazing stops, complete with Tremco Polyshim II exterior pre-shimmed tape and slide spine, exterior silicone pointing, Tremco vision strip or approved equivalent.
- 2.5.2 Frame shall consist of closed tubular aluminum sections reinforced if necessary and/or open channel profiles unless otherwise noted.
- 2.5.3 Framing members: Prefinished aluminum, minimum 0.062" (1.6 mm) thick.
- 2.5.4 Aluminum seam joint cover plates: Extruded aluminum.
- 2.5.5 Fixed Windows: Series 970 by Alumicor Ltd or approved equivalent.
- 2.6 FABRICATION - AWNING WINDOWS
- 2.6.1 Double glazed, top-hung project-out with rolled-in thermal break.

- 2.6.2 Maximum allowable air leakage of 0.06 (m³/hr) m⁻¹ @ 75 Pa and 23.20C (crack length =3.20 m).
- 2.6.3 Two piece extruded full-length hinge, Truth roto-operator with crank handles and one pair of heavy duty Anderburg friction arms/adjusters for sash greater than 9 square feet.
- 2.6.4 Window Vents: SERIES 1100 INSULCASEMENT by Alumicor Ltd, or approved equivalent.
- 2.6.5 Hardware:
- .1 Equip each project out unit with one Truth roto-operator.
 - .2 Equip each roto-operator with a Crank Handle #11329 with setscrew by Truth (Finish to be selected by Owner from Manufacturer's standard colour selections.)
 - .3 Provide one pair of Anderburg Heavy-Duty Friction Arms/Adjusters.
 - .4 A Continuous Extruded Hinge System (approved by owner). Exposed fasteners NOT acceptable.
- 2.6.6 Install restrictors to limit the projection of the operable sash to a maximum of 100mm (4 inches).
- 2.7 FABRICATION – SLIDING WINDOWS
- 2.7.1 All sliding windows shall be Wausau Window and Wall Systems® Series SX45 Thermal [AW-PG45-HS] Horizontal Sliding window or approved equal.
- 2.7.2 Standard structural performance for ventilators closed and locked, test unit in accordance with ASTM E 330 at a static air pressure difference of 60.2 psf (2880 Pa), both positive and negative.
- 2.7.3 Air infiltration field tests shall be conducted at the same uniform static test pressure as the laboratory test unit. The Maximum allowable rate of air leakage shall not exceed 1.5 times the laboratory test unit for hardware and glazing types consistent with the laboratory test unit.
- 2.7.4 Hardware:
- .1 Concealed plunger lock in the meeting rail with a flush mounted actuating handle.
 - .2 Sash shall ride on steel ball bearing rollers and a raised track, so dirt will not interfere with normal operation.
- 2.7.5 Weather-Strip:
- .1 All primary weather-strip shall be E-Ion or equal.
- 2.7.6 Thermal Barrier
- .1 All exterior aluminum shall be separated from interior aluminum by a rigid, structural thermal barrier. For purposes of this specification, a structural thermal barrier is defined as a system that shall transfer shear during bending and, therefore, promote composite action between the exterior and interior extrusions.
 - .2 The thermal barrier shall be thermal struts, consisting of glass reinforced polyamide nylon, mechanically crimped in raceways extruded in the exterior and interior extrusions.
 - .3 Poured and de-bridged urethane thermal barriers shall not be permitted.

2.8 WINDOW HARDWARE FOR ELEVATED OR CLERSTORY WINDOWS:

- 2.8.1 Roto operators: see specifications in the section 2.7.3.
- 2.8.2 Lock / Claw Handle: see specifications in section 2.7.2.
- 2.8.3 Folding Handle: Clerestory Pole Crane #30476 with 3-foot pole extensions by Truth hardware.
- 2.8.4 Equipment awning style projected units with Teleflex Operators.
- 2.8.5 Equipment hopper style projected units with spring loaded pull catch complete with integrated ring for pole operation and cam handle locks complete with integrated rig for pole operation.
- 2.8.6 Provide one (1) 1800mm long pole per room, with wall hook for pole storage.

2.9 FABRICATION - INSECT SCREENS

- 2.9.1 Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches, and as follows:
 - .1 Fabricate screens and frames in accordance with CAN/CSA A440 and CAN/CGSB 79.1.
 - .2 Fabricate insect screens to fully integrate with window frame.
 - .3 Locate screens on outside of window and provide for each operable exterior sash.
- 2.9.2 Screen Frames:
 - .1 Extruded Aluminum or Aluminum Tubular Framing Sections: Aluminum sections having 1/32" minimum nominal wall thickness, with finish matching aluminum window members.
- 2.9.3 Screen Fabric:
 - .1 Screen Class: Class A in accordance with CAN/CGSB 79.1.
 - .2 Screen Strength: S2 in accordance with CAN/CSA A440 and CAN/CGSB 79.1.
 - .3 Screen Style: Style 1 in accordance with CAN/CGSB 79.1.
 - .4 Fabric Mesh Material: Aluminum Wire: Charcoal grey or black finish; in accordance with CAN/CGSB 79.1.

2.10 COMBINATION/COMPOSITE WINDOWS

- 2.10.1 Manufacturer must demonstrate that the mullion separating the individual windows has sufficient strength and stiffness to support these windows under the appropriate wind pressure for the window class.

2.11 FINISHES

- 2.11.1 All aluminum visible in the completed work shall have a clear anodized finish AA-M12C22A41 Class I 0.4 mil thick, measured as per ASTM B244, Density at least 27 mg/sq in. to ASTM B37.

- 2.11.2 Steel anchors and fixed position support members and steel window components: Cleaned and hot dip galvanized complying with CGSB 31-GP-404 (blast cleaning) and CSA G164-M; coating weight, 1.25 oz./sq.ft..
- 2.11.3 Exposed fastenings: Finished and coloured to match the finish and colour of the material in which they appear. The finish provided shall be permanent and durable.

PART 3 - EXECUTION

3.1 INSPECTION

- 3.1.1 Ensure that openings to receive the work of this Section are within acceptable tolerances.

3.2 PREPARATION

- 3.2.1 Remove dust, loose material and debris from openings.
- 3.2.2 Supply threaded inserts to Section 04 20 00 - Unit Masonry where required for casting and building in place and instruct as to proper location and position.

3.3 ERECTION

- 3.3.1 All devices for anchoring the frame assemblies to the building structure shall have sufficient adjustment to permit correct and accurate alignment. After alignment, rivet, weld or positively lock all anchorage devices to prevent movement other than those designed for expansion and contraction.
- 3.3.2 Erection tolerances for frame assemblies are as related to the structural grid of the building and shall apply to each individual assemblies. Tolerances shall be:
 - .1 Vertical position; $\pm 1/8"$.
 - .2 Horizontal position; $\pm 1/8"$.
 - .3 Deviation from plumb; $1/8"$ maximum each plane.
 - .4 Racking of face; $1/4"$ maximum.
 - .5 Racking in elevation; nil.
- 3.3.3 Site located fixings to the in situ and precast concrete shall be stainless steel lag screws and lead expansion shields. Perform drilling of concrete as required to install shields. Bear cost of repair satisfactory to the Consultant of concrete chipped by drilling or fixing operations.
- 3.3.4 Give to aluminum or galvanized steel placed in or in contact with concrete, masonry, mortar, plaster or dissimilar metals a heavy brush coat of alkaline resistant bituminous or zinc chromate paint.
- 3.3.5 Group components with coloured aluminum finish so that those which relate most closely to one another, with regard to colour, will be installed adjacent to each other.
- 3.3.6 As erection progresses, pack frame cavities with insulation.
- 3.3.7 The completed installation shall be free from all objectionable noise, rattles, wind whistles, creak or noise due to thermal movement.

- 3.3.8 Supply and install flexible 1/16" thick continuous neoprene seals between window framing, metal air/vapour barrier and at locations shown, applied to each side of the joint with adhesive and retained with continuous aluminum bars and mechanical fasteners.
- 3.3.9 Provide continuity of thermal and air/vapour barriers with adjacent thermal and air/vapour barrier system.
- 3.3.10 Install bullnose window sills of aluminum in maximum possible lengths, diameter or indicated on Drawings, water level and with hairline tight joints to curtain wall mullions.
- 3.3.11 Provide heel bead continuous to perimeter of glass rebate to prevent cold exterior air from contacting edge of interior light of the insulating glass units.
- 3.3.12 Provide all air seals required within window components.

3.4 INSTALLATION - GLAZING

- 3.4.1 Perform all glazing associated with the work of this Section. Labels showing grade, thickness and quality are required on each piece of glass. Leave labels on glass until inspected and approved by the Consultant. Glaze in a weather tight manner. Leave all glass whole and without cracks, scratches or other defects and with all settings in perfect condition at completion, to the satisfaction of the Consultant. Remove all rejected, broken or damaged glass and replace with perfect materials. Any units producing distorted vision shall be rejected and replaced at the reasonable discretion of the Consultant.
- 3.4.2 Allow adequate edge clearance for glazed units and maintain adequate edge bite on stop.
- 3.4.3 Employ setting blocks and spacers on all units. Gun in a continuous heel bead shown on the Drawings.
- 3.4.4 Strip surplus glazing materials.
- 3.4.5 Perform glazing adhering to the applicable paragraphs of Section 08 80 00 - Glazing, as if fully noted herein, unless otherwise specified herein.

3.5 SEALING

- 3.5.1 Clean thoroughly joints and spaces to be sealed or caulked of foreign matter and keep them dry before applying gaskets, tapes, sealants or caulking. Apply gun grade sealants or caulking with an approved type of pressure gun having nozzles of proper size and shape to fit the various joints; drive sealants and caulking in with sufficient pressure to fill the joints full. Clean adjacent surfaces which have been soiled by tapes, sealants or caulking immediately before hardening. Apply surface primers, when used as per manufacturer's instructions.
- 3.5.2 Perform caulking and sealing adhering to the applicable paragraphs of Section 07 90 00 - Joint Sealants, as if fully cited herein, unless otherwise specified herein.

3.6 INSTALLATION - STORM DOORS

- 3.6.1 Install units, accessories and hardware in accordance with manufacturer's written instructions.
- 3.6.2 Apply bed of sealant to mating surface of door frame.
- 3.6.3 Accurately fit and secure door frame to building opening.

- 3.6.4 Adjust position to ensure door to frame gap 2 mm maximum.
- 3.6.5 Adjust operable parts for smooth operation.
- 3.6.6 Install hardware to manufacturer's written instructions.
- 3.6.7 Installation Tolerances:
 - .1 Maximum Diagonal Distortion: 3 mm measured with straight edge, corner to corner.
- 3.7 ADJUSTMENTS
 - 3.7.1 Upon completion of the project and just prior to the handing over of the building to the Owner or at a time as directed by the Consultant, return to the building and inspect, test and adjust installation as follows:
 - .1 Inspect all units for damage and correct same immediately.
 - .2 Test and adjust all hardware and replace or repair all faulty items to the satisfaction of the Consultant.
 - .3 Adjust all weather stripping so as to leave each opening unit in its most weather tight position.
 - .4 Test all openings and ensure easy and smooth operation.
- 3.8 CLEANING
 - 3.8.1 Remove concrete and alkali wash-offs on surfaces to prevent etching of glass and metal.
 - 3.8.2 Remove temporary protective materials on coatings.
 - 3.8.3 Wash down exposed exterior surfaces using a solution of mild domestic detergent in warm water, applied with soft, clean wiping cloths. Take special care to remove all dirt from corners. Use detergent of an approved brand and source. Wipe interior surfaces clean when construction is completed.
 - 3.8.4 Remove excess sealant and caulking by the moderate use of mineral spirits or other solvent acceptable by the sealant and caulking manufacturer and the metal fabricator.
 - 3.8.5 Where the accumulation of dirt does not respond to the washing or cleaning hereinbefore required, refer the condition to the Consultant, with your recommendations as to the remedial action required; but do not undertake any cleaning procedure of a more severe nature without the written approval of the Consultant.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1. 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. This Section includes supply and installation of commercial door hardware for the following:

1. Swinging doors.
2. Other doors to the extent indicated.

2. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.
3. Cylinders specified for doors in other sections.

3. Related Sections:

1. Division 01 Section "Cash Allowances".
2. Division 01 Section "Product Allowances".
3. Division 01 Section "Closeout Procedures".
4. Division 08 Section "Door Hardware Schedule".
5. Division 08 Section "Hollow Metal Doors and Frames".
6. Division 28 Section "Access Control Hardware Devices".

4. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. UL/ULC and CSA C22.2 - Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
8. State Building Codes, Local Amendments.

5. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.
5. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

1. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
2. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
3. Shop Drawings: Details of electrified access control hardware indicating the following:
 1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
 - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
 - b. Complete (risers, point-to-point) access control system block wiring diagrams.
 - c. Wiring instructions for each electronic component scheduled herein.
 2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

4. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
5. Informational Submittals:
 1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
6. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.4 QUALITY ASSURANCE

1. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
2. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).
3. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
4. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
5. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
6. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
7. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
 2. Plans for existing and future key system expansion.
 3. Requirements for key control storage and software.
 4. Installation of permanent keys, cylinder cores and software.
 5. Address and requirements for delivery of keys.
8. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
 3. Review sequence of operation narratives for each unique access controlled opening.
 4. Review and finalize construction schedule and verify availability of materials.
 5. Review the required inspecting, testing, commissioning, and demonstration procedures
9. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

1. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
2. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
3. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

1. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
2. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

3. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

1. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
2. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 1. Structural failures including excessive deflection, cracking, or breakage.
 2. Faulty operation of the hardware.
 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 4. Electrical component defects and failures within the systems operation.
3. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

1.8 MAINTENANCE SERVICE

1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

1. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
2. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
 1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
3. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

1. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
 1. Quantity: Provide the following hinge quantity:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
 3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
 4. Hinge Options: Comply with the following:
 - a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
 5. Manufacturers:
 - a. Hager Companies (HA).
 - b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).
 - c. Stanley Hardware (ST).

2.3 CYLINDERS AND KEYING

1. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
2. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
3. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:
 1. Threaded mortise cylinders with rings and cams to suit hardware application.
 2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
 4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 5. Keyway: Manufacturer's Standard.

4. Patented Cylinders: ANSI/BHMA A156.5, Grade 1 Certified Products Directory (CPD) listed cylinders employing a utility patented and restricted keyway requiring the use of a patented key. Cylinders are to be protected from unauthorized manufacture and distribution by manufacturer's United States patents. Cylinders are to be factory keyed with owner having the ability for on-site original key cutting.
 1. Patented key systems shall not be established with products that have an expired patent. Expired systems shall only be specified and supplied to support existing systems.
 2. Manufacturers:
 - a. Medeco (MC) - Medeco X4.
 - b. No Substitution.

5. Keying System: Each type of lock and cylinders to be factory keyed.
 1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 3. Existing System: Field verify and key cylinders to match Owner's existing system.

6. Key Quantity: Provide the following minimum number of keys:
 1. Change Keys per Cylinder: Two (2)
 2. Master Keys (per Master Key Level/Group): Five (5).

7. Key Registration List (Bitting List):
 1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
 2. Provide transcript list in writing or electronic file as directed by the Owner.

8. Provide keying per schedule below.

Site Code :553

DOOR #	COM DOOR TAG	LOCATION	1	2
ED-01	ACC1-E-10035-1	ENTRANCE TO STAIRWAY	CROR	
ED-02	ACC1-Y-10067-1	ELECTRICAL ROOM	SKD5	
ED-03	?	EXIT FROM STORAGE ROOM 50	N/A	
ED-04	ACC1-E-10042-1	EXTERIOR HALL 07 DOOR	CROR	
ED-05	OVERHEAD DOOR	OVERHEAD DOOR	N/A	
ED-06	ACC1-E-10054-1	CORRIDOR 41 EXTERIOR	CROR	
ED-07	ACC1-E-10016-1	EXTERIOR	CROR	
ED-08	ACC1-E-10013-1	EXTERIOR DOG RUNS	CROR	
ED-09	ACC1-E-10019-1	DOG ADOPTION 4 EXTERIOR	SKD5	
ED-10	ACC1-E-10012-1	DOG ADOPTION 2 EXTERIOR	SKD5	
ED11	ACC1-E-10004-1	CATS ROOM 2 EXTERIOR	N/A	
ED12	ACC1-E-10001-1	CATS ROOM 1 EXTERIOR	N/A	
G-01	?	DOG RUNS GATE	CROR	
ID-01	ACC1-Y-10002-1	CATS ROOM 1	A	A3
ID-02	ACC1-Y-10003-1	CATS ROOM 2	A	A4
ID-03	ACC1-Y-10006-1	CORRIDOR 22 FROM CORRIDOR 20	A	A5
ID-04	ACC1-Y-10007-1	COMMUNITY ROOM 21	A	A6
ID-05	ACC1-Y-10008-1	CORRIDOR 18 FROM CORRIDOR 20	A	A7
ID-06	ACC1-Y-10010-1	DOG ADOPTION ROOM 1	A	A8
ED-13	ACC1-E-20001-1	2ND FLOOR WILDLIFE OFFICE	CROR	

2.4 MECHANICAL LOCKS AND LATCHING DEVICES

1. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.
 1. Where specified, provide status indicators with highly reflective color and wording for "locked/unlocked" or "vacant/occupied" with custom wording options if required. Indicator to be located above the cylinder with the inside thumb-turn not blocking the visibility of the indicator status. Indicator window size to be a minimum of 2.1" x 0.6" with a curved design allowing a 180 degree viewing angle with protective covering to prevent tampering.
 2. Provide mortise lock bodies functionally compatible with a rose-less lever trim option.
 3. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - ML2000 Series.
 - b. Sargent Manufacturing (SA) - 8200 Series.
 - c. Yale Commercial(YA) - 8800FL Series.

2. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed.
 1. Furnish with solid cast levers, standard 2 3/4" backset, and 1/2" (3/4" at rated paired openings) throw brass or stainless steel latchbolt.
 2. Locks are to be non-handed and fully field reversible.
 3. Extended cycle test: Locks to have been cycle tested in ordinance with ANSI/BHMA 156.2 requirements to 2 million cycles.
 4. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - CLX3300 Series.
 - b. Sargent Manufacturing (SA) – 10X Line.

2.5 AUXILIARY LOCKS

1. Cylindrical Deadlocks: ANSI/BHMA A156.36 Grade 1 Certified Products Directory (CPD) listed deadlocks to fit standard ANSI 161 preparation and 1 3/8" to 1 3/4" thickness doors. Provide tapered collars to resist vandalism and 1" throw solid steel bolt with hardened steel roller pins. Deadlocks to be products of the same source manufacturer and keyway as other locksets.
 1. Manufacturers:
 - a. Arrow Locks (AW) - D Series.
 - b. Corbin Russwin Hardware (RU) - DL3000 Series.
 - c. Sargent Manufacturing (SA) - 480 Series.
 - d. Yale Commercial(YA) - D100 Series.

2.6 LOCK AND LATCH STRIKES

1. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
 4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.
2. Standards: Comply with the following:
 1. Strikes for Mortise Locks and Latches: BHMA A156.13.
 2. Strikes for Bored Locks and Latches: BHMA A156.2.
 3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
 4. Dustproof Strikes: BHMA A156.16.

2.7 ELECTRIC STRIKES

1. Standard Electric Strikes: Electric strikes conforming to ANSI/BHMA A156.31, Grade 1, for use on non-rated or fire rated openings. Strikes shall be of stainless steel construction tested to a minimum of 1500 pounds of static strength and 70 foot-pounds of dynamic strength with a minimum endurance of 1 million operating cycles. Provide strikes with 12 or 24 VDC capability, fail-secure unless otherwise specified. Where specified provide latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike.
 1. Manufacturers:
 - a. HES (HS) - 1500/1600 Series.
 2. Surface Mounted Rim Electric Strikes: Surface mounted rim exit device electric strikes conforming to ANSI/BHMA A156.31, Grade 1, and UL Listed for both Burglary Resistance and for use on fire rated door assemblies. Construction includes internally mounted solenoid with two heavy-duty, stainless steel locking mechanisms operating independently to provide tamper resistance. Strikes tested for a minimum of 500,000 operating cycles. Provide strikes with 12 or 24 VDC capability supplied standard as fail-secure unless otherwise specified. Option available for latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike. Strike requires no cutting to the jamb prior to installation.
 1. Manufacturers:
 - a. HES (HS) - 9400/9500/9600 Series.
 3. Provide electric strikes with in-line power controller and surge suppressor by the same manufacturer as the strike with the combined products having a five year warranty.

2.8 DOOR CLOSERS

1. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
 4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
 6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
2. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.
 1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - DC6000 Series.
 - b. Norton Door Controls (NO) - 7500 Series.
 - c. Sargent Manufacturing (SA) - 351 Series.
 - d. Yale Commercial(YA) - 4400 Series.

2.9 ELECTROMECHANICAL DOOR OPERATORS

1. Electromechanical Door Operators (Moderate Traffic): Provide ANSI/BHMA A156.19 Certified Products Directory (CPD) listed low energy operators that are UL325/991 certified and comply with requirements for the Americans with Disabilities Act (ADA). Operators shall accommodate openings up to 200 pounds and 48" wide.
 1. Provide operators with features as follows:
 - a. Non-handed with push and pull side mounting.
 - b. Activation by wall switch, hands-free or radio frequency devices.
 - c. Adjustable opening force and closing power.
 - d. Two-year limited warranty.
 - e. Wi-Fi interface.
 - f. Mounting backplate to simplify and speed up installation.
 2. Operators shall have the following functionality:

- a. Adjustable Hold Open: Amount of time a door will stay in the full open position after an activation.
 - b. Infinite Hold Open: Door will hold open at set position until power is turned off.
 - c. Latch Assist: At closed position, after an activation, the door is pulled in. After the door has closed, the door is pulled in to assist with latch release/engagement.
 - d. Obstruction Detection: Door closes if it hits an obstruction while opening; door will reverse to open position if it hits an obstruction while closing. Door will stop once it hits an obstruction and will rest against the obstruction until removed.
 - e. Open Delay: Delays operator opening for locking hardware.
 - f. Outside Wall Switch Disable: When contact is closed, outside wall switch is disabled.
 - g. Power Close: Additional force to assist door closing between 7° and 2°.
 - h. Presence Detector Input: Input for external sensor to detect presence at door open or close position only.
 - i. Selector Mode Switch: Off disables the signal inputs unless Blow Open is activated, on activates the signal inputs, hold open activates the unit (unless Blow Closed is activated) to the hold open position.
 - j. Restroom Function: Built-in, configurable operator logic to support single use restroom applications without the need for external relays, logic modules, or door position switches.
 - k. Executive Mode Feature: When the door receives an activation signal it opens and remains open until either a second signal is received, or the door is manually moved in closing direction.
3. Manufacturers:
- a. ASSA ABLOY Entrance Systems (BE) - SW60 Series.
 - b. Norton Rixson (NO) - 5200 Series.

2.10 DOOR STOPS AND HOLDERS

1. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
2. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
 1. Manufacturers:
 - a. Hiawatha, Inc. (HI).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Trimco (TC).

2.11 ARCHITECTURAL SEALS

1. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

2. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
3. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.
4. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
5. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
6. Manufacturers:
 1. National Guard Products (NG).
 2. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
 3. Reese Enterprises, Inc. (RE).

2.12 ELECTRONIC ACCESSORIES

1. Touchless Switches: Unit to have an adjustable sensing zone from 4" to 24". At exterior locations furnish foam gaskets and weather covers. Provide single gang or double gang unit as specified in the hardware sets
 1. Manufacturers:
 - a. Camden (CM) – CM324 Series
2. Request-to-Exit Motion Sensor: Request-to-Exit Sensors motion detectors specifically designed for detecting exiting through a door from the secure area to a non-secure area. Include built-in timers (up to 60 second adjustable timing), door monitor with sounder alert, internal vertical pointability coverage, 12VDC or 24VDC power and selectable relay trigger with fail safe/fail secure modes.
 1. Manufacturers:
 - a. Alarm Controls (AK) - SREX Series.
 - b. Securitron (SU) - XMS Series.
3. Door Contact: The Door Position Switch shall be of the compact balanced co-planar magnetic type, completely sealed and weatherproof. The switch shall have a narrow read angle and limited matching pairs of the switch and actuator pack for high defeat resistance. The switch shall also have a concealed pry tamper circuit to disallow the switch assembly being lifted off of the door frame. The switch shall have a single pole double throw output and have cabling options for concealed or armored surface connections. The switch gap shall be between 0.4"

inch and 0.6" inch and the operation shall remain unchanged whether the device is mounted on wood, steel or aluminum doors, indoors or outdoors.

4. Linear Power Supplies: Provide Nationally Recognized Testing Laboratory Listed 12VDC or 24VDC (field selectable) filtered and regulated power supplies. Include battery backup option with integral battery charging capability in addition to operating the DC load in event of line voltage failure. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw plus 50% for the specified electrified hardware and access control equipment.
 1. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.
 2. Manufacturers:
 - a. Alarm Controls (AK) - APS Series.
 - b. Securitron (SU) - BPS Series.

2.13 FABRICATION

1. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.14 FINISHES

1. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
2. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
3. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

1. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
2. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

1. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
2. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

1. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
2. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 2. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 3. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
3. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
4. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
5. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.
6. The General Contract shall only carry the COM-Approved Door Hardware Vendor "Royal Security Solution Inc." for Hardware & Keying under the cash allowances. All the hardware installation to be done by General Contractor as part of project contract.

The GC/Royal Security Solution Inc. to coordinate with City of Mississauga "Ray Grotke" for keying.

Lawrence Vrbanek
Royal Security Solution Inc., President
80 Hale Road, Brampton ON, Canada L6W 3N9
T: 905-840-0522 ext.251
lawrence@royalsecurity.ca

Ray Grotke

City of Mississauga Systems Specialist, Security Services
T: 905-615-3200 ext.5763 | 905-615-3229
24hr Operations Centre 905-896-5040
raymond.grotke@mississauga.ca

3.4 FIELD QUALITY CONTROL

1. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures" and "Cash Allowances". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
 1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.
 2. Submit documentation of incomplete items in the following formats:
 - a. PDF electronic file.
 - b. Electronic formatted file integrated with the Openings Studio™ door opening management software platform.
2. Fire Door Assembly Inspection: Reference Division 01 Sections "Closeout Procedures" and "Cash Allowances" for stipulations requiring an initial fire door assembly inspection, including documentation reporting, upon completion of door hardware installation according to NFPA 80 Standard for Fire Doors and Other Opening Protectives, paragraph 5.2.4, requirements.

3.5 ADJUSTING

1. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

1. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
2. Clean adjacent surfaces soiled by door hardware installation.
3. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

1. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

1. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
 1. Quantities listed are for each pair of doors, or for each single door.
 2. The supplier is responsible for handling and sizing all products.
 3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
 4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.
2. Manufacturer's Abbreviations:
 1. MK - McKinney
 2. MR - Markar
 3. RO - Rockwood
 4. SA - SARGENT
 5. SU - Securitron
 6. MC - Medeco
 7. HS - HES
 8. OT - Other
 9. NO - Norton
 10. BM - Besam
 11. PE - Pemko

Hardware Schedule

Set: 1.0

Doors: ED-05
Description: Overhead

1	Door Contact	4701-A BY SECURITY CONTRACTOR	OT
1	All Hardware	BY DOOR SUPPLIER	OT

Set: 2.0

Doors: ED-03
Description: Pair x Ext x ED EO x CPS x Seals - New

2	Continuous Hinge	FM300 HEIGHT	630	MR
2	Surface Vert Rod Exit, Exit Only	8710 EO	US32D	SA
1	Coordinator	1700	Black	RO
2	Surface Closer	CPS7500 DROP PLATE TO SUIT	689	NO
2	Kick Plate	K1050 200mm x WIDTH CSK	US32D	RO
1	Astragal (overlapping)	357C HEIGHT		PE
1	Gasketing	2891AV 1WIDTH x 2HEIGHT		PE
1	Rain Guard	346C WIDTH		PE
2	Sweep (w/raindrip)	345AV WIDTH		PE
1	Threshold	253xXAFG WIDTH		PE
2	Door Contact	199-12-B BY SECURITY CONTRACTOR		

Set: 3.0

Doors: ED-02
Description: Pair x Ext x Storeroom x CPS x Seals - New

2	Continuous Hinge	FM300 HEIGHT	630	MR
1	Flush Bolt	2845	US26D	RO
1	Dust Proof Strike	570	US26D	RO
1	Storeroom/Closet Lock	70 41 10XG04 LL	US26D	SA
1	Cylinder (mortise/rim)	33600006N-26-BCD	26	MC
1	Coordinator	1700	Black	RO
2	Surface Closer	CPS7500 DROP PLATE TO SUIT	689	NO
2	Kick Plate	K1050 200mm x WIDTH CSK	US32D	RO
1	Astragal (overlapping)	357C HEIGHT		PE
1	Gasketing	2891AV 1WIDTH x 2HEIGHT		PE
1	Rain Guard	346C WIDTH		PE
2	Sweep (w/raindrip)	345AV WIDTH		PE
1	Threshold	253xXAFG WIDTH		PE
2	Door Contact	199-12-B BY SECURITY CONTRACTOR		

Set: 4.0

Doors: ED-06

Description: Single x Ext x ED EO ES x DO x Seals - New

3	Hinge, Full Mortise, Hvy Wt	T4A3386 NRP 114 x 114	US32D	MK
1	Rim Exit Device, Exit Only	8810 EO	US32D	SA
1	Electric Strike	9500	630	HS
1	Door Pull	BF 112	US32D-MS	RO
1	Automatic Opener	SW60 INSTALL TO SUIT	689	BM
1	Kick Plate	K1050 200mm x WIDTH CSK	US32D	RO
1	Gasketing	2891AV 1WIDTH x 2HEIGHT		PE
1	Rain Guard	346C WIDTH		PE
1	Sweep (w/raindrip)	345AV WIDTH		PE
1	Threshold	253xXAFG WIDTH		PE
1	ElectroLynx Harness (in frame)	QC-CXXXXP LENGTH		MK
1	Motion Sensor (REX)	BY SECURITY CONTRACTOR		SU
1	Advanced Logic Relay	CX-33		OT
2	Touchless Switch (wave)	CM-324/42		OT
1	Door Contact	199-12-B BY SECURITY CONTRACTOR		
1	Card Reader	EXISTING		OT
1	Power Supply	BY ELECTRICAL CONTRACTOR		OT
1	Door Bell	EXISTING		OT

Note - Division 26 to provide 120VAC power to frame header, final connection to auto door operator, all back boxes and conduit with low voltage wiring.

Note - When opening is secure, outside actuator is inactive.

Note - Security contractor to reconnect the existing card reader and interface with new door operator.

Set: 5.0

Doors: ED-01

Description: Single x Ext x ED EO ES x CPS x Seals x VI - New

3	Hinge, Full Mortise, Hvy Wt	T4A3386 NRP 114 x 114	US32D	MK
1	Rim Exit Device, Exit Only	8810 EO	US32D	SA
1	Electric Strike	9500	630	HS
1	Door Pull	BF 112	US32D-MS	RO
1	Surface Closer	CPS7500 DROP PLATE TO SUIT	689	NO
1	Kick Plate	K1050 200mm x WIDTH CSK	US32D	RO
1	Gasketing	2891AV 1WIDTH x 2HEIGHT		PE
1	Rain Guard	346C WIDTH		PE
1	Sweep (w/raindrip)	345AV WIDTH		PE
1	Threshold	253xXAFG WIDTH		PE
1	ElectroLynx Harness (in frame)	QC-CXXXXP LENGTH		MK
1	Motion Sensor (REX)	EXISTING		OT
1	Door Contact	199-12-B BY SECURITY CONTRACTOR		
1	Card Reader	EXISTING		OT
1	Power Supply	BY ELECTRICAL CONTRACTOR		OT
1	Viewer	622	STNN	RO

Set: 5.1

Doors: ED-04

Description: Single x Ext x ED EO ES x CPS x Seals x VI - New

3	Hinge, Full Mortise, Hvy Wt	T4A3386 NRP 114 x 114	US32D	MK
1	Rim Exit Device, Exit Only	8810 EO	US32D	SA
1	Electric Strike	9500	630	HS
1	Door Pull	BF 112	US32D-MS	RO
1	Surface Closer	CPS7500 DROP PLATE TO SUIT	689	NO
1	Kick Plate	K1050 200mm x WIDTH CSK	US32D	RO
1	Gasketing	2891AV 1WIDTH x 2HEIGHT		PE
1	Rain Guard	346C WIDTH		PE
1	Sweep (w/raindrip)	345AV WIDTH		PE
1	Threshold	253xXAFG WIDTH		PE
1	ElectroLynx Harness (in frame)	QC-CXXXXP LENGTH		MK
1	Motion Sensor (REX)	BY SECURITY CONTRACTOR		SU
1	Door Contact	199-12-B BY SECURITY CONTRACTOR		
1	Card Reader	EXISTING		OT
1	Power Supply	BY ELECTRICAL CONTRACTOR		OT
1	Viewer	622	STNN	RO

Set: 6.0

Doors: ED-09, ED-10

Description: Single x Ext x ED Nightlatch x CPS x Seals - New

3	Hinge, Full Mortise, Hvy Wt	T4A3386 NRP 114 x 114	US32D	MK
1	Rim Exit Device, Storeroom	70 8804 862	US32D	SA
1	Cylinder (mortise/rim)	33600006N-26-BCD	26	MC
1	Surface Closer	CPS7500 DROP PLATE TO SUIT	689	NO
1	Kick Plate	K1050 200mm x WIDTH CSK	US32D	RO
1	Gasketing	2891AV 1WIDTH x 2HEIGHT		PE
1	Rain Guard	346C WIDTH		PE
1	Sweep (w/raindrip)	345AV WIDTH		PE
1	Threshold	253xXAFG WIDTH		PE
1	Door Contact	199-12-B BY SECURITY CONTRACTOR		

Set: 7.0

Doors: ED-13

Description: Single x Ext x Classroom ES x CPS x Seals - New

3	Hinge, Full Mortise, Hvy Wt	T4A3386 NRP 114 x 114	US32D	MK
1	Classroom Lock	70 41 10XG37 LL	US26D	SA
1	Cylinder (mortise/rim)	33600006N-26-BCD	26	MC
1	Electric Strike	1500C	630	HS
1	Strike Latch Guard	150		HS
1	Surface Closer	CPS7500 DROP PLATE TO SUIT	689	NO
1	Kick Plate	K1050 200mm x WIDTH CSK	US32D	RO
1	Gasketing	2891AV 1WIDTH x 2HEIGHT		PE
1	Rain Guard	346C WIDTH		PE
1	Sweep (w/raindrip)	345AV WIDTH		PE
1	Threshold	253xXAFG WIDTH		PE

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FINISHING HARDWARE

1	ElectroLynx Harness (in frame)	QC-CXXXXP LENGTH		MK
1	Motion Sensor (REX)	BY SECURITY CONTRACTOR		SU
1	Door Contact	199-12-B BY SECURITY CONTRACTOR		
1	Card Reader	BY SECURITY CONTRACTOR		OT
1	Power Supply	BY ELECTRICAL CONTRACTOR		OT

Set: 7.1

Doors: ED-07, ED-08

Description: Single x Ext x Classroom ES x CPS x Seals - New

3	Hinge, Full Mortise, Hvy Wt	T4A3386 NRP 114 x 114	US32D	MK
1	Classroom Lock	70 41 10XG37 LL	US26D	SA
1	Cylinder (mortise/rim)	33600006N-26-BCD	26	MC
1	Electric Strike	1500C	630	HS
1	Strike Latch Guard	150		HS
1	Surface Closer	CPS7500 DROP PLATE TO SUIT	689	NO
1	Kick Plate	K1050 200mm x WIDTH CSK	US32D	RO
1	Gasketing	2891AV 1WIDTH x 2HEIGHT		PE
1	Rain Guard	346C WIDTH		PE
1	Sweep (w/raindrip)	345AV WIDTH		PE
1	Threshold	253xXAFG WIDTH		PE
1	ElectroLynx Harness (in frame)	QC-CXXXXP LENGTH		MK
1	Door Contact	199-12-B BY SECURITY CONTRACTOR		
1	Card Reader	EXISTING		OT
1	Power Supply	BY ELECTRICAL CONTRACTOR		OT

Set: 8.0

Doors: ED-11, ED-12

Description: Single x Ext x DL PP x CPS x Seals - New

3	Hinge, Full Mortise, Hvy Wt	T4A3386 NRP 114 x 114	US32D	MK
1	Deadbolt	489	US26D	SA
2	Door Pull	BF 112	US32D-MS	RO
1	Surface Closer	CPS7500 DROP PLATE TO SUIT	689	NO
1	Gasketing	2891AV 1WIDTH x 2HEIGHT		PE
1	Rain Guard	346C WIDTH		PE
1	Sweep (w/raindrip)	345AV WIDTH		PE
1	Threshold	253xXAFG WIDTH		PE
1	Door Contact	199-12-B BY SECURITY CONTRACTOR		

Set: 9.0

Doors: ID-01, ID-02, ID-03, ID-04, ID-05

Description: Single x Classroom ES x DO - New

3	Hinge, Full Mortise, Hvy Wt	T4A3386 114 x 114	US32D	MK
1	Classroom Lock	70 41 10XG37 LL	US26D	SA
1	Cylinder (mortise/rim)	33600006N-26-BCD	26	MC
1	Electric Strike	1500C	630	HS

SECTION 08 71 00
FINISHING HARDWARE

1	Automatic Opener	SW60 INSTALL TO SUIT	689	BM
1	Kick Plate	K1050 200mm x WIDTH CSK	US32D	RO
1	Door Stop/Wall Stop	441H/403 INSTALL TO SUIT	US26D	RO
1	ElectroLynx Harness (in frame)	QC-CXXXXP LENGTH		MK
1	Advanced Logic Relay	CX-33		OT
2	Touchless Switch (wave)	CM-324/42		OT
1	Power Supply	BY ELECTRICAL CONTRACTOR		OT

Note - Division 26 to provide 120VAC power to frame header, final connection to auto door operator, all back boxes and conduit with low voltage wiring.

Set: 9.1

Doors: ID-06

Description: Single x Classroom ES x DO - New

3	Hinge, Full Mortise, Hvy Wt	T4A3386 114 x 114	US32D	MK
1	Classroom Lock	70 41 10XG37 LL	US26D	SA
1	Cylinder (mortise/rim)	33600006N-26-BCD	26	MC
1	Electric Strike	1500C	630	HS
1	Automatic Opener	SW60 INSTALL TO SUIT	689	BM
1	Kick Plate	K1050 200mm x WIDTH CSK	US32D	RO
1	Door Stop/Wall Stop	441H/403 INSTALL TO SUIT	US26D	RO
1	ElectroLynx Harness (in frame)	QC-CXXXXP LENGTH		MK
1	Motion Sensor (REX)	BY SECURITY CONTRACTOR		SU
1	Advanced Logic Relay	CX-33		OT
1	Touchless Switch (wave)	CM-324/42		OT
1	Door Contact	199-12-B BY SECURITY CONTRACTOR		
1	Card Reader	EXISTING		OT
1	Power Supply	BY ELECTRICAL CONTRACTOR		OT

Note - Division 26 to provide 120VAC power to frame header, final connection to auto door operator, all back boxes and conduit with low voltage wiring.

Note - Security contractor to reconnect the existing card reader and interface with new door operator.

Set: 10.0

Doors: G-01

Description: Single x Gate x Existing

1	Gate Lock	GL1-FL		SU
1	Card Reader	BY SECURITY CONTRACTOR		OT
1	Door Contact	ODC-59A-HG BY SECURITY CONTRACTOR		OT
1	All Hardware	BY DOOR SUPPLIER		OT
1	Bracket	FMK-SW		SU

Note - All other hardware and electrical items by others.

Set: 11.0

Doors: H-01

Description: Single x Hatch x Existing

1	Door Contact	ODC-59A-HG BY SECURITY CONTRACTOR	OT
1	All Hardware	EXISTING	OT

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

- 1.1.1 Comply with Division 1, General Requirements and all documents referred to therein.
- 1.1.2 All labour, materials, equipment and services required to supply and install the glass and glazing indicated on the Drawings, specified herein, and not specified in other Sections.

1.2 RELATED WORK SPECIFIED UNDER OTHER SECTIONS

- 1.2.1 Aluminium doors and screens: Section 08 11 16.
- 1.2.2 Hollow metal doors and frames: Section 08 11 00.
- 1.2.3 Wood doors: Section 08 14 00
- 1.2.4 Curtain Wall: Section 08 44 00
- 1.2.5 Aluminum Windows: Section 08 51 13
- 1.2.6 Wood Windows: Section 08 52 00
- 1.2.7 Vinyl Windows: Section 08 53 13

1.3 REFERENCES

- 1.3.1 ASTM A167-99(2009) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip (Withdrawn 2014).
- 1.3.2 ASTM B117-11 Standard Practice for Operating Salt Spray (Fog) Apparatus.
- 1.3.3 ASTM D395-14 Standard Test Methods for Rubber Property - Compression Set.
- 1.3.4 ASTM D412-06a(2013) Standard Test Methods for Vulcanized Rubber And Thermoplastic Rubbers and Thermoplastic Elastomers – Tension.
- 1.3.5 ASTM D1149-07(2012) Standard Test Method for Rubber Deterioration - Cracking in an Ozone Controlled Environment.
- 1.3.6 CAN/CGSB 12.1-M90 Tempered or Laminated Safety Glass.
- 1.3.7 CAN/CGSB 12.2-M91 Flat Clear Sheet Glass.
- 1.3.8 CAN/CGSB 12.3-M91 Flat, Clear Float Glass.
- 1.3.9 CAN/CGSB 12.5-M86 Mirrors, Silvered.
- 1.3.10 CAN/CGSB 12.20-M89 Structural Design of Glass for Buildings.
- 1.3.11 CAN/CGSB 19.24-M90 Multicomponent, Chemical-Curing Sealing Compound.

1.4 SUBMITTALS

- 1.4.1 Samples: Duplicate 12" x 12" samples of each type and thickness of glass and 12" long mirror frame.
 - 1.4.2 Product Data: Submit manufacturer's product data for each type of product specified. Data shall indicate compliance with specification and installation recommendations of manufacturer of products being used.
 - 1.4.3 Maintenance data: Written instructions for protection of completed work, for re-glazing, and for proper methods and materials to be used in cleaning.
 - 1.5 DELIVERY, STORAGE AND HANDLING
 - 1.5.1 Delivery and Acceptance Requirements: Deliver packaged materials in their original containers with manufacturer's labels and seals intact.
 - 1.5.2 Storage and Handling Requirements: Store vertically, blocked off the floor in a weatherproof enclosure in original containers with manufacturers labels and seals intact until read for installation, and as follows:
 - .1 Install glass as soon as possible after delivery to site.
 - .2 Handle glass carefully to its place of installation.
 - .3 Prevent damage to glass, adjacent materials and surfaces.
 - 1.6 SITE CONDITIONS
 - 1.6.1 Ambient Conditions: Maintain temperature, humidity and solar exposure conditions of Glass Glazing materials during shipping, storage and site installation as required by manufacturer to maintain warranty and performance of installed products.
 - 1.7 WARRANTIES
 - 1.7.1 Submit a two year warranty, commencing from date of Substantial Performance, against defects in the workmanship and materials, including and not necessarily limited to the following:
 - .1 Cracked or scratched glass, shrinking, cracking, staining, hardening, sagging of glazing materials, loosening or rattling of glass.
 - .2 Glazing work is water and weather tight and free from distortion, that glazing materials will not deteriorate due to exposure to atmosphere and weather, will not be displaced, and will be free from permanent deformation under load.
 - .3 Glass breakage due to thermal shock or change occurring within weather extremes stated for the place of building under OBC, and an inside temperature range of 5°C and 42°C.
 - .4 Loosening of mirror frame fastenings.
 - 1.7.2 Submit a five warranty, commencing from date of Substantial Performance, against deterioration of mirror silver backing and cracking of mirrors.
- PART 2 - PRODUCTS**
- 2.1 MATERIALS
 - 2.1.1 Except where more specifically specified herein, glass shall meet or exceed requirements of CAN/CGSB 12.20.

- 2.1.2 Glass: Each unit shall bear manufacturer's label indicating quality, and thickness.
- 2.1.3 Thickness of glass as shown on Drawings except as specified herein.
- 2.1.4 Sheet glass: CAN/CGSB 12.2, B quality or better.
- 2.1.5 Float glass: CAN/CGSB 12.3, glazing quality, annealed.
- 2.1.6 Safety glass: CAN/CGSB 12.1, Type 2, Class B, heat treated float glass, Category I Heat Strengthened, Category II Tempered. Tong and roller marks free.
- 2.1.7 Fire rated glass: Firelite
- 2.1.8 Glazing compound: CAN/CGSB 19.24, multi component, chemical curing.
- 2.1.9 Heel bead: Dymonic by Tremco, or other approved manufacture.
- 2.1.10 Glazing tape: Extruded, ribbon shaped, non-drying, non-skinning, non-oxidizing polyisobutylene tape with continuous synthetic rubber spacer rod, sufficiently wide and thick as to completely cover bite area of the glazing unit when the unit is pushed into place, Polyshim 2, by Tremco Ltd., or other approved manufacture.
- 2.1.11 Mirrors: CAN/CGSB 12.5, Type 1A, polished float glass 1/4" thick and withstanding a 72 hour exposure in accordance with ASTM B117, by Vitro Architectural Glass (formerly PPG Industries Ltd.), AFG Glass, Pilkington Glass Limited, or other approved manufacture. Mirror backing shall be resistant to sulphur and hydrogen sulphide fumes. Polish and round all corners of mirrors.
- 2.1.12 Adhesive for mirrors: Special mirror mastic, "Mirro-Mastic" by Palmer Products Corporation, or other approved manufacture.
- 2.1.13 Backpaint and sealer for mirrors to be adhesive applied: "Mirro-Bac" paint for back painting mirror and "Mirro-Mastic Bond" for sealing substrate surfaces by Palmer Products Corporation or other approved manufacture.
- 2.1.14 Shims (for wet glazing): Pressure sensitive resilient extruded synthetic rubber and as recommended by insulating glass unit manufacturer.
- 2.1.15 Spacers and setting blocks, 80 Durometer: Neoprene rubber or EPDM, A hardness ± 5 respectively, resistant to oxidation and permanent deformation under load.
- 2.1.16 One part glazing gaskets: Extruded neoprene or EPDM of approved profile. Gaskets properties - tensile strength, ASTM D412, 1500 psi; Durometer A hardness, 50 ± 5 ; resistance to permanent set, ASTM D395, Method D, 25 % maximum set; minimum elongation at break, ASTM D412, 300%; resistance to ozone, ASTM D1149, showing no cracks.
- 2.1.17 All glazing materials, products, primers and cleaning solvents: Mutually compatible.
- 2.1.18 Colours for glazing materials: As selected later from standard colours.
- 2.1.19 Glass for doors: 1/4" thick, safety glass.
- 2.1.20 Mirror trim: Formed to approved profile from 0.050" thick, ASTM A167, Type 302 stainless steel in No. 4 finish. Vandal-proof mounting fastenings to suit type of substrate and fully concealed in the finished work.

2.2 INSULATING GLASS

2.2.1 Insulating Glass Units: Provide sealed insulating glass units in accordance with CAN/CGSB-12.8 in configurations indicated, and as specified herein.

2.2.2 Manufacture sealed insulating glass units without edge channels or tape, that is, with bare glass edges.

2.2.3 Use two stage seal method of manufacture, as follows:

- .1 Primary Seal: polyisobutylene sealing compound between glass and metal spacer/separator.
- .2 Secondary Seal: polyurethane, silicone or polysulphide base sealant, filling gap between the two lites of glass at the edge up to the spacer/separator and primary seal.

2.2.4 Install stainless steel capillary breather tubes to equalize pressure differentials between insulating glass fabricating location and insulating glass installation location; crimp tube immediately prior to installation in accordance with glass fabricators written instructions.

2.2.5 Sealants for Insulating Glass Units:

- .1 Primary Seal: Polyisobutylene; colour black.
- .2 Secondary Seal: Structural silicone based; colour black.

2.2.6 Insulating Glass Units - Composition:

- .1 Exterior Glass: 6mm Solarban R100 as produced by Vitro, tempered
- .2 Air space: warm-edge spacer & argon
- .3 Interior glass: 6mm clear tempered

2.2.7 Spandrel Insulating Glass Units: In accordance with CAN/CGSB-12.9 and as follows:

- .1 Exterior Lite: Type: 2 - Heat Strengthened complete with applied silicone elastomeric coating, minimum thickness 1/64". Colour: As selected by the Consultant from the manufacturers standard product line.
 - .1 Opaci-Coat 300
 - .2 Span-Kote
- .2 Insulation: Rigid glass fibre insulation held in place with manufacturers standard fixing system to back face of back pan.
- .3 Back Pan – Concealed: Galvanized metal sheet, 1/16" thickness, formed into a pan shape to fit into glazing throat with back of pan flush with inside face of back section. If back pan is exposed to view, attach aluminum sheet to galvanized metal back pan by adhesive, finished to match mullions.

2.3 FABRICATION

2.3.1 Minimum thicknesses of glass shall be in accordance with CAN/CGSB 12.20, except as specified herein.

2.3.2 Accurately size glass to fit openings allowing the clearance recommended by the glass manufacturer, and in accordance with the following tables:

.1 Minimum Glass Clearances

Thickness	Edge Clearance	Face Clearance
18 oz. or 3/32"	1/8"	1/16"
24 oz. or 1/8"	1/8"	1/8"
32 oz.	1/8"	1/8"
3/16"	1/8"	1/8"
7/32"	3/16"	1/8"
1/4"	1/4"	1/8"
over 1/4"	1/4" or	
3/4 times the glass thickness, whichever is the greater.		

* Where any dimension of glass exceeds 30" increase minimum edge clearances by 1/16".

.2 Bite of glass edge on stop:

1. Up to 50" united size: 1/4" minimum.
2. Over 50" united size: 1/2" minimum.

PART 3 - EXECUTION

3.1 INSPECTION

- 3.1.1 Verify drawing dimensions at the site before proceeding with fabrication of work.
- 3.1.2 Ensure that openings are free from distortion, and that surfaces are free from protrusions that will obstruct face and edge clearances.
- 3.1.3 Ensure that wood is sealed, ferrous metals are painted or zinc coated, and that surfaces are suitable for adhesion of glazing materials.
- 3.1.4 Ensure that ambient and surface temperatures are above 5°C before applying glazing materials.
- 3.1.5 Ensure that surfaces to receive mirrors are sealed.
- 3.1.6 Ensure that movable units to be glazed are adjusted for proper operation.

3.2 PREPARATION

- 3.2.1 Free rabbets, stops and glass edges of dust, dirt, moisture, oil and other foreign matter detrimental to or obstructing the glazing material.
- 3.2.2 Mask surfaces subject to staining, and wherever necessary to ensure neat appearance of the glazing materials. Remove masking as work progresses.

3.3 INSTALLATION – GENERAL

- 3.3.1 Install work in accordance with manufacturer's instructions. Handle and install glass in accordance with manufacturer's directions. Prevent nicks, abrasion and other damage likely to develop stress on edges.
- 3.3.2 Remove and replace glazing stops in original locations using original fasteners, securely set and

undamaged.

- 3.3.3 Use setting blocks and spacers as required to properly support the glass, centred in place in glazing space independent of the materials and to uniformly distribute its load.
- 3.3.4 Use a minimum of 2 setting blocks, located at the quarter points. Locate spacers at jamb edges of glass, uniformly spaced at 2'-0" o.c. maximum, and 1'-0" maximum from top and bottom.
- 3.3.5 Set glass properly centred with uniform bite and face and edge clearance, free from twist, warp or other distortion likely to develop stress.
- 3.3.6 Leave labels on glass until it has been set and inspected and approved. Leave glass whole and without cracks, scratches or other defects and with settings in perfect condition at completion, to approval of Consultant.
- 3.3.7 Remove rejected, broken or damaged glass due to defective materials or improper setting and replace with perfect materials. Units producing distorted vision shall be rejected and replaced at the reasonable discretion of the Consultant.

3.4 INTERIOR GLAZING

- 3.4.1 Unless otherwise specified, all interior glazing shall be dry glazing.
- 3.4.2 Install extruded glazing gasket around entire perimeter of glass. Make tight butt joint at corners of lights. Place neoprene setting blocks at sill and spacers at both jambs as required to centre the unit in the frame. Place the unit into the frames and apply the stops against the gaskets. Tighten the screws or clips to obtain positive uniform pressure avoiding excessive pressure.
- 3.4.3 Ensure rattle-free cushioning.

3.5 INSTALLATION - EXTERIOR GLAZING

- 3.5.1 Install glass with labels facing the interior. Ensure that sufficient space is left within the glazing space to allow thermal movement of glass without imposing stress on the glass.
- 3.5.2 Install heat treated safety glass with convex side facing the exterior.
- 3.5.3 Install wet glazing materials to obtain complete contact and adhesion over the full bite area of the unit and to be free from gaps, air bubbles, and embedded foreign matter. Use primers when recommended by the glazing material manufacturer. Use sufficient bedding compound so that when glass is pushed into place, excess compound is forced out around the entire margin. Use shims to ensure maintenance of uniform face clearance. Where required on both sides of a unit, make shims coincident.
- 3.5.4 Install glazing tape to ensure complete contact and adhesion over the full bit area of the unit. Make joints only at corners of the unit. Where tape has no integral shim, cut it to fit close around applied shims. Fit tape accurately with tight joints, free from tension, gaps, and cracks. After installation of glass, the tape shall not extend more than 1/8" above the line of the fixed stop. Remove and re-glaze units where the tape exceeds this tolerance.
- 3.5.5 Where specified or shown on the Drawings, gun in a heel bead of glazing compound to ensure a continuous seal between glazed element and frame.
- 3.5.6 Where visible or exposed to weather, finish gunned bead surface to slope away from glass for shedding water. Ensure a weather tight seal.

3.6 INSTALLATION - MIRRORS

- 3.6.1 Thoroughly seal and prime substrate with sealer and primer as recommended by mirror manufacturer.
- 3.6.2 Adhesive apply mirror to plywood backing, and fasten plywood to structure with concealed fastenings.
- 3.6.3 Install mirrors using dollops of mirror mastic spaced as recommended by the manufacturer of the mirror mastic for 60% coverage. Brace mirrors in place until mastic has set. Butt-edged mirrors shall give an un-warped image.
- 3.6.4 Provide mirror trim at mirrors, using concealed fastening.

3.7 INSTALLATION - WIRED GLASS

- 3.7.1 Install wired glass to locations indicated.
- 3.7.2 Install wired glass where glazing is indicated in fire resistant closures (e.g. fire doors, steel framed openings in fire rated walls).
- 3.7.3 Install wired glass with wires parallel to frame opening.

3.8 CLEANING

- 3.8.1 Clean and make good to the approval of the Consultant, surfaces soiled or otherwise damaged in connection with the work of this Section. Pay the cost of replacing finishes or materials that cannot be satisfactorily cleaned.
- 3.8.2 Upon completion of the work, remove all debris, equipment and excess material resulting from the work of this Section from the site.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

- 1.1.1 Comply with Division 1, General Requirements and all documents referred to therein.
- 1.1.2 Provide all labour, materials, products, equipment and services to supply and install gypsum board systems and light gauge metal framing required and/or indicated on the Drawings and specified herein.

1.2 REFERENCES

- 1.2.1 ASTM C475/C475M-15 Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
- 1.2.2 ASTM C1002-14 Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
- 1.2.3 ASTM C1047-14a Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
- 1.2.4 ASTM C1178/C1178M-13 Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel.
- 1.2.5 ASTM E90-09 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- 1.2.6 CAN/CGSB 7.1-98 Lightweight Steel Wall Framing Components.
- 1.2.7 CAN/CGSB 19.21-M87 Sealing and Bedding Compound Acoustical.
- 1.2.8 CAN/CSA A82.27-M91 Gypsum Board
- 1.2.9 CAN/CSA A82.31-M91 Gypsum Board Application.
- 1.2.10 CAN/CSA A123.2-03(R2013) Asphalt-Coated Roofing Sheets.
- 1.2.11 CAN/ULC S702-14 Standard for Thermal Insulation Mineral Fibre for Buildings.

1.3 DESIGN

- 1.3.1 Fire Rated Construction: Construct to approved ULC design for fire resistance ratings indicated. Submit written proof of construction meeting ULC design.
- 1.3.2 Sound rated construction: STC tested in accordance with ASTM E90.

1.4 SUBMITTALS

- 1.4.1 Submit shop drawings showing pertinent construction details for fire and sound rated construction in large scale detail.
- 1.4.2 Product Data: Submit manufacturer's current technical literature for each component.
- 1.4.3 Samples: Supply for Consultant's review, if requested, samples of the following:

- .1 Board: Submit sample of each panel product specified, 150mm (6") square.
- .2 Trim: Submit sample of each type of trim specified, 305mm (12") long.
- .3 Texture: Submit sample, 305mm (12") square, of textured coated gypsum board.

1.4.4 Quality Assurance Submittals:

- .1 Design Data, Test Reports: Provide manufacturer's test reports indicating product compliance with indicated requirements.
- .2 Manufacturer's Instructions: Provide manufacturer's written installation instructions.

1.5 QUALITY ASSURANCE

- 1.5.1 Contractor executing work of this Section shall have a minimum of five (5) years continuous Canadian experience in successful installation of work of type and quality shown and specified. Submit proof of experience upon Consultant's request.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- 1.6.1 Deliver materials in original, unopened containers or bundles stored in a place providing protection from damage and exposure to elements.
- 1.6.2 Store board on flat, smooth and dry base.
- 1.6.3 Coordinate deliveries to comply with construction schedule and arrange ahead for off the ground, enclosed, under cover storage location. Do not load any area beyond the design limits.
- 1.6.4 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect materials with suitable non-staining waterproof coverings.
- 1.6.5 Store material in original, undamaged containers or wrappings with manufacturer's seals and labels intact, in accordance with GA-238 and manufacturer's recommendations.
- 1.6.6 Protect bagged products from excessive moisture or wetting. Store metal component sections in crates to prevent damage to material. Do not use bent or deformed material.

1.7 ENVIRONMENTAL REQUIREMENTS

- 1.7.1 Temperature within the building shall be maintained uniformly within the range of 12°C to 21°C, 24 hours before installation and until joint cement has dried.
- 1.7.2 Provide adequate ventilation to eliminate excessive moisture within the building before commencement of the work of this Section.

PART 2 - PRODUCTS

2.1 MATERIALS - GENERAL

- 2.1.1 Materials required for fire rated construction: Listed and labelled by ULC.

2.2 MATERIALS - GYPSUM BOARD

- 2.2.1 Gypsum board: Conforming to ASTM C1396, ivory paper faced, tapered edges, 1220mm (48") wide sheets of maximum practical lengths to minimize end joints, 1/2" thick unless indicated otherwise on drawings.

- .1 Sheetrock Brand Gypsum Panels by CGC Inc.
 - .2 ProRoc Regular by CertainTeed.
 - .3 ToughRock Gypsum Wallboard by Georgia-Pacific Canada.
- 2.2.2 Fire-Rated Gypsum Board 'Type X': Conforming to ASTM C1396, 1220mm (48") wide sheets of maximum practical lengths to minimize end joints, tapered edges, 16mm (5/8") thick, as indicated on drawing.
- .1 Sheetrock Brand Gypsum Panels, Firecode Core by CGC Inc.
 - .2 ProRoc Type X by CertainTeed.
 - .3 ToughRock Fireguard Gypsum Board by Georgia-Pacific Canada.
- 2.2.3 Gypsum Ceiling Board: Sag Resistant Gypsum Board: Meeting requirements of ASTM C1396M, ceiling board manufactured to have more sag resistance than regular type gypsum board with long edges tapered, and as follows:
- .1 Location: Ceiling surfaces.
 - .2 Acceptable Materials:
 - .1 Sheetrock Interior Ceiling Board by CGC Inc.
 - .2 Tough Rock CD Ceiling Board by Georgia Pacific Canada.
 - .3 ProRoc Interior Ceiling Board by CertainTeed.
- 2.2.4 Tile Backer Board: Glass Mat Water Resistant Gypsum Backer Board: Manufactured in accordance with ASTM C1178 and C1658 to produce greater resistance to water penetration and to provide improved surface bonding characteristics for ceramic tile than standard gypsum board:
- .1 Location: Substrate for ceramic tile.
 - .2 Acceptable Materials:
 - .1 Fiberock Aqua Tough Tile Backerboard by CGC Inc.
 - .2 Diamondback Tile Backer by CertainTeed.
 - .3 GlasRoc Tile Backer by Georgia-Pacific Canada.
- 2.2.5 Cement Board: Cementitious Backer Board: Reinforced portland cement board, reinforcing mesh embedded near both faces in accordance with ASTM C1325 or ANSI A118.9:
- .1 Substrate for high impact areas.
 - .2 Acceptable Materials:
 - .1 Durock by CGC Inc.
 - .2 PanaRoc by CertainTeed.
- 2.2.6 Abuse Resistant Gypsum Board: Manufactured to produce greater resistance to surface indentation and impact penetration resistance than standard gypsum panels:
- .1 Gypsum panels with glass fibre reinforced core, tapered edges, minimum 5/8" thickness, [Type X ULC fire rating], conforming to ASTM C1396M and tested to the following performance ratings.
 - .2 Acceptable Materials:
 - .1 Sheetrock Abuse Resistant [Firecode] by CGC Inc.
 - .2 Abuse Resistant [Type X] by CertainTeed.
 - .3 ToughRock Abuse Resistant [Fireguard] by Georgia Pacific Canada.
- 2.2.7 Water (Moisture) and Mould Resistant Wallboard: Conforming to ASTM C1396 or ASTM C1278, 1220mm (48") wide panels of maximum practical lengths to minimize end joints, tapered edges, 13mm (1/2") thick, with water (moisture) and mould resistant core. Mould resistant panel score of

10 when tested in accordance with ASTM D3273 and evaluated to ASTM D3274. Less than 5% water absorption by weight after 2-hour immersion, as per ASTM C473.

- .1 Acceptable Materials: Paperless, coated fibreglass mat on face, back and long edges, water-resistant treated core gypsum board. Conforming to ASTM C1658:
 - .1 DensArmour Plus High Performance Interior Panels by Georgia Pacific Canada.
 - .2 Fiberock Brand Aqua-Tough Interior Panels, by CGC Inc.

2.2.8 Exterior Sheathing Board: Glass mat faced, water-resistant treated core gypsum board, 1220mm (48") wide sheets of maximum practical lengths to minimize end joints, 13mm (1/2") thick, silicone treated gypsum core, front and back faces penetrated with inorganic glass fibre mats, square edge, conforming to ASTM C1177. Mould resistant panel score of 10 when tested in accordance with ASTM D3273 and evaluated to ASTM D3274.

- .1 Acceptable Materials:
 - .1 Securock Glass-Mat Sheathing by CGC Inc.
 - .2 Dens-Glass Gold by Georgia-Pacific Canada.
 - .3 GlasRoc Sheathing by CertainTeed.

2.2.9 Exterior Soffit Board: Mould and moisture resistant cement board, non-combustible, 48" wide sheets of maximum practical lengths to minimize end joints, 1/2" thick, aggregated portland cement core wrapped in polymer-coated, glass-fiber mesh. panel score of 10 when tested in accordance with ASTM D3273:

- .1 Acceptable Materials:
 - .1 Durock by CGC Inc.
 - .2 PermaBase Cement Board by CertainTeed
 - .3 ToughRock Fireguard Soffit Board by Georgia-Pacific Canada.

2.3 MATERIALS - FRAMING MEMBERS

2.3.1 Metal track: CAN/CGSB 7.1, 26 ga. galvanized steel, roll formed of width to suit metal studs.

2.3.2 Metal studs: CAN/CGSB 7.1, 26 ga. galvanized steel, cold-rolled formed face at least 1-5/8" wide, depth as indicated. Provide knock-outs in studs to facilitate pipe, and conduit installation.

2.3.3 Hangers: 9 lwg minimum soft annealed and galvanized wire for 1/2" thick gypsum board; 3/16" diameter galvanized mild steel pencil rods for thicker gypsum board.

2.3.4 Ceiling runner or carrying channels: Cold formed 18 ga. mild steel channels, weighing not less than 0.60 lbs/ft., coated with a rust inhibitive paint or galvanized.

2.3.5 Ceiling furring channels: 26 ga. cold formed galvanized steel hat-shaped section.

2.3.6 Metal furring clips: 10 IW ga. minimum.

2.3.7 Wall furring channel: 26 ga. cold rolled galvanized steel hat-shaped section, 1-3/8" wide at crown, 2-3/4" wide at brim, 7/8" deep.

2.3.8 Resilient channels: RC-1 by CGC, or other approved manufacture.

2.3.9 Tie wire: 16 ga. extra pliable, soft, annealed, galvanized wire of high strength.

2.3.10 Hanger wire anchors: "RedHead TW-1614" anchors, by Phillips Drill Company, Division of ITT Industries of Canada Ltd., or other approved manufacture.

2.4 MATERIALS - ACCESSORIES

- 2.4.1 Accessories shall comply with ASTM C1047.
- 2.4.2 Joint treatment: 2" wide perforated tape reinforcement, joint filler or compound, and topping compound. Joint compound and tape shall be of the same manufacturer as gypsum board and comply with ASTM C475/C475M.
- .1 Joint Compound for Tile Backing Panels: Gypsum based tile backing board: Use setting type taping and setting type, sandable topping compounds.
 - .2 Joint Compound for Exterior Sheathing Boards [and Soffit Panels]: Fibreglass mesh tape.
 - .3 Joint Compound for Abuse-Resistant Panels:
 - .1 ToughRock™ Sandable Joint Compound, by Georgia-Pacific.
 - .2 Durabond/Sheetrock Setting-Type Joint Compound, by CGC Canada Inc.
- 2.4.3 Laminating adhesive: Sheetrock brand laminating compound by Canadian Gypsum Co. Ltd., or other approved manufacture.
- 2.4.4 Tape for use with water resistant gypsum board: 2" wide 10 x 10 glass mesh tape.
- 2.4.5 Water: Clean, fresh, potable, free from deleterious materials.
- 2.4.6 Fasteners: Galvanized or aluminum, #6 x 1", 1-1/4", 1-5/8" drywall screws, flat head Phillips or recessed square socket type. 3/8" pan head door frame screws, (Type S12), and complying with ASTM C1002.
- 2.4.7 Fasteners for exterior soffit boards: 1-1/4", Type S-12, Wafer Head, Climaseal finished, screws.
- 2.4.8 Casing bead: Galvanized steel J-shaped trim, maximum lengths x thickness to suit gypsum board, concealed in the finish work by joint tape and joint compound, 200-A by CGC or other approved manufacture.
- 2.4.9 Control joint trim: Casing bead as specified above.
- 2.4.10 Corner bead and reveal trim: Galvanized steel L-shaped trim, maximum lengths, concealed in the finish work by joint tape and joint compound, 200-B by CGC or other approved manufacture.
- 2.4.11 Use No. 200-A trim or appropriate Beadex trim at reveals.
or
- 2.4.12 Reveal trim: No.200-B by Canadian Gypsum Company.
- 2.4.13 Acoustic sealant: CAN/CGSB 19.21, Acoustical Sealant by Tremco Ltd., or other approved manufacture.
- 2.4.14 Sealant for water-resistant gypsum board cut edges: Sheetrock Brand W/R sealant by Canadian Gypsum Co. Ltd., or other approved manufacture.
- 2.4.15 Sealant at ducts and frames and similar locations: Mono 555 as by Tremco Ltd., or other approved manufacture.
- 2.4.16 Sound insulation: Complying with CAN/ULC S702, "AFB" by Roxul Inc., "Noise Stop" sound attenuation blankets "Thermafibre" by CGC, or other approved manufacture.
- 2.4.17 Neoprene sponge strip: Moisture resistant closed cell insulating material.

- 2.4.18 Thermal break material: Neoprene sponge.
- 2.4.19 Asphalt felt: CAN/CSA A123.2-03(2008)
- 2.4.20 Mineral wool safing insulation: Firebarrier Firestopping by Double A/D Distributors Limited, Fire-Bloc Firestopping by M. W. McGill and Associates Ltd., Thermafibre by United States Gypsum Co., or other approved manufacture.
- 2.4.21 Access Panels: As indicated in Section 10 99 00.

PART 3 - EXECUTION

3.1 INSPECTION

- 3.1.1 Examine the work of other Sections which is to receive the work of this Section and proceed only when conditions are satisfactory.
- 3.1.2 Do not apply gypsum board over mechanical or electrical work which requires inspection and approval by authorities having jurisdiction and the Consultant. Ensure that insulation, if required, has been completed to walls, pipes and other items. Neglect of this instruction will nullify any claims for extra payment for removal and replacement of work of this Section.
- 3.1.3 Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
- 3.1.4 Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.2 INSTALLATION - GENERAL

- 3.2.1 Install all materials in accordance with the latest printed directions of the manufacturer and in accordance with CAN/CSA A82.31-M.
- 3.2.2 Perform all work by skilled craftsmen.
- 3.2.3 Provide partitions of thickness indicated on the Drawings.
- 3.2.4 Comply with CAN/CSA A82.31-M, except to its clauses referring to nailing.
- 3.2.5 Extend gypsum board to the underside of the structure above unless otherwise indicated.
- 3.2.6 Provide gypsum board baffles above ceilings, to underside of structure above, where indicated for sound barriers.
- 3.2.7 Install access doors supplied by respective Sections. Gypsum board infill at access panels shall have taped edges. Apply gypsum board with adhesive. Ensure finish of access panel is suitable for board, prime for adhesion if required. Fill and sand smooth perimeter edges as specified for joint finishing.
- 3.2.8 Locate vertical joints at least 12" from jamb lines of openings.
- 3.2.9 Where vapour barrier carries over metal framing members ensure that installation of insulation and vapour barrier and perimeter seals is complete before applying gypsum board finish.

- 3.2.10 Co-ordinate work of this Section with the Sections installing equipment above or in the suspended ceiling areas so as to produce a layout of hangers, carrying channels and furring channels suitable to accommodate fittings and units of equipment in a proper manner. This shall apply especially to flush mounted lighting fixtures, outlet boxes, diffusers and similar material. Failure to follow this procedure will require that the hangers and channels be revised to suit as necessary without extra cost to the Owner.
- 3.2.11 Provide bulkhead framing and gypsum board, were required, whether shown or not, for ductwork and plumbing. Coordinate with Mechanical Division.
- 3.3 INSTALLATION - PARTITION FRAMING
- 3.3.1 Accurately layout partitions as indicated on drawings. Securely attach floor and ceiling runners at 24" o.c. to the structure.
- 3.3.2 Position studs vertically in runners at 16" o.c. maximum unless otherwise indicated. Locate studs not more than 2" from all abutting partitions, partition corners and other construction.
- 3.3.3 Anchor studs located adjacent to door and window frames, partition intersections and corners to runner flanges with lock fasteners or by positive screw arrangement through each stud flange and runner flange.
- 3.3.4 When necessary, splice studs by nesting two studs with a minimum lap of 8" and attaching flanges together with two screws in each flange.
- 3.3.5 Make allowances for deflection at top of partitions to avoid transmission of structural loads to framing system.
- 3.3.6 Locate 2 framing members on each side of framed openings. Frame over and below openings with runner sections at least 6" longer than the rough openings. Cut ends to fit and bend web up and screw anchor to adjacent studs. Install cut to length intermediate vertical studs in same manner and spacing as wall studs over such framed openings. Securely anchor studs to head and jamb anchor of door frames by bolt or screw attachment. Insert intermediate studs above and below channels to support gypsum board.
- 3.3.7 Provide adequate reinforcing for framing to receive wall mounted counters and vanities.
- 3.3.8 Provide double studs or wood blocking and bolts in stud partitions for fastening of handrails, grab bars, to be capable of supporting 230 kg (500 lb) downward pull. Provide double studs and blocking for anchoring of door frames, and other items anchored to stud partitions.
- 3.3.9 At duct openings pack space between framing members and ducts with mineral wool safing insulation and seal with sealant.
- 3.3.10 Provide double stud partitions where indicated.
- 3.3.11 Provide asphalt felt under runners for partitions on slabs on grade.
- 3.3.12 Provide resilient channels at right angles to studs where indicated on special sound proof partitions. Space channels at 16" o.c.
- 3.3.13 Provide thermal break material to isolate metal studs and furring from steel framing, to eliminate cold bridges.
- 3.4 INSTALLATION - CEILING FRAMING

- 3.4.1 Space hangers at centres not exceeding 4'-0" each way, in rows parallel with the walls. Area between hangers shall not exceed 16 sq.ft. Supply hanger inserts or tabs in ample time and with instructions for their proper placement.
- 3.4.2 Use hangers of length required to assure secure anchorage and correct ceiling heights, straight and with a 90° bend at the lower end to engage the runner channels.
- 3.4.3 Do not secure hangers to pipes, ducts or any electrical or mechanical items.
- 3.4.4 Provide a row of hangers adjacent to and parallel with the walls for the support of the ends of runner channels at not more than 6" from the ends of runner channels.
- 3.4.5 Provide hangers to suspend gypsum board ceilings independent of partitions.
- 3.4.6 Start runners or carrying channels parallel to and not more than 6" away from edge of the ceiling. Ends of channels shall not contact vertical surfaces. Securely wire channels in parallel rows at not more than 4'-0" o.c. to hangers with double strand of tie wire. Twist tie wires up tight without slack.
- 3.4.7 Channels shall be level and true to a tolerance of 1/8" in 12'-0" in all directions.
- 3.4.8 Provide 12" lap at runner channel splice. Secure splice with double strand of tie wire at each end. Clustering or lining up of splices will not be permitted.
- 3.4.9 Frame around fixtures, grilles and other openings. Where ducts, or where a combination of ducts and other items interfere so that hanger spacing exceeds 4'-0" increase the size of the main runners and hanger wire accordingly, to sustain increased loading and span. Provide additional hangers as required to support the weight of lighting fixtures, diffusers, grilles and other built-in items occurring in ceilings.
- 3.4.10 Securely install furring channels at right angles to the runner channels and at 24" o.c. using furring clips or a double strand of tie wire. Fur around ducts, bulkheads and the like.
- 3.5 **INSTALLATION - METAL FURRING DIRECT ATTACHMENT TO MASONRY OR CONCRETE**
- 3.5.1 Secure metal furring runners to masonry or concrete vertically, spaced 24" o.c. Fasten runners 24" o.c. through alternate flanges of runners. Shim runners as required to present a true, plumb line for application of gypsum board.
- 3.5.2 At windows, doors or similar openings having returns, install lengths of notched and 90° bent pieces of channel horizontally at the returns spaced approximately 24" o.c. Locate runners not more than 2" away from all openings, interior corners, intersections, frames, jambs, control joints and the like.
- 3.5.3 Mitre furring around all corners. Form mitres by cutting the flanges and bending the web. Do not cut the web to form corners.
- 3.6 **APPLICATION - GYPSUM BOARD**
- 3.6.1 Take all measurements accurately. Cut boards by scoring the face paper, snapping the core of the board and then cutting the back paper. Smooth the cut edges with a rasp or coarse sandpaper.
- 3.6.2 Erect gypsum board vertically or horizontally whichever results in fewer end joints. Butt joints loosely with maximum gap of 1/4". Do not force boards into position. Place tapered edges next to one another. All end joints shall occur over framing members.

- 3.6.3 Minimize end joints. Align joints with edge of wall openings.
- 3.6.4 Provide approved thermal break material at edges of gypsum board in contact with non-thermally broken metal windows and at exterior door frames.
- 3.6.5 At curved surfaces, score back of gypsum board and wet boards, bend to required radius, and block in position until dry. Apply joint compound and trowel smooth to provide continuous, smooth radius, free from flat spots, facets or trowel marks.
- 3.6.6 Where gypsum board baffle occurs over door or glazed opening, extend baffle across door or glazing opening.
- 3.6.7 Provide special trim as specified at reveals.
- 3.6.8 Apply thermal break material to metal studs, where indicated, before applying gypsum board.
- 3.6.9 In areas where opposite side of partition is open to space below, provide metal lath on concealed side. Install lath with long dimension across the studs. Secure with tie wires at 6" o.c.
- 3.7 APPLICATION - GYPSUM BOARD LAMINATED TO CONCRETE AND/OR CONCRETE BLOCK MASONRY
 - 3.7.1 Ensure base is straight, dry, uncoated, clean and free from efflorescence. Mix laminating adhesive in accordance with manufacturer's directions. Allow to stand 30 minutes before using.
 - 3.7.2 Apply adhesive with a notched trowel to leave 3/8" x 1/2" ribbons, 1-1/4" apart over entire back side of face layer.
 - 3.7.3 Erect gypsum board immediately after spreading adhesive. Use moderate pressure to develop full adhesive contact with substrate.
 - 3.7.4 Temporarily secure gypsum board in place with concrete nails or bracing. Ensure that joints are accurately aligned. Avoid impact or movement of boards until adhesive sets firmly. Remove temporary support when adhesive has set.
- 3.8 APPLICATION - GYPSUM BOARD (MULTIPLE LAYERS)
 - 3.8.1 Use square edged gypsum board for base layer and tapered edge for face layer. Place face layer at right angles to preceding layer. Apply base layer to framing members so that there will be a minimum number of end joints in the face layer. Offset the joints between the two layers a minimum of 10".
 - 3.8.2 Apply base layer to framing members with 1" screws at 12" o.c. in the field and 8" o.c. at the end and edges. End joints may occur on or between framing members provided back blocking with supporting strips is used to assure alignment.
 - 3.8.3 Mix laminating adhesive in accordance with manufacturer's written specifications. Allow to slake.
 - 3.8.4 Cut and fit face layer and spread adhesive over back side with a metal spreader blade that has "V" shaped notches 1/2" deep, 5/16" wide and spaced 1-1/2" to 2" o.c.
 - 3.8.5 Apply face layer, loosely butting all joints and temporarily hold in place with fasteners of sufficient length to penetrate framing member 3/4". Wipe off any adhesive forced out along the edges. Place temporary fasteners at 16" o.c.

3.9 APPLICATION - WATER RESISTANT GYPSUM BOARD

- 3.9.1 Provide water resistant gypsum board to walls in washrooms.
- 3.9.2 Apply water resistant gypsum board where ceramic tile is scheduled.
- 3.9.3 Provide water resistant gypsum board behind mirrors.
- 3.9.4 Apply water resistant gypsum board in strict accordance with manufacturers' written instructions.
- 3.9.5 Do not apply water resistant board to ceilings.
- 3.9.6 Apply coated water resistant gypsum board with black side out.
- 3.9.7 Give particular attention to sealing of cut edges, utility holes and joints, with approved sealant material. Seal all openings with sealant.
- 3.9.8 Apply tape over joints and angles.
- 3.9.9 Apply full bodied coat of sealer prior to application of fixtures and trim.

3.10 APPLICATION - CEILING

- 3.10.1 Unless otherwise noted, construct ceilings in 1/2" thick gypsum board, screw attached at 8" o.c. maximum.
- 3.10.2 Suspended gypsum board ceilings with joints taped shall be level, to within 1/8" in 12'-0" in all directions.
- 3.10.3 Make allowance for air-transfer openings in above ceiling partition construction. Review Mechanical Drawings to establish locations. Provide openings in gypsum board baffle (in plenum space) to accommodate all cross-talk silencer ducts. Refer to Mechanical Drawings and specifications for type and location. Co-ordinate with Partition Type and partition Location Plans.
- 3.10.4 Where slab to slab or baffle above ceiling partitions occur and large mechanical ducts prevent installation of such, a lead blanket is to be used as an alternate. Ensure complete continuous sound seal is provided.
- 3.10.5 At all gypsum board ceiling areas, air supply and return shall be via continuous slim-line linear diffusers. Locations as indicated on Mechanical Drawings.
- 3.10.6 Provide all openings in gypsum board ceilings to accommodate sprinklers, exit lights, access panels, pot lights, air diffusers and speakers.
- 3.10.7 Caulk perimeter of gypsum board ceilings where suspended with sound isolation hangers.

3.11 TILE BACKING PANELS

- 3.11.1 Install standard gypsum board panels in areas not subject to wetting to produce a flat surface.
- 3.11.2 Install water resistant gypsum board in locations requiring tile applications in washrooms, and as indicated on the Drawings.
- 3.11.3 Shim surfaces to produce a uniform plane across panel surfaces where tile backing panels abut other types of panels in the same plane.

3.12 EXTERIOR SHEATHING BOARD

- 3.12.1 Install exterior sheathing board to exterior walls in accordance with manufacturer's written instructions. Seal all cut edges, ends, utility holes and fastener heads, as recommended by manufacturer.
- 3.12.2 Receive masonry veneer anchors from Section 04200 - Masonry and install the masonry veneer anchor to the structural studs. Spacing of the masonry veneer anchor system must be maximum 406mm (16") vertically O.C. and stud spacing horizontally. Sufficient anchors must be provided on each structural stud prior to erection of stud. Sequentially lift anchors as exterior sheathing board is being installed such that each anchor rests on edge of the exterior sheathing board.
- 3.12.3 Tape and fill all joints and fastener heads using materials recommended by exterior sheathing board manufacturer.

3.13 FIRE RESISTANT ASSEMBLIES

- 3.13.1 Fire resistance rating of gypsum board assemblies and framing shall be as called for on drawings or schedules, and as required to conform with applicable codes and requirements of authorities having jurisdiction.
- 3.13.2 Appropriate ULC designs as listed in current ULC list of equipment and materials, Volume II, Building Construction, shall be placed when applicable. Extend partitions full height through ceiling space unless otherwise noted on drawings.
- 3.13.3 Vertical bulkheads in ceiling spaces over fire rated glazed partitions, doors and the like shall have same fire rating as the door or partition over which they occur. All such bulkheads shall be of drywall construction unless otherwise noted.
- 3.13.4 Use fire rated gypsum board as specified.
- 3.13.5 Where lighting fixtures, diffusers, and the like are recessed into fire rated ceilings or bulkheads, provide enclosure to maintain required fire rating. Form removable panel to give access to fixture outlet box.
- 3.13.6 Where fire hose cabinets or other fixtures or equipment are recessed in fire rated walls or partitions, provide drywall enclosure or backing to maintain required fire rating, unless otherwise detailed.

3.14 INSTALLATION - FASTENERS AND FASTENING

- 3.14.1 Apply gypsum board to metal furring, studs, runner channels, angles and other framing with approved screws. Use 1" long screws for fastening gypsum board up to 5/8" thickness to metal and wood furring and framing, and 1-1/4" long screws for fastening gypsum board up to 1" thickness to metal angle and channel runners.
- 3.14.2 Space screws 12" o.c. in field of board and 8" o.c. staggered along abutting edges. Start securing the board in the central portion and work toward the edges and ends. Drive all screws so screw heads provide a slight depression below the surface of the gypsum board without puncturing the face paper. Do not drive screws closer than 3/8" from edges and ends of gypsum board.
- 3.14.3 Use adhesive application for laminating gypsum board direct to other gypsum board in two or more layer construction and direct to concrete and masonry as specified herein before.

3.15 FINISHING

- 3.15.1 Finish gypsum board in conformance to CAN/CSA A82.31-M, except as herein specified.
- 3.15.2 Apply corner beads to all external vertical and horizontal corners and edges. Apply casing beads where the gypsum board butts against a surface having no trim concealing the juncture.
- 3.15.3 Erect corner beads and casing beads plumb and level with a minimum number of joints and secured at 6" o.c. with screws in each flange. Stagger fasteners in each flange.
- 3.15.4 Do not treat joints of laminated gypsum board for at least 24 hours after lamination.
- 3.15.5 Mix joint compound in accordance with manufacturer's specifications and allow to stand a minimum of thirty minutes before using.
- 3.15.6 Fill all gaps and screw nail depressions with three coats of joint compound. Allow preceding coat to set before applying subsequent coats.
- 3.15.7 On all corners apply joint compound to one side of corner and allow to set before applying compound to the other side of corner.
- 3.15.8 Apply a thin coat of joint compound over the board on each side of joints and embed the reinforcing tape and roll firmly into place. Cover all edges of tape with a thin coat of joint compound. Neatly crease tape at all internal corners. Allow to dry for 24 hours.
- 3.15.9 Apply joint compound over flanges of all corner beads and casing beads flush with nose of bead and extending at least 3" onto the surface of the board.
- 3.15.10 After bedding coat has set, apply second coat of joint compound feathered at least 6" on each side of butt joints and 4" past flanges of all beads.
- 3.15.11 After second coat has set, apply third coat of joint compound and feather to 8" on each side of butt joints and 5" past flanges of all beads.
- 3.15.12 Feather all coats of joint compound onto adjoining surfaces so that all joints, tape holes and flanges of beads are invisible.
- 3.15.13 After complete treatment has thoroughly set and after at least 24 hours, sand lightly with fine grit sandpaper to leave it smooth and ready for decoration.
- 3.15.14 Make the finished work smooth, seamless, plumb, true, flush and with square, plumb, neat corners and edges.
- 3.15.15 Do not finish joints of non-fire-rated walls in mechanical rooms, above finished ceilings or where acoustic tiles are scheduled.
- 3.15.16 Provide casing beads to edge of gypsum board on demising partitions where board meets ceiling, and convactor cabinet enclosures, and at gypsum board terminations at recesses to accept carpet base and gypsum board terminations at coffered ceilings and to perimeter of gypsum board panels.
- 3.15.17 Tape joints in preparation for liquid applied vapour barrier.
- 3.15.18 Prepare surfaces ready for paint. Correct imperfections appearing after application of prime coat of paint.

3.16 CONTROL JOINTS

- 3.16.1 Install control joints in gypsum board where it is applied to concrete or masonry, either on furring or by adhesion, in the following locations; at masonry control joints and at junction of dissimilar wall materials.
- 3.16.2 Provide Control Joints at door panels, at each side of jamb, extending above door head.
- 3.16.3 Provide control joints in continuous runs of gypsum board at locations indicated or, if not indicated, spaced 30'-0" o.c. maximum at locations as directed by the Consultant.
- 3.16.4 Install double casing beads, back to back, fitted tightly together, on gypsum board edges at control joints. Finish casing beads but not joint between them.
- 3.16.5 Where application is on studs, double up studs at control and expansion joints, place one stud on each side of joint.

3.17 SOUND INSULATION

- 3.17.1 Provide sound attenuation blankets where indicated or required to attain sound attenuation, minimum STC 45 or as otherwise indicated.
- 3.17.2 Completely fill all spaces between studs laterally with blankets, run continuously from floor to ceiling or structure, over door frames and opening and around corners.
- 3.17.3 Provide sound attenuation blankets above ceilings as shown, completely covering ceiling to thickness indicated.
- 3.17.4 Pack sound insulation around cut openings in gypsum board walls and ceilings, behind outlet boxes around plumbing, heating or structural items passing through the system.
- 3.17.5 Pack sound insulation around openings in floors.
- 3.17.6 Secure blankets by adhesive or staples to one interior face of gypsum board.
- 3.17.7 Provide neoprene strips at perimeter of sound partitions as shown.
- 3.17.8 Provide batt insulation at air transfer ducts.

3.18 SEALING

- 3.18.1 Provide perimeter sealant (sound seal) at junction of gypsum board with structure, other partitions and at junction with dissimilar materials and adjacent construction. Apply in concealed locations only. Install in strict accordance with sealant manufacturer's written instructions.
- 3.18.2 Seal shall consist of 2 (STC 48 or less), 4 (STC 51) or 5 (STC 52) beads to meet or exceed partition rating.
- 3.18.3 Seal openings around ducts and similar protrusions passing through drywall system, at walls and ceilings.
- 3.18.4 Gypsum board shall be made air-tight around window and door openings. Return gypsum board at door and window openings and butt into window and door frames. At window stools, return gypsum board under stool. Perimeter edges where gypsum board butts to the frame shall be made air-tight with sealant.

3.18.5 In order to provide a continuous air barrier, the gypsum board on the exterior walls shall extend behind interior partitions, ducts, mechanical chases, heating units, etc. Coordinate with all relevant trades.

3.19 CUTTING AND PATCHING

3.19.1 Do all cutting, patching and making good as required by the installation of work of other trades and co-operate closely with these trades to assure a satisfactory finish. Remove and make good any work which, in the opinion of the Consultant is defective and not acceptable, at no additional cost to the Owner.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

1.1.1 Comply with Division 1, General Requirements and all documents referred to therein.

1.1.2 All labour, materials, products, equipment and services to supply and install the porcelain and ceramic tile work required and/or indicated on the Drawings and specified herein.

1.2 REFERENCES

- | | | |
|--------|----------------------------|---|
| 1.2.1 | ANSI/CTI A108.1-2012 | Specification for the Installation of Ceramic Tile: Collection of 21 ANSI/CTI A108, A118 and A136 Series of Standards on Tile Installation. |
| 1.2.2 | ANSI A137.1-2012 | Specification for Ceramic Tile. |
| 1.2.3 | ASTM C207-06 (2011) | Standard Specification for Hydrated Lime for Masonry Purposes. |
| 1.2.4 | ASTM C627-10 | Standard Test Method for Evaluating Ceramic Floor Tile Installation Systems Using the Robinson-Type Floor Tester. |
| 1.2.5 | ASTM C920-11 | Standard Specification for Elastomeric Joint Sealants. |
| 1.2.6 | ASTM D3273-12e1 | Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber. |
| 1.2.7 | ASTM E84-12c | Standard Test Method for Surface Burning Characteristics of Building Materials. |
| 1.2.8 | CSA A179-04 | Mortar and Grout for Unit Masonry, including updates. |
| 1.2.9 | CSA A3000-08 | Cementitious Materials Compendium. |
| 1.2.10 | CSA B79-08 | Commercial and Residential Drains and Cleanouts. |
| 1.2.11 | Technical Guidelines 03732 | Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings and Polymer Overlays. |
| 1.2.12 | | 2009/2010 Specification Guide 09 30 00#Tile Installation Manual. |
| 1.2.13 | | Hard Surface Maintenance Guide. |
| 1.2.14 | CAN/CSA-Z317.13-17 | Infection Control during construction, renovation & maintenance in Healthcare. |
| 1.2.15 | CAN/ULC S102.2-10 | Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies. |

1.3 QUALIFICATIONS

- 1.3.1 Subcontractor executing work of this Section shall employ installers having a minimum of five (5) years continuous Canadian experience in successful installation of work of type and quality shown and specified. Submit proof of experience upon Consultant's request.
- 1.3.2 Work of this Section shall be executed by workers especially trained and experienced in this type of work. Have a full time, senior, qualified representative at the Site to direct the work of this Section at all times. Representative shall meet Consultant's approval.
- 1.3.3 Ensure proper use of proprietary materials in strict accordance with the material manufacturer's directions. It shall be the responsibility of the material manufacturer or supplier to furnish these directions to the Contractor and to check periodically at the site to ensure that they are being carried out.
- 1.4 SUBMITTALS
 - 1.4.1 Submit two samples of all materials and products to the Consultant for review.
 - 1.4.2 Submit two full size tile samples of each colour and tile selected.
 - 1.4.3 Maintenance Instructions: Upon completion of the Work, furnish Consultant with copies of maintenance instructions, containing complete detailed and specific instructions for maintaining, preserving and keeping clean the surfaces of this Work and in particular, giving adequate warning of maintenance practices of materials detrimental to the work of this Section for inclusion in the Operation and Maintenance Manual.
- 1.5 SITE MOCK-UP
 - 1.5.1 Following the pre-installation conference, the Contractor shall install a 10'-0" x 10'-0" dry sample area of porcelain tiles, ceramic mosaic tiles and ceramic wall tile showing all colours of tiles and layout in areas designated later by the Consultant.
 - 1.5.2 After approval of tile colours and layout the Contractor shall set tile and grout including one caulked joint under the supervision of the material manufacturer's representative.
 - 1.5.3 Upon completion and approval, sample areas shall serve as a standard of quality for the balance of the work of this Section. Subsequent work carried out and not in the Consultant's opinion, equal to the quality standard shall be removed and replaced at no additional cost to the Owner.
 - 1.5.4 It shall be the responsibility of the material manufacturer's representative to visit the site during installation, at intervals agreed upon with the Consultant to ensure proper use of proprietary materials and assist the Contractor as may be required and shall also submit a report to the Consultant of their findings after each site review to ensure their directions are being adhered to.
 - 1.5.5 Co-ordinate work of mock-up with related work of other Sections.
 - 1.5.6 Samples: Colour charts for selection of grout.
 - 1.5.7 Accepted work may form a part of the final installation.
- 1.6 EXTRA STOCK
 - 1.6.1 At completion of work, deliver to the Owner 5% extra quantity of each type of tile, from same production run as installed tiles. Include cost of extra stock as part of the work of this Section.

1.7 DELIVERY, STORAGE, HANDLING AND PROTECTION

- 1.7.1 Co-ordinate deliveries to comply with construction schedule and arrange ahead for off the ground, under cover storage location. Do not load any area beyond the design limits.
- 1.7.2 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect materials with suitable non-staining waterproof coverings.
- 1.7.3 Store material in original, undamaged containers or wrappings with manufacturer's seals and labels intact.
- 1.7.4 Restrict traffic by other trades during installation.
- 1.7.5 Provide adequate protection of completed tiled surfaces to prevent damage by other trades until final completion of this project. Minimum protection shall consist of 4 mil polyethylene sheets lapped 4" and taped.
- 1.7.6 Heavily travelled areas shall have additional 1/2" thick fibreboard sheet protection with taped joints over polyethylene sheet protection as specified above.
- 1.7.7 Protect exposed edges of floor tile with same thickness as tile x 4" wide tapered strip of plywood adhered to floor until adjoining floor finish is to be installed.

1.8 ENVIRONMENTAL REQUIREMENTS

- 1.8.1 Maintain ambient temperature between 10 deg C and 20 deg C, for a period of 72 hours before commencement, during installation and 72 hours after installation.
 - .1 Temperature: Maintain tile materials and substrate temperature between TTMAC recommended minimum and maximum temperature range; unless indicated otherwise by manufacturer, for 48 hours before and during installation until materials are fully set and cured; provide additional heat during winter months or at any other time when there is a risk that surface temperatures may drop below minimum recommended temperatures.
 - .2 Ventilation: Maintain adequate ventilation where Work of this Section generates toxic gases or where there is a risk of raising relative humidity to levels that could damage building finishes and assemblies.
- 1.8.2 Moisture content of floor shall not exceed a maximum of 3 lbs. of water per 1,000 sq. ft. of concrete slab area over a 24 hour period as measured by one of the following methods, as approved by Consultant:
 - .1 Does not exceed 3% as measured by Calcium Carbide Hygrometer procedure.
 - .2 Does not exceed 5% as measured by normal Protimeter.

1.9 WARRANTY

- 1.9.1 Warrant the work of this Section against defects in materials for a period of five (5) years and in workmanship for a period of two (2) years, except as a result of structural failure of substrate.

1.10 LEED™ STRATEGIES

- 1.10.1 All trades must examine practices, as outlined in the related sections, to assist the team in achieving these results.

1.10.2 Related Sections:

- .1 01 35 20 General LEED® Requirements
- .2 01 35 50 Waste Management Disposal
- .3 01 35 90 Indoor Air Quality Management
- .4 01 61 10 LEED® Product Requirements
- .5 31 25 00 Construction Pollution Prevention.

1.10.3 Materials used for Work in this section are to include, but are not limited to the following criteria:

- .1 All materials under Work of this Section, including but not limited to, coatings, sealants, primers and adhesives are to have low VOC contents, in accordance with Section 01 35 90.
- .2 Materials used in work of this Section are to contain high amounts of recycled content and
are to be sourced regionally from within 800 km via truck or 2400 km via rail or ship from jobsite in accordance with Section 01 61 10.

1.10.4 The following must be submitted as appropriate for Consultant's review and approval:

- 1. Submit an MSDS or product data sheet stating the VOC and urea-formaldehyde content, along with Schedule A of Section 01 35 90A LEED Product Requirements Schedules following the measures outlined in Section 01 35 90, for all applicable products.
- 2. Submit Schedules A and D, as appropriate, of Section 01 61 10A LEED Product Requirements Schedules following the measures outlined in Section 01 61 10, for all applicable products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.1.1 Dynamic Coefficient of Friction: Tile installed on walkway surfaces shall achieve a DCOF measurement of 0.42 as determined by testing identical products per ANSI A137.1-2012. Where tile is installed in wet environments, including washrooms and showers, test method shall also be carried out on wet tile.

2.1.2 Floor Level Tolerances: Provide materials to attain floor levelness tolerances required by this Section; calculate quantity of materials based on the difference between the specified tolerance and the initial tolerance specified in Section 03 35 00; measurements will be made in the same manner as used in Section 03 35 00.

- .1 Small format floor tile: Tiles having dimensions less than 100 mm x 100 mm require floor flatness as specified in Section 03 35 00.
- .2 Standard format floor tile: Tiles having dimensions from 100 mm x 100 mm and less than 400 mm x 400 mm require floor flatness measured to a minimum FF35; equivalent to 5 mm with no more than 2 gaps under a 3000 mm straightedge measurement.
- .3 Large format floor tile: Tiles having dimensions 400 mm x 400 mm and larger require floor flatness measured to a minimum of FF50; equivalent to 3 mm with no more than 2 gaps under the 3000 mm straightedge measurement.
- .4 Wall tiles: Provide wall leveling similar to that specified for floors, for tiles having similar sizes listed above.

2.2 MATERIALS

- 2.2.1 PFT: 610mm x 610mm – Series: Glocal – Color: Ideal Natural GC0324 Porcelain Tile from Centura or approved equivalent
- 2.2.2 PWT and Wall Base: 305mm x 610mm – Series: Glocal – Color: Clear Natural GC011224 Porcelain Tile from Centura or approved equivalent
- 2.2.3 SWT: 50mm x 200mm – Series: Costa Nova – Color: Grey Glossy #CON28444 Subway Wall Tile from Centura or approved equivalent
- 2.2.4 Mosaic Shower Tile: 300mm x 300mm – Series: Basic Hexagon – Color: White HU0101B – Finish: Satin Mosaic Tile from Centura or approved equivalent
- 2.2.5 Provide all special units, coves, corners, caps, bullnose as required.

2.3 TRIMS:

- 2.3.1 Straight Edge Strips: Stainless steel edge strips, 2 mm wide at top edge; height as required to suit tile installation; with integral perforated anchoring leg for setting the strip into the setting material. Basis-of-Design Materials: Schlüter Schiene.
- 2.3.2 Countertop to Backsplash Transition Strips: Extruded satin anodized aluminum cove section with 10mm radius, height as required to suit tile installation; with integral perforated anchoring leg for setting the strip into the setting material. Basis-of-Design Materials: Schlüter Dilex AHK.
- 2.3.3 Cove Trims: Roll formed stainless steel inside corner, cove shaped joint profile with perforated anchoring legs for setting the corner joint into the setting material; heights as required to suit installation, complete with pre-formed outside and inside corners, connections, and pre-formed end caps. Basis-of-Design Materials: Schlüter Dilex EHK.

2.4 SETTING BEDS

- 2.4.1 Cement: CAN/CSA A3000-08, grey or white Portland cement for mortar, white Portland cement for grout.
- 2.4.2 Sand: CSA A82.56-M, sharp, screened concrete sand free from inorganic and deleterious materials.
- 2.4.3 Water: Clean and free from oil, acid, alkali, organic matter or other deleterious substances.
- 2.4.4 Lime: ASTM C206 or ASTM C207, Type S, hydrated lime.
- 2.4.5 Surface Preparation Materials: Levelling Bed/Mortar Additive: Performance standard meeting requirements of ANSI A108.1, Type 2; Acceptable material:
 - .1 Flextile Ltd., Mortar Bed with #43 Additive.
 - .2 MAPEI Inc. Mapecem Premix PL50.
 - .3 Custom Building Products Level Quik Underlayment
- 2.4.6 Interior Thin Set Wall System: Dry set mortar meeting or exceeding the requirements of ANSI A108.1 formulated for thin set applications of ceramic biscuit tile, factory sanded mortar

consisting of portland cement, sand and additives requiring only potable water to be added for installation:

- .1 Flextile Ltd., #51 Floor and Wall Mix
- .2 MAPEI Inc. Kerabond
- .3 Custom Building Products Premium Blend Thinset

2.4.7 Interior Thin Set Floor System: Dry set mortar meeting or exceeding the requirements of ASTM C627 for Heavy installation using latex modified, portland cement mortar meeting requirements of ANSI A108.1:

- .1 Flextile Ltd., #53 Floor Mix
- .2 MAPEI Inc. Kerabond
- .3 Custom Building Products Master Blend Thinset

2.4.8 Large Format Tile Mortar: Medium bed, dry set polymer modified mortar system designed specifically for use with large format tile materials over 305mm x 305mm (12" x 12"), requiring only the addition of water, rated for extra heavy service installation:

- .1 Flextile Ltd., #50 PM Medium Bed Thin Set Mortar
- .2 MAPEI Inc., Ultracontact
- .3 Custom Building Products, Complete Contact

2.4.9 Epoxy Adhesive Setting Materials: Thin set adhesive system using 100% solids epoxy resin and epoxy hardener meeting or exceeding the requirements for ANSI A108.1; stain proof, chemical resistant and having high temperature resistance, water cleanable.

- .1 Flextile Ltd., Flex Epoxy 100 Setting
- .2 MAPEI Inc. Ker 410 Kerapoxy Mortar
- .3 Custom Building Products 100% Solids Epoxy Mortar

2.4.10 All materials comprising a system shall be from one manufacturer and shall be compatible with each other.

2.5 GROUT

2.5.1 Colours will be selected from manufacturer's full range.

2.5.2 Portland Cement Grout for Wall and Floor Joints $\leq 1/8$ " Interior Only: factory blended polymer modified mixture meeting requirements of ANSI A108.1:

- .1 Flextile Ltd., 500 Series Unsanded Grout
- .2 MAPEI Inc. Ker 800 Unsanded Grout
- .3 Custom Building Products Polyblend Unsanded Grout

2.5.3 Latex-Portland Cement Grout for Floors with Joints $\geq 1/8$ " Interior or Exterior: factory blended stain resistant latex modifiers, portland cement and graded silica sand and dry-set grout and meeting requirements of A108.1:

- .1 Flextile Ltd., 600/100 Series Sanded Grout
- .2 MAPEI Inc. Keracolor S Sanded Grout
- .3 Custom Building Products Polyblend Sanded Grout

2.5.4 Epoxy Grout for Floors and Walls: Water cleanable, chemical resistant, factory blended modified portland cement compound with 100% epoxy additives and hardeners meeting requirements of ANSI A108.1:

- .1 Flextile Ltd., Flex Epoxy 100 Grout
- .2 MAPEI Inc. Ker 400 Kerapoxy Grout
- .3 Custom Building Products 100% Solids Epoxy Grout

2.6 MIXES

2.6.1 Underlayment, by volume: 3 parts sand, 1 part cement and water with latex additive as required for proper trowelling consistency.

2.6.2 Thin set mortar: Mix to manufacturer's recommendations.

2.7 MISCELLANEOUS MATERIALS

2.7.1 Primers: As recommended by the manufacturer of the setting bed for the various substrate conditions.

2.7.2 Edge moulding: L-shaped extruded aluminum, anodized finish, 1/4" face depth x 7/8" perforated concealed flange, one piece length per location, by Ramca Tile, or other approved manufacture.

2.7.3 Polyethylene film: 0.1 mm (4 mil) thick.

2.7.4 Sealant and backing: CAN/CGSB 19.22-M, one component silicone, 'DC786' by Dow Corning Canada Limited or other approved manufacture, colour to match grout; tested by sealant manufacturer for non-staining of tile specified. Submit test reports. Joint filler as recommended by sealant manufacturer.

2.8 MEMBRANES

2.8.1 Crack Suppression Membranes: Load bearing, premanufactured self adhering lightweight fabric reinforced crack isolation membrane; nominal 1 mm thick manufactured to accommodate in-plane substrate movement in thin set applications meeting requirements of ANSI A108.1 and as follows:

- .1 Flextile Ltd., 1000 Flexilastic Crack Isolation Membrane
- .2 MAPEI Inc., Mapeguard 2

2.8.2 Waterproofing Membranes: Load bearing, reinforced, liquid applied membrane; manufactured to accommodate flood testing and reduce the incidence of thermal shock cracking to tiling installations; meeting requirements of ANSI A108.1 and as follows:

- .1 Flextile Ltd., Flex WP-980 Waterproof and Crack Isolation Membrane
- .2 MAPEI Inc. Mapelastic 315 Waterproofing and Reinforcing Fabric
- .3 Custom Building Products Level Quik Waterproof and Anti-Fracture Membrane

2.9 SEALERS

2.9.1 Floor sealer and protective coating: Clear, non-slip "Traction Master", or other approved manufacture.

PART 3 - EXECUTION

3.1 INSPECTION

- 3.1.1 Examine the work upon which the work of this Section depends and report any defects to the Consultant.
- 3.1.2 Ensure that backings are structurally sound, level and plumb within the required tolerances.
- 3.1.3 Tolerance of substrate for thin set mortar or epoxy setting bed is used, ensure that overall surface variations do not exceed plus/minus 3 mm (1/8") and 1.6 mm (1/16") within any single running foot, non-cumulative.
- 3.1.4 Ensure that access doors are set to provide a flush installation of the tile.

3.2 PREPARATION

- 3.2.1 Where work is applied to areas having floor drains, apply primer at the rate of 5 sq m to 6 sq m/4.5 (250/300 sq.ft./gal.). Trowel apply underlayment to form a continuous and uniform slope from the room edges to drains provided.
- 3.2.2 Prime gypsum board before application of dry set mortar setting bed.
- 3.2.3 Ensure that concrete substrates are free from latency and foreign matter which would impair bond. Grind concrete if necessary to present a sufficiently smooth surface to ensure proper performance of membrane. Vacuum substrate.
- 3.2.4 Crack Suppression Membranes:
 - .1 Prepare all surfaces of non-structural and structural cracks in strict accordance with the crack suppression membrane manufacturer's written instructions.
 - .2 Prime and fill all surfaces of non-structural and structural cracks in strict accordance with the crack suppression membrane manufacturer's written instructions.

3.3 INSTALLATION - GENERAL

- 3.3.1 Do tile work in accordance with Specification Guide 09 30 00 Tile Installation Manual 2009/2010, produced by Terrazzo Tile and Marble Association of Canada (TTMAC) and Construction Specifications Canada (CSC), except where specified otherwise.

3.4 INSTALLATION - SETTING BED

- 3.4.1 Use thin set with latex mortar system for application of tile to concrete floors in accordance with Detail No. 311F-07.
- 3.4.2 Thin set mortar system for masonry or concrete walls: Apply slight levelling coat plaster base and bond coat in accordance with TTMAC Detail 303W-02.
- 3.4.3 Thin set mortar with latex additive for application of tile to water resistant gypsum board in accordance with Detail 304W-02.
- 3.4.4 Use epoxy setting bed for ceramic wall tile on plywood.

- 3.4.5 On metal access doors, install ceramic tile using epoxy setting bed with rust-inhibitive additives. Pressure apply setting bed to 1.6 mm (1/16") thickness with trowel and comb it prior to the setting of tiles. Mix setting bed in accordance with the written recommendations of the manufacturer.
- 3.5 INSTALLATION - TILE
- 3.5.1 Back-mortar, tile larger than 150 mm x 150 mm (6" x 6").
- 3.5.2 Unless otherwise detailed, lay out tile so that fields or patterns are centred on wall and floor areas, or architectural features and so that no tile less than one-half size occurs. Align wall, floor and base tile joints at wall base, if tile sizes are suitable. Do not use cut tiles at finished ceiling level.
- 3.5.3 Schedule delivery of tile so that a homogeneous blend of colours can be achieved throughout entire extent of this work. Colour blend tile.
- 3.5.4 Distribute production run varieties evenly maintaining the continuity of pattern.
- 3.5.5 Unless otherwise detailed, arrange accessories in tile work so that they are evenly spaced, centred with joints and set true with correct projection. Ensure that each tile has continuous solid backing. Saw cut and trim tile as required around fittings, pipes, holdfasts, and fixtures. Cut or drill and set holdfasts, bolts and anchors required for fastening fixtures and fittings in tile areas. Grind cut edges smooth.
- 3.5.6 Back butter all floor tile.
- 3.5.7 Finish tile work clean, free of broken, damaged or defective tiles. Reject warped tiles.
- 3.5.8 Joints in base shall match floor patterns. Joints shall be watertight without voids, cracks or excess grout.
- 3.5.9 Cure tile installations for three days, sponging and wetting down as necessary.
- 3.5.10 Unless otherwise noted, install tile with 4.6 mm (3/16") maximum width joints.
- 3.5.11 Finish exposed edge of tiles with edge moulding at termination of wall, termination of wall tile panels, at external corner and elsewhere as required to provide finished appearance to tile application where bullnosed tile is not used. Secure moulding to substrate straight and true, Grout in perforated flange.
- 3.5.12 Sound tiles after setting and remove and replace tiles not fully bedded.
- 3.5.13 Re-point joints after cleaning to eliminate imperfections. Avoid scratching tile surfaces.
- 3.5.14 Finished tile work shall be clean and free of tiles which are pitted, chipped, cracked or scratched. All damaged tile shall be removed and replaced.
- 3.5.15 Where indicated on Drawings or as required, install continuous single piece metal edge trims centered under doors in closed position and other locations where tile meets other floor finishes.
- 3.6 CONTROL JOINTS AND SEALANT
- 3.6.1 Provide control joint in tile at locations where substrate changes to different material or construction, between new and existing substrates, where tile abuts other hard material, where

areas change direction, at similar joints in structure, where structural substrate abuts non-structural substrate, at 4.8 m (16'-0") maximum in each direction as determined by tile pattern, around room perimeter and where indicated.

- 3.6.2 Apply sealant around fittings penetrating tile work including pipes and drains, around door frames, between tile and threshold, around fixtures, escutcheon plates, along floor/wall junction, and similar areas. Coordinate sealant application at wall/base junction with floor and base installation.

3.7 GROUTING

- 3.7.1 Ensure setting bed has cured before commencing grouting.
- 3.7.2 Grout floor tile using acid resistant grout.
- 3.7.3 Grout wall tile using dry curing grout.
- 3.7.4 Grout epoxy set tile using epoxy grout.
- 3.7.5 Where indicated, colour grout to match middle range of tile colours, as directed. Grout to suit the contour of the tile. Fill joints, tool and make uniform in appearance without voids or cracks and watertight. Where floor and wall tile are matching, use floor grout on walls.
- 3.7.6 Make joints between tile uniform, plumb, straight, true and aligned with adjacent tile. Ensure sheet layout is not visible after installation. Align patterns.
- 3.7.7 Grout all joints in accordance with manufacturer's instructions and ANSI A108.10 or ANSI 108.6.
- 3.7.8 When grout hardens damp cure for next 3 days.

3.8 WATERPROOFING

- 3.8.1 Install waterproofing in accordance with waterproofing manufacturer's written instructions to produce a waterproof membrane of uniform thickness bonded securely to substrate.
- 3.8.2 Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.9 SEALING

- 3.9.1 Seal unglazed floor tile in accordance with manufacturer's instructions to provide a matte sheen.

3.10 FIELD QUALITY CONTROL

- 3.10.1 Sound walls and floors with a solid object. If there is a hollow sound remove grout around that tile and check tile adhesion.
- 3.10.2 Ensure that adhesive containers bear certification of compliance with specified standards.
- 3.10.3 Ensure that tile containers are labelled with grade seals.

3.11 CLEANING AND FINISHING

- 3.11.1 Clean, seal and finish tile works installed under this Section of the work in accordance with TTMAC Maintenance Guide.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

- 1.1.1 Comply with Division 1, General Requirements and all documents referred to therein.
- 1.1.2 This Section includes requirements for supply and installation of ceilings consisting of acoustic panels, complete with exposed suspension system and trim.

1.2 REFERENCES.

- 1.2.1 ASTM A653/A653M-15 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
- 1.2.2 ASTM C635/C635M-13a Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- 1.2.3 ASTM C636/C636M-13 Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
- 1.2.4 ASTM E84-15a Standard Test Method for Surface Burning Characteristics of Building Materials.
- 1.2.5 ASTM E1477-98a(2013) Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers.
- 1.2.6 CAN/CGSB 1.132-M90 Zinc Chromate Primer, Low Moisture Sensitivity.

1.3 QUALITY ASSURANCE

- 1.3.1 Install ceilings by mechanics skilled in this trade and in accordance with system manufacturer's printed directions to produce a finished ceiling level, in true plane, free from warped, soiled or damaged tile or grid. Where manufacturer's directions are at variance with Drawings, consult the Consultant before proceeding.

1.4 SUBMITTALS

- 1.4.1 Product Data: Submit product data for each type of product specified.
- 1.4.2 Submit shop drawings indicating complete layout of sound baffles, hanger spacing, fastening details, splicing method and change in level details. Show areas of co-ordination with other trades and erection sequence.
- 1.4.3 Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling mounted items indicating the following:
- .1 Ceiling suspension system members.
 - .2 Method of attaching suspension system hangers to building structure.
 - .3 Ceiling mounted items including light fixtures; air outlets and inlets; speakers; sprinklers; and special mouldings at walls, column penetrations, and other junctures of acoustic ceilings with adjoining construction.

- 1.4.4 Submit 3 copies of manufacturer's maintenance instructions.
- 1.4.5 For special size units, conduct a load test to ensure ceiling grid will not deflect more than 1/360 span. Submit test report.
- 1.4.6 Obtain approval of hydro authorities having jurisdiction for ceiling grid and supports as related to the support of light fixtures. Adjust grid, fixing devices, and support hangers or guy wire to obtain approval. Submit copy of approval in triplicate to the Consultant.
- 1.4.7 Obtain and submit anchor manufacturer's certification for hanger anchors to be used, stating that anchors are suitable for hanger loading, spacing, and other conditions relating to use intended. Submit anchor manufacturer's instructions for anchor installation.
- 1.4.8 Submit representative samples of colour and finish of all exposed materials.
- 1.5 **MOCK-UP**
 - 1.5.1 Erect in area designated a 10'-0" x 10'-0" sample installation. Modify or replace mock-up to obtain approval. After acceptance, retain mock-up as standard of quality for acoustical ceiling installation. Mock-up shall contain typical lighting fixture, and diffusers.
 - 1.5.2 Do not begin fabrication and erection of remainder of ceiling system until mock-up has been inspected and approved.
- 1.6 **PRODUCT DELIVERY, HANDLING, AND STORAGE**
 - 1.6.1 Deliver materials in their original wrappings or containers with manufacturer's labels and seals intact and store in a dry area under cover and clear of the ground.
 - 1.6.2 Ship grid members and mouldings in rigid crates and avoid damage. Bent or deformed material will be rejected.
 - 1.6.3 Suitably wrap members and protect against damage.
- 1.7 **ENVIRONMENTAL REQUIREMENTS**
 - 1.7.1 Do not commence installation until glazing has been completed and exterior openings closed in. Maintain humidity not exceeding 65% where mineral panels are used and temperature in the range of 12°C for 72 hours prior to commencement of work and maintain this temperature until completion.
- 1.8 **EXTRA STOCK**
 - 1.8.1 Leave five (5) percent in sealed cartons of each type of panel upon completion, and two (2) percent of each suspension system and trim for Owner's maintenance. Panels shall be from same production run as panels installed. Identify cartons as to type and location of installation.
- 1.9 **WARRANTY**
 - 1.9.1 **Manufacturer Warranty:** Provide manufacturers standard ten (2) year written warranty indicating replacement of fabrics that have sagged or failed to anchor to edge clip system arising from defects in materials or workmanship.

1.9.2 Warrant work of this Section to remain dimensionally stable throughout the year and to not sag or distort due to variations in temperature and humidity conditions. Grain patterns and seams shall remain, level, plumb, true and aligned.

1.10 LEED™ STRATEGIES

1.10.1 All trades must examine practices, as outlined in the related sections, to assist the team in achieving these results.

1.10.2 Related Sections:

- .1 01 35 20 General LEED® Requirements
- .2 01 35 50 Waste Management Disposal
- .3 01 35 90 Indoor Air Quality Management
- .4 01 61 10 LEED® Product Requirements
- .5 31 25 00 Construction Pollution Prevention.

1.10.3 Materials used for Work in this section are to include, but are not limited to the following criteria:

- .1 Materials used in work of this Section are to contain high amounts of recycled content and are to be sourced regionally from within 800 km via truck or 2400 km via rail or ship from jobsite in accordance with Section 01 61 10.

1.10.4 The following must be submitted as appropriate for Consultant's review and approval:

- .1 Submit Schedules A and D, as appropriate, of Section 01 61 10A LEED Product Requirements Schedules following the measures outlined in Section 01 61 10, for all applicable products.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

2.1.1 Acceptable Materials Manufacturers: Subject to compliance with requirements specified in this Section, manufacturers offering products that may be incorporated into the Work include the following:

- .1 Armstrong World Industries, Inc.
- .2 Chicago Metallic
- .3 CertainTeed
- .4 CGC Interiors, a USG Company

2.2 DESIGN CRITERIA

2.2.1 Superimposed Loads: Determine superimposed loads applied to suspension systems by components of the building and verify that adequate hangers are installed to support additional loads in conjunction with normal loads of the ceiling system, and as follows:

- .1 Maximum Deflection: Limit deflection to L/360 in accordance with ASTM C635 deflection test.

2.3 SUSPENSION - GENERAL

2.3.1 Suspension system shall support ceiling assembly indicated on the Drawings, or specified herein, with a maximum deflection of 1/360 of the span, in accordance with ASTM C635/C635M intermediate duty classification. Suspension system shall be hot dipped galvanized metal.

- .1 Main and Cross Tees: 15/16" face exposed tee system, standard white finish. Basis of design product: USG DONN brand DX/DXL, by CGC Interiors, a USG Company
- .2 Perimeter Wall Molding: Shadowline molding to provide a 9/16" face, 15/16" vertical leg and a 1/4" x 1/4" reveal, standard white finish. Basis of design product: USG Suspension System Accessories – MS125, by CGC Interiors, a USG Company.
- .3 Transition Molding: Shadowline molding from acoustic tile to gypsum board ceiling to provide a 9/16" face and 1/4" x 1/4" reveal, standard white finish. Acoustic tile and gypsum board to align at the same elevation. Basis of design product: USG Suspension System Accessories – MS125, by CGC Interiors, a USG Company.
- .4 Edge Trim: 2" nominal height profile with vertical fin detail, attaching to metal suspension system. Standard white finish. Basis of design product: USG Suspension System Accessories – M20SM-2, 2" Profile, by CGC Interiors, a USG Company.
- .5 Hangers, Braces, Ties: Nominal 14 ga. diameter steel wire, galvanized.
- .6 Accessories: Stabilizer bars, access splines, and required anchors and attachment to structure, 22 ga. minimum steel.
- .7 Tie Wire: 3/64" galvanized soft annealed steel wire.

2.3.2 Suspension system shall lock together in a positive manner providing pull out values in tension of 300 lb. or greater.

2.4 ACOUSTICAL PANELS

2.4.1 Acoustic Panels(AC-1): Provide manufacturer's standard panels of configuration indicated in accordance with ASTM E1264 classifications as designated by the nominal values for types, patterns, acoustic ratings, and light reflectance class listed in this Section; with flame spread rating of 25 or less and smoke developed rating of 50 or less when tested in accordance with CAN/ULC S102 and as follows:

- .1 Physical Properties: Type: III, Form: 2
- .2 Dimensions: 24" x 48" x 5/8" and 24" x 24" x 5/8" (Refer to Drawings for location)
- .3 Edge Profile: Square
- .4 Colour: White.
- .5 Acoustic and Visual Performance (Minimum Nominal):
 - 1. Noise Reduction Coefficient: 0.55
 - 2. Ceiling Attenuation Class: 35
 - 3. Light Reflectance: 0.83
- .6 Basis of Design Product:
 - 1. Radar Basic lay-in by CGC Interiors, a USG Company

2.4.2 Steel members: Galvanized in accordance with ASTM A653/A653M, light commercial coating class or coated with rust inhibitive primer complying with CAN/CGSB 1.132-M.

2.4.3 Exposed metal surfaces: Baked-on, special white enamel, with a gloss value of 25 when tested in accordance with ASTM E1477.

PART 3 - EXECUTION

3.1 INSPECTION

- 3.1.1 Ensure work above ceilings is complete, inspected and approved by authority having jurisdiction before commencing installation.

3.2 INSTALLATION WORK

- 3.2.1 Co-ordinate work with all trades affected by work of this Section. Provide a layout of hangers and framing suitable to accommodate fittings and units of equipment. Failure to follow this procedure will require that hangers and channels be revised to suit as necessary without additional cost to the Owner.
- 3.2.2 Where ducts or other equipment prevent the regular spacing of hangars, reinforce nearest adjacent hangers and all related carrying channels and furring as required to span the greater distance.
- 3.2.3 Lay out work in accordance with reflected ceiling plans. Provide a tolerance of 1/360 of span and 5/64" maximum between adjacent edges of metal pans. Allowable tolerance of finished acoustical ceiling system: 1/8" in 12'-0" and 1/64" between adjacent metal members. Tolerances shall not be cumulative.
- 3.2.4 Install acoustical ceilings in accordance with ASTM C636/C636M, "Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels."
- 3.2.5 Supply hangers or inserts for installation to respective section in ample time and with clear instructions for their correct placement. Provide additional hangers and inserts as required.
- 3.2.6 Design and space hangers and carrying members to support entire ceiling system, including lighting fixtures, diffusers and grilles. Recessed objects shall replace or be centred on acoustical panels, except where indicated otherwise. Consult with mechanical and electrical trades to co-ordinate the work.
- 3.2.7 Secure hangers to structure. Hang suspended ceilings independently of walls, columns, ducts, pipes and conduit. Where carrying members are spliced avoid visible displacement of longitudinal axis of face plane of adjacent members.
- 3.2.8 Centre acoustical ceiling installation on room axis leaving equal border pieces. Provide a row of hangers adjacent to and parallel with walls for support of ends of main tee runners at not more than 6" from ends of runners. Lay directionally patterned tile one way with pattern parallel to longest room axis unless otherwise directed.
- 3.2.9 Install components to form a level ceiling with all parts flush and true, parallel to module lines, and to pattern shown. Install panels in level, uniform plane free from twist, warp, dents and flush, without gaps and exposed face of carrying members. Fit border units neatly against abutting surfaces.
- 3.2.10 Do not support fixtures from main runners or cross runners if weight of fixture causes total dead load to exceed deflection capability of suspension system. In such cases, support fixture load by supplementary hangers located within 6" of each corner, or support fixture independently. Do not install fixtures so that main runners and cross runners will be eccentrically loaded. Where fixtures installation would produce rotation of runners, provide stabilizer bars. Provide carrying channels to transfer fixture load to carrying members as required. Ensure that joints in suspension do not

occur at recessed fixture sides. Frame around recessed fixtures, diffusers, grilles, and other openings; provide allowance for thermal movement. Furr around ducts, beams, and bulkheads as required. Suspension of electrical fixtures shall comply with requirements of hydro.

3.2.11 Accessibility percentage: 100.

3.3 INSTALLATION - GRID SYSTEM

3.3.1 Grid system shall consist of the following components: Hangers, Exposed main tee, exposed cross tee, wall moulding, lay-in panels, and hold-down clips where required.

3.3.2 Install hangers of correct length at 4'-0" o.c. maximum in each direction.

3.3.3 Install main runners level and in maximum length available. Do not bend hangers as a means of levelling. Form wire loops tightly to prevent vertical movement or rotation within the loop.

3.3.4 Join abutting sections of main tees by means of suitable connections such as splices, interlocking ends, tab locks, pin locks. Intersecting tees shall form a right angle. Butt ends of cross tees flush to exposed edge of intersecting member. Fur around ducts, beams and bulkheads as required. Provide edge moulding at intersection of ceiling and vertical surfaces.

3.3.5 Provide edge moulding at intersection of vertical surfaces using maximum lengths, straight, true to line and level. Mitre corners. Provide edge transition moulding at junction with gypsum board ceilings as indicated. Where bullnose concrete block occurs, provide preformed closers to match edge moulding.

3.3.6 Carefully fit acoustic tile in place, no broken edges permitted.

3.3.7 Install hold-down clips on all lay-in panels to hold such panels tight to grid system where within 20'-0" of an exterior door.

3.3.8 Recessed items shall replace or be centred on acoustical tiles, except where indicated otherwise. Consult with mechanical and electrical trades to co-ordinate the work.

3.4 ADJUSTMENTS

3.4.1 Adjust any sags or twists which develop in suspension system and replace any part of complete system which is damaged or faulty.

3.5 CLEANING

3.5.1 Thoroughly clean all acoustic ceiling surfaces upon completion of the installation.

3.5.2 Promptly as the work proceeds and on completion, remove all surplus materials and debris resulting from the work of this Section.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

1.1.1 Comply with Division 1, General Requirements and all documents referred to therein.

1.1.2 This Section includes, but is not limited to, the following:

- .1 Vinyl composition floor tile.
- .2 Static dissipative floor tile.
- .3 Rubber tile flooring.
- .4 Resilient wall bases.
- .5 Resilient accessories for transition strips, area dividers.
- .6 Luxury Vinyl Tile.

1.2 REFERENCES

- 1.2.1 ASTM F141-08a, Terminology Relating to Resilient Floor Covering
- 1.2.2 ASTM F150-06, Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring
- 1.2.3 ASTM F710-08, Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
- 1.2.4 ASTM 970-06, Standard Test Method for Static Load Limit
- 1.2.5 ASTM F1066-04, Vinyl Composition Floor Tile
- 1.2.6 ASTM F1303-04(2009), Standard Specification for Sheet Vinyl Floor Covering with Backing
- 1.2.7 ASTM F1344-12e1, Standard Specification for Rubber Floor Tile
- 1.2.8 ASTM F1516-13, Standard Practice for Sealing Seams of Resilient Flooring Products by the Heat Weld Method
- 1.2.9 ASTM F1861-08(2012), Standard Specification for Resilient Wall Base
- 1.2.10 ASTM F1869-10, Standard Test Method for Measuring Moisture Vapor Emission Rate for Concrete Subfloor Using Anhydrous Calcium Chloride
- 1.2.11 ASTM 2047, Standard Test Method for Static Coefficient of Friction (SCOF) of Polish-Coated Floor Surfaces as Measured by the James Machine
- 1.2.12 ASTM D2047-04, Standard Test Method for Dynamic Coefficient of Friction (DCOF) of Polish-Coated Floor Surfaces as Measured by the James Machine
- 1.2.13 ASTM F2170, Standard Test Method for determining relative humidity in Concrete Subfloor Using in situ probes

1.3 SUBMITTALS

- 1.3.1 Product Data: Submit one copy of product data for each type of product specified.
- 1.3.2 Shop Drawings: Submit shop drawings indicating:
 - .1 Location of seams and edges
 - .2 Location of columns, doorways, enclosing partitions, built-in furniture, cabinets, and cut-out locations
 - .3 Type and style of resilient transition strip used between adjacent flooring types
- 1.3.3 Submit the following samples to the Consultant for approval: 2 samples 300mm x 300 mm (12" x 12") of each colour of sheet flooring, 1 300mm (12") length of edge strip.
- 1.3.4 Submit three copies of maintenance data for incorporation into maintenance manual. Manual shall give specific warning of any maintenance practice which may damage or disfigure sheet flooring.
- 1.3.5 Site Quality Control Test Results: Submit results or moisture emission testing of concrete subfloors prior to installation of flooring. Results shall include comparison of manufacturer's recommended moisture content to actual moisture vapour emission rate.
- 1.4 SITE MOCK-UP
 - 1.4.1 Following the pre-installation conference, the Contractor shall install a 10'-0" x 10'-0" dry sample areas of flooring material and accessories, indicating all colour variations, and layout in areas designated later by the Consultant.
 - 1.4.2 After approval of tile colours and layout, install flooring materials and accessories, under the supervision of the material manufacturer's representative.
 - 1.4.3 Upon completion and approval, sample areas shall serve as a standard of quality for the balance of the work of this Section. Subsequent work carried out and not in the Consultant's opinion, equal to the quality standard shall be removed and replaced at no additional cost to the Owner.
 - 1.4.4 It shall be the responsibility of the material manufacturer's representative to visit the site during installation, to ensure proper use of proprietary materials and assist the Contractor as may be required.
 - 1.4.5 Co-ordinate work of mock-up with related work of other Sections.
 - 1.4.6 Accepted work may form a part of the final installation.
- 1.5 EXTRA STOCK
 - 1.5.1 Provide 5% of each colour of flooring material and 30' lineal feet coil stock of each colour of base specified, boxed and labelled. Store maintenance materials on the premises as directed by the Owner.
- 1.6 QUALITY ASSURANCE
 - 1.6.1 Contractor executing work of this Section shall have a minimum of five (5) years continuous Canadian experience in successful and installation of work of type and quality shown and specified. Submit proof of experience upon Consultant's request.
 - 1.6.2 Resilient Flooring Installer: Use an installer who is competent in heat welding and have a minimum of five (5) years documented experience in the installation of resilient sheet flooring and seams in accordance with manufacturer's training or certification program:

1.7 DELIVERY, STORAGE, HANDLING AND PROTECTION

- 1.7.1 Coordinate deliveries to comply with Construction Schedule and arrange ahead for off-the-ground, under cover storage location. Do not load any area beyond the design limits.
- 1.7.2 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect materials with suitable non-staining waterproof coverings.
- 1.7.3 Store material in original, undamaged containers or wrappings with manufacturer's seals and labels intact.
- 1.7.4 Restrict traffic by other trades during installation.
- 1.7.5 Provide adequate protection of completed tiled surfaces to prevent damage by other trades until final completion of this project. Minimum protection shall consist of kraftpaper.

1.8 ENVIRONMENTAL CONDITIONS

- 1.8.1 Temperature of room, floor surface and materials shall not be less than 21 deg C for 48 hours before, during and for 48 hours after installation. Concrete floors shall be aged for a minimum of 28 days and shall be dry before application of the resilient floor tile.
- 1.8.2 Moisture content of floor shall not exceed a maximum of 3 lbs. of water per 1,000 sq. ft. of concrete slab area over a 24 hour period as measured by one of the following methods, as approved by Consultant:
 - .1 Rubber Manufacturer's Association (RMA) moisture test using anhydrous calcium chloride.
 - .2 Does not exceed 3% as measured by Calcium Carbide Hygrometer procedure.
 - .3 Does not exceed 5% as measured by normal Protimeter.
- 1.8.3 Avoid exposure to high humidity, cold drafts and abrupt temperature changes.

1.9 WARRANTY

- 1.9.1 Warrant the work of this Section against defects in materials and workmanship in accordance with the General Conditions but for an extended period of Ten (15) years and agree to repair or replace faulty materials or work which become evident during warranty period without cost to the Owner. Defects shall include, but not limited to, bond failure, and extensive colour fading.

1.10 LEED™ STRATEGIES

- 1.10.1 All trades must examine practices, as outlined in the related sections, to assist the team in achieving these results.
- 1.10.2 Related Sections:
 - .1 01 35 20 General LEED® Requirements
 - .2 01 35 50 Waste Management Disposal
 - .3 01 35 90 Indoor Air Quality Management
 - .4 01 61 10 LEED® Product Requirements
 - .5 31 25 00 Construction Pollution Prevention.
- 1.10.3 Materials used for Work in this section are to include, but are not limited to the following criteria:

PART 3 - EXECUTION

3.1 PREPARATION

- 3.1.1 Ensure that floors are clean, level and dry, free from cracks, ridges, dusting, scaling and carbonation.
- 3.1.2 Test concrete substrate for excessive moisture content by a method acceptable to the Consultant and material manufacturer.
- 3.1.3 Maintain room and material temperature at 21°C for at least 24 hours before, during and 7 days after flooring installation. Concrete shall be at least 28 days old before commencing application.
- 3.1.4 Do not install sheet flooring until ceiling and partition finishing work are completed.
- 3.1.5 Before spreading primer or adhesive, thoroughly clean the surface of the floor, remove dust and debris.
- 3.1.6 Apply filler as may be required. Prohibit traffic until filler has cured.
- 3.1.7 Prime concrete slabs to flooring manufacturer's recommendations.

3.2 FLOORING INSTALLATION

- 3.2.1 Apply adhesive uniformly using recommended trowel in accordance with flooring manufacturer's instructions. Do not spread more adhesive than can be covered by flooring before initial set takes place.
- 3.2.2 Lay flooring to produce a minimum number of seams. Border widths minimum 1/3 width of full material.
- 3.2.3 Run sheets parallel to length of room. Double cut sheet joints and continuously heat or chemically weld.
- 3.2.4 As installation progresses, roll flooring with 45kg (100lb) roller to ensure full adhesive, according to manufacturer's instructions.
- 3.2.5 Cut flooring and fit neatly around fixed or excessively heavy objects.
- 3.2.6 Provide flush joint transition strip where sheet resilient flooring meets carpet.
- 3.2.7 Terminate flooring with metal edge strips at centreline of door in openings where adjacent floor finish or colour is dissimilar.
- 3.2.8 Layout tile flooring as follows:
 - .1 Lay tile with joints parallel to building lines to produce a symmetrical tile pattern.
 - .2 Install tile flooring so that perimeter tile width is minimum 1/2 full size.

3.3 SEAMING

- 3.3.1 After adhesive has set, groove seams with equipment recommended by flooring manufacturer. Width of groove; 3.5mm (0.14") wide x 2.5mm (1/10") deep.

- 3.3.2 Clean seams carefully by vacuum.
- 3.3.3 Use high-speed hot-air welding gun to weld all grooved seams, in accordance with flooring manufacturer's instructions.
- 3.3.4 Trim off excess surplus material in two operations.
- 3.4 **INSTALLATION – BASE**
 - 3.4.1 Provide resilient base or cove base as indicated on Room Finish Schedule.
 - 3.4.2 Securely adhere cove base filler at juncture of wall and floor. Spread adhesive up wall, full coverage.
 - 3.4.3 Extended flooring material to form cove base, ensure solid backing behind base.
 - 3.4.4 Terminate top of base in base cap, straight, level and true.
- 3.5 **CLEAN AND WAXING**
 - 3.5.1 Remove excess adhesive from floor, base and wall surfaces without damage.
 - 3.5.2 Clean, seal and wax floor surface to flooring manufacturer's instructions.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

- 1.1.1 Comply with Division 1, General Requirements and all documents referred to therein.
- 1.1.2 Provide all labour, materials, products, equipment and services to supply and install seamless epoxy flooring.

1.2 REFERENCES

- 1.2.1 ASTM C307-03(2012) Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing.
- 1.2.2 ASTM C579-01(2012) Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
- 1.2.3 ASTM C580-02(2012) Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
- 1.2.4 ASTM D2240-05(2010) Standard Test Method for Rubber Property—Durometer Hardness.

1.3 QUALIFICATIONS

- 1.3.1 Subcontractor executing work of this Section shall employ installers having a minimum of five (5) years continuous Canadian experience in successful installation of work of type and quality shown and specified. Submit proof of experience upon Consultant's request.
- 1.3.2 Work of this Section shall be executed by workers especially trained and experienced in this type of work. Have a full time, senior, qualified representative at the Site to direct the work of this Section at all times. Representative shall meet Consultant's approval.
- 1.3.3 Ensure proper use of proprietary materials in strict accordance with the material manufacturer's directions. It shall be the responsibility of the material manufacturer or supplier to furnish these directions to the Contractor and to check periodically at the site to ensure that they are being carried out.

1.4 SUBMITTALS

- 1.4.1 Cracks arising from normal shrinkage and/or expansion of concrete shall not be considered as structural failure. Hairline cracks which result from these causes shall be considered normal and consequently the warranty shall not be voided as a result of these minor defects.
- 1.4.2 Submit samples and obtain Consultant's approval before ordering materials and proceeding with work.
- 1.4.3 Maintenance Instructions: Upon completion of the Work, furnish Consultant with copies of maintenance instructions, containing complete detailed and specific instructions for maintaining, preserving and keeping clean the surfaces of this Work and in particular, giving adequate warning of maintenance practices of materials detrimental to the work of this Section for inclusion in the Operation and Maintenance Manual.

- 1.4.4 Site Quality Control Test Results: Submit results or moisture emission testing of concrete subfloors prior to installation of flooring. Results shall include comparison of manufacturer's recommended moisture content to actual moisture vapour emission rate.
- 1.5 SITE MOCK-UP
 - 1.5.1 Following the pre-installation conference, the Contractor shall install a 10'-0" x 10'-0" area of flooring material and accessories, indicating all colour variations, and layout in areas designated later by the Consultant.
 - 1.5.2 Upon completion and approval, sample areas shall serve as a standard of quality for the balance of the work of this Section. Subsequent work carried out and not in the Consultant's opinion, equal to the quality standard shall be removed and replaced at no additional cost to the Owner.
 - 1.5.3 It shall be the responsibility of the material manufacturer's representative to visit the site during installation, to ensure proper use of proprietary materials and assist the Contractor as may be required.
 - 1.5.4 Co-ordinate work of mock-up with related work of other Sections.
 - 1.5.5 Accepted work may form a part of the final installation.
- 1.6 PRODUCT HANDLING
 - 1.6.1 Co-ordinate deliveries to comply with construction schedule and arrange ahead for off the ground, under cover storage location. Do not load any area beyond the design limits.
 - 1.6.2 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect materials with suitable non-staining waterproof coverings.
 - 1.6.3 Store material in original, undamaged containers or wrappings with manufacturer's seals and labels intact.
 - 1.6.4 Restrict traffic by other trades during installation.
 - 1.6.5 Provide adequate protection of completed epoxy surfaces to prevent damage by other trades until final completion of this project. Minimum protection shall consist of 4 mil polyethylene sheets lapped 100mm (4") and taped.
- 1.7 ENVIRONMENTAL CONDITIONS
 - 1.7.1 Moisture content of floor shall not exceed a maximum of 3 lbs. of water per 1,000 sq. ft. of concrete slab area over a 24 hour period as measured by one of the following methods, as approved by Consultant:
 - .1 Does not exceed 3% as measured by Calcium Carbide Hygrometer procedure.
 - .2 Does not exceed 5% as measured by normal Protimeter.
 - 1.7.2 Avoid exposure to high humidity, cold drafts and abrupt temperature changes.
- 1.8 WARRANTY
 - 1.8.1 Warrant the work of this Section against defects in materials and workmanship in accordance with the General Conditions, but for a period of two (2) years, and agree to promptly make good

defects which become evident during the warranty period without cost to the Owner. Defects shall include but not be limited to the following; cracking, crazing, discolouration, staining.

1.9 LEED™ STRATEGIES

1.9.1 All trades must examine practices, as outlined in the related sections, to assist the team in achieving these results.

1.9.2 Related Sections:

- .1 01 35 20 General LEED® Requirements
- .2 01 35 50 Waste Management Disposal
- .3 01 35 90 Indoor Air Quality Management
- .4 01 61 10 LEED® Product Requirements
- .5 31 25 00 Construction Pollution Prevention.

1.9.3 Materials used for Work in this section are to include, but are not limited to the following criteria:

- .1 All materials under Work of this Section, including but not limited to, paints, coatings, sealants, primers and adhesives are to have low VOC contents in accordance with Section 01 35 90.

1.9.4 The following must be submitted as appropriate for Consultant's review and approval:

- .1 Submit an MSDS or product data sheet stating the VOC and urea-formaldehyde content, along with Schedule A of Section 01 35 90A LEED Product Requirements Schedules following the measures outlined in Section 01 35 90, for all applicable products.

PART 2 - PRODUCTS

2.1 GENERAL

2.1.1 All components and products of the epoxy flooring system shall be manufactured and supplied by a single manufacturer, to ensure compatibility between components.

2.2 MANUFACTURERS

2.2.1 Basis-of-Design products are named in this Section; additional manufacturers offering similar epoxy floor systems may be incorporated into the work provided they meet the performance requirements established by the named products.

2.2.2 Acceptable Materials Manufacturers: Subject to compliance with requirements specified in this Section and as established by the Basis-of-Design Materials, manufacturers offering products that may be incorporated into the Work include; but are not limited to, the following:

- .1 Sika Canada
- .2 Stonhard

2.3 MATERIALS

2.3.1 Epoxy Flooring System:

- .1 Two-component, 100% solids, flexible, urethane-modified epoxy resin.
- .2 Basis of Design Materials: Sikalastic Duochem 8200 by Sika Canada.

2.3.2 Colour as selected by Consultant from standard colour range.

PART 3 - EXECUTION

3.1 PREPARATION

3.1.1 Free surfaces to receive the work of this Section, from dust and loose particles, grease, paint, frost, form oil and other material detrimental to the bond of the flooring material.

3.1.2 Surfaces shall be acceptable in accordance with flooring material manufacturer's recommendations. Report defects to the Consultant in writing for correction before work progresses. Commencement of work shall imply acceptance of all conditions.

3.1.3 Maintain ambient and surface temperatures at 15C for a minimum period of 72 hours before, during and after flooring application, moisture content not in excess of 3%.

3.1.4 Prepare sub-floor according to manufacturer's directions.

3.1.5 Remove projections and other conditions that may affect the installation of the flooring system.

3.1.6 Protect adjacent surfaces, fixtures and equipment with drop cloths or masking as necessary to prevent damage from surface preparation.

3.2 INSTALLATION

3.2.1 Pre-stir each component separately prior to mixing. Mix components in the correct mix ratio, as indicated by flooring manufacturer, minimizing entrapping air while mixing. Mix only the quantity which can be used within its pot life.

3.2.2 Apply epoxy flooring by notched squeegee at the rate of 0.9 - 1.2 m²/L (35 - 50 ft²/US gal.). Broadcast select aggregate recommended by flooring manufacturer, into wet resin, to refusal.

3.2.3 After initial cure of first layer remove excess aggregate, and apply two (2) grout coats at approximately 3 m²/L (123 ft²/US gal.) per coat to obtain the surface finish as required.

3.2.4 Allow sufficient final cure time, as recommended by flooring manufacturer, before opening to traffic.

3.3 FIELD QUALITY CONTROL

3.3.1 Supervise the work of other Sections where such is associated with the epoxy flooring system including the placement, finishing and curing of the concrete substrate.

3.4 CLEANING

3.4.1 Clean flooring areas after completion, using compatible solutions and methods as recommended by the manufacturer.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

- 1.1.1 Comply with Division 1, General Requirements and all documents referred to therein.
- 1.1.2 Provide all labour, materials, products, equipment and services to complete the painting and finishing work required and/or indicated on the Drawings and specified herein.
- 1.1.3 Provide surface preparation to receive painting and finishing specified under this Section of the work, in accordance with the the Master Painters Institute (MPI) Painting Specification Manual and as specified herein.
- 1.1.4 Examine the Specifications and Drawings for the work of other Sections regarding the provisions for prime and finish coats. Paint or finish all materials installed throughout the project which are required to be painted and which are left unfinished or unpainted by other Sections.
- 1.1.5 The only exception to the requirements of the preceding paragraph is where the drawings, Specifications, or Schedules state positively and explicitly that a surface is not to be finished.
- 1.1.6 For areas indicated as unfinished in the specifications, Finish Schedules, and Drawings, painting is not required, except for doors and frames, windows and frames, railings, steel stairs, insulation on mechanical equipment, pipes and fittings, and other items requiring protection including electrical panels.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- 1.2.1 Shop painting of structural, miscellaneous and ornamental metal.
- 1.2.2 Shop coating of hollow metal doors and frames: Section 08 11 00.
- 1.2.3 Colour code markings for identification of piping and ductwork: Division 15.

1.3 REFERENCES

- 1.3.1 ASTM D523-14 Standard Test Method for Specular Gloss.
- 1.3.2 CAN/CGSB 1.213-2004 Etch Primer (Pretreatment Coating or Tie Coat) for Steel and Aluminum.
- 1.3.3 CAN/CGSB 85.100-93 Painting.

1.4 QUALITY ASSURANCE

- 1.4.1 Arrange with the paint manufacturer's and Canadian Paint and Coatings Association (CPCA) representatives to visit the site prior to the commencement of the painting operation to discuss the painting and finishing procedures to be used and to analyse the surface conditions in order that alternative recommendations may be made to the Consultant should adverse conditions exist.
- 1.4.2 Arrange with the paint manufacturer and CPCA to visit the site at intervals during the surface preparation and painting operations to insure that the proper surface preparation has been completed, the specified paint products are being used, the proper number of coats are being applied and the agreed finishing procedures are being used, and that the paint manufacturer

regularly submits written reports to the Consultant.

1.5 QUALIFICATIONS

- 1.5.1 Use only paint manufacturers and products as listed under the Approved Products section of the MPI Manual Architectural Painting Specification Manual.
- 1.5.2 Applicator shall have a minimum of ten (10) years proven satisfactory experience and shall maintain a qualified crew of painters throughout the duration of the work, who shall be qualified to fully satisfy the requirements of this specification. Only qualified journeymen (and apprentices) shall be engaged in painting and decorating work who have Tradesman Qualification certificate of proficiency.

1.6 SUBMITTALS

- 1.6.1 Submit 2 samples of every colour, in the required number of coats on 8"x 8" pieces of hardboard. Include specifications of materials, products and installation procedure used to obtain the finish. Resubmit samples until colours have been approved by the Consultant.
- 1.6.2 Colours shall match those specified in the Colour Schedule.
- 1.6.3 Retain samples at job site until completion of the work.
- 1.6.4 Two weeks after award of Contract submit to the Consultant a complete list of paint and finish materials to be used, showing the name of the manufacturer, the catalogue number, grade and quality of the materials proposed for use.
- 1.6.5 Materials and products delivered to the work shall comply with the approved list.

1.7 MOCK UP

- 1.7.1 A sample installation area located in the building will be designated by the Consultant.
- 1.7.2 Apply samples of finishes in the presence of the Consultant, Contractor and paint manufacturer. Apply samples with the correct material, number of coats, colour, texture and degree of gloss required. Refinish if required, until approval of the Consultant is obtained.
- 1.7.3 Leave sample installation undisturbed until completion of the Work. Approved sample installation shall serve as a standard for similar work throughout the Project. Work which does not match the approved finishes shall be corrected and refinished at no expense to the Owner.

1.8 PRODUCT DELIVERY, STORAGE AND HANDLING

- 1.8.1 Store materials in a single place. Keep storage clean and tidy.
- 1.8.2 Accept only paint and finishing materials and products delivered to the site in the manufacturer's unbroken, sealed containers, with manufacturer's label indicating type of paint, colour and instructions for reducing.
- 1.8.3 Store packaged materials undamaged in their original wrappings or containers with manufacturer's labels and seals intact.
- 1.8.4 Before commencement of work, remove electrical plates, surface hardware, canopies of lighting fixtures, and other escutcheons or appurtenances. Reinstall items in satisfactory condition when painting is completed. Do not clean hardware with solvents which will remove permanent lacquer

finish.

- 1.8.5 Use sufficient drop cloth and protective coverings for the full protection of floors and surfaces not to be painted.
- 1.8.6 Protect materials and products from frost.
- 1.9 ENVIRONMENTAL REQUIREMENTS
 - 1.9.1 Atmosphere at the area of work shall be dust free.
 - 1.9.2 Temperatures, humidity, and moisture content of surfaces shall conform to the following:
 - .1 Temperatures; No painting shall be performed when temperatures on the surface, or the air in the vicinity of painting work are below 5°C. The minimum temperatures allowed for latex paints shall be 7°C. for interior work and 10°C for exterior work, unless specifically approved by the Consultant.
 - .2 Relative humidity shall not be higher than 85%.
 - .3 Moisture of surfaces shall be tested by an electronic Moisture Meter.
 - .4 Moisture content of wallboard shall not exceed 12%, of masonry, concrete or concrete block, 12% for solvent type paint.
 - .5 Masonry surfaces shall be tested for alkalinity.
 - .6 Maximum moisture content of wood; 15%.
 - 1.9.3 Masonry and concrete block must be installed at least 28 days prior to painting, with a moisture content not exceeding 12%, before painting commences. This is not to be construed as including a "wetting down" process for latex.
 - 1.9.4 Painting work shall not proceed unless a minimum of 15 candle power/sq ft lighting is provided on the surface to be painted.
 - 1.9.5 All areas where painting work is proceeding shall have adequate continuous ventilation and sufficient heating to maintain temperatures above 7°C. for 24 hours before and after paint application.
 - 1.9.6 Take all necessary precautions to prevent fire hazard and spontaneous combustion.
 - 1.9.7 Where toxic materials, and both toxic and explosive solvents are used, take appropriate precautions and prohibit smoking.
- 1.10 INSPECTION AND WARRANTY
 - 1.10.1 Inspections shall be carried out in accordance with the Canadian Painting Contractors' Architectural Painting Specification Manual.
 - 1.10.2 Warrantee the work of this Section against faulty workmanship for a period of two (2) years from date of Substantial Completion.
 - 1.10.3 Warrantee shall be in a form acceptable to the Consultant.
- 1.11 PROTECTION
 - 1.11.1 Adequately protect other surfaces from paint and damage and make good any damage caused by failure to provide suitable protection.

- 1.11.2 Furnish sufficient drop cloths, shields and protective equipment to prevent spray or dropping from fouling surfaces not being painted and in particular, surfaces within storage and preparation area.
- 1.11.3 Cotton waste, cloths and material which may constitute a fire hazard shall be placed in closed metal containers and removed daily from the site.
- 1.11.4 Remove all electrical plates, surface hardware, fittings and fastenings, prior to painting operations. Carefully store, clean and replace these items on completion of work in each area. Do not use solvent that will remove the permanent lacquer to clean hardware.

PART 2 - PRODUCTS

2.1 MATERIALS

- 2.1.1 Paint, varnish, stain, enamel, lacquer, fillers and other finishing materials shall comply with or exceed CAN/CGSB 85.100 for Premium Grade Work, highest grade, top line quality products of the specified manufacturers, and be of a type and brand herein specified and listed under "Paint Product Recommendations" as covered in the CPCA Painting Manual, for the specific purposes
 - 2.1.2 Paints shall use a latex bonding agent.
 - 2.1.3 Paint materials such as linseed oil, shellac, turpentine, etc., and any of the above materials not specifically mentioned herein but required for first class work shall be the highest quality of an approved manufacturer. All coating materials shall be compatible.
 - 2.1.4 Paints, finishing and cleaning products shall be formulated with no petroleum based or other organic solvents (no V.O.C.'s) wherever possible.
 - 2.1.5 The approval of the manufacturer of the painting and finishing materials will be based on his agreement to provide the supervision service herein before specified.
 - 2.1.6 The following manufacturers are acceptable:
 - .1 Pittsburgh Paints (PPG) Manor Hall Series
 - .2 Benjamin Moore Aura exterior/interior paint
 - .3 Dulux Diamond exterior/interior paint
 - 2.1.7 The Consultant reserves the right to refuse any paint or finishing material if in his opinion it is not suitable or adequate for the use which it is proposed.
 - 2.1.8 Exterior paints: Factory tinted to scheduled colours.
 - 2.1.9 Interior galvanized metal primer: to comply with LEED VOC limit of 250g/L per Green Seal GC-03 Anti-Corrosive Paints.
 - 2.1.10 Etch primer: Complying with CAN/CGSB 1.213.
- ### **2.2 MIXING**
- 2.2.1 Paints shall be ready-mixed unless otherwise specified, except that any coating in paste or powder form, or to be field-catalysed shall be field-mixed in accordance with directions of its manufacturer. Pigments shall be fully ground and shall maintain a soft paste consistency in the vehicle during storage that can and shall be dispersed readily and uniformly by paddle to a complete homogeneous mixture.

- 2.2.2 Paint shall have good flowing and brushing properties and shall dry cure free of sags and runs etc. to yield the desired finish specified.

PART 3 - EXECUTION

3.1 INSPECTION

- 3.1.1 Examine the work upon which the work of this Section depends prior to commencement of work. If surfaces cannot be put in proper condition by customary cleaning, sanding and puttying, report any defects to the Consultant.
- 3.1.2 Failure to report defects will constitute acceptance of surfaces. Refinish the faulty work at no expense to the Owner.
- 3.1.3 Test all surfaces by an approved moisture testing device for moisture content before commencing work. Do not apply paint to substrates when the moisture content exceeds 12%.

3.2 PREPARATION

- 3.2.1 Refer to Canadian Painting Contractors' Architectural (CPCA) Painting Specification Manual for surface preparations.
- 3.2.2 Clean floors, adjacent surfaces and surfaces to be painted before work is commenced.
- 3.2.3 Cut out scratches, cracks and abrasions in wall surfaces and adjoining trim, as required, and fill with an approved non-shrink patching compound flush with adjoining surface. When dry, sand the patch smooth and seal before the application of the prime coat.
- 3.2.4 Fill nail holes, screw holes and other similar defects after the first coat of paint has been applied. The filler shall match the colour of the finish.
- 3.2.5 Surfaces to be finished shall be clean, free from machine, tool, or sanding marks, dust, grease, soil or other extraneous matter which could be detrimental to an acceptable finish.
- 3.2.6 Wood: Prepare in accordance with CAN/CGSB 85.100 Sand smooth, removing all tool marks, and dust clean. Apply one coat of aluminum primer to all knots and sap streaks, on wood if to be painted or one coat of white shellac if to be stained and varnished. Putty nail holes, cracks and defects only after the correct priming coat is dry. Fine sanding and dusting to be carried out between coats.
- 3.2.7 Gypsum board: Inspect to ensure properly filled joints, sand smooth. Remove contamination.
- 3.2.8 Concrete, Masonry: Surfaces shall be clean, free from all contamination. Scrape off all mortar nibs and cement spatter. Remove form oil by washing with Xylol. Remove efflorescence by brushing or washing with a dilute solution of muriatic acid - 1 part commercial muriatic acid to 20 parts water by volume - followed by complete rinsing with clean water. Remove mildew by the application of one part sodium hypochloride (Javex) to three parts water. If dirt is also in evidence, add 1/2 lb. trisodium phosphate to 1 gallon of the above solution. Scrub surface well and follow with a thorough clean water rinse.
- 3.2.9 Wash masonry surfaces which are to be painted with a solution consisting of 2.0 lb. of zinc sulphate to 1 gallon of water. Rinse with clean water and allow to dry thoroughly. Remove mortar spots and sharp edges with a scraper and ensure that patching is done where required.

3.2.10 Mildew removal: Scrub with solution of T.S.P. and bleach, rinse with clear water and allow surface to dry completely.

3.3 APPLICATION - GENERAL

3.3.1 Apply paint according to accepted trade method.

3.3.2 Apply each coat at proper consistency.

3.3.3 Sand lightly between coats to provide anchor for successive coat.

3.3.4 Each coat of paint shall be slightly darker than preceding coat unless otherwise approved.

3.3.5 Do not apply finishes on surfaces that are not sufficiently dry. Each coat of finish shall be dry and hard before next coat is applied unless manufacturer's directions state otherwise. (Refer to polyurethane coatings).

3.3.6 Tint filler to match wood when clear finishes are specified. Work filler well into grain and before it has set wipe excess from surface.

3.3.7 On exterior work do not paint during temperatures under 5°C, or immediately following rain, frost or dew. On interior work do not paint during temperatures under 5°C, or on surfaces where condensation has formed or is likely to form (unless specifically formulated paints are used). Minimum temperatures allowed for latex paints shall be 7°C for interior work and 10°C for exterior work.

3.4 FIELD QUALITY CONTROL

3.4.1 Use pink litmus paper for testing surfaces for alkalinity. Where extreme alkali conditions occur, neutralize surface by washing. Wash shall consist of a 4% solution of Zinc Sulphate. Does not apply to surfaces to receive latex paints.

3.5 APPLICATION - PRIMERS

3.5.1 Apply one coat of primer to exposed ferrous metal surfaces including structural steel, mechanical and electrical equipment, piping, ducts and conduit that have not received a shop coat of primer.

3.5.2 Touch up primed metal work after loose paint and scale have been removed.

3.5.3 Thoroughly clean galvanized steel, including piping and ductwork of oil and grease with mineral spirits, treat with an approved chemical phosphoric metal etch and allow to dry, unless galvanized metal primer is to be used.

3.5.4 Wash masonry surfaces which are to be painted, with a solution consisting of 2.0 lb. of zinc sulphate to 1 gal. of water. Rinse with clean water and allow to dry thoroughly. Remove mortar spots and sharp edges with a scraper and ensure that patching is done where required. Prime masonry block surfaces with primer/block filler to fill all pores including pin holes.

3.5.5 Apply primer to piping having bituminous covering which is compatible with finish paint which will prevent bitumen bleeding through finish.

3.5.6 Apply sealer and prime coat on walls to receive mirrors before installation of mirrors.

- 3.5.7 When the primer-sealer coat is dry, touch up all visible suction spots before the first finish coat is applied and do not proceed with the work until all suction spots are sealed.
- 3.5.8 Minimal cracks, holes and imperfections appearing after application of prime coat shall be filled, patched and smoothed to match adjoining surface by Section providing the surface being painted.
- 3.6 APPLICATION - FINISH COATS
- 3.6.1 Mix materials thoroughly before application, apply evenly under adequate illumination and free from sags, runs, crawls and other defects. Do cutting in neatly.
- 3.6.2 Apply finish coats of the proper consistency as received from the container, and brush well showing a minimum of brush marks.
- 3.6.3 Sand semi-gloss, medium and high gloss lightly between coats.
- 3.6.4 Gloss terms shall have the following values when tested in accordance with ASTM D523 "Test for Specular Gloss":
- | | | | |
|----|---------------|-------------|--------------|
| .1 | Gloss Term | Gloss Value | Pittsburgh |
| .2 | Flat | 5 to 20 | Less than 15 |
| .3 | Eggshell | 20 to 40 | 5 to 20 |
| .4 | Lo-Lustre | 15 to 25 | |
| .5 | Satin | 15 to 35 | |
| .6 | Semi-gloss | 40 to 60 | 30 to 65 |
| .7 | Gloss, medium | 60 to 80 | over 65 |
| .8 | Gloss, High | 80 to 90 | |
- 3.6.5 Finish walls in eggshell, ceilings in flat and frames in semi-gloss, unless noted otherwise.
- 3.6.6 Apply coats only when the previous coat of paint, varnish or enamel is perfectly dry. Each finish coat shall be a tint lighter than the following. Only the last coat shall match the accepted samples.
- 3.6.7 Finish tops, bottoms and edges of doors in the same manner as the remainder of the door.
- 3.6.8 Finish the work uniformly as to sheen, gloss, colour and texture.
- 3.6.9 Apply materials in accordance with the directions and instructions of the manufacturers of the various materials. Do not use adulterants.
- 3.6.10 Finish closets and the interior of cabinets the same as adjoining surfaces of rooms, unless otherwise specified. Finish all other surfaces the same as the nearest or adjoining surfaces unless otherwise specified or directed by the Consultant.
- 3.6.11 Spray painting may be used only with the approval of the Consultant.
- 3.6.12 Repaint the entire plane of areas showing incomplete coverage. Patching is prohibited.
- 3.6.13 Paint surfaces and items visible through convector covers, grilles, heating cabinets, louvres and soffits with two coats black matte paint.
- 3.6.14 Do not paint over fire rating labels on doors and frames and over identification labels on mechanical and electrical equipment.

- 3.6.15 Paint reveals the same colour as the surface in which it occurs, unless otherwise indicated.
- 3.6.16 All interior metalwork which is exposed in the completed work, in rooms which are shown on the "Room Finish Schedules" to have a finish on the walls or ceiling shall receive two coats of interior paint over the prime coat. Painting shall include without being limited to, all structural steel, mechanical and electrical equipment, ductwork, and piping.
- 3.6.17 All interior metalwork in unfinished areas shall receive one coat of interior paint over the prime coat. Painting shall include without being limited to structural steel, steel ladders, mechanical and electrical equipment, piping and ductwork.
- 3.6.18 The following generally, will be painted in colour, texture and sheen to match adjacent surfaces:
- .1 Access doors
 - .2 Registers
 - .3 Radiators and covers
 - .4 Prime coated butts
 - .5 Prime painted door closers
 - .6 Exposed piping.

3.7 APPLICATION - EXISTING SURFACES

- 3.7.1 Main off-white paint colour used in classrooms and corridors to match Pratt & Lambert 2127 – "Snowflake", semi-gloss only; to be used on gypsum wallboard as well.
- 3.7.2 Paint or repaint all existing surfaces of rooms where noted on the "Room Finish Schedule" including "new" work which has been incorporated into the existing work and existing work which has been damaged, altered, or otherwise disturbed during renovation operations.
- 3.7.3 Repaint surfaces or rooms adjacent to rooms where alterations or renovations have been carried out and which have been damaged or otherwise disturbed by the alterations or renovations. Where such damage occurs, repaint completely.
- 3.7.4 Remove from existing surfaces to be coated all rust, scale, oil, grease, mildew, chemicals, and other foreign matter.
- 3.7.5 If coatings on existing surfaces have failed so as to affect the proper performance or appearance of coatings to be applied, or if such coatings can be easily scraped off, remove them and prepare their substrates properly. Dull hard or glossy surfaces by sanding, sandblasting, or by other abrasive methods prior to painting.
- 3.7.6 Repaint surfaces entirely between changes of plane which have been incorporated into the existing work and existing work which has been damaged, altered, or otherwise disturbed during renovation operations. Give existing surfaces two coats of paint or enamel over existing finish to match the previous finish.
- 3.7.7 Paint existing mechanical and electrical items exposed to view in areas indicated.

3.8 CLEANING

- 3.8.1 Promptly as the work proceeds and on completion of the work, remove all paint where spilled, splashed or spattered. During progress of the work keep premises free from unnecessary accumulation of tools, equipment, surplus materials and debris. At conclusion of the work leave

premises neat and clean to the satisfaction of the Consultant, Paint Inspector and/or Owner.

3.9 INTERIOR FINISHES

3.9.1 Finish the various interior surfaces as follows, in addition to previously specified treatments, coatings or primers:

Concrete Block	1 coat masonry block filler and primer 2 coats eggshell latex
Galvanized Steel	1 coat galvanized metal primer or pretreatment 2 coats vinyl latex or epoxy of selected sheen
Gypsum Drywall	1 coat primer-sealer
Ceilings	2 coats flat vinyl-latex paint
Walls	2 coats eggshell latex paint
Steel, Miscellaneous	1 coat rust inhibiting primer 2 coats alkyd enamel of selected sheen
Shop Primed Steel	1 coat vinyl wash primer 2 coats alkyd paint of selected sheen
Piping, Conduit & Ductwork	1 coat metal primer 1 coat fire retardant and mildew resistant paint of selected sheen
Mechanical Equipment	2 coats gloss enamel
High heat areas	2 coats heat resistant paint
Insulation on pipes and ducts	1 coat fire retardant and latex sealer 2 coats latex paint of selected sheen
Metal Convectors & Heating Units	2 coats gloss enamel

3.10 EXTERIOR FINISHES

3.10.1 Finish the various exterior surfaces as follows:

Galvanized Steel	1 coat rust inhibiting metal primer 1 coats exterior epoxy or vinyl enamel of selected sheen
Shop Primed	1 coat vinyl wash primer
Steel	2 coats alkyd paint of selected sheen
Steel	1 coat rust inhibiting primer 2 coats exterior alkyd enamel

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

1.1.1 Furnish, deliver and install all Toilet Partitions as indicated on the drawings and as required by actual conditions at the building. The Toilet Partitions shall include the furnishing of all necessary screws, special screws, bolts, special bolts, expansion shields and all other devices necessary for the proper installation and application of the Toilet Partitions.

.1 Floor Mounted.

1.1.2 Related Sections:

Section: 10 28 00	Washroom Accessories
Division 15	Plumbing Fixtures

1.2 REFERENCES

1.2.1 All Toilet Partitions must be scheduled, supplied and installed in accordance with: Local Building Code, CGSB (Canadian Government Specifications Board), CSA (Canadian Standards Association), ANSI (American National Standards Institute), ADA (Americans with Disabilities Act). In all cases the above references shall be taken to mean the latest edition of that particular standard including all revisions.

1.2 DESIGN CRITERIA

1.2.1 Design: "barrier free access" toilet compartments conforming to CAN/CSA-B651-M, ANSI A117.1 and O.B.C. requirements.

1.3 ADMINISTRATION REQUIREMENTS

1.3.1 Coordination: Coordinate site dimensions affecting work of other Sections and provide data, dimensions and components, anchors and assemblies installed by other Sections in sufficient time for installation of products specified in this Section.

1.3 SUBMITTALS

1.3.1 Make all submittals in accordance with Section: 01 33 00

1.3.2 Submit (4) copies of detailed shop drawings for the Consultant's/Owner's review within (2) weeks of being awarded this subcontract.

1.3.3 Product Data: Submit (2) copies of product sheets and/or catalogue cuts, of all products listed in the shop drawings.

1.3.4 Upon request, a returnable sample of the Toilet Partitions shall be submitted to the Consultant/Owner for approval not later than (10) days after requested. All samples must be properly identified including: name of supplier, and name of manufacturer.

1.3.5 At completion of the job, furnish to the owner (2) copies of an Owners Operation and Maintenance Manual. The Manual shall consist of a hard cover three ring binder with the project name in the front. Include in the manual the following information: Maintenance instructions, Catalogue pages for each product, Name/Address and phone number of the Manufacturer and their Sales Agent, Copy of the final shop drawings.

1.4 QUALITY ASSURANCE

1.4.1 Substitutions

1. Manufacturers and model number listed are to establish a standard of quality. Similar items by approved manufacturers that are equal in design, function, quality and finish may be accepted upon prior written approval from the Architect/Owner.
2. All requests for acceptable substitutions must be made in writing and submitted to the Architect at least 14 days prior to tender closing. If requested, all requests for substitutions must be accompanied by product literature and actual product samples.

1.4.2 Toilet Partition shop drawings and Toilet Partitions shall be procured from a source of supply approved by the Consultant/Owner/Architect. Supplier is responsible for the complete Toilet Partition subcontract.

1.5 DELIVERY, STORAGE AND HANDLING

1.5.1 Toilet Partitions must be delivered to the job site in the manufacturers' original packages and marked to correspond with the approved shop drawings.

1.5.2 Toilet Partitions must be delivered in an amount of time deemed appropriate by the Consultant/Owner.

1.6 WARRANTY

1.6.1 The Toilet Partition manufacturer shall guarantee all Powder Coated Toilet Partitions by written certification, for a period of 25 years against breakage, delamination, and corrosion of metal parts. Warranty is for manufacturer's material only and does not include installation errors, improper usage or vandalism.

1.7 MAINTENANCE

1.7.1 Upon request, at completion of the project, the Toilet Partition supplier may be required to brief Owner's maintenance staff regarding proper care of Toilet Partitions, such as: required lubrications, adjustments, cleaning, etc.

PART 2 – PRODUCTS

2.1 MANUFACTURER

2.1.1 Only those manufacturers' names and product numbers listed herein are approved for use on this project. All other manufacturers must request approval as per section (1.04 - A - Substitutions). Absolutely no variations from listed and preapproved items will be permitted.

2.1.2 Acceptable Manufacturer: Hadrian® Powder Coated (Class B fire rated) Elite Series in headrail braced style.

2.2 MATERIALS

2.2.1 Construction: Doors, panels and pilasters shall be certified CLASS A fire rated powder coated galvanized steel in compliance with ASTM#A653. Hard, even and run-free, consistent finish with ASTM D 6578 Graffiti Resistance. Material is ideal for toilet partition installations, especially in high abuse and high moisture environments and cleaning chemical exposure.

- 2.2.2 Doors, panels and pilasters structurally reinforced with 25mm cell honeycomb (total thickness 32mm) bonded from top to bottom and edge to edge throughout their entire core. Corners shall be mitered, welded and ground smooth with full corner weld that offers a hygienic seal.
- 2.2.3 Doors and panels: Shall be 32mm thick by (1473mm) 58" high
 - .1 Minimum steel thickness:
 - .1 Doors and Panels: 22 gauge.
 - .2 Pilasters [and head rails]: 20 gauge.
 - .3 Urinal Screen: 22 gauge.
- 2.2.4 Pilaster shoes: One-piece welded design of polished stainless steel conforming to ASTM A66-72-1979, Type 304, satin finish.
- 2.2.5 Headrail: Clear anodized aluminium with satin finish and anti-grip profile.
- 2.2.6 Brackets and door hardware components shall be zinc die-cast and triple plated with copper, nickel and chrome to gleaming finish. Thumb-turn latch level that conforms to ADA and the Canadian Handicap Code, and with safety release latch on outside.
- 2.2.7 Hinges: Heavy duty, stainless steel, Type 304, concealed within the thickness of the door, top to bottom.
- 2.2.8 Slide Bolt and Keeper: Stainless steel with emergency access.
- 2.2.9 Door Stops: Full height continuous stop with rubber inserts.
- 2.2.10 Door Pull: Stainless steel, for barrier-free units.
- 2.2.11 Fasteners: Theft proof-6-lobe security head stainless steel.
- 2.2.12 Anchors: Floor channel fastened to pilasters with pan head screws and to floor slab with #12 x 37mm pan head screws into nylon expansion sleeves.
- 2.2.13 Hadrian's unique designer coat hook & bumper features a solid cast zinc hook and oversized black rubber bumper that functions as both a door stop and bag hook.

2.3 FINISH

- 2.3.1 Finish surfaces of doors, pilaster and partition panels with two (2) coats of baked thermosetting acrylic enamel; Colour: As selected by the Consultant from the manufacturers standard colour line.

PART 3 – EXECUTION

3.1 EXAMINATION

- 3.1.1 The contractor must examine all site conditions that would prevent the proper application and installation of Toilet Partitions. Any defect must be immediately identified and corrected, prior to the installation of the Toilet Partitions.
- 3.1.2 Take field dimensions of Work upon which Work of this Section depends for fabrication. Field adaptation of Work fabricated in error or without field check will be allowed without Consultant's approval.
- 3.1.3 Co-ordinate installation of any inserts or anchors which must be built in by other trades.

3.2 INSTALLATION

- 3.2.1 All Toilet Partitions must be mounted according Manufacturers standard locations and those specified on the drawings.
- 3.2.2 Erect Work straight, plumb, level, and secure to prevent distortion or displacement, or both.
- 3.2.3 Ensure clearance between panels and pilasters or walls does not exceed 12mm.

3.2.4 Fasten panels and pilasters to walls with brackets. Fasten headrails to walls with brackets. Joint lengths of headrails only at pilasters.

3.2.5 Securely attach fixing brackets and shoes.

3.2.6 Equip each door with hinges, latch and door stop. Provide stainless steel pull installed to door face of barrier free units.

3.2.7 Provide door plates at top and bottom of doors, through bolted.

3.3 FIELD QUALITY CONTROL

3.3.1 After installation has been completed, provide for a site inspection of all Toilet Partitions to determine that all items have been supplied and installed as per the enclosed details. Also, check the operation and adjustment of all Toilet Partitions. Any discrepancies, or malfunctioning product, must be reported to the Architect immediately.

3.4 ADJUSTMENT AND CLEANING

3.4.1 At final completion, Toilet Partitions shall be left clean and free from disfigurement. Make all final adjustments. Where Toilet Partitions are found defective, repair or replace or otherwise correct as directed.

3.4.2 Remove and replace damaged or defective Work from Site, at no extra cost to the Owner.

3.4.3 Remove soil and dirt deposits resulting from fabrication and installation.

3.4.4 Provide protection to prevent damage after installation.

3.4.5 Remove protection immediately prior to occupation of building by Owner. Perform final cleaning in accordance with Division 1.

3.5 PROTECTION

3.5.1 The Contractor must provide for the proper protection of all Toilet Partitions until the owner accepts the project as complete.

3.6 TOILET PARTITION SCHEDULE

3.6.1 Provide Toilet Partitions as specified in all above sections and as per the detailed Architectural Drawings.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

- 1.1.1 Comply with Division 1, General Requirements and all documents referred to therein.
- 1.1.2 Provide all labour, materials, products, equipment and services to supply and install washroom accessories required as shown on the Drawings and as specified herein.

1.2 REFERENCE STANDARDS

- 1.2.1 ASTM A167-99(2009) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip (Withdrawn 2014).
- 1.2.2 ASTM A653/A653M-15 (Galvanized) Standard Specification for Steel Sheet, Zinc-Coated or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- 1.2.3 ASTM B117-11 Standard Practice for Operating Salt Spray (Fog) Apparatus.
- 1.2.4 CAN/CGSB 12.5-M86 Mirrors, Silvered.
- 1.2.5 CSA W55.3-08(R2013) Certification of Companies for Resistance Welding of Steel and Aluminum.

1.3 SUBMITTALS

- 1.3.1 Submit shop drawings, clearly indicating accessory materials, products and finishes and showing in large scale detail the construction, reinforcing, anchorage and location of exposed fastenings, where permitted. Submit a prototype of each accessory for review before delivery to the site.
- 1.3.2 Submit necessary templates and instructions where recesses, openings, fastenings or anchors have to be built in by others.
- 1.3.3 Submit three copies of list of accessories requiring supplies together with names and addresses of local distributors of the supplies.

1.4 DELIVERY AND STORAGE

- 1.4.1 Carefully wrap accessories ensuring protection during shipping and storage.
- 1.4.2 Store accessories inside the building in location directed, and so that their identification is readily visible, and in the general order in which they will be required for installation.
- 1.4.3 Adequately protect the structure and work of other Sections during delivery, storage, handling and execution of the work of the Section.
- 1.4.4 Provide tools, plant and other equipment required for the proper execution of the work of this Section.

1.5 LEED™ STRATEGIES

- 1.5.1 All trades must examine practices, as outlined in the related sections, to assist the team in achieving these results.
- 1.5.2 Related Sections:
- .1 01 35 20 General LEED® Requirements
 - .2 01 35 50 Waste Management Disposal
 - .3 01 35 90 Indoor Air Quality Management
 - .4 01 61 10LEED® Product Requirements
 - .5 31 25 00 Construction Pollution Prevention.
- 1.5.3 Materials used for Work in this section are to include, but are not limited to the following criteria:
- .1 Materials used in work of this Section are to contain high amounts of recycled content and are to be sourced regionally from within 800 km via truck or 2400 km via rail or ship from jobsite in accordance with Section 01 61 10.
- 1.5.4 The following must be submitted as appropriate for Consultant's review and approval:
- .1 Submit Schedules A and D, as appropriate, of Section 01 61 10A LEED Product Requirements Schedules following the measures outlined in Section 01 61 10, for all applicable products.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

2.1.1 The following manufacturers may be used for Base Bid:

- .1 Bobrick Washroom Equipment of Canada
- .3 ASI Watrous
- .5 Or other approved manufacturers meeting or exceeding these requirements.

2.1.2 Manufacturer's standard products shall be modified to comply with these Specifications unless otherwise stated with bid submission for work of this Section.

2.1.3 Washroom accessories shall be as specified in this Section, and shall be of one manufacturer except as otherwise specified or approved. Washroom accessories of the same materials, construction and finishes, and similar in function, design and appearance to those specified of other manufacturers will be considered, in accordance with the requirements of the Contract Documents for proposing substitutions.

2.2 MATERIALS

2.2.1 Stainless steel: ASTM A167 Type 304 or Type 316, of one type throughout.

2.2.2 Galvanized steel sheet: ASTM A653/A653M, commercial quality sheets, plain commercial galvanized or electro-galvanized.

2.3 FABRICATION

2.3.1 Fabricate accessories true, square, rigid, free from distortion and from defects detrimental to appearance and performance.

- 2.3.2 Visible joints, where permitted, shall be straight, accurate, hairline butt joints. Corner joints shall be mitred.
- 2.3.3 Assemble sheet metal accessories by welding in accordance with CSA W55.3. Conceal welds, or grind smooth such as to be invisible in completed work.
- 2.3.4 Except as otherwise specified, assemble fastenings, hardware fixings, and mounting or installation devices shall be concealed in the finished work.
- 2.3.5 Provide fasteners for mounting accessories. Fasteners shall be of non-corrosive, expansion type metal, toggle type or other approved type of positive, mechanical anchor as required to suit the construction to which the accessory is to be mounted. Exposed fasteners, where permitted, shall be finished to match adjacent accessory surface, and shall be countersunk. Where accessories are mounted to sheet metal, provide 1/8" thick minimum full size metal back plate drilled and tapped to receive machine screws and finished to match the adjacent sheet metal surface.
- 2.3.6 Unless otherwise specified, hinges shall be concealed stainless steel piano hinges and shall extend full length of hinged element. Hinged elements shall have concealed, mechanically retained, rubber bumpers for silent closing, and shall close flush with faces of fronts or frames.
- 2.3.7 Unless otherwise specified, portions of sheet metal accessory items which are visible in the completed work shall be stainless steel. Changes in plane shall be formed or continuously welded and ground smooth.
- 2.3.8 Sheet metal accessory parts concealed in the finished installation shall be electro galvanized sheet metal.
- 2.3.9 Accessories for flange type mounting shall have forged brass, full flanges drilled and countersunk for three mounting fasteners. Fix flanges to tubes using solid silver soldering.
- 2.3.10 Accessory lettering shall be silk screened with durable paint to withstand wear, or shall be engraved. Size, location and typeface of lettering shall selected by Consultant. Edges of letters shall be straight and sharp.
- 2.3.11 Washroom and Custodial Accessories:
 - .1 Surface Mounted:
 - .1 Fabricate units with tight seams and joints, and exposed edges rolled.
 - .2 Hang doors and access panels with continuous stainless steel hinge.
 - .3 Provide concealed anchorage where possible.
 - .2 Recessed Mounted:
 - .1 Fabricate units of all welded construction, without mitred corners.
 - .2 Hang doors and access panels with full length, stainless steel hinge.
 - .3 Provide anchorage that is fully concealed when unit is closed.
 - .3 Workmanship shall be best grade of modern shop practice known to recognized manufacturers specializing in this work. Joints and intersecting members shall be accurately fitted, made in true planes with adequate fastening. Wherever possible fastenings shall be concealed.
 - .4 Isolate where necessary to prevent electrolysis between dissimilar metal to metal or metal to masonry or concrete contact.
 - .5 Keys: Provide universal keys for internal access to accessories for servicing and re-supplying. Provide minimum of six (6) keys to Owner's representative.

2.4 FINISHES

- 2.4.1 Finish stainless steel to a standard No. 4 mechanical finish. Where possible, arrange sheet stainless steel so that the grain of the finish runs vertically in the finished installation. Where accessories consist of stainless steel and brass, finish all visible surfaces to match a No. 4 stainless steel finish including etching, nickel strike, chromium plating and mechanical finishing.
- 2.4.2 Finish metal surfaces for paint finish visible in the completed installation with a comprehensive pre-treatment including mechanical removal of imperfections, buffing, degreasing, non etch chemical cleaning and 2 baked on coats of thermo setting acrylic enamel. Colour and gloss of enamel finish as designated by the Consultant.

2.5 WASHROOM AND LUNCHROOM SCHEDULE

QTY.	Description / Model
11	Coat Hooks: Satin finished stainless steel, square profiled robe hook with concealed mounting, provide 2 for each washroom, located as directed by Consultant: ASI 7340-S Bobrick B-76717 1 for each water closet stall 1 for each shower area 3 additional for each washroom next to lockers.
3	Feminine Napkin Disposal: Satin finished, Surface mounted, concealed fastening, self-closing disposal opening with leak proof plastic receptacle and 10 disposable liners for initial stocking purposes for each unit: ASI 0852 Bobrick B-270 1 for each female water closet stall 1 for female shower area
3	Paper Towel Dispenser: Satin finished, Surface mounted Bobrick B-2860 1 for each washroom 1 for lunchroom
4	Tempered Glass Welded-Frame Mirror (Flat): 24"W x36"H, Satin finished Bobrick B-2908 2436 2 for each washroom

3	<p>Toilet Tissue Dispenser: Satin finished, Surface mounted. Bobrick B-2892</p> <p>1 for each WC stall</p>
7	<p>Soap Dispenser: Satin finished, Surface mounted. Bobrick B-2111</p> <p>1 for each washroom sink 1 for each shower area 1 for lunchroom</p>
2	<p>Shower Curtain: Opaque, matte white vinyl, 0.2mm (.008") thick, containing antibacterial and flame retardant agents. Complete with grommets every 150mm (6"), and hemmed top, bottom and sides. ASI 1200-V Bobrick 204-2</p>
As require d	<p>Shower Curtain Hook: Fabricated of type 304 stainless steel alloy 18-8, solid formed wire 2.5mm (0.98") in diameter. Hook shall accommodate 25mm to 32mm (1" to 1-1/4") diameter curtain rods. ASI 1200-SHU Bobrick 204-1</p>
2	<p>Shower Curtain Rod: Extra-heavy duty rod, 32mm (1-1/4") diameter fabricated of alloy 18-8 stainless steel, type 304, 18 gauge. Flanges fabricated from 20 gauge stainless steel. Satin Finish. Length: As determined on the Drawings. ASI 1204 Bobrick B-6047</p>
5	<p>Convenience shelf: 610mm long, 125mm wide, 18-gauge type 304 stainless steel, satin finish. 19mm return edge, hemmed front edge, 16-gauge supporting brackets. ASI 0692-524 Bobrick B-295 x 24</p> <p>1 for each water closet stall 1 for each shower area</p>
3	<p>Waste Bin: Stainless Steel Satin-Finished, Floor-Standing Waste Receptacle with Top Bobrick B-2250</p> <p>1 for each washroom 1 for lunchroom</p>

1	<p>Wall-mounted folding dressing area seat. Bench to support up to 227 kg, 650mm wide and 400mm deep.</p> <p style="margin-left: 40px;">ASI 8203-28 Bobrick B-5193</p> <p>1 for female washroom shower area</p>
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PART 3 – EXECUTION

3.1 EXAMINATION

3.1.1 Inspect surfaces over which the work of this Section is dependent for any irregularities detrimental to the application and performance of the work. Notify Consultant in writing of all conditions which are at variance with those in the Contract Documents and/or detrimental to the proper and timely installation of the work of this Section. The decision regarding corrective measures shall be obtained from the Consultant prior to proceeding with the affected work.

3.1.2 Commencement of work of this Section implies acceptance of surfaces and conditions.

3.2 INSTALLATION

3.2.1 Securely fasten accessories, level and plumb in the locations shown on the Drawings, specified herein and as further directed by the Consultant on the site.

3.2.2 Co-ordinate installation with Work of trades providing adjacent construction as required to achieve reveals or other edge conditions shown on Drawings. Install fully recessed frameless accessories so that their front face is flush with finished wall surface.

3.2.3 Perform drilling of steel, masonry and concrete necessary to install work of this Section.

3.2.4 Insulate accessory surfaces to prevent electrolytic action due to contact with masonry, concrete or dissimilar metal surfaces. Use bituminous paint, building paper or other approved means.

3.3 INSTALLATION – MIRRORS

3.3.1 Do not install mirrors until back up wall has been thoroughly sealed and primed.

3.3.2 Install hand dryers in accordance with manufacturer’s recommendations.

3.4 ADJUSTMENT

3.4.1 Upon completion of the work or when directed, remove all traces of protective coatings or paper.

3.4.2 Test mechanisms, hinges, locks and latches and where necessary, adjust and lubricate and ensure accessories are in perfect working order.

3.4.3 Load accessories with initial charge of supplies and leave ready for use.

3.5 CLEANING

- 3.5.1 Clean and make good surfaces soiled or otherwise damaged in connection with the work of this Section. Pay the cost of replacing finishes or materials that cannot be satisfactorily cleaned.
- 3.5.2 Upon completion of the Work, remove all debris, equipment and excess materials resulting from the work of this Section from the site.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

1.1.1 Confirm to Sections of Division 1 as applicable.

1.1.2 This Section includes supply and installation of manual chain operated, roller type fabric shade assembly consisting of the following:

- .1 Shade housing complete with fascia
- .2 Single, sunscreen fabric shade material
- .3 Dual shade, fabric shade material containing blackout / sunscreen combo

1.2 REFERENCE

1.2.1 AAMA 611-98 Voluntary Specification for Architectural Anodized Aluminum.

1.2.2 ANSI/ WCMA A100.1-2010 Safety of Corded Window Covering Products.

1.2.3 ASTM B429-02 Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.

1.2.4 CAN/ULC S109-03 Flame Tests of Flame-Resistant Fabrics and Films.

1.3 SUBMITTALS

1.3.1 Sample: Submit for approval. A sample shade, installed where directed, fully representing the shades to be provided. Submit samples of fabrics and finish colours for selection and approval.

1.3.2 Shop Drawings: Submit shop drawings showing and describing details of opening sizes, clearances, handing of operating chains, anchorage, assembly, materials, components, finishes and assembly.

1.3.3 Failure to submit samples may result in disqualification of tender.

1.3.4 Fire-Performance Characteristics: Provide shade material tested in accordance with NFPA 701 – Vertical-Burn Test and rated “PASS”. AND CAN/ULC S109.

1.3.5 Operation and Maintenance Data: Submit copies of manufacturers maintenance data sheets in accordance with Section 01 33 00 Submittals: Maintenance Manual and Operating Instructions, and as follows:

- .1 Provide written literature and instructions to Owner’s personnel addressing maintenance and replacement of fabric shades specified in this Section.
- .2 Provide specific warning of any maintenance practice or materials that may damage or disfigure the finished Work.

1.4 QUALITY ASSURANCE

1.4.1 Qualifications: Shade systems specified in this Section shall be provided by one manufacturer who takes full responsibility for design, engineering, and installation:

- .1 Patry Products Inc. (Solarfective System)
- .2 Sun Project of Canada Inc.

- .3 Hunter Douglas Contract Window Coverings Inc.
- .4 Equivalent product by other manufacturer acceptable to consultant or Owner.

- 1.5 DELIVERY, STORAGE AND HANDLING
 - 1.5.1 All materials shall be free of damage when delivered to the site. Protect all work with suitable heavywrapping before delivery to the site. Maintain protection until final clean-up.
 - 1.5.2 Store parts in a designed area to permit natural ventilation over their finished surfaces.
 - 1.5.3 Protect the work of this Section from damage resulting from the work of other Sections.

- 1.6 SITE CONDITIONS
 - 1.6.1 Check dimensions and on-site measure before fabrication commences, and report to Architect or owner in writing all discrepancies.
 - 1.6.2 Where dimensions are not available before fabrication is commenced, the dimension required to be agreed upon between the various Sections concerned.

- 1.7 SITE MOCKUP
 - 1.7.1 Prior to performing work of this Section, subcontractor executing work of this Section shall install one (1) fabric shade type window covering, complete with all attachments and accessories. Adjust site mockup as required to gain approval of Consultant.
 - 1.7.2 Maintain site mockup on Site until directed by the Consultant/Tenant to remove. Site mockup maybe incorporated into the work of this Section if so approved by the Consultant.
 - 1.7.3 Upon completion and approval, site mockup shall serve as a standard of quality for the balance of the work of this Section. Subsequent work of this Section carried out and not in the Consultant's opinion, equal to the quality standard established by the site mockup, shall be removed and replaced at no additional cost to the Owner.

- 1.8 WARRANTY
 - 1.8.1 Provide an extended warranty certificate of the work of this Section, covering the period for five (5) years beyond the expiration of the one year warranty period specified in the General Conditions of the Contract as amended by Document 00 80 00: Supplementary Conditions or Part 2 under General Requirements section 2.18

Total warranty of five (5) years (Labour and Parts).
Plus ten (10) year no nonsense manufacturer's warranty.
 - 1.8.2 Promptly correct, at no expense to the Owner, any defects or deficiencies which become apparent within Warranty Period from date of Substantial Performance.
 - 1.8.3 Warranty certificate shall provide for steadfastness of dye colours, fade-proof fabric, free from deterioration in any fashion due to exposure to sunlight, to be permanently flame-retardant, shrink and complete replacement cost including removal of existing system material and installation of new materials.

- 1.9 MAINTENANCE
 - 1.9.1 Submit maintenance and operating instructions, detailing the care, maintenance and cleaning of

fabric.

1.10 ALTERNATES

1.10.1 Bidder must provide bid on specified items.

1.10.2 Bidder providing or requesting consideration of alternate products shall be fully liable for all costs attributable to acceptance of the change from the architects, engineers; general contractors and subcontractors effected by the charge. Further, bidder shall clearly indicate reasons for the consideration of the alternate product. Such description shall include, but not be limited to cost; performance; construction; installation and operation; advantages of the proposed alternate system.

1.10.3 Alternate product requests must be applied for 14 days prior to bid closing.

PART 2 - PRODUCTS

2.1 WINDOW SHADES SYSEMS

2.1.1 Models:

SunProject Model - Lite-Lift Cassette Roller System
Solarfective Model - Teleshade System
Hunter Douglas Model - Roller Shades FR
Mechoshade by MechoShade Systems Inc.
Equal or better approved by Consultant or Owner

2.2 MANUFACTURER

2.2.1 To establish a standard of quality, design and function desired, drawings and product specifications are based on;

- .1 Solarfective Products Ltd. Toronto, Ontario, Canada. 416-421-3800
- .2 Sunproject of Canada. Concord, Ontario, Canada. 905-660-3117
- .3 Hunter Douglas Contract Window Coverings Inc. Brampton, ON, Canada. 905-796-5540
- .4 Other manufacturers approved by Consultant or Owner.

2.3 OPERATION

2.3.1 Effortless, easy-lift manual chain drive. Shade to be able to move freely when pulled on hembar or chain. The unit shall consist of a tension activated lifting mechanism utilizing a multi-layer concentric coil spring system. The lifting mechanism must contain a memory lock which shall maintain pre-tensioning when the shade is removed from the cassette bracket, and shall not require re-tensioning when shade is re-inserted into the bracket. The multilayer coil spring mechanism must be free-floating along a grooved non-corrosive shaft and must be reversible for future alterations and maintenance on site.

2.3.2 Internal tension idler (I.T.I) limiter automatically adjusts and controls the amount of torque being generated for constant smooth operation of the shade system. The (I.T.I.) automatically releases during down-travel, and automatically engage during up-travel of the shade system.

2.3.3 Lifting mechanism must accommodate tension modules-(type D) for maximum shade performance when necessary. The tension modules must also contain a memory lock for torque retention.

- 2.3.4 Noise reduction seals must be used for sound isolation and absorption of the mechanism.
- 2.3.5 Drive sprocket must contain a planetary gear system for increased operational performance, speed ratio control, smoothness of lift, and balance to the chain and shade system.
- 2.4 ASSEMBLY
- 2.4.1 Shade unit shall be supplied to site fully assembled in a one piece fully extruded aluminum cassette closed on two sides, top and bottom return with plastic injected-molded end caps.
- Mounting detail: A) Ceiling mounted
 B) Face/Wall mounted on mullion recessed above the ceiling snap in mount.
- Shade Orientation: A) Regular-roll, shadecloth to roll at window side of roller.
 B) Reverse-roll, shadecloth to roll at room side of roller.
- Removal must not require the disassembly of the shade unit.
- 2.5 SHADE ROLLER TUBE
- 2.5.1 Rigid roller tubes shall be all aluminum extruded available in 32mm, or 50mm with reinforced internal ribs to provide maximum span without tube deflection. Tube sizes will depend on shade size – see weights and measures chart.
- 2.6 TUBE END PLUG
- 2.6.1 Internal tension idler (I.T.I.) limiter automatically adjusts and controls the amount of torque being generated for constant smooth operation of the shade system. The (I.T.I.) must automatically release during down-travel, and automatically engage during up-travel of the shade system.
- 2.7 CHAIN DRIVE
- 2.7.1 Shall consist of a heavy duty commercial grade sprocket. Drive sprocket must contain a planetary gear system for increased performance, speed ratio, smoothness, and balance to the chain and shade system. Must provide for infinite positioning of shade system.
- 2.8 OPERATING CHAIN
- 2.8.1 Shall be No. 10 qualified heavy duty bead chain 90 lb load test formed in a continuous loop. With stops at highest and lowest positions to prevent overwinding and unrolling.
- 2.9 EXTERIOR OVAL HEMBAR
- 2.9.1 Shall be tubular extruded aluminum with recess to secure fabric without visible seams. End plugs shall be screwed securely on ends showing no exposed aluminum. Design allowing shade to be pulled on the hembar or chain. Finish/colour shall match fascia.
- 2.10 CHAIN HOLD DOWN
- 2.10.1 Operating chain shall be fully secured to SP chain holder.
- 2.10.2 Supply and install chain retainer with bracket.

2.11 MOUNTING BRACKETS

2.11.1 Shall be 0.60 galvanized steel snap on brackets for ceiling, wall, or recessed mount in ceiling.

2.12 CASSETTE BOX

2.12.1 Cassette design shall be a one piece aluminum extruded box closed on two face and bottom return or all three sides if surface mounted. Cassette sections to be 55mm, 73mm or 110mm in square profile or 110mm in radius face profile. Cassette section with internal groove to accommodate a self cleaning brush to insure fabric maintenance as well as a gap brush on top back side of cassette to provide for a light seal. Wall thickness to be 1.52. Cassette end caps shall be 2mm delrin plastic with four countersunk flat headed screw holes.

2.12.2 Finish clear anodized or custom painted in colour selected by Consultant or Owner.

2.13 FABRICS

2.13.1 Construction of shadeband includes the fabric, the external bottom bar, and the attachment of the shadeband to the roller tube:

Fabric shade cloths shall be woven of .018, vinyl coated polyester yarn consisting of single thickness non-raveling 0.030-inch thick vinyl fabric, comprising of 21 % polyester and 79% reinforced vinyl, the fabric shall be dimensionally stable. Colors selected from manufacturer's available range.

Linear Weave solarblock, 3% open, dense linear-weave pattern. Abrasion resistance and U.V. Deterioration resistance.

2.14 SOLARSCREEN / MULTICOLOR SHADING FABRIC

2.14.1 Approximate

Openness Factor	3%
Weight/sq. mt.	505 g/mt or 21 oz.
Tensile strength 1lb.... (1in. strip)	
Warp	315
Fill	270

Stretch (271 lb. Wt.)	
Warp	26%
Fill	22%
Set% Warp	0.5 to 1.5%
Fill	0.5 to 1.5%

Abrasive resistance (500 Taber cycles)	
Yarn rupture	None
Wear	Trace
U.V. Deterioration	
Fade	None
Tensile Retention	96%

2.15 FLAME RETARDANCE

2.15.1 Fabric shall be certified by independent laboratory to pass the small scale vertical burn

requirements test CAN/ULC S109 and NFPA 701.

2.16 FABRICATION

- 2.16.1 Prior to fabrication, the actual dimensions of openings must be verified by accurate site measurements taken by the fabricator himself.
- 2.16.2 Fabricate fabric shades to completely fill the openings from head to sill and from jamb to jamb, excluding fabrication and installation clearances.
- 2.16.3 Install hem bars at bottoms of fabric shades, providing double thickness of shade fabric on room side and securely sew-in hem bar, with continuous hem just above hem bar and at both ends of hem bar.
- 2.16.4 Securely install fabric shades in roller tubes "keyway" channels with shade mounting splines.
- 2.16.5 Fabricate aluminum fascia/soffits and custom trims of single length piece to suit location of each fabric shade, free of splices or joints.
- 2.16.6 For multiple window installations, fabricate fabric shades so that the ends occur only over mullions or over defined vertical separations.
- 2.16.7 Fabricate fabric shades for full operation.
- 2.16.8 Hand manual chain operators in suitable positions for each room, confirmed by the Consultant and Owner/Tenant.
- 2.16.9 Manual Operation:
 - .1 Fabric shades shall be operated by chain and sprocket assembly incorporating an adjustable slip clutch to control the rate of fall, from free running to zero friction factor, to 100% friction factor.
 - .2 Fabric shades shall be adjustable to stop and hold at an infinite number of positions, to be adjustable at any percentage of friction and to control the fall rate of the fabric shades.
 - .3 When position of fabric shades are set as free fall, system shall be mechanical by use of chain retainer.
 - .4 Highest and lowest fabric shade position shall have automatic stops to prevent overwinding or unrolling.

2.17 FINISHES

- 2.17.1 Aluminum Fascia/Soffits and Custom Trims:
 - .1 Ultra-violet light resistant polyester powder coating finish in colours to match adjacent aluminum framing finish colour.
 - .2 Protect finish with strippable protective film.
- 2.17.2 Mounting brackets/clips shall have painted finish, with colour, gloss and sheen to match baked enamel finish.
- 2.17.3 Isolate where necessary to prevent electrolysis due to dissimilar metal-to-metal contact or metal-to-masonry and concrete contact. Use butyl tape or other approved divorcing material.

PART 3 - EXECUTION

3.1 EXAMINATION

3.1.1 Examine substrate and conditions for installation. Notify the Architect or Owner in writing prior to installation when the project conditions are unacceptable for shade installation. "Beginning of installation" means acceptance of substrate and project condition. Contractor to verify all measurements, do not scale drawings.

3.2 REMOVAL OF EXISTING DRAPES

3.2.1 Remove all existing drapes and tracks and dispose away from the site.

3.3 INSTALLATION

3.3.1 Install units to comply with the Manufacturer's instructions for the type of mounting and operation required. Provide units plumb, true, and securely anchored in place with recommended hardware and accessories to provide smooth operation without binding.

3.3.2 Install units within the following tolerances:

- .1 Maximum variation of gap at window opening perimeter: ¼ inch, per 8 feet (+/- 1/8 inch) of shade height.
- .2 Maximum offset from level: 1/8 inch.
- .3 Follow Manufacturer's edge-clearance specifications for shades where the width-to-height (W:H) ratio exceeds 1:3.
- .4 Locate equipment, controls, switches in locations shown, or if not shown, as directed by Consultant or Owner.

3.4 ADJUSTING

3.4.1 Adjust units for smooth operation. Adjust shade and shadecloth to hang flat without buckling or distortion. Replace any units or components which do not hang properly or operate smoothly.

3.5 CLEANING

3.5.1 Touch up damaged finishes and repair minor damage in order to eliminate evidence of repair. Remove and replace work that cannot be satisfactorily repaired.

3.5.2 Clean exposed surfaces, including metal and shadecloth, using non-abrasive materials and methods recommended by the Shadecloth Manufacturer. Remove and replace work which cannot be satisfactorily cleaned.

3.6 DEMONSTRATION

3.6.1 Demonstrate operation method and instruct Owner's personnel in the proper operation and maintenance of the window shade systems and provide all instructions.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

1.1.1 General Conditions, Supplementary Conditions and Division 01 apply to this section.

1.2 SUMMARY

1.2.1 This Section includes requirements for supply and installation of quartz surfacing on top of millwork, ready to accept under mount sinks indicated on Mechanical Drawings.

1.3 RELATED REQUIREMENTS

1.3.1 Section 05 99 90: Miscellaneous Metals

1.3.2 Section 06 10 00: Rough Carpentry

1.3.3 Section 06 20 00: Finish Carpentry

1.3.4 Section 07 92 00: Caulking and Sealants

1.3.5 Section 22 42 00: Commercial Plumbing Fixtures

1.4 REFERENCES

1.4.1 American Society for Testing of Materials (ASTM):

.1 ASTM C615/C615M 11, Standard Specification for Granite Dimension Stone

1.5 SUBMITTALS

1.5.1 Provide product information in accordance with Section 01 33 00 Submittals.

1.5.2 Action Submittals: Provide the following samples before starting any work:

.1 Product Data: Indicate product description, fabrication information, and compliance with specified performance requirements.

.2 Shop Drawings: Submit shop drawings indicating dimensions, component sizes, fabrication details, attachment provisions and coordination requirements with adjacent work.

.3 Samples for Initial Selection: Submit minimum 305mm x 305mm (12" x 12") samples. Indicate full colour and pattern variation.

.4 Consultant recognizes that stone is a natural material, and that variations in tone and hue are normal to this material; however, countertops will be rejected at site if finish, texture colour and hue are outside of a reasonable range of variation based on the submitted samples.

1.5.3 Project Closeout Submissions:

.1 Operation and Maintenance Data: Submit manufacturers care and maintenance data, including repair and cleaning instructions in accordance with Section 01 33 00 Submittals: Operations and Maintenance Data.

1.6 QUALITY ASSURANCE

1.6.1 Qualifications: Provide proof of qualifications when requested by Consultant:

- .1 Fabricator: Use a fabricator having a minimum of three (3) years experience in fabrication and installation of stone countertops and have training and certification from the manufacturer for work of similar scope and complexity as that required for the project.
- .2 Installer: Install using personnel experienced in installation decorative stone countertops of similar design and complexity as that required for this Project.

1.7 DELIVERY, STORAGE AND HANDLING

1.7.1 Delivery and Acceptance Requirements: Deliver components to project when areas are ready for installation.

- .1 Transport stone countertops with care, securely anchored to pallet, to prevent damage to materials or finishes.
- .2 Transport stone countertops to the site after completion of adjacent construction that could damage materials of this Section.

1.7.2 Storage and Handling Requirements:

- .1 Store stone countertops indoors in an area adjacent to installation. Store away from direct exposure to sunlight, and between 25°F and 130°F (-4°C and 54°C)
- .2 Block off floor.
- .3 Tilt slightly and secure to prevent falling over, with finished face turned toward finished face.
- .4 Protect and wrap to prevent abuse, damage, warpage or soiling.

1.8 SITE CONDITIONS

1.8.1 Site Measurements: Verify dimensions by site measurements before fabrication and indicate measurements on shop drawings where stone countertops are indicated to fit between or around other construction; coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.8.2 Established Dimensions: Establish dimensions and proceed with fabricating stone countertops without site measurements where site measurements cannot be made without delaying the Work; coordinate construction to ensure that actual site dimensions correspond to established dimensions; allow for trimming and fitting.

1.9 WARRANTY

1.9.1 Provide manufacturer's commercial 10 year warranty against product defects when fabricated and installed by a certified fabricator.

PART 2 - PRODUCTS

2.1 COUNTERTOP MATERIALS

2.1.1 Provide Grade 1 stone only; seconds material will not be acceptable, sealed in accordance with manufacturer's standard to prevent staining and discoloration, and as follows:

- .1 Quartz countertop: crushed quartz aggregate combined with resins and pigments, fabricated into slabs under a vacuum vibro-compaction process.
- .2 Accepted Manufacturer: Corian Quartz Surfacing by Corian, or approved equivalent.
- .3 Colour: Calacatta Medallion (For Male & Female Washroom and Lunch Room)
- .4 Finish: Polished
- .5 Thickness: 20mm (3/4")
- .6 Edge Profile: Refer to Drawings

2.2 COUNTERTOP SUPPORT MATERIALS

- 2.2.1 Steel Support Framing: Refer to Section 05 50 00, fabricate steel support framing to support weight of stone materials and to account for cut outs and openings required for installation.
- 2.2.2 Wood Core: Fabricate countertop core from shop sanded exterior grade veneer core plywood.
- 2.2.3 Shims: Fabricator's standard shim materials to fully support stone slab on wood core to provide flat and level installation that does not transfer stresses that could cause cracking in stone slab.
- 2.2.4 Fasteners: As recommended by manufacturer and as follows:
 - .1 Draw Bolt Fasteners: Mitre butt joint fastener, adjustable and requiring no special tools for installation, galvanized.
 - .2 Non-Exposed Fasteners: Fabricators choice consistent with quality level specified; exposed fasteners will not be permitted.

2.3 ACCESSORIES

- 2.3.1 Joint Adhesive: Manufacturers recommended adhesive designed to create chemically bonded, inconspicuous, nonporous joints. Adhesive that will be visible in the finished work to be tinted to match the quartz surfacing.
- 2.3.2 Sealant: Manufacturer's recommended mildew resistant, clear silicone joint sealant.
- 2.3.3 Stone Sealer: Clear penetrating sealer as recommended by manufacturer having zero Volatile Organic Compounds (VOC).
- 2.3.4 Cleaner: Type recommended by manufacturer.

2.4 FABRICATION

- 2.4.1 Fabricate units to maximum size capable of being safely transported and handled to place of final installation in accordance with shop drawing and manufacturers written instructions using a fabricator certified by the manufacturer.
- 2.4.2 Fabricate and machine shapes to profiles indicated on Drawings; obtain all dimensions affecting fabrication and installation from job site before starting fabrication.
- 2.4.3 Cut, drill and shape fabrications as required to receive plumbing fittings and services, and built-in accessories, provide edge treatments, back splashes, and other details as indicated on Drawings.
- 2.4.4 Finish edges and surfaces true, level and even with inconspicuous joints between having no voids formed using manufactures standard joint adhesive and reinforcing strips.
- 2.4.5 Make cut outs with 10mm (3/8") radius corners to prevent stress cracking.

- 2.4.6 Fabrication assemblies with tolerances as follows:
 - .1 Variation in component size: + 3mm (1/8").
 - .2 Location of openings: + 3mm (1/8") from indicated location.
- 2.4.7 Match numbered components assembled on site; number items to show proper location on site; number on back using material that will not show or telegraph through finished assemblies.
- 2.4.8 Materials used throughout the project shall be from the same batch and bear labels with the same batch numbers. Visually inspect materials to be used for adjacent panels to ensure acceptable colour match.
- 2.4.9 Provide anchorage to receive Work of other Sections scheduled and detailed to be installed.

PART 3 - EXECUTION

3.1 EXAMINATION

- 3.1.1 Examine substrates, areas, and conditions where installations of stone countertops occur, with Installer present, for compliance with manufacturers requirements. Verify that substrates and conditions are satisfactory for installation and comply with requirements specified.
 - .1 Carefully inspect the backup structure and millwork to verify that it is ready to accept the work of this Section. Substrates supporting quartz surfaces shall be plumb, level, and flat to within 1/16" in 10 feet (1.6mm in 3000mm).
 - .2 Verify all anchors, seats, connections attached to miscellaneous metal supports properly and securely fastened in correct locations.
 - .3 Verify access to point of installation for each stone unit.

3.2 INSTALLATION

- 3.2.1 Seal stone materials before shipping to site.
- 3.2.2 Support stone countertops evenly to prevent stress fractures.
- 3.2.3 Apply a thin bead of adhesive to top edges of base cabinet and set stone on top, square to face of cabinet work; cut out openings to match fixtures required and remove from countertops after final set of adhesive.
- 3.2.4 Secure and tighten connections with equal torque to prevent stress fractures after stone units are properly aligned, vertically and horizontally with each other and with other related building components.
- 3.2.5 Seal joints between countertops and adjacent materials, and between abutting countertops with silicone sealant. Joints shall be flush, tight fitting, and level with quartz surfacing.
- 3.2.6 Adhere under mount sinks to countertops using manufacturer's recommended adhesive and mounting hardware.
- 3.2.7 Install backsplashes and end splashes as indicated on Drawings; adhere to countertops using manufacturer's standard colour matched silicone sealant.
- 3.2.8 Coordinate plumbing connections and electrical requirements with affected Sections of work.

3.3 CLEANING AND PROTECTION

- 3.3.1 Keep components and hands clean during installation; remove adhesives, sealants and other stains as work progresses; keep components clean until Substantial Performance for the Project.
- 3.3.2 Demonstration: Inform Owner of cleaning techniques and required cleansing materials.
- 3.3.3 Repair or replace damaged work that cannot be repaired to match installed work at no additional cost to the Owner.
- 3.3.4 Protect quartz surfaces and corners liable to damage with wood blocking, sacking, or other means, to prevent damage and chipping of installed countertops until Substantial Performance of the Project.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.1.1 General Conditions, Supplementary Conditions and Division 01 apply to this section.

1.2 SUMMARY

1.2.1 This Section includes requirements for supply and installation of solid surface countertops on top of millwork, ready to accept under mount sinks indicated on Mechanical Drawings.

1.3 RELATED REQUIREMENTS

1.3.1 Section 05 99 90 Miscellaneous Metals

1.3.2 Section 06 10 00 Rough Carpentry

1.3.3 Section 06 20 00 Finish Carpentry

1.3.4 Section 07 90 00 Caulking and Sealants

1.3.5 Section 09 30 00 Porcelain and Ceramic Tile

1.4 REFERENCE STANDARDS

1.4.1 American Society for Testing of Materials (ASTM):

.1	ANSI/NPA A208.2-09	Medium Density Fiberboard (MDF) for Interior Application.
.2	ASTM C920-14a	Standard Specification for Elastomeric Joint Sealants.
.3	ASTM D638-10	Standard Test Method for Tensile Properties of Plastics.
.4	ASTM D785-08	Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials.
.5	ASTM D790-10	Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
.6	ASTM D5420-10	Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker, Impacted by a Falling Weight (Gardner Impact)
.7	ASTM E84-14	Standard Test Method for Surface Burning Characteristics of Building Materials.
.8	ASTM E228-11	Standard Test Method for Linear Thermal Expansion of Solid Materials with a Push-Rod Dilatometer.
.9	ASTM G21-13	Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
.10	ASTM G22-76(96)	Standard Practice for Determining Resistance of Plastics to Bacteria.
.11	ASTM G155-13	Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials.
.12	CSA B45.5-11/ IAPMO Z124-2011	Plastic Plumbing Fixtures.
.13	CSA O115-M82	Hardwood and Decorative Plywood.
.14	NFPA 255-06	Standard Method of Test of Surface Burning Characteristics of Building Materials.

.15	NSF/ANSI 51-07	Food Equipment Materials.
.16	SCAQMD Rule 1168	Adhesive and Sealant Applications (amended January 2005)
.17	CAN/ULC-S102-07	Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
.18	UL 723	Standard for Test for Surface Burning Characteristics of Building Materials.
.19	UL Environment/ GREENGUARD – UL 2818	Standard for Chemical Emission for Building Materials, Finishes and Furnishings, Section 7.1.
.20	UL Environment/ GREENGUARD – UL 2818	Gold Standard for Chemical Emission for Building Materials, Finishes and Furnishings, Section 7.1 and 7.2.
.21	UL 2824	GREENGUARD Certification Program, Method for Measuring Microbial Resistance from Various Sources Using Static Environmental Chambers.

1.5 DEFINITION

1.5.1 Solid surface is defined as nonporous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment.

1.6 SUBMITTALS

1.6.1 Provide product information in accordance with Section 01 33 00 Submittals.

1.6.2 Action Submittals: Provide the following samples before starting any work:

- .1 Product Data: Indicate product description, fabrication information, and compliance with specified performance requirements.
- .2 Shop Drawings: Submit shop drawings indicating dimensions, component sizes, fabrication details, attachment provisions and coordination requirements with adjacent work.
- .3 Samples for Initial Selection: Submit minimum 100 mm x 100 mm samples. Indicate full colour and pattern variation.
- .4 Samples for Verification: Submit minimum 305 mm x 305 mm sample for each type, texture, pattern and colour of solid polymer.
- .5 Maintenance Data: Submit manufacturers care and maintenance data, including care, repair and cleaning instructions. Include in Project closeout documents.

1.6.3 Informational Submittals: Provide the following submittals during the course of the work:

- .1 Coordination Drawings: Submit coordination drawings indicating layout of plumbing and electrical work, steel reinforcing, recessed and built-in items and wall blocking information.
- .2 Fire-Test-Response Characteristics: Provide original fire test reports to ensure compliance with the following requirements:
 - .1 Rate of Burning: ASTM D635 Class: CC1 for a nominal thickness of 1.5 mm (0.060 in.)
 - .2 Self-Ignition Temperature: ASTM D1929: greater than 650 deg F
 - .3 Density of Smoke: ASTM D2843: Less than 75%
- .3 Impact Resistance: Provide Solid Polymer Fabrications that comply with the following requirements:

- .1 Impact Strength, Un-notched (23 deg), ASTM D4812: No breakage.
 - .2 Impact Strength, Notched (23 deg), ASTM D526: 88J/m (1/16)

 - .4 Allowable Tolerances: Maximum deflection: 2 mm over 305 mm.
- 1.6.4 Project Closeout Submissions:
- .1 Operation and Maintenance Data: Submit manufacturers care and maintenance data, including repair and cleaning instructions in accordance with Section 01 33 00
Submittals: Operations and Maintenance Data.
- 1.7 QUALITY ASSURANCE
- 1.7.1 Qualifications: Provide proof of qualifications when requested by Consultant:
- .1 Fabricator: Use a fabricator having a minimum of three (3) years experience in fabrication and installation of solid surface materials and have training and certification from the manufacturer for work of similar scope and complexity as that required for the project.
- 1.8 DELIVERY, STORAGE AND HANDLING
- .1 Delivery and Acceptance Requirements: Deliver components to project when areas are ready for installation.
 - .2 Storage and Handling Requirements: Store components indoors in heated conditions similar to the area of installation until ready for installation; handle materials to prevent damage to finished surfaces; provide protective coverings to prevent physical damage or staining following installation until just prior to Substantial Performance for the Project.
- 1.9 SITE CONDITIONS
- 1.9.1 Environmental Limitations: Do not install Solid Polymer Fabrications until spaces are enclosed and weatherproof, and ambient temperatures and humidity conditions are maintained at the levels recommended by manufacturer.
- 1.10 WARRANTY
- 1.10.1 Manufacturer Warranty: Provide manufacturer's standard 10 year warranty against defects in materials and workmanship; including material and labour to repair or replace defective materials.

PART 2 - PRODUCTS

- 2.1 MANUFACTURERS
- 2.1.1 Basis-of-Design products are named in this Section; additional manufacturers offering similar setting systems may be incorporated into the work provided they meet the performance and aesthetic requirements established by the named products.
- 2.1.2 Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- .1 Corian
 - .2 Dupont
 - .3 Formica
 - .4 Hanex

2.2 MATERIALS

2.2.1 Solid Surfacing Sheet: Cast, nonporous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminium trihydrate filler and pigment; not coated, laminated or of composite construction; meeting the following criteria:

- .1 Thickness: ½" (13 mm)
- .2 Surface Burning Characteristics: in accordance with CAN/ULC S102 and as follows:
 - .1 Flame Spread: Maximum 25
 - .2 Smoke Developed: Maximum 450
- .3 Pattern and Colour: As approved by client.
 - Corian - Silver Grey (Reception Millwork - Colour-01)
 - Corian - Lava Rock (Reception Millwork - Colour-02)
 - Corian - Lava Rock (Window Sill)

2.3 ACCESSORIES

2.3.1 Joint Adhesive: Manufacturers recommended adhesive designed to create chemically bonded, inconspicuous, nonporous joints.

2.3.2 Sealant: Mildew resistant, silicone sealant, as specified in Section 07 90 00. Colour: As selected by the Consultant from the manufacturers standard product line.

2.4 FABRICATION

2.4.1 Fabricate units to maximum size capable safely transported and handled to place of final installation in accordance with shop drawing and manufacturers written instructions using a fabricator certified by the manufacturer.

2.4.2 Fabricate and machine shapes to profiles indicated on Drawings; obtain all dimensions affecting fabrication and installation from job site before starting fabrication.

2.4.3 Cut, drill and shape fabrications as required to receive plumbing fittings and services, and built-in accessories

2.4.4 Finish edges and surfaces true, level and even with inconspicuous joints between having no voids formed using manufacture's standard joint adhesive and reinforcing strips.

2.4.5 Make cut outs with 3 mm radius corners to prevent stress cracking.

2.4.6 Fabrication assemblies with tolerances as follows:

- .1 Variation in component size: + 3 mm.
- .2 Location of openings: + 3 mm from indicated location.

2.4.7 Match numbered components assembled on site; number items to show proper location on site; number on back using material that will not show or telegraph through finished assemblies.

2.4.8 Provide anchorage to receive Work of other Sections scheduled and detailed to be installed.

2.5 MISCELLANEOUS MATERIALS

2.5.1 Cleaner: Type recommended by manufacturer.

- 2.5.2 Fasteners: Use stainless steel fasteners designed specifically for plastics. Self-threading screws are acceptable for permanent installations. Provide threaded metal inserts for applications requiring frequent disassembly such as light fixtures. Use threaded rods and bolts to suit application.

PART 3 - EXECUTION

3.1 EXAMINATION

- 3.1.1 Examine substrates, areas, and conditions where installations of solid surface materials occur, with Installer present, for compliance with manufacturers requirements. Verify that substrates and conditions are satisfactory for installation and comply with requirements specified.

3.2 INSTALLATION

- 3.2.1 Install components plumb and level, in accordance with shop drawings and manufacturers written installation requirements.
- 3.2.2 Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work.
- 3.2.3 Adhere under mount sinks to countertops using manufacturer's recommended adhesive and mounting hardware.
- 3.2.4 Adhere top mount sinks to countertops using manufacturer's recommended adhesives and colour matched silicone sealant.
- 3.2.5 Install backsplashes and end splashes as indicated on Drawings; adhere to countertops using manufacturer's standard colour matched silicone sealant.
- 3.2.6 Coordinate plumbing connections and electrical requirements with affected Sections of work.

3.3 CLEANING AND PROTECTION

- 3.3.1 Keep components and hands clean during installation; remove adhesives, sealants and other stains as work progresses; keep components clean until Substantial Performance for the Project.
- 3.3.2 Repair or replace damaged work that cannot be repaired to match installed work at no additional cost to the Owner.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

1.1.1 Comply with Division 1, General Requirements and all documents referred to therein.

1.1.2 Provide labour, materials, products, equipment and services to complete the traffic, parking and pavement marking work.

1.2 REFERENCE DOCUMENT

1.2.1 CAN/CGSB 1.74-2001 Alkyd Traffic Paint.

1.3 SUBMITTALS

1.3.1 Submit two 1 litre (1 qt.) samples of each type of paint.

1.3.2 Clearly mark samples with name of Project and its location, paint manufacturer's name and address, name of paint, CGSB standard number, formulation number and batch number.

1.4 QUALITY ASSURANCE - QUALIFICATIONS

1.4.1 Work of this Section shall be performed by a company specializing in the type of work specified.

1.5 SITE CONDITIONS

1.5.1 Do not apply markings at ambient and surface temperatures below 10°C.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 Paint: CAN/CGSB 1.74, abrasion resistive traffic paint, colour (white / yellow) to match with existing.

2.1.2 Thinner: To CAN/CGSB-1.5.

PART 3 - EXECUTION

3.1 APPLICATION

3.1.1 Ensure that substrates are properly cured and thoroughly cleaned before markings are applied.

3.1.2 Ensure surfaces are free from water, frost, ice, dust, oil, grease and other foreign materials.

3.1.3 Ensure that surfaces to receive line marking paint which are also to receive sealer have been sealed first, that sealer is dry and cured, and that paint is compatible with sealer.

3.1.4 Lay out traffic, parking and pavement markings including graphic symbols and curbs as indicated on the Drawings. Use standard graphic symbol for areas reserved for disabled persons.

3.1.5 Use approved pressure type paint applicator capable of applying paint in width required, that will ensure uniform application and a positive means of shut-off.

- 3.1.6 Apply sufficient number of coats by brush or marking machine until a uniform colour and density is obtained. Coverage shall not exceed 3 sq.m/L (150 sq.ft./gal).
- 3.1.7 Do not use spray application unless written approval has been obtained. Where spray application is permitted provide adequate shielding or masking.
- 3.1.8 Lines and markings shall have neat, straight and clean edges. Lines shall have edges parallel. Refinish ragged edges or lines incorrectly laid out. Remove incorrect lines. Make inconspicuous.
- 3.1.9 Make lines 100 mm (4") wide unless otherwise indicated. Arrows and other graphics as detailed. Pavement messages: Font type - Helvetica, thickness

| 3.2 PROTECTION OF APPLIED WORK

- 3.2.1 Protect pavement markings until cured.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS:

1.1.2 This section specifies, rough grading, fine grading & finish grading.

1.1.3 All depths of materials indicated on the drawings and in these specifications refer to minimum required depth of materials, after compacting.

1.2 REFERENCES

1.2.2 CSA Z614-14 Children's Playspaces and Equipment.

1.2.3 OPSS 1010 Material Specification for Aggregates-base, Subbase, Select Subgrade, and Backfill Material.

1.2.4 OPSS 1004 Material Specification for Aggregates-Miscellaneous.

1.3 TESTS AND INSPECTIONS:

1.3.2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit in a timely fashion and in an organized and orderly manner as to not cause delay in the Work. Testing to be at the Contractors expense.

1.4 PROTECTION:

1.4.2 Protect site features required to remain undisturbed; man-made and natural.

1.4.3 Protect existing trees to satisfaction of municipality.

1.4.4 Protect buried services that are required to remain undisturbed.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 Designation OPSS refers to Ontario Provincial Standard Specifications.

2.2.1 Granular A to OPSS 1010 & TS 1010 and TS 1010

2.2.2 Sand to OPSS 1004 (may be referred to as Concrete Sand) unless specified to be Hutcheson Sand of which the contractor must follow manufacturers recommendations and CSA Z614 Table D.1

2.2.3 Durolawn Base Recipe: 70% ¾"-1 ½" Crushed Clear Stone, 25% Clay Loam (consisting of: gravel <5%, sand 25-30%, silt 20-40%, clay 25-40%), 5% Organic Mater

2.2.4 Limestone Screenings may not be washed and must consist of fines.

2.2.5 Engineered Wood Fibre to conform to manufacturers installation procedures and CSA Z614 Table D.1

2.2.6 Shredded Cedar Mulch to be red or white cedar shredded in strands with no chips larger than 50mm

- 2.2.7 Topsoil to be approx 50% sand with silt clay mixture between 30-40% and organic mater not exceeding 10% and may be subject to review by Consultant.
- 2.2.8 Unshrinkable Fill to TS 13.10
- 2.2.9 General fill material: clean, free from debris, organic matter, rocks larger than 75mm and other deleterious material.
- 2.2.10 Other Materials not specifically described but required for complete and proper installation, shall be selected by the Contractor and may be subject to review by the Consultant.

PART 3 - EXECUTION

3.1 ROUGH GRADING

- 3.1.1 Strip topsoil over areas where grade changes are required and stockpile in approved location. Do not handle topsoil in wet or frozen conditions.
- 3.1.2 Cut back areas to be lowered to the grades indicated on the drawings, allowing for placement of topsoil.
- 3.1.3 Where existing grades are to be raised, scarify existing grade to minimum 75mm supply and place fill material approved by the consultant or identified in the drawing in 150mm lifts and compact each lift to 95% Standard Proctor Dry Density.
- 3.1.4 Compact material to 90% Standard Proctor Dry Density under areas to be sodded or planted.

3.2 FINE GRADING

- 3.2.1 Perform all fine grading required to achieve finished elevations indicated on the drawings.
- 3.2.2 Tolerance for fine grade next to finished grade of plus or minus 50mm.
- 3.2.3 Regard all area's that pool water.

3.3 FINISH GRADING

- 3.3.1 Applies to aggregate paths, sod and seed areas, sand and mulch.
- 3.3.2 Ensure that finish grade slopes are met as indicated on the drawings.
- 3.3.3 Grade so that water will drain away from walls and paved areas, to catch basins and other area's as approved by Consultant.
- 3.3.4 Grade to be gradual between finished spot elevations.
- 3.3.5 Topsoil: roll to compact topsoil to 90% Standard Proctor Dry Density.
- 3.3.6 Engineered Wood Fibre to be installed as per manufacturers recommendations to a depth specified on the drawings, hand raked level and compacted.
- 3.3.7 Shredded Cedar Mulch to be installed to a depth specified on the drawings. Where shredded cedar mulch is being used as a walking/play surface the mulch must be compacted.

- 3.3.8 Where soft surfaces meet hard surfaces the contractor must compact the soft surface level with the hard surface to prevent ankle rolling.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL REQUIRMENTS

1.1.1 This section specifies the requirements for topsoil, hauling, spreading and fine grading.

1.1.2 General Conditions of the Contract shall apply as if repeated here.

1.2 RELATED WORK SPECIFIED ELSEWHERE

1.2.1 Durolawn Surfacing Section 32 18 00

1.2.2 Grading Section 32 22 00

1.2.3 Planting Section 32 90 00

1.2.4 Sodding Section 32 92 23

1.3 TESTING

1.3.1 Test stockpiled topsoil for N, P, K, Mg, soluble salt content, organic matter and pH value in place and other requirements as noted on the drawings prior to starting work on site.

1.3.2 Perform pH test to determine required lime treatment to bring pH value of soil within 5.5 to 7.5 level.

1.3.3 Submit two copies of soil analysis and recommendations for correction for review by the Landscape Architect.

1.3.4 Inspection and testing of topsoil will be carried out by testing laboratory designated by the Landscape Architect. Contractor to pay for cost of testing.

1.3.5 If required, adjust fertilizer requirements and other additives to conform to soil testing report recommendations.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 Topsoil: Friable natural loam, range 6.0 pH to 7.5 pH containing a minimum 4% organic matter, shall be free of stones, roots, lumps and other solid materials.

PART 3 - EXECUTION

3.1 TOPSOIL AND FINE GRADING

3.1.1 Submit topsoil testing analysis and recommendations to the Landscape Architect prior to hauling to and spreading topsoil on the work site. Failure to obtain topsoil samples and testing and submitting soil analysis report will delay commencement of work until reports are submitted and reviewed by the Landscape Architect. Provide proof that specified topsoil amendments were carried out.

3.1.2 Obtain approval by the Landscape Architect of prepared subgrades prior to hauling, placing and spreading of topsoil.

3.1.3 Topsoil obtained from designated stockpiles shall be amended by mechanical shredder; other

methods of blending shall be reviewed and approved only the Landscape Architect.

3.1.4 Spread topsoil to the following minimum depths (refer to Tender Proposal Form for extent of topsoil to be provided by the Landscape Contractor):

- .1 450-600mm for all shrub, tree and flower beds
- .2 150mm for all areas to be sodded; 150mm for all areas to be seeded
- .3 Depth indicated is compacted depth.
- .4 Spread topsoil on prepared subgrade of the work site.
- .5 Fine grade topsoil to produce a smooth even surface, free debris, sod, stones and roots over 25mm in diameter.
- .6 Compact to 85% Standard Proctor Density.
- .7 Meet and match all existing sodded areas, curbs, sidewalks, manholes and catchbasin frames, asphalt and other surface areas in a smooth, uniform line to the satisfaction of the Landscape Architect.

3.1.5 Prepare topsoil mix for planting beds as specified in Section 02 48 80.

3.1.6 Maintain all topsoil so that it is erosion free. Correct erosion as required.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

1.1.1 Comply with Division 1, General Requirements and all documents referred to therein.

1.2 RELATED WORK

1.2.1 Topsoil Supply and Fine Grading Section 32 22 00

1.3 SOURCES QUALITY CONTROL

1.3.1 Obtain the Consultant's approval of supplier of sod

1.3.2 If required by the Consultant, top soil shall be tested for including but not limited to the following; N, P, K, other minor element values, soluble salts contents, organic matter contents and pH value. Arrange for assume all costs for such testing. Testing shall be carried out by a reputable testing company as approved by the Consultant.

1.3.3 Submit soils analysis report to the Consultant prior to commencement of the work of this Section. When the source of such top soil is exhausted, top soil from new source shall not be used until it has been tested and approved by the Consultant.

1.4 DELIVERY AND STORAGE

1.4.1 Schedule delivery in order to keep storage on the job site to a minimum without causing delays.

1.4.2 Deliver, unload and store sod on pallets. Deliver sod to site within 24 hours of being lifted and lay sod within 36 hours of being lifted.

1.4.3 Do not deliver small, irregular or broken pieces of sod.

1.4.4 During dry weather protect sod from drying and water sod as necessary to ensure its vitality and prevent dropping of soil in handling. Sod which has dried out will be rejected.

1.5 SCHEDULING OF WORK

1.5.1 Schedule sod laying to coincide with topsoil operations.

1.6 ACCEPTANCE

1.6.1 Sodded areas will be accepted by the Consultant:

.1 Sod is properly established.

.2 Turf is free of dead spots and weeds.

.3 Sodded areas have been cut within 24 hours prior to acceptance inspection.

.4 Minimum of 30 days have elapsed following laying.

.5 A minimum of two cuts has taken place.

1.7 WARRANTY

- 1.7.1 Warrant the work of this Section against defects in materials and workmanship in accordance with the General Conditions for a period of one (1) year, and agree to promptly make good defects which become evident during the warranty period without cost to the Owner. Any sod which, during the warranty period, shows deterioration, bare spots or damage resulting from faulty materials and/or workmanship, shall be replaced at no cost to the Owner. Also, erosion occurring as a result of faulty workmanship and/or materials shall be repaired at no cost to the Owner.
- 1.7.2 During the warranty period, provide monthly inspections and replace all sod which is dead or is not in a vigorous growing condition.

PART 2 - PRODUCTS**2.1 MATERIALS**

- 2.1.1 Turf grass nursery sod: specially sown and cultivated in nursery fields in compliance with the specifications of the latest issue of the Nursery Sod Growers Association of Ontario (B) number one Kentucky Bluegrass-Fescue Sod.
- 2.1.2 Fertilizer shall be slow release, 10/20/20 commercial type fertilizer unless specified otherwise, containing not less than 60% urea-formaldehyde and the following percentages by weight;
- .1 Nitrogen: 10.
 - .2 Phosphoric Acid: 20.
 - .3 Potash: 20.
- 2.1.3 Sod Pegs: Sod pegs shall be solid hardwood type, 1" x 1" square x minimum 9" long, with pointed end at one end. Ensure that sod pegs are of sufficient length to ensure satisfactory anchorage of the sod.
- 2.1.4 Top Soil: Shall be friable, fertile natural loam, capable of sustaining vigorous plant growth, containing not less than 4% organic matter for clay loams and not less than 2% organic matter for sandy loams to a maximum 15%, free of subsoil contamination, free of roots and weeds, free of rocks and stones over 2" in diameter and having a pH ranging from 6.0 to 7.5.

PART 3 - EXECUTION**3.1 WORKMANSHIP**

- 3.1.1 Keep site well drained.
- 3.1.2 Clean up immediately any soil or debris spilled onto pavement and dispose of deleterious materials off the site.
- 3.1.3 Lay sod in areas as shown on the Drawings.

3.2 INSTALLATION OF TOP SOIL

- 3.2.1 Spread top soil during dry weather, over dry, unfrozen subgrade where sod is to be installed.

- 3.2.2 Fine grade top soil eliminating rough and low areas, and ensuring positive drainage.
- 3.2.3 Roll spread top soil with a roller to compact and retain surfaces. Finished depth of prepared top soil shall be minimum of 4". Keep top soil 1" below finished grade for sodded areas.
- 3.2.4 Ensure that finished top soil surface is smooth and firm against footprints, with a fine, loose texture before sod is installed.
- 3.2.5 Obtain approval of Consultant of the finished top soil surface prior to proceeding with installation of sod.
- 3.3 LAYING OF SOD
 - 3.3.1 Lay sod during growing season. Sodding at freezing temperatures or on frozen ground is not permitted.
 - 3.3.2 Sodding during dry weather is acceptable only if sufficient and continuous watering is assured.
 - 3.3.3 Where necessary, sod shall be pegged to assure non-slippage is obtained and shall be at no extra cost to the Owner.
 - 3.3.4 Obtain the approval of the Consultant of finished grade prior to beginning sodding.
 - 3.3.5 Lay sod even with adjoining areas. The rows shall have staggered joints. Butt sections closely without over-lapping or leaving gaps between sections. Cut out irregular or thin sections with a sharp tool.
 - 3.3.6 Provide close contact between sod and soil by means of light roller. Heavy rolling to correct irregularities in grade is not permitted.
 - 3.3.7 Water immediately after laying to obtain moisture penetration through sod into top 100mm of topsoil.
 - 3.3.8 Provide adequate protection of sodded areas against erosion and other damage. Remove this protection after sod has become established and if approved by the Consultant.
 - 3.3.9 As necessary, peg sod to prevent movement. When sod is established, drive pegs flush with sod.
- 3.4 MAINTENANCE
 - 3.4.1 Maintain sodded areas for a minimum of two (2) cuts following installation. Maintain at 75mm height.
 - 3.4.2 Water and apply fertilizer to sustain healthy growth and prevent deterioration.
 - 3.4.3 Remove silt traps installed around existing catch basins after completion of sodding work.

END OF SECTION

APPENDIX A



RE: GEOTECHNICAL INVESTIGATION
PROPOSED RENOVATION ANIMAL SERVICES CENTRE
735 CENTRAL PARKWAY WEST
MISSISSAUGA, ONTARIO

FOR: NGA Architects
220 Duncan Mill Road, Suite 319
Toronto, Ontario
M3B 3J5

ATTENTION: Mr. Amin M. Ali

REPORT NO.: 2023-18789R

DATE: October 30, 2023

DISTRIBUTION: 1 Copies: NGA Architects
PDF Copy: NGA Architects
- Mr. Amin M. Ali [aali@ngaa.ca]

Original: (File No. 11238-S0003-GEO)



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APPENDICES

APPENDIX A: Soil Chemical Testing Results

October 30, 2023

REPORT NO.: 2023-18789R

FILE NO.: 11238-S0003-GEO

1.0 INTRODUCTION

Sola Engineering Inc. (Sola) was retained by Mr. Amin M. Ali of NGA Architects on behalf of the City of Mississauga (herein “Client”) to carry out a geotechnical investigation for a proposed renovation at the animal services center at 735 Central Parkway West, Mississauga, Ontario (the subject sites or sites). Authorization to proceed with the investigation was received on September 5, 2023, through the acceptance of Sola’s Proposal No. 2023-3525 dated August 31, 2023.

As per the scope of services detailed in Sola’s proposal, the purpose of this investigation is to collect information on the soil and groundwater conditions at the subject site and, based on the investigation data, to provide recommendations to assist with the design of the proposed renovation for the animal services center.

This report presents the details of Sola’s fieldwork and laboratory testing, outlines the soil and groundwater conditions at the site, and provides comments on the aforementioned items.

In this report, standard site investigation procedures have been adopted. The procedures including those developed by the Ontario Building Code, Canadian Foundation Engineering Manual, Ontario Ministry of Transportation, and Toronto Transit Commission, are considered by far the most accepted methods by the geotechnical society for general engineering purposes. Soil Classification Systems used for developing this report have been in general conformance with those outlined in the above-mentioned procedures, with modifications where appropriate. Where in doubt, this office must be contacted for further interpretation or clarification.

This report has been prepared for the Client, and their nominated engineers and designers. Third-party use or reproduction, in part or in full, of this report, is prohibited without written authorization from Sola. This report is also subject to the Statement of Limitations which forms an integral part of this document.

2.0 SITE SETTING

2.1 SITE LOCATION, DESCRIPTION, AND PROPOSED DEVELOPMENT

The site is located 735 Central Parkway West, Mississauga, Ontario, and is currently occupied by Animal Services Centre which is bounded to the North, East and West by commercial properties, and to the south by the Central Parkway West.

The Client has provided a site plan with the proposed borehole locations.



2.2 PUBLISHED GEOLOGY

Based on a review of the existing geological publication for the site area, Ontario Geological Survey (OGS) Map P2204: *“Quaternary Geology, Toronto and Surrounding Area (Southern Ontario)”*, the site surrounding areas are underlain by Glacial Ice Deposits, comprising Young Till (clayey silt tills and sandy silt tills and interglacial deposits). According to the OGS Map M2544: *“Bedrock Geology of Ontario – Southern Ontario”*, the overburden is underlain by the bedrock of the Upper Ordovician Georgian Bay Formation; Blue Mountain Formation; Billings Formation; Collingwood Member; and Eastview Member, comprising Shale, Limestone, Dolostone, and Siltstone.

3.0 GROUND INVESTIGATION

3.1 FIELD INVESTIGATION

3.1.1 Soil Investigation

Prior to undertaking field drilling, Sola obtained clearances of existing public utility services for the site from all applicable agencies and companies. In addition, private utility locates were also carried out.

The geotechnical investigation was carried out on September 27, 2023, and comprised the advancement of two (2) boreholes (BH1 and BH2). The boreholes were advanced through the existing ground surface to depths of 2.3 m (BH1) and 3.1 m (BH2) below the ground surface, using a continuous auto-hammer drill rig equipped with solid stem augers and for split spoon sampling. The approximate locations of the boreholes are shown in **Enclosure 1**.

All drilling equipment was supplied and operated by Terra Firma Environmental Services Ltd, Ontario, and the drilling works were completed under the full-time supervision of a qualified Sola Technician.

Standard Penetration Tests (SPTs) split spoon samples were collected in the drilled boreholes using a 50 mm outer diameter and 35 mm inner diameter split barrel sampler driven with a 63.5 kg automatic hammer dropping 760 mm. All soil samples were logged in the field and returned to Sola’s laboratory in Vaughan for review and subsequent laboratory testing.

The logs of the boreholes completed are presented in **Enclosures 2 and 3**.



3.1.2 Groundwater Investigation

Groundwater level observations were made during the advancement of the boreholes and in the open boreholes upon completion of the drilling operations. Details of groundwater observations for the boreholes are presented on the borehole logs in **Enclosures 2 and 3**. Further discussion on groundwater is provided in **Section 4.2** of this report.

3.2 GEOTECHNICAL LABORATORY TESTING

All soil samples were submitted to Sola's laboratory for natural moisture content determination. The results of the moisture content tests are presented on the borehole logs on **Enclosures 2 and 3**. In addition, one (1) representable soil samples were submitted for testing of particle size distribution and hydrometer. The results of the laboratory tests are provided in **Enclosure 4**.

4.0 SUBSURFACE CONDITIONS

The detailed descriptions of the sub-soil conditions encountered at each borehole location are given in the Borehole Logs on **Enclosures 2 and 3**.

The borehole data collected by Sola only represents the subsurface conditions at the borehole locations. It should be pointed out that the material boundaries indicated on the Borehole Logs are approximate and based on visual observations and interpolation between successive samples. These boundaries typically represent a transition from one material type to another and should not be regarded as an exact plane of geological change. It should also be noted that the subsurface conditions may vary across the site.

A summary of the characteristics of each unit of subsoil encountered within the borehole depths is given in the following paragraphs.

4.1 SOIL CHARACTERISATION

4.1.1 Topsoil

A layer of topsoil with a thickness of approximately 50 mm was initially encountered in both boreholes. It is important to note that topsoil thicknesses may vary throughout the site area, depending upon their location. As such, these findings should not be relied upon for any estimation of topsoil quantities to be stripped prior to construction.

4.1.2 Fill Materials

Fill materials were encountered below the topsoil layer in both boreholes. The thicknesses of the fill materials in the borehole locations were approximately 0.7 m (BH2) and 0.8 m (BH1).



The fill materials consisted of sand and gravel which included trace rootlets. The fill was generally brown in colour. In-situ resistance testing results were from 15 (BH1) and 11 (BH2) blows per 300 mm of spoon penetration, indicating that the fill may not have been constructed under engineering control.

In the fill materials, the measured moisture contents of the samples recovered from the boreholes ranged from 6.5% (BH1) to 10.9% (BH1), indicating a moist condition.

4.1.3 Clayey Silt Till and Sandy Silt Till

A clayey silt deposit was encountered below the fill materials in borehole BH2 at depth of approximately 0.8 m and extended to a depth of 1.5 m below the ground surface. An SPT value of 24 blows was recorded in this deposit indicating a very stiff consistency. IN this borehole (BH2) the clayey silt till was found to be underlain by a basically granular (i.e., non cohesive) glacial deposit consisting of sandy silt till, extending from 1.5 m to 3.1 m (i.e., end of the borehole). Based on “N” values ranging from 49 blows per 300 mm to 50 blows per 30 mm, the relative density of this deposit is described as dense to very dense.

Owing to their mode of deposition the presence of cobbles and boulders should always be anticipated in the glacial till deposits.

In the glacial till deposits, the moisture content of the sample recovered from the boreholes ranged from 8.1% to 14.4%, indicating a moist condition.

4.1.4 Sandy Silt

In borehole BH1 a sandy silt deposit was encountered below the fill materials at a depth of approximately 0.9 m and extended to the termination depth of approximately 2.3 m below existing ground surface.

SPT “N” values for the sandy silt deposit ranged from 31 to in excess of 50 blows per 300 mm of spoon penetration, indicating that the deposit has a dense to very dense relative density.

In the sandy silt deposit, the moisture content of the samples recovered were found to be 8.2% to 12.5%, indicating a moist condition.

4.2 GROUNDWATER

The groundwater conditions encountered, and cave-in depth observations were made during drilling and in the open boreholes upon completion of the drilling of each borehole and are presented on the borehole logs in **Enclosures 2 through 3** as well as in **Table 1**.



Table 1: Water Depth and Cave-in

BOREHOLE NUMBER	UPON DRILLING COMPLETION	
	WATER DEPTH (MBGS)	CAVE-IN DEPTH (MBGS)
BH1	Dry	Open
BH2	Dry	Open

Note: mbgs = meters below the existing ground surface

It should be noted that water levels can vary in response to seasonal fluctuations and major weather events. In addition, a perched water condition can occur due to the accumulation of surface water in the more pervious fill overlying less pervious deposits, especially during seasonally wetter periods.

Long-term “stabilized” groundwater level measurements should be determined by a hydrogeologist.

5.0 DISCUSSION AND RECOMMENDATIONS

The investigation and comments should be considered ongoing as new information about the underground conditions will continue to become available, for example, when construction is underway and more specific information is available with respect to soil conditions. The interpretation and recommendations of this report must, therefore, be checked through field inspections carried out by Sola to validate the information for use during construction.

It is proposed to construct a new generator at the northwest corner of the property and a new pylon sign at the entrance. It is understood the anticipated bearing pressures below the pad will be 15 kPa.

Based on the ground conditions found at the site, our recommendations are presented in the following sections.

5.1 FROST PROTECTION

All footings and structural elements exposed to seasonal freezing conditions must have at least 1.2 metres of permanent soil cover, or equivalent artificial insulation, for frost protection.

5.2 CONVENTIONAL STRIP AND SPREAD FOUNDATIONS

At the time of preparation of this report, design loading requirements and foundation configurations have not been made available. The following discussions are provided to assist the preliminary design phase of the proposed generator and sign installation. For geotechnical design purposes, it is assumed that the foundations will be positioned below the frost penetration depth, i.e., at least 1.2 m below the finished grade and precautions will be taken to prevent an uplift due to adfreeze.



If the structure(s) is(are) to be supported on conventional strip or spread footing foundations, the following resistances would be available for foundations placed at the depth of 1.2 to 1.8 m below the existing ground surface on the undisturbed native soil at the borehole locations. Bearing resistance at:

- Serviceability limit states (SLS) = 200 kPa; and,
- Factored geotechnical resistance at ultimate limit state (ULS) = 300 kPa.

These values should be revisited once the details of the foundations are known. Bearing resistances at greater depths would be available but deeper boreholes may be needed. At both boreholes SPT “N” values show increasing trend and higher design values may be available.

The design values provided above are based on the presumption that the bearing resistance at SLS is governed by total and differential settlements of 25 mm and 20 mm respectively, and the structure will tolerate an angular distortion of 1 in 300.

The construction may be carried out by open cut methodology. Contractors who bid on the job should assess the site condition to establish the feasible way to carry out the work. During excavations, adjacent existing structures and public right of way must be protected by proper shoring or sloping.

Where it is necessary to place footings on the soil at a different level, the upper footing must be founded below an imaginary 10 horizontal to 7 vertical line (10H:7V) drawn up from the base of the lower footing. The lower footing must be installed first to minimize the risk of undermining the upper footing.

Footings should be reinforced as per the design to be provided by the Structural Engineer of the project.

The recommended bearing resistances and the corresponding founding depth would need to be confirmed by geotechnical engineering staff at the site prior to pouring footing concrete.

It should be noted that the recommended bearing resistances have been calculated by Sola from the borehole information for the preliminary design stage only. Should higher bearing values be required, this office should be contacted to review this report.

Foundation for Pylon Signage

The foundation design should be carried out in accordance with the City of Mississauga and Peel Region Standards, with some modification as stated below.



The foundation design objective for pole-type elements is to resist lateral or uplift loading, rather than vertical downward loading. Standard design methodologies developed by Brinch-Hansen (1961)¹ and Broms (1964)² have provided solutions for short piles installed in the sandy stratum.

The undisturbed native soil is capable of supporting the proposed new traffic signals and street lighting through caissons. The short caisson foundations can be designed based on a factored geotechnical resistance of 200 kPa SLS (Serviceability Limit States) and 300 kPa at ULS (Ultimate Limit States) when the toe of the caisson is founded a minimum 3 to 4 m below the ground surface and having at least 1 m embedded into the native ground.

The caisson foundation should be checked for stability against uplift and lateral loads. Allowable uplift resistance of 25 kPa should be used for the native soils to resist the uplift force. The allowable uplift resistance for the part of the caisson shaft within the fill should be limited to about 10 kPa.

Alternatively, if a prototype product is to be used, the City Standard Drawing No. 3100.230 may be followed, however, it is our recommendation that the frost zone and the upper fill should be ignored, plus an extra 1.5 m depth beyond the City Standard requirements.

Prior to pouring concrete, the base of each caisson should be inspected by a Geotechnical Engineer.

5.3 SLAB ON GRADE PAD

For slab-on-grade construction, all fill within the pad footprint should be completely removed, as directed by the geotechnical engineer. The grade can be raised using approved granular fill such as granular A or B. Depending on the design grade and loading conditions, some of the existing fill (e.g., the sand and gravel fill contacted below the topsoil), if environmentally acceptable and approved by the geotechnical engineer, may be used to raise the grade after striping. Any exposed soil subgrade must be proof rolled or otherwise inspected to detect any soft or unstable areas, which must be removed and replaced with suitably compacted engineered fill. Once the required subgrade has been developed, Sola recommends that the exposed subgrade be evaluated, inspected and approved by the Geotechnical Engineer before the placement of any fill or concrete. The fill used to raise the grade must be placed in shallow lifts not exceeding 300 mm when first placed and each lift uniformly compacted to not less than 98% or 100% of the Standard Proctor Maximum Dry Density (SPMDD), depending on the loading condition

¹ Brinch-Hansen, J. (1961). The Ultimate Resistance of Rigid Piles against Transverse Forces. Geoteknisk Instit. Bull. No.12, Copenhagen.

² Broms, B.B.(1964). Lateral Resistance of Pile in Cohesionless Soils. Journal of Soil Mech. And Found. Engineering. ASCE Vol.90, SM3, pp.123-156



Completed excavations for slab should not be left open before pouring concrete for any period longer than 24 hours, particularly if the construction works are being completed during the winter months or wet weather periods. The base of slab excavation that is to be left exposed for longer than 24 hours should be suitably covered and protected from water ponding, and/or protected to prevent degradation of the exposed founding stratum with the construction of a mud mat.

Prior to placing the granular under-slab fill, the final subgrade should be proof-rolled and approved by the Geotechnical Engineer.

The design of the concrete slabs on engineered fill may be made on the basis of a value of modulus of subgrade reaction which is 20 MPa/m on the surface of the granular moisture barrier. This value can be adjusted once the design details are known.

If the slab is to be unheated, then a minimum of 1.2 m frost protection is required. Therefore, underneath the slab, considering for example, 200 mm thick concrete, a minimum 1000 mm thick granular underfloor fill should be placed. It is recommended that the final lift of the material immediately beneath this slab consist of 150 mm of 19 mm clear stone, in order to provide a capillary break as well as for fine grading purposes, followed by OPSS granular A or B (Type I or II) material (all with no more than 6% fines), which should be placed in lifts not exceeding 250 mm when loosely placed and compacted to not less than 100 % of its SPMDD. It must be noted that its site grading should be such that ground surface immediately adjacent to the slab is not more than few centimeters below the top of the slab for sufficient frost protection. Backfill at the perimeter of the slab should extend at a slope no steeper than 1V:1.5H from the bottom of the excavation outwards with a granular backfill with no more than 6% fines. The final grade surrounding the slab should be such that water will run away from the structure (for slabs constructed in this manner on inspected and approved subgrade for modulus of subgrade reaction of 24 MPa can be used for design purposes. To prevent a differential frost heave precautions should be taken to ensure any water that may enter the under-floor fill can be expeditiously intercepted by means of subdrains and removed.

Alternatively, rigid insulation beneath the slab can be used in lieu of the 1 m granular fill replacement and should extend 1 m outwardly from the edge of the concrete pad.

5.4 SITE PREPARATORY WORKS

The site preparation work may include stripping the ground cover and existing fill within the area of the proposed generator and sign in order to develop the required construction. The stripping depths will likely vary locally and should be adjusted to remove all unsuitable material.

It is recommended that the Geotechnical Engineer monitors the stripping operations to ensure that unsuitable materials have been fully removed prior to construction works. Unacceptable



areas identified are to be remediated as soon as practicable and the procedures would be dependent upon conditions encountered.

5.5 EARTH PRESSURES

The recommendations in this subsection may be ignored if the construction can be carried out using open-cut techniques.

It should be noted that, if shoring is required, a specialist shoring contractor should be consulted to establish the most appropriate design and seating depths for the construction shoring solution.

The shoring system may be designed in accordance with the Canadian Foundation Engineering Manual (CFEM), the 4th Edition. Though not a design code, the CFEM design manual provides a comprehensive guide for shoring and anchor design and is still considered the most widely used and accepted design approach in the Greater Toronto Area (herein "GTA").

Shoring subject to unbalanced earth pressures must be designed to resist a pressure distribution that can be calculated as follows:

$$p = K [\gamma (h-h_w) + \gamma' h_w + q] + \gamma_w h_w$$

- where: p = Lateral earth pressure in kPa acting at depth h
 K = parameters are provided below
 h = the depth below the ground surface (m)
 h_w = the depth below the groundwater level (m)
 γ = the bulk unit weight of soil, (kN/m³) use 20.0
 γ' = the submerged unit weight of the exterior soil, (γ - 9.8 kN/m³)
 q = equivalent value of surcharge on the ground surface in kPa (min 12 kPa)

Where the backfill against the buried structure can be drained effectively to eliminate hydrostatic pressures on the wall, this equation can be simplified to:

$$p = K (\gamma h + q)$$

The soil parameters estimated to be applicable for this design are as follows in **Table 2**:

Table 2: Soil Parameters for Shoring

MATERIAL	EFFECTIVE FRICTION ANGLE ϕ' (DEG)	UNIT WEIGHT γ (kN/m ³)	COEFF. OF ACTIVE EARTH PRESSURE, K _A	COEFF. OF PASSIVE EARTH PRESSURE, K _P	COEFF. OF AT-REST EARTH PRESSURE, K _O
OPSS Granular A or B	34	22	0.28	3.6	0.44
Fill	28	19	0.37	2.7	0.53
Native	31	20.5	0.32	3.2	0.48



For a global stability check:

$$\begin{aligned}\phi &= 30^\circ \\ \gamma &= 20 \text{ kN/m}^3\end{aligned}$$

Wall friction should be considered negligible.

The design groundwater table and the long-term groundwater level should be determined by the project hydrogeologist.

The surcharge needs should be determined by the Structural Engineer but should not be less than 12 kPa.

The design calculations should be submitted to Sola for geotechnical review.

The movement of the shoring system is considered inevitable. The magnitude of this movement can be controlled by sound construction practices, and it is anticipated that the horizontal movement will be in the range of 0.1 % H to 0.25 % H. Vertical movements increase the horizontal movements because of the reduced stress in the inclined anchors. For this reason, the shoring design must be carried out to minimize the vertical movement of the shoring system.

To ensure that movements of the shoring are within an acceptable range, monitoring must be undertaken throughout the site development process. Vertical and horizontal targets must be located and surveyed before excavation begins. Weekly readings during excavation should show that the movements will be within those predicted; if not, the monitoring results should enable directions to be given to improve the shoring.

5.6 EXCAVATION AND BACKFILL

5.6.1 Excavatability and Site Excavations

It has been assumed that all excavations will be open cut in the 'dry'. In order to enable entry into excavations during the construction process, all excavations must comply with the definitions prescribed by the "Occupational Health and Safety Act" (OHSA), Ontario Regulation 213/91 "Construction Projects".

The borehole data indicate that the fill materials and native soils encountered in the boreholes should present as Type 3 soil above the groundwater level and Type 4 soil below the groundwater level as defined in the OHSA and Regulations for Construction Projects (Part III Excavations, Section 226). Excavations in these materials should be constructed in conformance with the regulations. It is noted that the above soil classifications have been estimated based on small and discontinuous samples from the boreholes. The excavation



conditions must be confirmed and/or modified on the basis of field inspections during the construction stage when large-scale observations can be made with ease.

As defined by the OHSA, excavation walls within the Type 3 soils will require battering back at slopes no steeper than 1H (horizontal):1V (vertical) and flatter for Type 4 soil. Fill materials may require flat side slopes even above the water table. Depending on the construction feasibility the excavation walls can be supported by temporary shoring systems. During excavations, adjacent existing structures if present, must be protected by proper shoring or sloping.

Based on the findings of the investigation, it is considered that the excavation of the overburden fill and native soils at the site can be carried out using a conventional backhoe excavator.

It is important to note that the above discussion about the excavation is for information purposes only. Contractors bidding on the projects must make their own assessments based on the real site conditions.

It is assumed that the groundwater will be lowered to not less than 0.8 m below the required excavation depth to enable the construction to be carried out in the 'dry' condition. It is expected that the 'perched water' can be controlled by the conventional 'sump and pump' methodology. Although unlikely, if a large volume discharge of water is required, the contractor should implement a more aggressive measure with the consultation of a dewatering specialist.

6.0 LIMITED SOIL CHEMICAL TESTING

As part of the geotechnical investigation carried out for the Client, Sola conducted limited Soil Chemical Testing to scan for the general soil conditions at the borehole location. At the time of sampling, no obvious evidence of staining or odours was observed in the samples collected at the sampling location. one (1) soil sample was selected from the collected samples, named TP1 at an approximate depth from 0.2 m to 0.6 m below the ground surface. The sample was submitted to Eurofins Environment Testing Canada Inc for laboratory analyses of (non-volatile) parameters of Petroleum Hydrocarbons (PHC F2-F4 Fractions), volatiles such as Petroleum Hydrocarbons (PHC F1 Fraction), Metals and Inorganics (M&I), Volatile Organic Compounds (VOCs) and Benzene, Toluene, Ethylbenzene, Xylene (BTEX).

Based on the comparison of the soil analysis results to the 2011 MOECC Standards, there are no parameter exceedances. Further details are presented in the Summary of Guideline Exceedances section of the Certificates of Analysis in **Appendix A**.

It should be noted that the soil may vary within the site and further chemical testing may be required by the receiving site, if applicable.



7.0 MATERIAL TESTING AND INSPECTION

It is recommended that Sola be appointed to carry out field inspection and materials testing during construction to ensure that the construction complies with the design recommendations.

8.0 DRAWING REVIEW

Once the final design drawings for this project are prepared, it is recommended that one (1) set of the drawings should be submitted to Sola for review and to make any amendments to our recommendations that may be required, prior to starting construction.

Sola should also be retained for a general review of the final design and specifications to verify that this report has been properly interpreted and implemented. If not accorded the privilege of making this review, Sola will assume no responsibility for the interpretation of the recommendations in this report.

The comments given in this report are preliminary and intended only for the guidance of design engineers. Contractors bidding on or undertaking the works should make their own interpretations of the factual borehole results, so that they may draw their own conclusions on how the subsurface conditions may affect them.

The information in this report in no way reflects on the environmental aspects of soil conditions at the site and has not been addressed in this report, since this aspect was beyond the scope and terms of reference.

9.0 CLOSURE

This report is subject to the *Statement of Limitations* which forms an integral part of this document. The Statement of Limitations is not intended to reduce the level of responsibility accepted by Sola, but rather to ensure that all parties who have been given reliance for this report are aware of the responsibilities each assumes in so doing.

We trust that this report meets your needs. Should you have any queries, please contact the Sola office.

Sincerely,

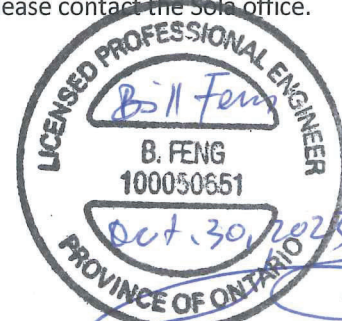
SOLA ENGINEERING INC.

Clement Chan

EIT

Y:\PROJECTS\11238-(3525)-NGA Architects-GEO-Animal Service Centre-735 Central Parkway West-Mississauga-Sept\GEO\08 Draft Reports\2023-18789R-11238-S0003-GEO-FINAL.docx

Enclosures



Bill Feng P. Eng.

Chief Engineer



STATEMENT OF LIMITATIONS

Standard of Care and Basis of this Report

Sola Engineering Inc. ("Sola Engineering") has prepared this report in a manner consistent with generally accepted engineering and/or environmental practices in the jurisdiction in which the specified services were provided. The information and conclusions set out in this report reflects Sola Engineering's best professional judgment in light of the information available to Sola Engineering at the time of preparation. Sola Engineering disclaims any and all warranties, express or implied, including without limitation any warranty of merchantability and/or fitness for a particular purpose, and makes no representations concerning the legal effect, interpretation or significance of this report or the information, conclusions or recommendations contained in it.

The conclusions and recommendations provided in this report have been prepared in relation to the specified site (the "Site") and the proposed project (the "Project"), as described by the Client to Sola Engineering. Given the nature of the work undertaken by Sola Engineering as part of this report, the Client acknowledges that ground conditions may vary over distances and may change over time. Should there arise any changes to the conditions of the Site or the Project (as to purpose or design), Sola Engineering is to be notified within a reasonable period of time, and in any event within 24 hours of the Client's learning of such changes, so as to give Sola Engineering an opportunity to review and revise this report in light of such changes. Sola Engineering accepts no liability or responsibility for any use of this report or reliance on this report following any changes to the conditions of the Site or the Project.

The scope of professional services provided by Sola Engineering for the Project are as set out in this report. Should such services be limited to those of a geotechnical nature, Sola Engineering shall not be held liable or responsible for any environmental services that may be required, nor shall this report be interpreted to reflect any environmental aspects of the Project. Alternatively, should such services be limited to those of an environmental nature, Sola Engineering shall not be held liable or responsible for any geotechnical services that may be required, nor shall this report be interpreted to reflect any geotechnical aspects of the Project.

This report is not intended to provide recommendations for possible future conditions or use of the Site or adjoining properties. Should the need arise for such recommendations Sola Engineering may need to conduct further investigations.

Use of this Report

This report is intended to be read and used in its entirety. No reliance may be made upon any individual portion or section of this report without reference to the entire report as a whole. In preparing this report, Sola Engineering has relied on information, instructions and communications given by the Client to Sola Engineering, the applicability, truth and accuracy of which is the sole responsibility of the Client.

This report with the information, sampling data, analysis, conclusions and recommendations contained in it (if any), has been prepared for and may only be used by the Client and only for the specific purpose as specified by the Client to Sola Engineering in connection with the Project. Without prior written consent from Sola Engineering, use of this report or any portion thereof by any person or entity other than the Client, or for any purpose other than as communicated by the Client to Sola Engineering, is strictly prohibited. Sola Engineering accepts no liability or responsibility for the unauthorized use of this report. This report and all documents that form part of it are the sole property of Sola Engineering. Sola Engineering relies on and retains any and all intellectual property rights it has in this report, including any copyright to which it is entitled. The Client shall not give, lend or sell this report, or any portion thereof, to any entity, person or association without the express prior written consent of Sola Engineering. This report and the information contained herein shall be treated as strictly confidential.

The contents of this report, inclusive of Sola Engineering's conclusions and recommendations in relation to the Project, are intended only for the guidance of the Client in carrying out the specified services for the Project, as described by the Client to Sola Engineering. Accordingly, Sola Engineering does not accept any liability or responsibility for any inaccuracy contained in this report arising as a result of or in any way connected with any exclusion, oversight or falsification of the information provided to Sola Engineering by the Client. This report, including the effect of the subsurface conditions as described in this report, is to be interpreted at the risk and discretion of the Client and any contractors or others bidding on or undertaking contractual work to be performed as part of the Project who may come into possession of or learn of this report or its contents. It is exigent that all contractors bidding or undertaking the work are to rely on their own interpretations of the data contained in this report in addition to their own investigations and conclusions. Sola Engineering shall not be held liable or responsible for any interpretation of or conclusions that may be drawn from the data or information contained in this report.

The information, recommendations and conclusions presented in this report are based on Sola Engineering's interpretation of conditions revealed through the limited investigation conducted within a defined scope of services. In no event will Sola Engineering be held responsible or liable to the Client or any other person or entity for any special, indirect, incidental, punitive or consequential loss or damage (including, loss of use, lost profits or expenses incurred) resulting from or in any way related to the independent interpretations, interpolations, conclusions or decisions of the Client or any other person or entity, based on the information contained in this report. The restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.

Notwithstanding the exclusions of liability contained herein but without in any way limiting their effect or generality, if there is found to be any finding of liability or responsibility whatsoever on the part of Sola Engineering which in any way relates to or arises from this report, or the information, conclusions or recommendations contained in it, such liability and/or responsibility shall cease and forever be extinguished from and after the date which is two (2) years from the date of this report. In no event shall any liability or responsibility of Sola Engineering exceed the fees charged by Sola Engineering to the Client for the preparation of this report (excluding any arms' length disbursements or expenditures made or incurred by Sola Engineering as a result thereof and reimbursed by the Client).

Site Conditions

The material conditions, classifications, conclusions and recommendations contained in this report were based on the site conditions observed or tested by Sola Engineering or otherwise communicated to Sola Engineering by the Client. The description, identification and classification of soils, rocks, chemical contamination and other materials have been made based on limited investigations, sampling and testing of materials performed by Sola Engineering and its qualified representatives in reliance on the use of relevant or applicable equipment, all in accordance with commonly acceptable standards in the geotechnical and/or environmental disciplines. Accordingly, this report may include assumptions of conditions which are based on discrete sample locations and thus some conditions may not have been detected. The Client accepts all liability and risk for the use of this report and the information and data contained in it. Sola Engineering shall not be held liable or responsible for any conditions beyond the scope of tests conducted on samples of the subsurface and soil conditions of the subject property as set out in this report.

For clarity, the Client acknowledges and accepts that unique risks exist whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive sampling and testing program may fail to detect certain conditions. The environmental, geological, geotechnical, geochemical and hydrogeological conditions that Sola Engineering interprets to exist between sampling points may differ from those that actually exist. As a result, the Client acknowledges and accepts that because of the inherent uncertainties in subsurface evaluations, unanticipated underground conditions may occur or become known subsequent to Sola Engineering's investigation that could affect conclusions, recommendations, total Project cost and/or execution.

Indemnification of Risk

Though Sola Engineering adheres to the highest degree of integrity and employs due diligence in limiting the potential release of toxins and hazardous substances, the risk of accidental release of such substances is a possibility when providing geotechnical and environmental services.

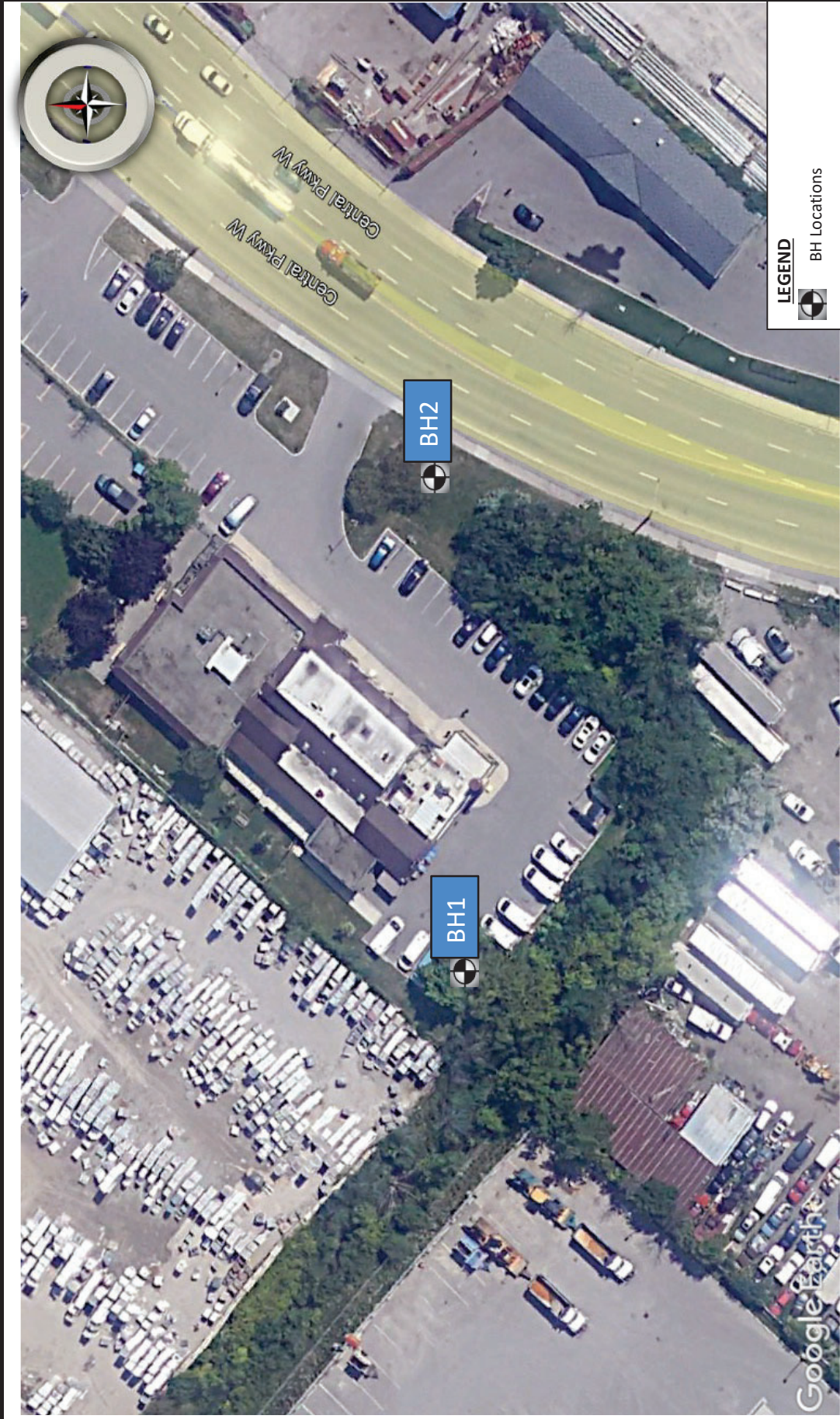
In consideration of the provision of services by Sola Engineering, the Client agrees to defend, indemnify and hold Sola Engineering and its employees and agents harmless from and against any and all claims, liabilities, damages, causes of action, judgments, costs or expenses (including reasonable legal fees and disbursements), resulting from or arising by reason of the death or bodily injury to persons, damage to property, or other loss, whether related to an accidental release of pollutants or hazardous substances occurring as a result of carrying out this Project or otherwise, and whether or not resulting from Sola Engineering's negligent actions or omissions. This indemnification shall include and extend to any and all third party claims brought or threatened against Sola Engineering under any federal or provincial law or statute as a result of Sola Engineering conducting work on the Project. In addition to and notwithstanding the foregoing, the Client further agrees to unconditionally and irrevocably release Sola Engineering from, and not to bring any claims against Sola Engineering in connection with, any of the aforementioned claims or causes.

Subconsultants and Contractor Services

In conjunction with the services provided by Sola Engineering's own employees, external services provided by other persons or entities that are specializing in services other than those offered by Sola Engineering, such as drilling, excavation and laboratory testing, are often employed in order to carry out the defined scope of work. If such external services have been employed for this Project, the Client acknowledges that Sola Engineering is not in any way liable or responsible for any costs, claims or damages in relation to the services rendered by such other persons or entities or payment therefor, nor shall Sola Engineering be liable or responsible for damages for errors, omissions or negligence caused by such other persons or entities while providing such external services.

Work and Job Site Safety

Sola Engineering shall be responsible only for its activities and that of its employees on the Site. Sola Engineering shall not direct any of the fieldwork nor the work of any other person or entity on the Project. The presence of Sola Engineering staff on the Site does not relieve the Client or any contractor on the Site from their responsibilities pertaining to site safety. The Client at all times retains any and all responsibility for the safety of those individuals present on the Site and/or working on the Project, including Sola Engineering's employees.



File No.: 11238-S0003-GEO
 Report Number: 2023-18789R
 Date: October 16, 2023

BH Location Plan
Proposed Parking Lot Improvement
735 Central Parkway West, Mississauga, Ontario
NGA Architects

The figure provided is for the intended purpose of presenting the approximate borehole locations. This figure should not be used for any other purposes including construction, architecture or for accuracy of dimensions and orientation of objects.

Enclosure No.: **1**
 Not to Scale






RECORD OF BOREHOLE No. BH1

1 OF 1

METRIC

PROJECT NUMBER 11238 LOCATION 735 Central Pkwy W, Mississauga, ON ORIGINATED BY KC
 NAME Proposed Animal Service Centre Renovation CLIENT NGA Architects METHOD Soild Stem Augers COMPILED BY HH
 DATUM DATE 2023.09.27 - 2023.09.27 NORTHING EASTING CHECKED BY HH





SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION & RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa									WATER CONTENT (%)
0.0	Topsoil TOPSOIL - 50 mm thick FILL - sand and gravel, trace rootlets, brown, moist		1	SS	15												
			2A														
0.9	SANDY SILT - trace gravel, dense to very dense, brown, moist		2B	SS	42												
			3	SS	31												
2.3	End of Borehole at the Targeted Depth; Borehole was Open and Dry Upon Completion of Drilling Period.		4	SS	54/ 3 cm												

RECORD OF BOREHOLE No. BH2

1 OF 1

METRIC

PROJECT NUMBER 11238 LOCATION 735 Central Pkwy W, Mississauga, ON ORIGINATED BY KC
 NAME Proposed Animal Service Centre Renovation CLIENT NGA Architects METHOD Soild Stem Augers COMPILED BY HH
 DATUM DATE 2023.09.27 - 2023.09.27 NORTHING EASTING CHECKED BY HH

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa								
0.0	Topsoil TOPSOIL - 50 mm thick FILL - sand and gravel, trace rootlets, brown, moist		1	SS	11											
0.8	CLAYEY SILT TILL - brown, oxidation, very stiff, moist		2	SS	24											
1.5	SANDY SILT TILL - brown, dense to very dense, moist		3	SS	49											
			4	SS	85/ 20 cm											
3.1	End of Borehole at the Targeted Depth; Borehole was Open and Dry Upon Completion of Drilling Period.		5	SS	50/ 3 cm											

+ 3, X 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT NUMBER 11238

LOCATION 735 Central Pkwy W, Mississauga, ON

PROJECT NAME Proposed Animal Service Centre Renovation

CLIENT NGA Architects

LITHOLOGIC SYMBOLS (Unified Soil Classification System)



CL-SL-TL: clayey silt till



FILL: TTC Fill (made ground)



SN-SL: sandy silt



SN-SL-TL: sandy silt till



TOPSOIL: Topsoil/peat/organics

SAMPLER SYMBOLS



Split Spoon Sample

WELL CONSTRUCTION SYMBOLS

Notes:

Terms describing RELATIVE DENSITY, based on Standard Penetration Test "N"-Value for COURSE GRAINED soils (major portion retained on No. 200 sieve):

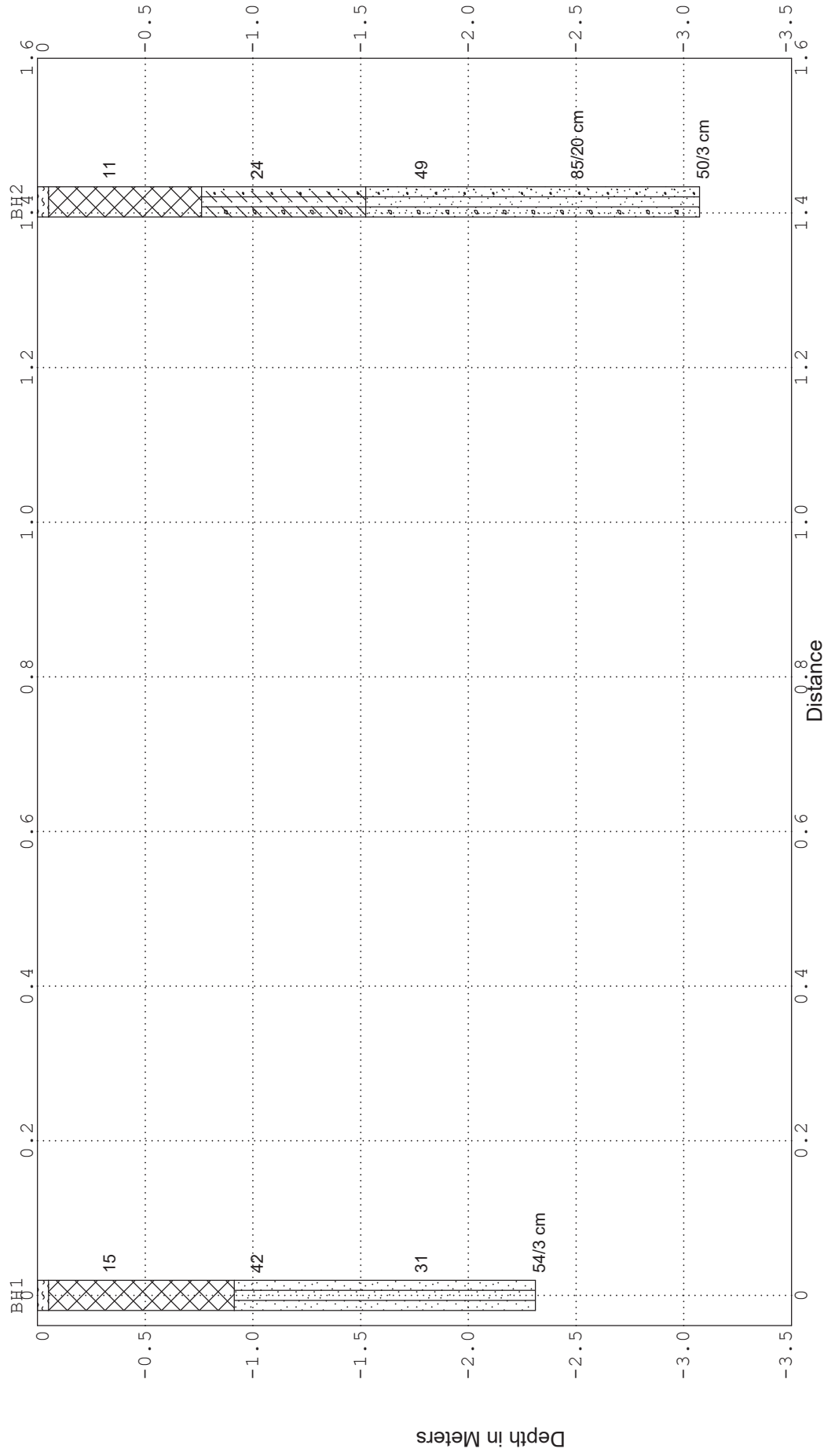
DESCRIPTIVE TERM ["N"-Value (blows/0.3m), Relative Density (%)]

- Very Loose [less than 4, less than 15]
- Loose [4 to 10, 15 to 35]
- Compact or Medium [10 to 30, 35 to 65]
- Dense [30 to 50, 65 to 85]
- Very Dense [greater than 50, greater than 85]

Terms describing CONSISTENCY, based on Standard Penetration Test "N"-Value for FINE GRAINED soils (major portion passing No. 200 sieve):

DESCRIPTIVE TERM [Unconfined Compressive Strength (kPa), "N"-Value (blows/0.3m)]

- Very Soft [less than 25, less than 2]
- Soft [25 to 50, 2 to 4]
- Firm [50 to 100, 4 to 8]
- Stiff [100 to 200, 8 to 15]
- Very Stiff [200 to 400, 15 to 30]
- Hard [greater than 400, greater than 30]



Plan View



SOLA ENGINEERING INC.
CONCEPTUAL SOIL PROFILE

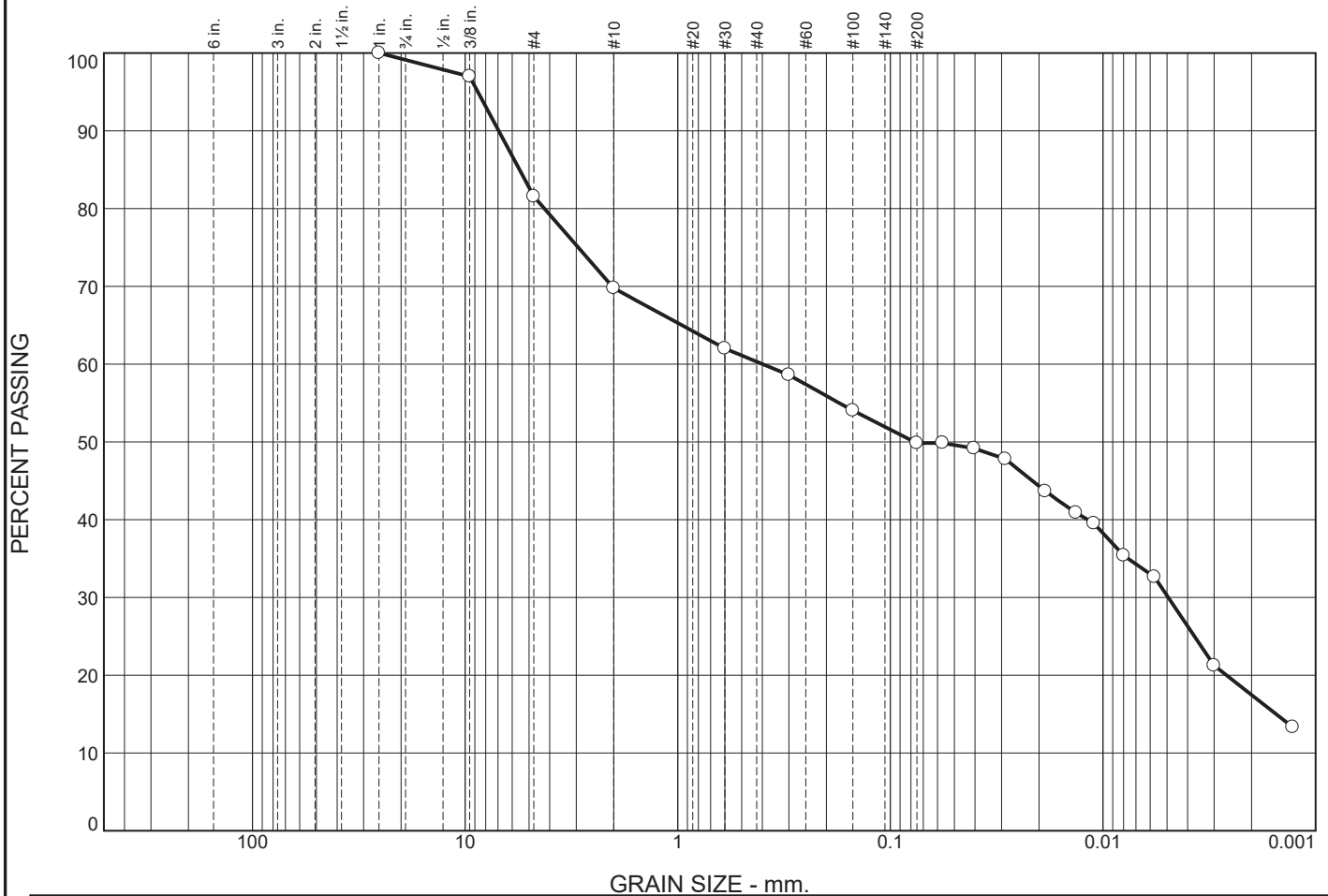
Horizontal Scale:
 Vertical Scale:
 Drawn By:
 Approved By:

Proposed Animal Service Centre Renovation
 735 Central Pkwy W, Mississauga, ON

Project Number: 11238

Enclosure No.: 5

Particle Size Distribution Report



%	+3"	% Gravel		% Sand			% Fines			
		Coarse	Fine	Coarse	Medium	Fine				
○	0	1	17	12	10	10	50			
⊗	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○			5.5459	0.3985	0.0769	0.0049	0.0015			

Material Description	USCS	AASHTO
○ Borehole Sample		

Project No. 11238 **Client:** NGA Architects
Project: Animal Service Centre

 ○ **Location:** BH1 SS3 **Sample Number:** 23-265

Remarks:
 ○ Sampled By: Katrina
 Date: September 27, 2023
 Report No: 2023-18789R
 Note: Additional information is available upon request.

SOLA ENGINEERING INC.



Appendix A

Soil Chemical Testing

Client: Sola Engineering Inc.
390 Edgeley Blvd
Concord, Ontario
L4K 3Z6
Attention: Mr. Naveed Rehman
Invoice to: Sola Engineering Inc.
PO#:

Report Number: 3002246
Date Submitted: 2023-10-13
Date Reported: 2023-10-20
Project: #112S8
COC #: 911066
Temperature (C): 5
Custody Seal:

Page 1 of 15

Dear Naveed Rehman:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

Raheleh Zafari, Environmental Chemist

All analysis is completed at Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) unless otherwise stated

Eurofins Environment Testing Canada Inc. is accredited by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025 for tests which appear on the scope of accreditation. The scope is available at <https://directory.cala.ca/>

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only. Guideline or regulatory limits listed on this report are provided for ease of use (informational purposes) only. Eurofins recommends consulting the official guideline or regulation as required. Unless otherwise stated, measurement uncertainty is not taken into account when determining guideline or regulatory exceedances.

Client: Sola Engineering Inc.
 390 Edgeley Blvd
 Concord, Ontario
 L4K 3Z6
 Attention: Mr. Naveed Rehman
 PO#:
 Invoice to: Sola Engineering Inc.

Report Number: 3002246
 Date Submitted: 2023-10-13
 Date Reported: 2023-10-20
 Project: #112S8
 COC #: 911066

Exceedence Summary

Sample I.D.	Analyte	Result	Units	Criteria

Results relate only to the parameters tested on the samples submitted.
 Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Client: Sola Engineering Inc.
 390 Edgeley Blvd
 Concord, Ontario
 L4K 3Z6
 Attention: Mr. Naveed Rehman
 PO#:
 Invoice to: Sola Engineering Inc.

Report Number: 3002246
 Date Submitted: 2023-10-13
 Date Reported: 2023-10-20
 Project: #112S8
 COC #: 911066

Guideline = Excess Soil-T2.1-Ind/Cml/Comm

Hydrocarbons

Lab I.D. 1707026
 Sample Matrix Soil153
 Sample Type
 Sample Date 2023-10-12
 Sampling Time 14:00
 Sample I.D. TP1

Analyte	Batch No	MRL	Units	Guideline	
PHC's F1	450724	10	ug/g	STD 25	<10
PHC's F1-BTEX	450731	10	ug/g		<10
PHC's F2	450553	2	ug/g	STD 26	<2
PHC's F3	450553	20	ug/g	STD 240	<20
PHC's F4	450553	20	ug/g	STD 3300	<20

Metals

Lab I.D. 1707026
 Sample Matrix Soil153
 Sample Type
 Sample Date 2023-10-12
 Sampling Time 14:00
 Sample I.D. TP1

Analyte	Batch No	MRL	Units	Guideline	
Antimony	450751	1	ug/g	STD 40	<1
Arsenic	450751	1	ug/g	STD 18	7
Barium	450751	1	ug/g	STD 670	109
Beryllium	450751	1	ug/g	STD 8	1
Boron (Hot Water Soluble)	450676	0.5	ug/g	STD 2	<0.5
Boron (total)	450751	5	ug/g	STD 120	8
Cadmium	450751	0.4	ug/g	STD 1.9	<0.4
Chromium Total	450751	1	ug/g	STD 160	28
Chromium VI	450649	0.20	ug/g	STD 8	<0.20
Cobalt	450751	1	ug/g	STD 80	12
Copper	450751	1	ug/g	STD 230	37
Lead	450751	1	ug/g	STD 120	5
Mercury	450751	0.1	ug/g	STD 0.27	<0.1

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Client: Sola Engineering Inc.
 390 Edgeley Blvd
 Concord, Ontario
 L4K 3Z6
 Attention: Mr. Naveed Rehman
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 Invoice to: Sola Engineering Inc.

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Metals

Lab I.D. 1707026
 Sample Matrix Soil153
 Sample Type
 Sample Date 2023-10-12
 Sampling Time 14:00
 Sample I.D. TP1

Analyte	Batch No	MRL	Units	Guideline	
Molybdenum	450751	1	ug/g	STD 40	<1
Nickel	450751	1	ug/g	STD 270	25
Selenium	450751	0.5	ug/g	STD 5.5	<0.5
Silver	450751	0.2	ug/g	STD 40	<0.2
Thallium	450751	1	ug/g	STD 3.3	<1
Uranium	450751	0.5	ug/g	STD 33	<0.5
Vanadium	450751	2	ug/g	STD 86	34
Zinc	450751	2	ug/g	STD 340	64

Volatiles

Lab I.D. 1707026
 Sample Matrix Soil153
 Sample Type
 Sample Date 2023-10-12
 Sampling Time 14:00
 Sample I.D. TP1

Analyte	Batch No	MRL	Units	Guideline	
Acetone	450721	0.50	ug/g	STD 0.5	<0.50
Benzene	450721	0.0068	ug/g	STD 0.02	<0.0068
Bromodichloromethane	450721	0.05	ug/g	STD 0.05	<0.05
Bromoform	450721	0.05	ug/g	STD 0.05	<0.05
Bromomethane	450721	0.05	ug/g	STD 0.05	<0.05
Carbon Tetrachloride	450721	0.05	ug/g	STD 0.05	<0.05
Chlorobenzene	450721	0.05	ug/g	STD 0.083	<0.05
Chloroform	450721	0.05	ug/g	STD 0.05	<0.05
Dibromochloromethane	450721	0.05	ug/g	STD 0.05	<0.05
Dichlorobenzene, 1,2-	450721	0.05	ug/g	STD 6.8	<0.05
Dichlorobenzene, 1,3-	450721	0.05	ug/g	STD 0.26	<0.05

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Volatiles

Lab I.D. 1707026
 Sample Matrix Soil153
 Sample Type
 Sample Date 2023-10-12
 Sampling Time 14:00
 Sample I.D. TP1

Analyte	Batch No	MRL	Units	Guideline	
Dichlorobenzene, 1,4-	450721	0.05	ug/g	STD 0.05	<0.05
Dichlorodifluoromethane	450721	0.05	ug/g	STD 1.5	<0.05
Dichloroethane, 1,1-	450721	0.05	ug/g	STD 0.05	<0.05
Dichloroethane, 1,2-	450721	0.05	ug/g	STD 0.05	<0.05
Dichloroethylene, 1,1-	450721	0.05	ug/g	STD 0.05	<0.05
Dichloroethylene, 1,2-cis-	450721	0.05	ug/g	STD 0.05	<0.05
Dichloroethylene, 1,2-trans-	450721	0.05	ug/g	STD 0.05	<0.05
Dichloropropane, 1,2-	450721	0.05	ug/g	STD 0.05	<0.05
Dichloropropene, 1,3-	450729	0.05	ug/g	STD 0.05	<0.05
Dichloropropene, 1,3-cis-	450721	0.05	ug/g		<0.05
Dichloropropene, 1,3-trans-	450721	0.05	ug/g		<0.05
Ethylbenzene	450721	0.018	ug/g	STD 0.05	<0.018
Ethylene dibromide	450721	0.05	ug/g	STD 0.05	<0.05
Hexane (n)	450721	0.05	ug/g	STD 2.5	<0.05
Methyl Ethyl Ketone	450721	0.50	ug/g	STD 0.5	<0.50
Methyl Isobutyl Ketone	450721	0.50	ug/g	STD 0.5	<0.50
Methyl tert-Butyl Ether (MTBE)	450721	0.05	ug/g	STD 0.05	<0.05
Methylene Chloride	450721	0.05	ug/g	STD 0.05	<0.05
Styrene	450721	0.05	ug/g	STD 0.05	<0.05
Tetrachloroethane, 1,1,1,2-	450721	0.05	ug/g	STD 0.05	<0.05
Tetrachloroethane, 1,1,2,2-	450721	0.05	ug/g	STD 0.05	<0.05
Tetrachloroethylene	450721	0.05	ug/g	STD 0.05	<0.05
Toluene	450721	0.08	ug/g	STD 0.2	<0.08

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Volatiles

Lab I.D. 1707026
 Sample Matrix Soil153
 Sample Type
 Sample Date 2023-10-12
 Sampling Time 14:00
 Sample I.D. TP1

Analyte	Batch No	MRL	Units	Guideline	
Trichloroethane, 1,1,1-	450721	0.05	ug/g	STD 0.12	<0.05
Trichloroethane, 1,1,2-	450721	0.05	ug/g	STD 0.05	<0.05
Trichloroethylene	450721	0.01	ug/g	STD 0.05	<0.01
Trichlorofluoromethane	450721	0.05	ug/g	STD 0.25	<0.05
Vinyl Chloride	450721	0.02	ug/g	STD 0.02	<0.02
Xylene Mixture	450725	0.05	ug/g	STD 0.091	<0.05
Xylene, m/p-	450721	0.05	ug/g		<0.05
Xylene, o-	450721	0.05	ug/g		<0.05

Inorganics

Lab I.D. 1707026
 Sample Matrix Soil153
 Sample Type
 Sample Date 2023-10-12
 Sampling Time 14:00
 Sample I.D. TP1

Analyte	Batch No	MRL	Units	Guideline	
Cyanide (CN-)	450760	0.005	ug/g	STD 0.051	<0.005
Electrical Conductivity	450739	0.05	mS/cm	STD 1.4	0.69
pH - CaCl2	450631	2.00			7.87
Sodium Adsorption Ratio	450755	0.01		STD 12	6.04

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Moisture

Lab I.D. 1707026
 Sample Matrix Soil153
 Sample Type
 Sample Date 2023-10-12
 Sampling Time 14:00
 Sample I.D. TP1

Analyte	Batch No	MRL	Units	Guideline
Moisture-Humidite	450553	0.1	%	12.2

PHC Surrogate

Lab I.D. 1707026
 Sample Matrix Soil153
 Sample Type
 Sample Date 2023-10-12
 Sampling Time 14:00
 Sample I.D. TP1

Analyte	Batch No	MRL	Units	Guideline
Alpha-androstrane	450553	0	%	63

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VOCs Surrogates

Lab I.D.	1707026
Sample Matrix	Soil153
Sample Type	
Sample Date	2023-10-12
Sampling Time	14:00
Sample I.D.	TP1

Analyte	Batch No	MRL	Units	Guideline
1,2-dichloroethane-d4	450721	0	%	96
4-bromofluorobenzene	450721	0	%	85
Toluene-d8	450721	0	%	94

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Quality Assurance Summary

Batch No	Analyte	Blank	QC % Rec	QC Limits	Spike % Rec	Spike Limits	Dup % RPD	Duplicate Limits
450553	PHC's F2	<2 ug/g	103	80-120	92	60-140	0	0-30
450553	PHC's F3	<20 ug/g	104	80-120	92	60-140	0	0-30
450553	PHC's F4	<20 ug/g	104	80-120	92	60-140	0	0-30
450553	Moisture-Humidite	<0.1 %	100	80-120			8	
450631	pH - CaCl2	5.20	100	90-110			0	
450649	Chromium VI	<0.20 ug/g	98	70-130	98	70-130	0	0-35
450676	Boron (Hot Water Soluble)	<0.5 ug/g	95	70-130	112	60-140	0	0-30
450721	Tetrachloroethane, 1,1,1,2-	<0.05 ug/g	106	60-130	107	50-140	0	0-50
450721	Trichloroethane, 1,1,1-	<0.05 ug/g	107	60-130	111	50-140	0	0-50
450721	Tetrachloroethane, 1,1,2,2-	<0.05 ug/g	93	60-130	91	50-140	0	0-30
450721	Trichloroethane, 1,1,2-	<0.05 ug/g	115	60-130	115	50-140	0	0-50
450721	Dichloroethane, 1,1-	<0.05 ug/g	109	60-130	112	50-140	0	0-50
450721	Dichloroethylene, 1,1-	<0.05 ug/g	101	60-130	87	50-140	0	0-50
450721	Dichlorobenzene, 1,2-	<0.05 ug/g	103	60-130	111	50-140	0	0-50
450721	Dichloroethane, 1,2-	<0.05 ug/g	113	60-130	114	50-140	0	0-50
450721	Dichloropropane, 1,2-	<0.05 ug/g	111	60-130	119	50-140	0	0-50
450721	Dichlorobenzene, 1,3-	<0.05 ug/g	102	60-130	112	50-140	0	0-50
450721	Dichlorobenzene, 1,4-	<0.05 ug/g	104	60-130	112	50-140	0	0-50
450721	Acetone	<0.50 ug/g	115	60-130	112	50-140	0	0-50
450721	Benzene	<0.0068	116	60-130	114	50-140	0	0-50
450721	Bromodichloromethane	<0.05 ug/g	111	60-130	110	50-140	0	0-50
450721	Bromoform	<0.05 ug/g	112	60-130	109	50-140	0	0-50
450721	Bromomethane	<0.05 ug/g	102	60-130	105	50-140	0	0-50
450721	Dichloroethylene, 1,2-cis-	<0.05 ug/g	108	60-130	115	50-140	0	0-50
450721	Dichloropropene, 1,3-cis-	<0.05 ug/g	103	60-130	115	50-140	0	0-50
450721	Carbon Tetrachloride	<0.05 ug/g	103	60-130	107	50-140	0	0-50
450721	Chloroform	<0.05 ug/g	114	60-130	115	50-140	0	0-50
450721	Dibromochloromethane	<0.05 ug/g	103	60-130	101	50-140	0	0-50
450721	Dichlorodifluoromethane	<0.05 ug/g	83	60-130	106	50-140	0	0-50
450721	Methylene Chloride	<0.05 ug/g	118	60-130	95	50-140	0	0-50
450721	Ethylbenzene	<0.018 ug/g	112	60-130	121	50-140	0	0-50
450721	Ethylene dibromide	<0.05 ug/g	111	60-130	113	50-140	0	0-50

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Quality Assurance Summary

Batch No	Analyte	Blank	QC % Rec	QC Limits	Spike % Rec	Spike Limits	Dup % RPD	Duplicate Limits
450721	Hexane (n)	<0.05 ug/g	100	60-130	112	50-140	0	0-50
450721	Xylene, m/p-	<0.05 ug/g	116	60-130	112	50-140	0	0-50
450721	Methyl Ethyl Ketone	<0.50 ug/g	112	60-130	116	50-140	0	0-50
450721	Methyl Isobutyl Ketone	<0.50 ug/g	106	60-130	114	50-140	0	0-50
450721	Methyl tert-Butyl Ether (MTBE)	<0.05 ug/g	119	60-130	114	50-140	0	0-50
450721	Chlorobenzene	<0.05 ug/g	108	60-130	115	50-140	0	0-50
450721	Xylene, o-	<0.05 ug/g	110	60-130	118	50-140	0	0-50
450721	Styrene	<0.05 ug/g	112	60-130	117	50-140	0	0-50
450721	Dichloroethylene, 1,2-trans-	<0.05 ug/g	106	60-130	110	50-140	0	0-50
450721	Dichloropropene, 1,3-trans-	<0.05 ug/g	106	60-130	115	50-140	0	0-50
450721	Tetrachloroethylene	<0.05 ug/g	116	60-130	119	50-140	0	0-50
450721	Toluene	<0.08 ug/g	117	60-130	114	50-140	0	0-50
450721	Trichloroethylene	<0.01 ug/g	116	60-130	115	50-140	0	0-50
450721	Trichlorofluoromethane	<0.05 ug/g	99	60-130	98	50-140	0	0-50
450721	Vinyl Chloride	<0.02 ug/g	96	60-130	92	50-140	0	0-50
450724	PHC's F1	<10 ug/g	110	80-120	96	60-140	0	0-30
450725	Xylene Mixture							
450729	Dichloropropene, 1,3-							
450731	PHC's F1-BTEX							
450739	Electrical Conductivity	<0.05	100	90-110			0	0-10
450751	Silver	<0.2 ug/g	87	70-130	99	70-130	0	0-20
450751	Arsenic	<1 ug/g	98	70-130	113	70-130	0	0-20
450751	Boron (total)	<5 ug/g	102	70-130	156	70-130	0	0-20
450751	Barium	<1 ug/g	87	70-130	134	70-130	18	0-20
450751	Beryllium	<1 ug/g	99	70-130	117	70-130	0	0-20
450751	Cadmium	<0.4 ug/g	87	70-130	99	70-130	0	0-20
450751	Cobalt	<1 ug/g	100	70-130	108	70-130	14	0-20
450751	Chromium Total	<1 ug/g	95	70-130	105	70-130	12	0-20
450751	Copper	<1 ug/g	80	70-130	78	70-130	16	0-20
450751	Mercury	<0.1 ug/g	90	70-130	105	70-130	0	0-20
450751	Molybdenum	<1 ug/g	93	70-130	91	70-130	0	0-20
450751	Nickel	<1 ug/g	86	70-130	81	70-130	12	0-20
450751	Lead	<1 ug/g	76	70-130	85	70-130	0	0-20

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Quality Assurance Summary

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450751	Antimony	<1 ug/g	84	70-130	92	70-130	0	0-20
450751	Selenium	<0.5 ug/g	105	70-130	119	70-130	0	0-20
450751	Thallium	<1 ug/g	79	70-130	80	70-130	0	0-20
450751	Uranium	<0.5 ug/g	71	70-130	83	70-130	0	0-20
450751	Vanadium	<2 ug/g	94	70-130	143	70-130	15	0-20
450751	Zinc	<2 ug/g	111	70-130	126	70-130	21	0-20
450755	Sodium Adsorption Ratio	<0.01					4	
450760	Cyanide (CN-)	<0.005 ug/g	89	75-125	92	70-130	0	0-20

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Test Summary

Batch No	Analyte	Instrument	Preparation Date	Analysis Date	Analyst	Method
450553	PHC's F2	GC/FID	2023-10-17	2023-10-17	H_S	CCME
450553	PHC's F3	GC/FID	2023-10-17	2023-10-17	H_S	CCME
450553	PHC's F4	GC/FID	2023-10-17	2023-10-17	H_S	CCME
450553	Moisture-Humidite	Oven	2023-10-17	2023-10-17	H_S	ASTM 2216
450631	pH - CaCl2	pH Meter	2023-10-18	2023-10-18	IP	Ag Soil
450649	Chromium VI	FAA	2023-10-18	2023-10-18	MW	M US EPA 3060A
450676	Boron (Hot Water Soluble)	iCAP OES	2023-10-18	2023-10-18	Z_S	MOECC E3470
450721	Tetrachloroethane, 1,1,1,2-	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Trichloroethane, 1,1,1-	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Tetrachloroethane, 1,1,2,2-	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Trichloroethane, 1,1,2-	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Dichloroethane, 1,1-	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Dichloroethylene, 1,1-	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Dichlorobenzene, 1,2-	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Dichloroethane, 1,2-	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Dichloropropane, 1,2-	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Dichlorobenzene, 1,3-	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Dichlorobenzene, 1,4-	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Acetone	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Benzene	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Bromodichloromethane	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Bromoform	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Bromomethane	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Dichloroethylene, 1,2-cis-	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Dichloropropene, 1,3-cis-	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Carbon Tetrachloride	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Chloroform	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Dibromochloromethane	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Dichlorodifluoromethane	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Methylene Chloride	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Ethylbenzene	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Ethylene dibromide	GC-MS	2023-10-18	2023-10-19	SS	V 8260B

Results relate only to the parameters tested on the samples submitted.
 Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Client: Sola Engineering Inc.
 390 Edgeley Blvd
 Concord, Ontario
 L4K 3Z6
 Attention: Mr. Naveed Rehman
 PO#:
 Invoice to: Sola Engineering Inc.

Report Number: 3002246
 Date Submitted: 2023-10-13
 Date Reported: 2023-10-20
 Project: #112S8
 COC #: 911066

Test Summary

Batch No	Analyte	Instrument	Preparation Date	Analysis Date	Analyst	Method
450721	Hexane (n)	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Xylene, m/p-	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Methyl Ethyl Ketone	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Methyl Isobutyl Ketone	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Methyl tert-Butyl Ether (MTBE)	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Chlorobenzene	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Xylene, o-	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Styrene	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Dichloroethylene, 1,2-trans-	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Dichloropropene, 1,3-trans-	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Tetrachloroethylene	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Toluene	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Trichloroethylene	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Trichlorofluoromethane	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450721	Vinyl Chloride	GC-MS	2023-10-18	2023-10-19	SS	V 8260B
450724	PHC's F1	GC/FID	2023-10-18	2023-10-19	SS	CCME
450725	Xylene Mixture	GC-MS	2023-10-19	2023-10-19	SS	V 8260B
450729	Dichloropropene, 1,3-	GC-MS	2023-10-19	2023-10-19	SS	V 8260B
450731	PHC's F1-BTEX	GC/FID	2023-10-19	2023-10-19	SS	CCME
450739	Electrical Conductivity	Electrical Conductivity Meter	2023-10-19	2023-10-19	IP	Cond-Soil
450751	Silver	ICAPQ-MS	2023-10-19	2023-10-19	AaN	EPA 200.8/6020
450751	Arsenic	ICAPQ-MS	2023-10-19	2023-10-19	AaN	EPA 200.8/6020
450751	Boron (total)	ICAPQ-MS	2023-10-19	2023-10-19	AaN	EPA 200.8/6020
450751	Barium	ICAPQ-MS	2023-10-19	2023-10-19	AaN	EPA 200.8/6020
450751	Beryllium	ICAPQ-MS	2023-10-19	2023-10-19	AaN	EPA 200.8/6020
450751	Cadmium	ICAPQ-MS	2023-10-19	2023-10-19	AaN	EPA 200.8/6020
450751	Cobalt	ICAPQ-MS	2023-10-19	2023-10-19	AaN	EPA 200.8/6020
450751	Chromium Total	ICAPQ-MS	2023-10-19	2023-10-19	AaN	EPA 200.8/6020
450751	Copper	ICAPQ-MS	2023-10-19	2023-10-19	AaN	EPA 200.8/6020
450751	Mercury	ICAPQ-MS	2023-10-19	2023-10-19	AaN	EPA 200.8/6020
450751	Molybdenum	ICAPQ-MS	2023-10-19	2023-10-19	AaN	EPA 200.8/6020
450751	Nickel	ICAPQ-MS	2023-10-19	2023-10-19	AaN	EPA 200.8/6020
450751	Lead	ICAPQ-MS	2023-10-19	2023-10-19	AaN	EPA 200.8/6020

Results relate only to the parameters tested on the samples submitted.
 Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Client: Sola Engineering Inc.
 390 Edgeley Blvd
 Concord, Ontario
 L4K 3Z6
 Attention: Mr. Naveed Rehman
 PO#:
 Invoice to: Sola Engineering Inc.

Report Number: 3002246
 Date Submitted: 2023-10-13
 Date Reported: 2023-10-20
 Project: #112S8
 COC #: 911066

Test Summary

Batch No	Analyte	Instrument	Preparation Date	Analysis Date	Analyst	Method
450751	Antimony	ICAPQ-MS	2023-10-19	2023-10-19	AaN	EPA 200.8/6020
450751	Selenium	ICAPQ-MS	2023-10-19	2023-10-19	AaN	EPA 200.8/6020
450751	Thallium	ICAPQ-MS	2023-10-19	2023-10-19	AaN	EPA 200.8/6020
450751	Uranium	ICAPQ-MS	2023-10-19	2023-10-19	AaN	EPA 200.8/6020
450751	Vanadium	ICAPQ-MS	2023-10-19	2023-10-19	AaN	EPA 200.8/6020
450751	Zinc	ICAPQ-MS	2023-10-19	2023-10-19	AaN	EPA 200.8/6020
450755	Sodium Adsorption Ratio	iCAP OES	2023-10-19	2023-10-19	Z_S	Ag Soil
450760	Cyanide (CN-)	Skalar CN Analyzer	2023-10-19	2023-10-19	Z_S	MOECC E3015

Results relate only to the parameters tested on the samples submitted.
 Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Client: Sola Engineering Inc.
390 Edgeley Blvd
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Project: #112S8
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CWS for Petroleum Hydrocarbons in Soil - Tier 1**Notes:**

1. The laboratory method complies with CCME Tier 1 reference method for PHC in soil. It is validated for laboratory use.
2. Where the F1 fraction (C6 to C10) and BTEX are both measured, F1-BTEX is reported.
3. Where the F2 fraction (C10 to C16) and naphthalene are both measured, F2-naphthalene is reported.
4. Where the F3 fraction (C16 to C34) and PAHs* are both measured, F3-PAH is reported.
5. F4G is analyzed if the chromatogram does not descend to baseline before C50. Where F4 (C34 to C50) and F4G are both reported, the higher result is compared to the standard.
6. Unless otherwise stated in the sample comments, the following criteria have been met where applicable:
 - nC6 and nC10 response factors within 30% of response factor for toluene;
 - nC10, nC16, and nC34 response factors within 10% of each other;
 - C50 response factors within 70% of nC10 + nC16 + nC34 average; and,
 - Linearity is within 15%.
7. Unless otherwise stated in the sample comments, sampling requirements and analytical holding times have been met.
8. Gravimetric heavy hydrocarbons (F4G) cannot be added to the C6 and C50 hydrocarbons.
9. *PAHs = phenanthrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-c,d)pyrene and pyrene.

APPENDIX B



November 27, 2023

City of Mississauga
950 Burnhamthorpe Road West, 2nd Floor
Mississauga, Ontario, L5B 3B4

Re: REVISED Asbestos and Lead Test Results
Animal Services Centre, 735 Central Parkway West, Mississauga, Ontario
Pinchin File: 0333656.000

Pinchin Ltd. (Pinchin) was retained by City of Mississauga to collect bulk samples of building finishes suspected to contain asbestos and lead within the Animal Services Centre located at 735 Central Parkway West, Mississauga, Ontario. Sample collection was performed by Pinchin on October 25, 2023.

The purpose of this sample collection was to facilitate renovations to building. Sample collection included materials found on the exterior of the building in preparation for building renovation as per drawings provided by the Client via email on October 17, 2023. The extent of the assessed area is indicated on the drawings appended.

Pinchin has previously completed assessments in the building. The following reports are to be read in conjunction with this letter:

- “Asbestos Reassessment, Animal Services Centre – ACC1 735 Central Parkway West, Mississauga, Ontario” dated April 12, 2021, Pinchin File No. 282188.
- “Asbestos Abatement Completion Letter, Animal Services Centre, 735 Central Parkway West, Mississauga, Ontario” dated February 4, 2022, Pinchin File No. 305272.

Copies of these reports are provided in Appendix IV.

1.0 SUMMARY OF FINDINGS

The following is a summary of significant findings; refer to the body of the report for detailed findings:

Asbestos: Caulking around exterior door frames at the back side of the building and exterior window frames throughout the building.

Lead: Insignificant concentrations of lead are present in paints and coatings.



2.0 METHODOLOGY

2.1 Asbestos

An inspection for asbestos-containing materials (ACM) was conducted. A separate set of samples is collected of each type of homogenous material suspected to contain asbestos. A homogeneous sampling area is defined by the U.S. Environmental Protection Agency (EPA) as containing 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 asbestos analysis was completed using a stop positive approach. Stop positive means samples in a homogenous material sample set were analyzed consecutively and when a sample was identified as an asbestos-containing material (ACM), further sample analysis within that sample set was not completed.

Samples of materials were analyzed using polarised light microscopy (PLM) methods in accordance with EPA Test Method 600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials, July 1993.

Positive results were assessed for friability and condition.

2.2 Lead Paint

Samples of paint finishes were collected by scraping the painted finish to include base and covering applications. Analysis was performed in accordance with EPA Method No. 3050B/Method No. 7420; flame atomic absorption at an accredited laboratory.

Any paints containing lead at a concentration of 0.1% or greater were assessed for condition.

3.0 RESULTS AND CONCLUSIONS

3.1 Asbestos

Sample No.	Location	Description / Friability / Condition	Result (Type and %)
S0001A-C	Around exterior window frames throughout the building	Light grey caulking/ non-friable/ good condition	None Detected
S0002A-C	Around exterior window frames throughout the building	Grey and off-white caulking/ non-friable/ good condition	Chrysotile 0.5-5%
S0003A-C	Mortar Between bricks on exterior façade	Grey and beige mortar/ non-friable/ good condition	None Detected
S0004A-C	Around door frame on the back side of the building	Grey and brown caulking/ non-friable/ good condition	None Detected
S0005A-C	Around door frame on the back side of the building	Silver and beige caulking/ non-friable/ good condition	Chrysotile 0.5-5%*



*A third phase of the sample in the form of beige caulking was found to contain asbestos in Sample S0005A. As it is difficult to determine the full extent of asbestos-containing caulking around doors, presume the caulking around all door frames to contain asbestos.

3.2 Lead Paint

Sample No.	Location	Description / Condition	Result (%)
L0001	Door frame on the back side of the building	Brown paint on metal/ good condition	<0.0074
L0002	Door frame on the back side of the building	Black paint on metal/ good condition	<0.0058

Paint containing less than 0.009% (90 mg/kg) lead is assumed to be insignificant.

4.0 RECOMMENDATIONS

Provide this report to the contractor prior to bidding or commencing work.

Do not disturb suspected hazardous building materials discovered during the work, which have not been identified in this report and arrange for further testing.

Remove and dispose of asbestos-containing materials if disturbed by the planned renovation work. Follow appropriate safe work procedures when handling or disturbing asbestos. The specific work procedures, engineering controls and personal protective equipment (risk level) will need to be assessed on a project-by-project basis.

Analytical results indicate that all of the paints in the assessed area contain low levels of lead (i.e., less than the EACC guideline of 0.1% for lead-containing paints). Special precautions are not recommended unless aggressive disturbance (grinding, blasting, torching) is planned.

5.0 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.



Asbestos and Lead Test Results

Animal Services Centre, 735 Central Parkway West, Mississauga, Ontario
City of Mississauga

November 27, 2023
Pinchin File: 0333656.000
REVISED

6.0 CLOSURE

If you have any questions regarding this report, please contact the undersigned.

Sincerely,

Pinchin Ltd.

Prepared by:

Madhat Nazmi, B.Sc. Hons., EIT
Project Technologist
289.971.8427
mnazmi@pinchin.com

Reviewed by:

Anthony Rakic, PMP, EP
Senior Client Manager
905.363.1370
arakic@pinchin.com

Reviewed by:

Dustin Copeland, C. Tech.
Director, Hazardous Materials
905.363.1469
dcopeland@pinchin.com

- Encl.: Laboratory Report
 Drawings
 Photographs
 Previous Reports

\\pinchin.com\Miss\Job\333000s\0333656.000 CofMiss,735CenParkwayW,MISS,HAZ,ASSMT\Deliverables\0333656.000 REVISED Results Letter, 735 Central W Mississauga ON, City of Mississauga, Nov 27 2023.docx

Template: Master Asbestos Bulk Sample Results Letter, HAZ, February 19, 2020

APPENDIX I
Laboratory Report



Pinchin Ltd. Asbestos Laboratory *Certificate of Analysis*

Project Name: City of Mississauga, Animal Center, 735 Central Parkway West, Mississauga, Ontario
Project No.: 0333656.000
Prepared For: M. Nazmi / A. Rakic

Lab Reference No.: b303200
Analyst(s): J. Raisch-Berkoff

Date Received: October 30, 2023 **Samples Submitted:** 15
Date Analyzed: November 6, 2023 **Phases Analyzed:** 18

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.

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 Name: City of Mississauga, Animal Center, 735 Central Parkway West, Mississauga, Ontario
 Project No.: 0333656.000
 Prepared For: M. Nazmi / A. Rakic

Lab Reference No.: b303200
 Date Analyzed: November 6, 2023

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
S0001A Off-white Caulking on Window frames	Homogeneous, light grey, caulking material.	None Detected	Non-Fibrous Material > 75%
S0001B Off-white Caulking on Window frames	Homogeneous, light grey, caulking material.	None Detected	Non-Fibrous Material > 75%
S0001C Off-white Caulking on Window frames	Homogeneous, light grey, caulking material.	None Detected	Non-Fibrous Material > 75%
S0002A White Caulking on Window frames	Homogeneous, grey and off-white, caulking material.	Chrysotile 0.5-5%	Non-Fibrous Material > 75%
S0002B White Caulking on Window frames			Not Analyzed
Comments:	Analysis was stopped due to a previous positive result.		
S0002C White Caulking on Window frames			Not Analyzed
Comments:	Analysis was stopped due to a previous positive result.		
S0003A Morar on Brick Walls	Non-homogeneous, grey and beige, hard, cementitious material.	None Detected	Non-Fibrous Material > 75%
S0003B Morar on Brick Walls	Homogeneous, grey, hard, cementitious material.	None Detected	Non-Fibrous Material > 75%



Pinchin Ltd. Asbestos Laboratory Certificate of Analysis

Project Name: City of Mississauga, Animal Center, 735 Central Parkway West, Mississauga, Ontario
 Project No.: 0333656.000
 Prepared For: M. Nazmi / A. Rakic

Lab Reference No.: b303200
 Date Analyzed: November 6, 2023

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
S0003C Morar on Brick Walls	2 Phases: a) Homogeneous, grey, hard, cementitious material.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, beige, hard, cementitious material.	None Detected	Non-Fibrous Material > 75%
Comments:	Phase b) is small in size.		
S0004A Grey Caulking Around Door Frame	Homogeneous, grey-brown, caulking material.	None Detected	Non-Fibrous Material > 75%
S0004B Grey Caulking Around Door Frame	Homogeneous, grey-brown, caulking material.	None Detected	Non-Fibrous Material > 75%
Comments:	Foam is present on the surface of this sample.		
S0004C Grey Caulking Around Door Frame	Homogeneous, grey-brown, caulking material.	None Detected	Non-Fibrous Material > 75%
S0005A Sliver Caulking Around Door Frame	3 Phases: a) Homogeneous, grey, caulking material.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, brown, caulking material.	None Detected	Non-Fibrous Material > 75%
	c) Homogeneous, beige, caulking material.	Chrysotile 0.5-5%	Non-Fibrous Material > 75%
Comments:	Phase c) is small in size. Cellulose is present on the surface of this sample.		



Pinchin Ltd. Asbestos Laboratory
Certificate of Analysis

Project Name: City of Mississauga, Animal Center, 735 Central Parkway West, Mississauga, Ontario
Project No.: 0333656.000
Prepared For: M. Nazmi / A. Rakic

Lab Reference No.: b303200
Date Analyzed: November 6, 2023

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
S0005B Sliver Caulking Around Door Frame	2 Phases: a) Homogeneous, grey, caulking material.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, brown, caulking material.	None Detected	Non-Fibrous Material > 75%
Comments:	Phase b) is small in size. Cellulose is present on the surface of this sample.		
S0005C Sliver Caulking Around Door Frame	a) Homogeneous, grey, caulking material.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, brown, caulking material.	None Detected	Non-Fibrous Material > 75%
Comments:	Phase b) is small in size. Cellulose is present on the surface of this sample.		

Reviewed by:

Digitally signed by
Cheryl Hendsbee
Date: 2023.11.06
16:28:47-05'00'

Reporting Analyst:

Digitally signed by
Cheryl Hendsbee
Date: 2023.11.06
16:28:38-05'00'



NOV 6/23

Analyzed by:

JRB (18)

Reviewed by:

Report Sent by:

Cell



Special Instructions:

Pinchin Ltd. - Asbestos Laboratory
Internal Asbestos Bulk Sample Chain of Custody

Client Name:	City of Mississauga	Project Address:	735 Central Parkway West, Mississauga, Ontario.
Portfolio/Building No:	Animal Center	Pinchin File:	333656
Submitted by:	Madhat Nazmi	Email:	mnazmi@pinchin.com
CC Results to:	Anthony Rakic	CC Email:	arakic@pinchin.com
Invoice to:		Invoice Email:	arakic@pinchin.com
Date Submitted:	October 27 2023	Required by:	November 3 2023
# of Samples:	15	Priority:	5 Day Turnaround
Year of Building Construction (Mandatory Field):			1987
Do NOT Stop on Positive (Sample Numbers):			
Pinchin Group Company (Mandatory Field):			Pinchin

To be Completed by Lab Personnel Only: **6303200 CA**

Lab Reference #:		Time:	24 hour clock		
Received by:	OCT 30 2023	Date:	Month	Day	2021
Name(s) of Analyst(s):					

Sample Prefix	Sample No.	Sample Suffix	Sample Description/Location (Mandatory)
S	0001	A	Off-white Caulking on Window frames ND
S	0001	B	Off-white Caulking on Window frames ND
S	0001	C	Off-white Caulking on Window frames ND
S	0002	A	White Caulking on Window frames CH 0.5-59.
S	0002	B	White Caulking on Window frames NA

Sample Prefix	Sample No.	Sample Suffix	Sample Description/Location (Mandatory)
S	0002	C	White Caulking on Window frames NA
S	0003	A	Morar on Brick Walls ND
S	0003	B	Morar on Brick Walls ND
S	0003	C	Morar on Brick Walls a) ND b) ND
S	0004	A	Grey Caulking Around Door Frame ND
S	0004	B	Grey Caulking Around Door Frame ND
S	0004	C	Grey Caulking Around Door Frame ND
S	0005	A	Sliver Caulking Around Door Frame a) ND b) ND c) CH 0.5-5?
S	0005	B	Sliver Caulking Around Door Frame a) ND b) ND
S	0005	C	Sliver Caulking Around Door Frame a) ND b) ND



Analysis for Lead Concentration in Paint Chips

by Flame Atomic Absorption Spectroscopy
EPA SW-846 3050B/6010C/7000B



Customer: Pinchin Ltd.
2360 Meadowpine Blvd, Unit 2
Mississauga, ON L5N 6C3

Attn: Anthony Rakic

Lab Order ID: 10036108

Analysis: PBP

Date Received: 10/31/2023

Date Reported: 11/07/2023

Project:

Sample ID	Description	Mass (g)	Concentration (ppm)	Concentration (% by weight)
Lab Sample ID	Lab Notes			
L0001	Brown Paint on Door Frames	0.0539	<74	<0.0074%
10036108_0001				
L0002	Black Paint on Door Frames	0.0686	<58	<0.0058%
10036108_0002				

Disclaimer: Unless otherwise noted blank sample correction was not performed on analytical results. Scientific Analytical Institute participates in the AIHA ELPAT program. ELPAT Laboratory ID: 173190. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. Analytical uncertainty available upon request. The quality control samples run with the samples in this report have passed all EPA required specifications unless otherwise noted. RL: (Report Limit for an undiluted 50ml sample is 4µg Total Pb).

Matthew Caffey (2)

Analyst

Approved Signatory

16032108


Version 1-15-2012

Client:	Pinchin Ltd.	*Instructions: Use Column "B" for your contact info To See an Example Click the bottom Example Tab. Enter samples between "<<" and ">>" Begin Samples with a "<<" above the first sample and end with a ">>" below the last sample. Only Enter your data on the first sheet "Sheet1" <i>Note: Data 1 and Data 2 are optional</i> <i>fields that do not show up on the official</i> <i>report, however they will be included</i> <i>in the electronic data returned to you</i> <i>to facilitate your reintegration of the report data.</i>
Contact: Address: Phone: Fax:	Anthony Rakic 2360 Meadowpine Boulevard, Unit 2, Mississauga ON 416-816-5498	
Email:	arakic@pinchin.com	
Project:		
Client Notes:		
P.O. #:	333656	
Date Submitted:	10/27/2023 0:00	
Analysis: TurnAroundTime:	Lead Regular	

Invoice to:

Anthony Rakic
arakic@pinchin.com

Scientific Analytical Institute



4604 Dundas Dr.
Greensboro, NC 27407
Phone: 336.292.3888
Fax: 336.292.3313
Email: lab@sailab.com

Sample Number	Data 1 (Lab use only)	Sample Description	Data 2 (Lab use only)
<<	[Enter data of your choosing here]	Brown Paint on Door Frames	[Enter data of your choosing here]
L0001	[Enter data of your choosing here]	Black Paint on Door Frames	[Enter data of your choosing here]
L0002			
>>			

Accepted

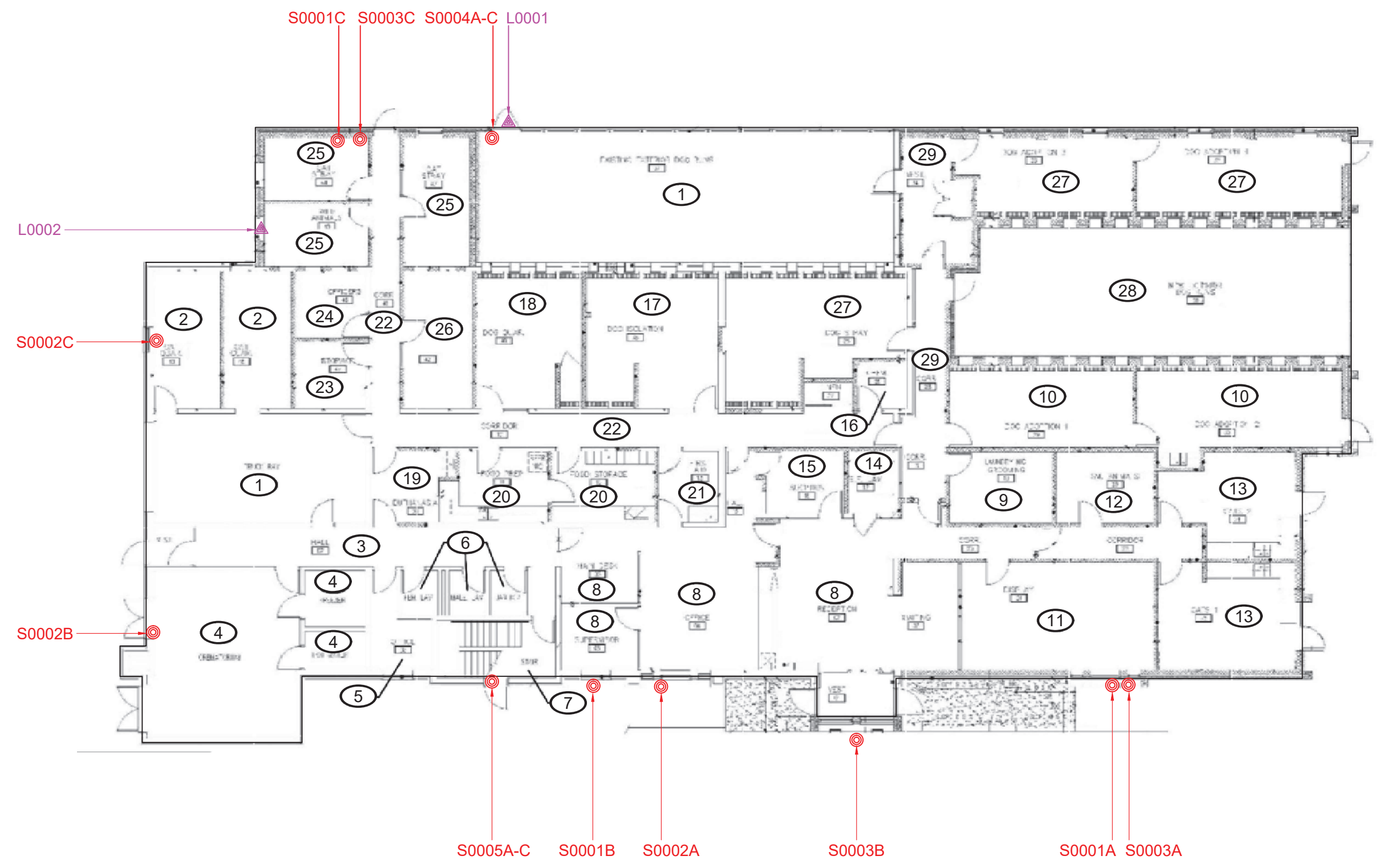
Rejected

y. Selb 10/31
10:30am

APPENDIX II
Drawings



- LEGEND**
- X PINCHIN LOCATION NUMBER
 - ⊙ ASBESTOS BULK SAMPLE
 - ▲ LEAD 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:
735 CENTRAL PARKWAY WEST MISSISSAUGA, ONTARIO

FIGURE NAME:
GROUND FLOOR

PROJECT NUMBER: 333656.000	SCALE: NOT TO SCALE
DRAWN BY: DP	REVIEWED BY: MN
DATE: NOVEMBER 2023	FIGURE NUMBER: 1 OF 1

APPENDIX III
Photographs



Photo 1 - Non-asbestos light grey caulking around exterior window frame.



Photo 2 - Asbestos containing grey and off-white caulking on window frame.



Photo 3 - Asbestos containing grey and off-white caulking on window frame.



Photo 4 - Non-asbestos mortar between bricks.



Photo 5 - Non asbestos brown and grey caulking around door frame.

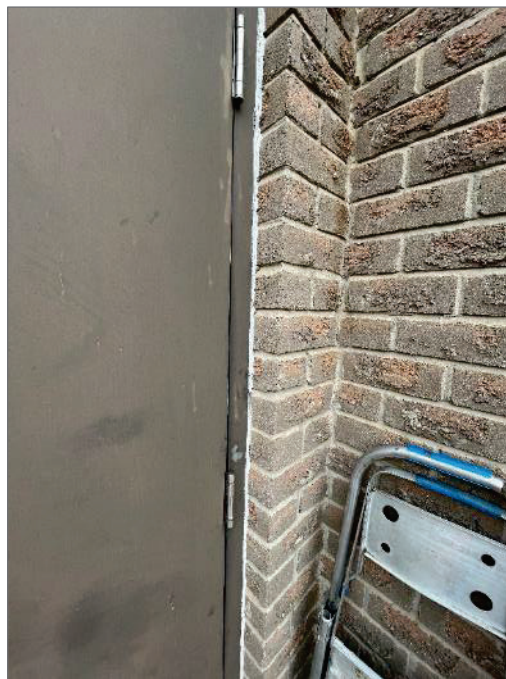


Photo 6 - Non-asbestos sliver caulking around door frame.



Asbestos and Lead Test Results

City of Mississauga

Photographs

November 27, 2023

Pinchin File: 0333656.000

Appendix III



Photo 7 - Brown paint on doors.



Photo 8 - Black paint on doors.

APPENDIX IV
Previous Reports



Asbestos Reassessment

Animal Services Centre – ACC1
735 Central Parkway West,
Mississauga, Ontario

Prepared for:

City of Mississauga
950 Burnhamthorpe Road West, 2nd Floor
Mississauga, Ontario, L5B 3B4

April 12, 2021

Pinchin File: 282188.000



Asbestos Reassessment

Animal Services Centre – ACC1, 735 Central Parkway West, Mississauga, Ontario
City of Mississauga

April 12, 2021
Pinchin File: 282188.000

Issued to: City of Mississauga
Issued on: April 12, 2021
Pinchin File: 282188.000
Issuing Office: Mississauga, ON

Author: Justin Dotto, EPt
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Reviewer: Scott Cryer, P. Geo.
Operations Manager – Hazardous Materials/Radon
905.363.1311
scryer@pinchin.com



EXECUTIVE SUMMARY

City of Mississauga (Client) retained Pinchin Ltd. (Pinchin) to conduct an asbestos building materials reassessment of the ACC1 Animal Services Centre located at 735 Central Parkway West, Mississauga, Ontario. The reassessment was performed on January 14, 2021.

The objective of the reassessment was to evaluate the condition and quantity of previously reported asbestos-containing materials (ACM), and develop corrective action plans as required for the purposes of long-term management. The results of this reassessment are not intended for construction, renovation, demolition or project tendering purposes.

The reassessed area was limited to the areas of the building where ACM was previously identified as documented in the report titled, *Asbestos Reassessment Report, Animal Services Centre – ACC1, 735 Central Parkway West, Mississauga, Ontario*, prepared by Pinchin, dated September 27, 2019, Pinchin File No. 239479.

SUMMARY OF FINDINGS

Asbestos-containing materials (ACM) are present as follows:

- Non-friable asbestos cement (Transite) pipe.

SUMMARY OF RECOMMENDATIONS

The following is a summary of significant recommendations; refer to the body of the report for detailed recommendations.

1. Perform a reassessment of asbestos materials on an annual basis.
2. Prior to renovations or demolition, perform a pre-construction assessment to identify any hazardous materials that may be disturbed by the work.
3. Follow appropriate safe work procedures when handling or disturbing asbestos.

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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APPENDIX III Location Summary Report

APPENDIX IV Confirmed and Presumed Asbestos Report

APPENDIX V All Data Report

APPENDIX VI Photo Summary Report



1.0 INTRODUCTION AND SCOPE

City of Mississauga (Client) retained Pinchin Ltd. (Pinchin) to conduct an asbestos building materials reassessment of the ACC1 Animal Services Centre located at 735 Central Parkway West, Mississauga, Ontario.

Pinchin performed the reassessment on January 14, 2021. The surveyor was accompanied by City of Mississauga personnel during the reassessment. The assessed area was occupied at the time of the reassessment.

The objectives of the reassessment were to document the locations, quantities and conditions of previously identified asbestos-containing building materials and develop corrective action plans as required. This reassessment is only to be used for the purposes of long-term management and routine maintenance. The results of this reassessment are not to be used for construction, renovation, demolition or project tendering purposes.

1.1 Scope of Reassessment

The reassessment included a review of previously identified ACMs as identified in the report, *Asbestos Reassessment Report, Animal Services Centre – ACC1, 735 Central Parkway West, Mississauga, Ontario*, prepared by Pinchin, dated September 27, 2019, Pinchin File No. 239479.

Please refer to Appendix III for a detailed description of the methodology used for this reassessment.

2.0 BACKGROUND INFORMATION

2.1 Building Description

Description Item	Details
Use	Animal Centre
Number of Floors	2 Floors
Total Area	15,250 square feet
Year of Construction	Constructed in 1987, with renovations in 2002.
Structure	Structural steel, concrete
Exterior Cladding	Brick veneer, concrete
HVAC	Supplied air system by AHU and Boiler
Roof	Built-up roofing, shingled sloped roof systems
Flooring	Vinyl tile, vinyl sheet flooring, carpet, ceramic tile, concrete
Interior Walls	Drywall, concrete block
Ceilings	Drywall, acoustic ceiling tiles



2.2 Existing Reports

2.2.1 Review of Previous Reports

Pinchin relied on the following report, which has been reviewed as part of this reassessment:

- “Asbestos Reassessment Report, Animal Services Centre – ACC1, 735 Central Parkway West, Mississauga, Ontario” dated September 27, 2019, Pinchin File No. 239479.

2.2.2 Summary of Asbestos Abatement since the Previous Reassessment

Based on a observations made during the reassessment, asbestos abatement has not been conducted since the last reassessment.

3.0 FINDINGS

The following section summarizes the findings of the reassessment and provides a general description of the asbestos materials identified and their locations.

For details on quantities, condition and locations of ACM; refer to the Confirmed and Presumed Asbestos Report and All Data Report in Appendix V and VI.

Appendix II presents the asbestos bulk sample analytical results.

3.1 Asbestos

3.1.1 Pipe Insulation

Pipes are either uninsulated or insulated with fibreglass and jacketed with paper throughout the building.

3.1.2 Duct Insulation

Ducts are either uninsulated or insulated with non-asbestos fibreglass (foil-faced).

3.1.3 Mechanical Equipment Insulation

Mechanical equipment (fan unit) is uninsulated in the Truck Bay (Location 1).

3.1.4 Acoustic Ceiling Tiles

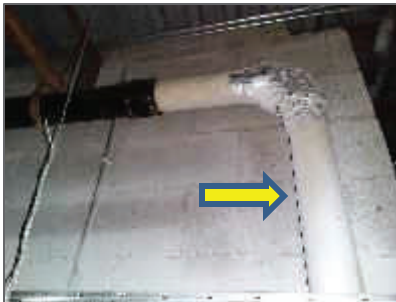
All ceiling tiles are presumed to be non-asbestos based on the date of manufacture determined from the date stamp applied to the top of the tiles, or the age of the materials determined from the date of the building construction. The tiles were manufactured after asbestos was stopped being used in acoustic ceiling tiles.

3.1.5 Drywall Joint Compound

Asbestos in drywall joint compound was banned in Canada in 1980. Drywall joint compound in the building was installed after 1986 (1980 plus a reasonable non-compliance period based on our experience) and is assumed to contain no asbestos.

3.1.6 Asbestos Cement Products (Transite)

Transite pipe, presumed to contain asbestos based on visual observation, is present as rain water leaders above ceiling in the 1st Floor Front Reception Area (Location 8). Transite is non-friable material and in good condition. There is ten linear feet of Transite pipe present.



Transite pipe, Offices & Waiting Area (Location 8).

3.1.7 Vinyl Sheet Flooring

Vinyl sheet flooring is presumed to be non-asbestos based on the age of construction of the building (1987).

3.1.8 Presumed Asbestos Materials

The following is a list of materials which may contain asbestos, which were not observed and/or not sampled during the assessment; these materials are presumed to contain asbestos until otherwise proven by sampling and analysis:

- Roofing felts and tar, mastics
- Floor levelling compound
- Electrical components
- Mechanical packing, ropes and gaskets
- Vermiculite in wall and ceiling cavities
- Adhesives and duct mastics
- Caulking and putties



- Paper products
- Soffit and fascia boards
- Fire resistant doors

4.0 RECOMMENDATIONS

4.1 General

Perform a detailed intrusive assessment prior to building renovation or demolition operations. The assessment should include; destructive testing (i.e. coring and/or removal of building finishes and components), sampling of other hazardous materials (lead, mercury, PCBs, mould, etc.), and materials not tested in this study (i.e. roofing materials, caulking, mastics).

4.2 On-going Management and Maintenance

The following recommendations are made regarding on-going management and maintenance work involving the asbestos materials identified.

Perform a reassessment of asbestos materials on an annual basis.

Remove asbestos-containing materials (ACM) prior to alteration or maintenance work if ACM may be disturbed by the work. Follow appropriate asbestos precautions for the classification of work being performed.

Update the asbestos inventory report for the building upon completion of any abatement of ACM.

5.0 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.



6.0 REFERENCES

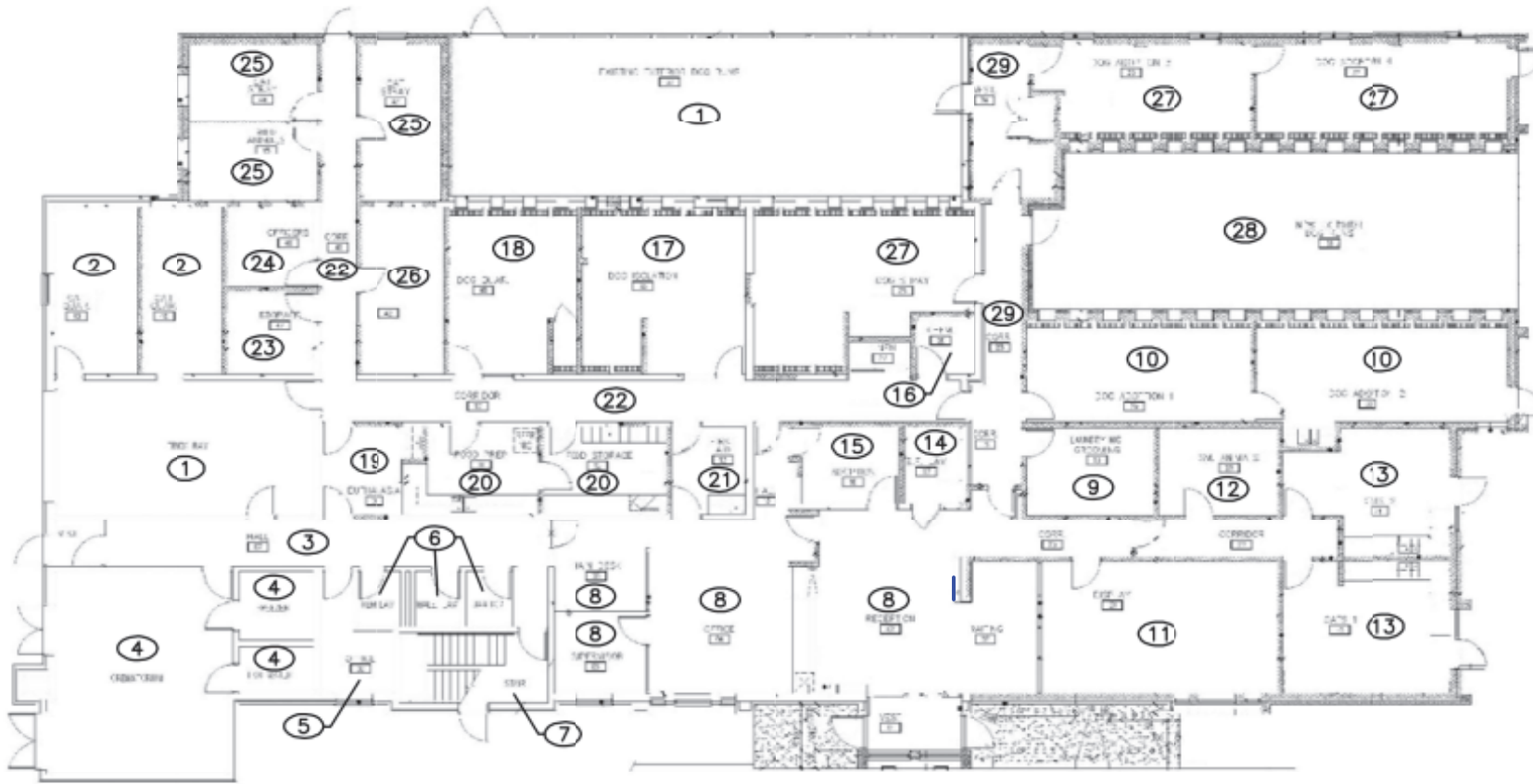
The following legislation and documents were referenced in completing the assessment and this report:


1. Asbestos on Construction Projects and in Buildings and Repair Operations, Ontario Regulation 278/05.
2. Designated Substances, Ontario Regulation 490/09.
3. Ministry of the Environment Regulation, R.R.O. 1990 Reg. 347 as amended.

\\pinchin.com\Miss\Job\282000s\0282188.000 CofMiss,2020Portfolio,AsbestosReass,HAZ\Deliverables\ACC1- Animal Services Centre\282188 2021 Re assessment Report, ACC1 735 Central Pkwy Miss, CoM, Apr 12 2021.docx

Template: Master Report for Asbestos Reassessment, HAZ, November 19, 2020


APPENDIX I
Drawings





-G-1-1
 (1) INDICATED LOCATION NUMBER
 (●) AREA(S) FOR CONTAINING MATERIALS
 (—) TRANSFER PATH

NOT ALL ROOMS OR SURFACES LISTED AS POTENTIALLY CONTAINING ASBESTOS. THIS IS ONLY A PRELIMINARY ASSESSMENT. FOR A COMPLETE LIST OF ROOMS AND SUSPECTED ASBESTOS-CONTAINING SURFACES, REFER TO THE ASBESTOS ASSESSMENT REPORT TO BE AVAILABLE. LEGENDS COULD BE EXPLICIT. HOWEVER, COPIES MAY ALTER INTERPRETATION.
 BASED ON PHOTOGRAPHY BY GIBCO.



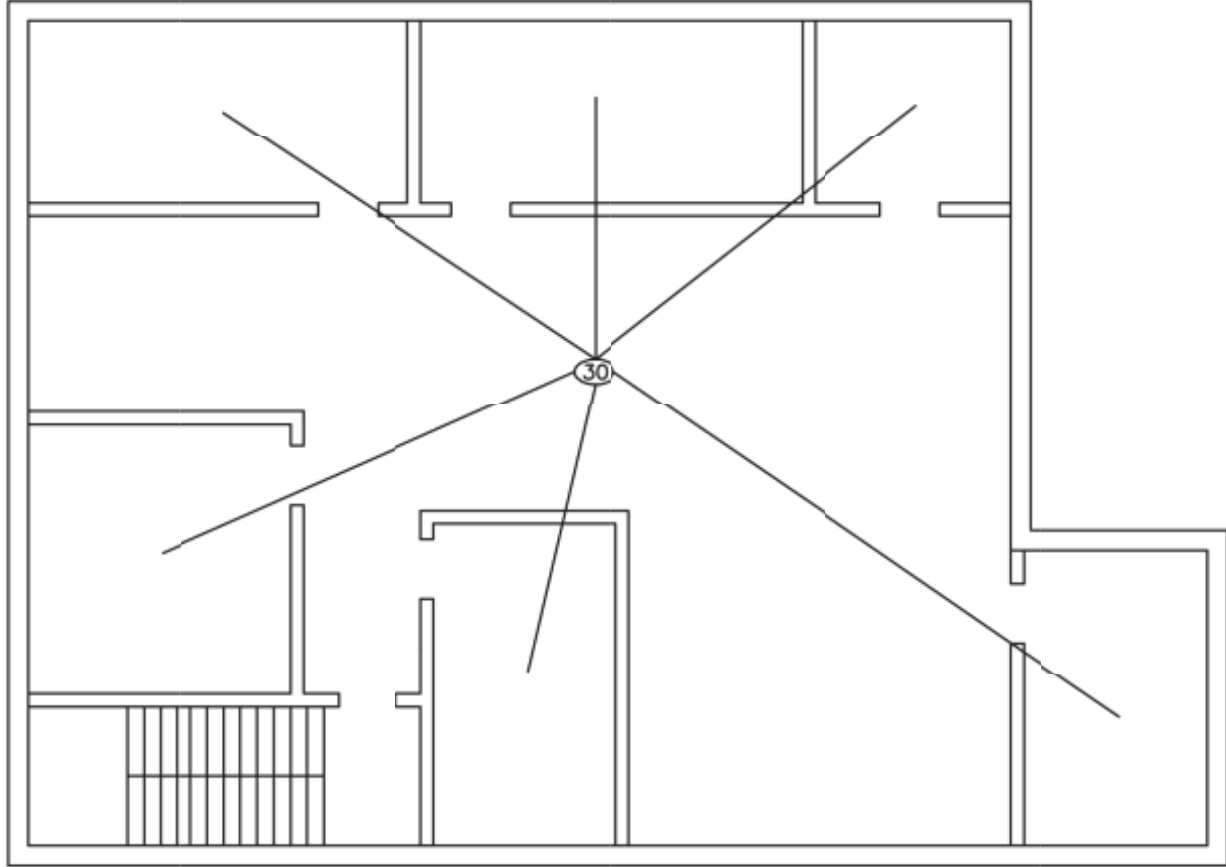
INDUSTRIAL
ASBESTOS REASSESSMENT

CITY OF MISSISSAUGA

PROJECT NAME
 ANIMAL SERVICE CENTRE
 755 CENTRAL PARK AVE WEST
 MISSISSAUGA, ONTARIO

FLOOR NAME
 GROUND FLOOR

PROJECT NUMBER 282188	SCALE NOT TO SCALE
DATE 5/1	REVISION JD
DATE MARCH 2021	PAGE NUMBER 1 OF 2



LEGEND:
 ○ INDICATE LOCATION NUMBER
 ○ ASBESTOS-CONTAINING MATERIALS
 — WALL OPENING

NOT ALL FINDINGS OR SUSPECTED ASBESTOS-CONTAINING BUILDING MATERIALS MAY BE IDENTIFIED IN THIS DRAWING. REFER TO THE ASBESTOS REASSESSMENT REPORT TO THE COMPLETE LIST OF KNOWN AND SUSPECTED ASBESTOS-CONTAINING BUILDING MATERIALS.

LEGEND IS TO BE USED IN CONJUNCTION WITH DOTEE'S RAY ALTER INTERPRETATION.

RASHAD HADJIPOUR, P. ENG.



PROJECT NAME:
 ASBESTOS REASSESSMENT

CITY:
 CITY OF MISSISSAUGA

CLIENT:
 ANIMAL SERVICE CENTRE
 735 CENTRAL PARKWAY WEST
 MISSISSAUGA, ONTARIO

FLOOR:
 SECOND FLOOR

PROJECT NUMBER: 2821AR **SCALE:** NOT TO SCALE

DATE: 5/2 **BY:** J.D.

DATE: MARCH 2021 **PAGE NUMBER:** 2 OF 2

APPENDIX II
Methodology



1.0 METHODOLOGY

Pinchin conducts an inspection of previously identified asbestos-containing materials (ACM) to evaluate the current condition of all accessible identified in the most recent assessment. The surveyor makes reference to any existing assessment or abatement reports (as provided by the Client).

1.1 Limitations on Scope

The re-assessment excludes the following:

- Articles belonging to the owner, tenant or occupant (e.g. stored items, furniture, appliances, etc.);
- Underground materials or equipment (e.g. vessels, drums, underground storage tanks, pipes, etc.);
- Building envelope, structural components, inaccessible or concealed materials or other items where sampling may cause consequential damage to the property.
- Energized systems (e.g. internal boiler components, elevators, mechanical or electrical components);
- Controlled products (e.g. stored chemicals, operational or process-related substances); and
- Materials not typically associated with construction (e.g. settled dust, spills, residual contamination from prior spills, etc.).

As per the original scope of work, concealed locations such as ceiling spaces above solid ceilings, shafts and chases are accessed via existing access panels. Our investigation does not include demolition of drywall or plaster walls to view concealed conditions. Structural items or exterior building finishes are not removed to determine the presence of concealed materials.

1.2 Methodology

Existing sampling data is reviewed and relied upon. If sampling is conducted, samples are collected at a rate that is in compliance with the requirements of local regulations and guidelines. The sampling strategy is 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.

Materials listed as exclusions in the previous reports remain as exclusions. Sampling, assessment or verification of excluded materials was not conducted.



2.0 ANALYSIS AND IDENTIFICATION OF ASBESTOS MATERIALS

Pinchin relies on the analytical results of prior surveys. Asbestos bulk samples (if required) are analyzed at an independent NVLAP accredited laboratory. Preliminary identification of asbestos fibres is made using polarized light microscopy, with confirmation of the presence and type of asbestos made by dispersion staining optical microscopy. The analysis is performed in accordance with Test Method EPA/600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials, June 1993. All independent laboratories used by Pinchin, including our laboratory, are certified under the National Voluntary Laboratory Accreditation Program (NVLAP) to perform asbestos analysis of bulk samples.

Analytical results are compared to the following criteria.

Jurisdiction	Friable	Non-Friable
Ontario	0.5%	0.5%

The asbestos analysis is completed using a stop positive approach. Only one result meeting the above regulated criteria is 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 stops 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 are analyzed if no asbestos is detected. In some cases, all samples are analyzed in the sample set regardless of result.

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.

Asbestos materials are evaluated in order to make recommendations regarding remedial work. The priority for remedial action is 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).

APPENDIX III
Location Summary Report

Client: City Of Mississauga
Building Name: Animal Services Centre
Surveyor:
Reassessment Surveyor: Justin Dotto

Site: , , ON
Survey Date:
Last Re-Assessment: 2021-02-24

Location No.	Name or Description	ft ²	Floor No.	Notes
1	Truck Bay	750	1	
2	Cat Isolation Room	500	1	NAC above ceiling
3	SW Corridor	500	1	
4	Cremation & Freezer	750	1	
5	SW Office	100	1	NAC above ceiling.
6	Washrooms & Janitor's Closet	100	1	
7	Stairwell	200	1	
8	Front Reception, Offices & Waiting Area	2000	1	During the 2019 reassessment it was observed that 7 linear feet of transite has been abated.
9	Laundry Room	100	1	NAC above ceiling.
10	Dog Kennel	1000	1	NAC above ceiling.
11	Education Room	300	1	NAC above ceiling.
12	Adoption Waiting Area & Corridor	200	1	NAC above ceiling.
13	Cat Adoption Area	800	1	
14	Public Washroom	50	1	
15	Interview Room	100	1	
16	Chemical Storage Room	50	1	NAC above ceiling.
17	Dog Isolation Room	500	1	NAC above ceiling.
18	Dog Quarantine Room	500	1	NAC above ceiling.
19	Examination Room	100	1	NAC above ceiling.
20	Food Preparation & Kitchen	400	1	NAC above ceiling.
21	First Aid Room	100	1	NAC above ceiling.
22	Northwest Corridor	800	1	NAC above ceiling.
23	Storage Room	100	1	NAC above ceiling.
24	Office	100	1	NAC above ceiling.
25	Cat Quarantine & Receiving	750	1	NAC above ceiling.
26	Office	200	1	NAC above ceiling.
27	Dog Adoption Area	1200	1	NAC above ceiling.
28	Exterior Dog Runs	1500	1	NAC above ceiling. Drywall panels on ceiling.
29	Northeast Corridor	500	1	NAC above ceiling.
30	Second Floor Offices	1000	2	

APPENDIX IV
Confirmed and Presumed Asbestos Report



CONFIRMED AND PRESUMED HAZARDOUS REPORT



Client: City Of Mississauga
 Location: #8 : Front Reception, Offices & Waiting Area
 Surveyor:

Site: , , ON
 Floor: 1
 Survey Date: 2021-01-09

Building Name: Animal Services Centre
 Room #:
 Reassessment Surveyor: Justin Dotto

Area (sqft): 2000
 Last Re-Assessment: 2021-02-24

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Piping ¹	Rain Water Leader	Cement Product			C	N		10			LF	V9000	Confirmed Asbestos		Confirmed Asbestos(NF)

During the 2019 reassessment it was observed that 7 linear feet of transite has been abated.

1 - Transite pipe is visible above ceiling but also runs down behind drywall wall

Legend:

Sample number		Units		Other	
S####	Asbestos sample collected	SF	Square feet	A	Access
V####	Material visually similar to numbered sample collected	LF	Linear feet	V	Visible
V0000	Known non-asbestos material	EA	Each	AP	Air Plenum
V9000	Visually identified as an asbestos material	%	Percentage	F	Friable material
V9500	Material is presumed to be an asbestos material			NF	Non Friable material
				PF	Potentially Friable material

Access		Condition	
A	Accessible to all building occupants	Good	No visible damage or deterioration
B	Accessible to maintenance and operations staff without a ladder	Fair	Minor, repairable damage, cracking, delamination or deterioration
C	Accessible to maintenance and operations staff with a ladder. Also rarely entered, locked areas	Poor	Irreparable damage or deterioration with exposed and missing material
D	Not normally accessible		

APPENDIX V
All Data Report



ALL DATA REPORT



Client: City Of Mississauga
 Location: #1 : Truck Bay
 Surveyor:

Site: , , ON
 Floor: 1
 Survey Date: 2021-01-09

Building Name: Animal Services Centre
 Room #:
 Reassessment Surveyor: Justin Dotto

Area (sqft): 750
 Last Re-Assessment: 2021-02-24

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling		None Found													
Duct		Fibreglass													
Duct		Not Insulated													
Floor		Concrete (poured)													
Mechanical Equipment	Fan Unit	Not Insulated													
Piping		Fibreglass													
Piping		Not Insulated													
Structure	Beam Deck Joist	Steel		Not Insulated	C	Y									
Wall		Concrete (poured)													

Client: City Of Mississauga
 Location: #2 : Cat Isolation Room
 Surveyor:

Site: , , ON
 Floor: 1
 Survey Date: 2021-01-09

Building Name: Animal Services Centre
 Room #:
 Reassessment Surveyor: Justin Dotto

Area (sqft): 500
 Last Re-Assessment: 2021-02-24

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling		Drywall and joint compound			A	Y		100			%	V0000	Non-Asbestos		None
Duct		None Found													
Floor		Concrete (poured)													
Mechanical Equipment		None Found													
Piping		Not Insulated													
Structure		None Found													
Wall		Concrete (poured)													

NAC above ceiling



ALL DATA REPORT



Client: City Of Mississauga
 Location: #3 : SW Corridor
 Surveyor:

Site: , , ON
 Floor: 1
 Survey Date: 2021-01-09

Building Name: Animal Services Centre
 Room #:
 Reassessment Surveyor: Justin Dotto

Area (sqft): 500
 Last Re-Assessment: 2021-02-24

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling		Ceiling Tiles (lay-in)			C	Y		500			SF	V0000	Non-Asbestos		None
Duct		Not Insulated													
Floor		Vinyl Sheet Flooring			A	Y		500			SF	V0000	Non-Asbestos		None
Mechanical Equipment		None Found													
Piping		Fibreglass													
Piping		Not Insulated													
Structure	Beam Deck Joist	Steel		Not Insulated	C	N									
Wall		Concrete (poured)													



ALL DATA REPORT



Client: City Of Mississauga
 Location: #4 : Cremation & Freezer
 Surveyor:

Site: , , ON
 Floor: 1
 Survey Date: 2021-01-09

Building Name: Animal Services Centre
 Room #:
 Reassessment Surveyor: Justin Dotto

Area (sqft): 750
 Last Re-Assessment: 2021-02-24

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling		None Found													
Duct		Not Insulated													
Floor		Concrete (poured)													
Mechanical Equipment		Not Insulated													
Piping		Fibreglass													
Piping		Not Insulated													
Structure	Beam Deck Joist	Steel		Not Insulated	C	Y									
Wall		Drywall and joint compound													

Client: City Of Mississauga
 Location: #5 : SW Office
 Surveyor:

Site: , , ON
 Floor: 1
 Survey Date: 2021-01-09

Building Name: Animal Services Centre
 Room #:
 Reassessment Surveyor: Justin Dotto

Area (sqft): 100
 Last Re-Assessment: 2021-02-24

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling		Drywall and joint compound			C	Y		100			%	V0000	Non-Asbestos		None
Duct		None Found													
Floor		Vinyl Sheet Flooring			A	Y		100			SF	V0000	Non-Asbestos		None
Mechanical Equipment		None Found													
Piping		Not Insulated													
Structure		None Found													
Wall		Concrete (poured)													

NAC above ceiling.



ALL DATA REPORT



Client: City Of Mississauga

Site: , , ON

Building Name: Animal Services Centre

Location: #6 : Washrooms & Janitor's Closet

Floor: 1

Room #:

Area (sqft): 100

Surveyor:

Survey Date: 2021-01-09

Reassessment Surveyor: Justin Dotto

Last Re-Assessment: 2021-02-24

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling		Drywall and joint compound			C	Y		100			%	V0000	Non-Asbestos		None
Duct		None Found													
Floor		Vinyl Sheet Flooring			A	Y		100			SF	V0000	Non-Asbestos		None
Mechanical Equipment		None Found													
Piping		Not Insulated													
Structure		None Found													
Wall		Concrete (poured)													

Client: City Of Mississauga

Site: , , ON

Building Name: Animal Services Centre

Location: #7 : Stairwell

Floor: 1

Room #:

Area (sqft): 200

Surveyor:

Survey Date: 2021-01-09

Reassessment Surveyor: Justin Dotto

Last Re-Assessment: 2021-02-24

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling		Drywall and joint compound			C	Y		100			%	V0000	Non-Asbestos		None
Duct		None Found													
Floor		Vinyl Sheet Flooring			A	Y		100			SF	V0000	Non-Asbestos		None
Mechanical Equipment		None Found													
Piping		Not Insulated						170							
Structure		None Found													
Wall		Concrete (poured)													



ALL DATA REPORT



Client: City Of Mississauga
 Location: #8 : Front Reception, Offices & Waiting Area
 Surveyor:

Site: , , ON
 Floor: 1
 Survey Date: 2021-01-09

Building Name: Animal Services Centre
 Room #:
 Reassessment Surveyor: Justin Dotto

Area (sqft): 2000
 Last Re-Assessment: 2021-02-24

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling		Ceiling Tiles (lay-in)			C	Y		2000			SF	V0000	Non-Asbestos		None
Duct		Fibreglass													
Duct		Not Insulated													
Floor		Vinyl Sheet Flooring			A	Y		2000			SF	V0000	Non-Asbestos		None
Mechanical Equipment		None Found													
Piping		Fibreglass													
Piping		Not Insulated													
Piping ¹	Rain Water Leader	Cement Product			C	N		10			LF	V9000	Confirmed Asbestos		Confirmed Asbestos(NF)
Structure	Beam Deck Joist	Steel		Not Insulated	C	N									
Wall		Concrete (poured)													

During the 2019 reassessment it was observed that 7 linear feet of transite has been abated.

1 - Transite pipe is visible above ceiling but also runs down behind drywall wall



ALL DATA REPORT



Client: City Of Mississauga
Location: #9 : Laundry Room
Surveyor:

Site: , , ON
Floor: 1
Survey Date: 2021-01-09

Building Name: Animal Services Centre
Room #:
Reassessment Surveyor: Justin Dotto

Area (sqft): 100
Last Re-Assessment: 2021-02-24

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling		Drywall and joint compound			C	Y		100			%	V0000	Non-Asbestos		None
Duct		Not Insulated													
Floor		Concrete (poured)													
Mechanical Equipment		None Found													
Piping		Not Insulated													
Structure		None Found													
Wall		Concrete (poured)													

NAC above ceiling.

Client: City Of Mississauga
Location: #10 : Dog Kennel
Surveyor:

Site: , , ON
Floor: 1
Survey Date: 2021-01-09

Building Name: Animal Services Centre
Room #:
Reassessment Surveyor: Justin Dotto

Area (sqft): 1000
Last Re-Assessment: 2021-02-24

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling		Drywall and joint compound			C	Y		100			%	V0000	Non-Asbestos		None
Duct		None Found													
Floor		Concrete (poured)													
Mechanical Equipment		None Found													
Piping		None Found													
Structure		None Found													
Wall		Concrete (poured)													

NAC above ceiling.



ALL DATA REPORT



Client: City Of Mississauga
Location: #11 : Education Room
Surveyor:

Site: , , ON
Floor: 1
Survey Date: 2021-01-09

Building Name: Animal Services Centre
Room #:
Reassessment Surveyor: Justin Dotto

Area (sqft): 300
Last Re-Assessment: 2021-02-24

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling		Drywall and joint compound			C	Y		100			%	V0000	Non-Asbestos		None
Duct		None Found													
Floor		Vinyl Sheet Flooring			A	Y		100			SF	V0000	Non-Asbestos		None
Mechanical Equipment		None Found													
Piping		Not Insulated													
Structure		None Found													
Wall		Concrete (poured)													

NAC above ceiling.

Client: City Of Mississauga
Location: #12 : Adoption Waiting Area & Corridor
Surveyor:

Site: , , ON
Floor: 1
Survey Date: 2021-01-09

Building Name: Animal Services Centre
Room #:
Reassessment Surveyor: Justin Dotto

Area (sqft): 200
Last Re-Assessment: 2021-02-24

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling		Drywall and joint compound			C	Y		100			%	V0000	Non-Asbestos		None
Duct		None Found													
Floor		Concrete (poured)													
Mechanical Equipment		None Found													
Piping		None Found													
Structure		None Found													
Wall		Concrete (poured)													

NAC above ceiling.



ALL DATA REPORT



Client: City Of Mississauga
Location: #13 : Cat Adoption Area
Surveyor:

Site: , , ON
Floor: 1
Survey Date: 2021-01-09

Building Name: Animal Services Centre
Room #:
Reassessment Surveyor: Justin Dotto

Area (sqft): 800
Last Re-Assessment: 2021-02-24

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling		Drywall and joint compound			C	Y		100			%	V0000	Non-Asbestos		None
Duct		None Found													
Floor		Concrete (poured)													
Mechanical Equipment		None Found													
Piping		None Found													
Structure		None Found													
Wall		Concrete (poured)													

Client: City Of Mississauga
Location: #14 : Public Washroom
Surveyor:

Site: , , ON
Floor: 1
Survey Date: 2021-01-09

Building Name: Animal Services Centre
Room #:
Reassessment Surveyor: Justin Dotto

Area (sqft): 50
Last Re-Assessment: 2021-02-24

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling		Ceiling Tiles (lay-in)			C	Y		50			SF	V0000	Non-Asbestos		None
Duct		Not Insulated													
Floor		Concrete (poured)													
Mechanical Equipment		None Found													
Piping		Not Insulated													
Structure	Beam Deck Joist	Steel		Not Insulated	C	N									
Wall		Concrete (poured)													



ALL DATA REPORT



Client: City Of Mississauga
Location: #15 : Interview Room
Surveyor:

Site: , , ON
Floor: 1
Survey Date: 2021-01-09

Building Name: Animal Services Centre
Room #:
Reassessment Surveyor: Justin Dotto

Area (sqft): 100
Last Re-Assessment: 2021-02-24

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling		Ceiling Tiles (lay-in)			C	Y		50			SF	V0000	Non-Asbestos		None
Duct		Not Insulated													
Floor		Concrete (poured)													
Mechanical Equipment		None Found													
Piping		Not Insulated													
Structure	Beam Deck Joist	Steel		Not Insulated	C	N									
Wall		Concrete (poured)													

Client: City Of Mississauga
Location: #16 : Chemical Storage Room
Surveyor:

Site: , , ON
Floor: 1
Survey Date: 2021-01-09

Building Name: Animal Services Centre
Room #:
Reassessment Surveyor: Justin Dotto

Area (sqft): 50
Last Re-Assessment: 2021-02-24

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling		Drywall and joint compound			A	Y									
Duct		None Found													
Floor		Concrete (poured)													
Mechanical Equipment		None Found													
Piping		Not Insulated													
Structure		None Found													
Wall		Concrete (poured)													

NAC above ceiling.



ALL DATA REPORT



Client: City Of Mississauga
Location: #17 : Dog Isolation Room
Surveyor:

Site: , , ON
Floor: 1
Survey Date: 2021-01-09

Building Name: Animal Services Centre
Room #:
Reassessment Surveyor: Justin Dotto

Area (sqft): 500
Last Re-Assessment: 2021-02-24

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling		Drywall and joint compound			A	Y									
Duct		None Found													
Floor		Concrete (poured)													
Mechanical Equipment		None Found													
Piping		Not Insulated													
Structure		None Found													
Wall		Concrete (poured)													

NAC above ceiling.

Client: City Of Mississauga
Location: #18 : Dog Quarantine Room
Surveyor:

Site: , , ON
Floor: 1
Survey Date: 2021-01-09

Building Name: Animal Services Centre
Room #:
Reassessment Surveyor: Justin Dotto

Area (sqft): 500
Last Re-Assessment: 2021-02-24

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling		Drywall and joint compound			A	Y									
Duct		None Found													
Floor		Concrete (poured)													
Mechanical Equipment		None Found													
Piping		Not Insulated													
Structure		None Found													
Wall		Concrete (poured)													

NAC above ceiling.



ALL DATA REPORT



Client: City Of Mississauga
Location: #19 : Examination Room
Surveyor:

Site: , , ON
Floor: 1
Survey Date: 2021-01-09

Building Name: Animal Services Centre
Room #:
Reassessment Surveyor: Justin Dotto

Area (sqft): 100
Last Re-Assessment: 2021-02-24

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling		Drywall and joint compound			A	Y									
Duct		None Found													
Floor		Concrete (poured)													
Mechanical Equipment		None Found													
Piping		Not Insulated													
Structure		None Found													
Wall		Concrete (poured)													

NAC above ceiling.

Client: City Of Mississauga
Location: #20 : Food Preparation & Kitchen
Surveyor:

Site: , , ON
Floor: 1
Survey Date: 2021-01-09

Building Name: Animal Services Centre
Room #:
Reassessment Surveyor: Justin Dotto

Area (sqft): 400
Last Re-Assessment: 2021-02-24

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling		Drywall and joint compound			A	Y									
Duct		None Found													
Floor		Concrete (poured)													
Mechanical Equipment		Parging Cement													
Piping		Not Insulated													
Structure		None Found													
Wall		Concrete (poured)													

NAC above ceiling.



ALL DATA REPORT



Client: City Of Mississauga
Location: #21 : First Aid Room
Surveyor:

Site: , , ON
Floor: 1
Survey Date: 2021-01-09

Building Name: Animal Services Centre
Room #:
Reassessment Surveyor: Justin Dotto

Area (sqft): 100
Last Re-Assessment: 2021-02-24

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling		Drywall and joint compound			A	Y									
Duct		None Found													
Floor		Concrete (poured)													
Mechanical Equipment		None Found													
Piping		Not Insulated													
Structure		None Found													
Wall		Concrete (poured)													

NAC above ceiling.

Client: City Of Mississauga
Location: #22 : Northwest Corridor
Surveyor:

Site: , , ON
Floor: 1
Survey Date: 2021-01-09

Building Name: Animal Services Centre
Room #:
Reassessment Surveyor: Justin Dotto

Area (sqft): 800
Last Re-Assessment: 2021-02-24

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling		Drywall and joint compound			A	Y									
Duct		None Found													
Floor		Concrete (poured)													
Mechanical Equipment		None Found													
Piping		Not Insulated													
Structure		None Found													
Wall		Concrete (poured)													

NAC above ceiling.



ALL DATA REPORT



Client: City Of Mississauga
 Location: #23 : Storage Room
 Surveyor:

Site: , , ON
 Floor: 1
 Survey Date: 2021-01-09

Building Name: Animal Services Centre
 Room #:
 Reassessment Surveyor: Justin Dotto

Area (sqft): 100
 Last Re-Assessment: 2021-02-24

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling		Drywall and joint compound			A	Y									
Duct		None Found													
Floor		Concrete (poured)													
Mechanical Equipment		None Found													
Piping		Not Insulated													
Structure		None Found													
Wall		Concrete (poured)													

NAC above ceiling.

Client: City Of Mississauga
 Location: #24 : Office
 Surveyor:

Site: , , ON
 Floor: 1
 Survey Date: 2021-01-09

Building Name: Animal Services Centre
 Room #:
 Reassessment Surveyor: Justin Dotto

Area (sqft): 100
 Last Re-Assessment: 2021-02-24

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling		Drywall and joint compound			A	Y									
Duct		None Found													
Floor		Concrete (poured)													
Mechanical Equipment		None Found													
Piping		Not Insulated													
Structure		None Found													
Wall		Concrete (poured)													

NAC above ceiling.



ALL DATA REPORT



Client: City Of Mississauga
 Location: #25 : Cat Quarantine & Receiving
 Surveyor:

Site: , , ON
 Floor: 1
 Survey Date: 2021-01-09

Building Name: Animal Services Centre
 Room #:
 Reassessment Surveyor: Justin Dotto

Area (sqft): 750
 Last Re-Assessment: 2021-02-24

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling		Drywall and joint compound			A	Y									
Duct		None Found													
Floor		Concrete (poured)													
Mechanical Equipment		None Found													
Piping		Not Insulated													
Structure		None Found													
Wall		Concrete (poured)													

NAC above ceiling.

Client: City Of Mississauga
 Location: #26 : Office
 Surveyor:

Site: , , ON
 Floor: 1
 Survey Date: 2021-01-09

Building Name: Animal Services Centre
 Room #:
 Reassessment Surveyor: Justin Dotto

Area (sqft): 200
 Last Re-Assessment: 2021-02-24

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling		Drywall and joint compound			A	Y									
Duct		None Found													
Floor		Concrete (poured)													
Mechanical Equipment		None Found													
Piping		Not Insulated													
Structure		None Found													
Wall		Concrete (poured)													

NAC above ceiling.



ALL DATA REPORT



Client: City Of Mississauga
Location: #27 : Dog Adoption Area
Surveyor:

Site: , , ON
Floor: 1
Survey Date: 2021-01-09

Building Name: Animal Services Centre
Room #:
Reassessment Surveyor: Justin Dotto

Area (sqft): 1200
Last Re-Assessment: 2021-02-24

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling		Drywall and joint compound			A	Y									
Duct		None Found													
Floor		Concrete (poured)													
Mechanical Equipment		None Found													
Piping		Not Insulated													
Structure		None Found													
Wall		Concrete (poured)													

NAC above ceiling.

Client: City Of Mississauga
Location: #28 : Exterior Dog Runs
Surveyor:

Site: , , ON
Floor: 1
Survey Date: 2021-01-09

Building Name: Animal Services Centre
Room #:
Reassessment Surveyor: Justin Dotto

Area (sqft): 1500
Last Re-Assessment: 2021-02-24

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling		Drywall and joint compound			A	Y									
Duct		None Found													
Floor		Concrete (poured)													
Mechanical Equipment		None Found													
Piping		Not Insulated													
Structure		None Found													
Wall		Concrete (poured)													

NAC above ceiling. Drywall panels on ceiling.



ALL DATA REPORT



Client: City Of Mississauga
Location: #29 : Northeast Corridor
Surveyor:

Site: , , ON
Floor: 1
Survey Date: 2021-01-09

Building Name: Animal Services Centre
Room #:
Reassessment Surveyor: Justin Dotto

Area (sqft): 500
Last Re-Assessment: 2021-02-24

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling		Drywall and joint compound			A	Y									
Duct		None Found													
Floor		Concrete (poured)													
Mechanical Equipment		None Found													
Piping		Not Insulated													
Structure		None Found													
Wall		Concrete (poured)													

NAC above ceiling.

Client: City Of Mississauga
Location: #30 : Second Floor Offices
Surveyor:

Site: , , ON
Floor: 2
Survey Date: 2021-01-09

Building Name: Animal Services Centre
Room #:
Reassessment Surveyor: Justin Dotto

Area (sqft): 1000
Last Re-Assessment: 2021-02-24

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling		Ceiling Tiles (lay-in)			C	Y		1000			SF	V0000	Non-Asbestos		None
Duct		Fibreglass													
Duct		Not Insulated													
Floor		Vinyl Sheet Flooring			A	Y		100			%	V0000	Non-Asbestos		None
Floor		Carpet													
Mechanical Equipment		None Found													
Piping		Fibreglass													
Piping		Not Insulated													
Structure	Beam Deck Joist	Steel			C	N									
Wall		Concrete (poured)													
Wall		Drywall and joint compound			A	Y		100			%	V0000	Non-Asbestos		None

Legend:

Sample number		Units		Other	
S####	Asbestos sample collected	SF	Square feet	A	Access
V####	Material visually similar to numbered sample collected	LF	Linear feet	V	Visible
V0000	Known non-asbestos material	EA	Each	AP	Air Plenum
V9000	Visually identified as an asbestos material	%	Percentage	F	Friable material
V9500	Material is presumed to be an asbestos material			NF	Non Friable material
				PF	Potentially Friable material

Access		Condition	
A	Accessible to all building occupants	Good	No visible damage or deterioration
B	Accessible to maintenance and operations staff without a ladder	Fair	Minor, repairable damage, cracking, delamination or deterioration
C	Accessible to maintenance and operations staff with a ladder. Also rarely entered, locked areas	Poor	Irreparable damage or deterioration with exposed and missing material
D	Not normally accessible		

APPENDIX VI
Photo Summary Report



V9000, Cement Product, Front Reception, Offices; Waiting Area (Loc. 8).

Transite pipe is visible above ceiling but also runs down behind drywall wall.



REVISED
Hazardous Building
Materials Assessment
(Pre-construction)

Roof

Animal Service Centre
735 Central Parkway West,
Mississauga, Ontario

Prepared for:

City of Mississauga

950 Burnhamthorpe Road West, 2nd Floor
Mississauga, Ontario, L5B 3B4

September 16, 2022

Pinchin File: 313261.000



Issued to: City of Mississauga
Issued on: September 16, 2022
Pinchin File: 313261.000
Issuing Office: Mississauga, ON

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EXECUTIVE SUMMARY

City of Mississauga (Client) retained Pinchin Ltd. (Pinchin) to conduct a hazardous building materials assessment at the Animal Service Centre located at 735 Central Parkway West, Mississauga, Ontario. Pinchin performed the assessment on August 31, 2022.

The objective of the assessment was to identify specified hazardous building materials in preparation for an upcoming roof replacement project. The proposed work as identified by the Client will be limited to the replacement of sections of the roof system, which consists of low-slope built-up roofs (sections A and E1) and sloped asphalt shingles roofs (sections E, F, G, H, J, K, L, M), as indicated in the Project Scope Document provided by the Client via email on July 13, 2022. As informed by the Client, built-up roof sections B, B1, C, C1 and D were replaced in 2014 and were also included in the roof sections to be assessed even though these roof sections will not be replaced at this time.

SUMMARY OF FINDINGS

The following is a summary of significant findings; refer to the body of the report for detailed findings:

Asbestos: Asbestos-containing materials were not confirmed to be present.

Lead:

- Lead is present in paint on a metal attachment transition on Roof M. There is approximately 10 linear feet of paint present on the metal attachment transition.

Silica: Crystalline silica is present in concrete and other materials such as asphalt.

Mercury: Mercury is not present.

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 lead and silica.

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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APPENDICES

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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 the Animal Service Centre located at 735 Central Parkway West, Mississauga, Ontario.

Pinchin performed the assessment on August 31, 2022. The surveyor was unaccompanied during the assessment. The assessed area was unoccupied 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 proposed work as identified by the Client will be limited to the replacement of sections of the roof system, which consists of low-slope built-up roofs (sections A and E1) and sloped asphalt shingles roofs (sections E, F, G, H, J, K, L, M), as indicated in the Project Scope Document provided by the Client via email on July 13, 2022. As informed by the Client, built-up roof sections B, B1, C, C1 and D were replaced in 2014 and were also included in the roof sections to be assessed even though these roof sections will not be replaced at this time.

1.1 Scope of Assessment

The **assessed area** is limited to the sections of the roof to be replaced, as described by the Client, and identified on the drawing 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 roof assessment to identify the hazardous building materials as defined in the scope.

The assessment included sampling of roofing materials. Repairs to the roof was made by a qualified roofer retained by the Pinchin. Pinchin will not be responsible or liable for leaks or water damage caused by sampling and or repair.

For further details on the methodology including test methods, refer to Appendix III.

3.0 BACKGROUND INFORMATION

3.1 Building Description

Assessed Area Description Item	Details
Use	Animal service centre
Number of Floors	The building is 2 storeys.
Total Area	The total area of the building is 15,250 square feet. The assessed area is 12,400 square feet.
Year of Construction	The building was constructed in 1987, with renovations in 2002.
Structure	Structural steel, concrete
Exterior Cladding	Brick veneer, concrete
HVAC	Rooftop AHU
Roof	Built-up roofing, shingled sloped roof systems
Flooring	Not in assessed area
Interior Walls	Not in assessed area
Ceilings	Not in assessed area

3.2 Existing Reports

Pinchin has previously completed assessments in the building. The following report will be reviewed as part of this assessment:

- “Asbestos Reassessment, Animal Services Centre – ACC1 735 Central Parkway West, Mississauga, Ontario”, dated April 12, 2021, Pinchin File No. 282188.
- “Asbestos Abatement Completion Letter, Animal Services Centre, 735 Central Parkway West, Mississauga, Ontario”, dated February 4, 2022, Pinchin File No. 305272.

4.0 FINDINGS

The following section summarizes the findings of the assessment and provides a general description of the hazardous building materials identified. For details on approximate quantities, condition, friability, accessibility, and locations of hazardous building materials; refer to the Hazardous Material Summary / Sample Log and All Data Report in Appendices V and VI.

Any quantities listed in this report or data tables are estimated based on visual approximations only and are subject to variation.

4.1 Asbestos


4.1.1 Asbestos Cement Products

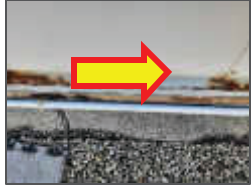
Transite pipe, presumed to contain asbestos, was previously found to be present as rainwater leaders in the Front Reception Area within the building. Ten (10) linear feet of Transite pipe was abated in 2021 and therefore no longer present in the building. No other Transite pipe is confirmed to be present in the building.

Transite pipe may be present in concealed locations within the building such as in pipe shafts and above solid ceilings with no access. Rainwater leaders are not expected to be impacted by proposed renovations to the roof.

4.1.2 Sealants, Caulking, and Putty

The following is a summary of sealants, caulking, and putties sampled, for a complete list of locations, refer to Appendix V.

Material, Description and Application	Sample Location (Location #)	Sample Number	Asbestos	Photo
Caulking, dark grey on roof edges	Roof J (Loc. 2), Roof H (Loc. 3)	S0002A-C	None detected	

Material, Description and Application	Sample Location (Location #)	Sample Number	Asbestos	Photo
Caulking, light grey on mechanical equipment seams and skylight	Roof A (Loc. 1)	S0006A-C	None detected	

4.1.3 Roofing Products

The materials associated with the built-up roof system on Roof A (Loc. 1) and Roof E1 (Loc. 4) do not contain asbestos (samples S0001A-C, S0005A-C).

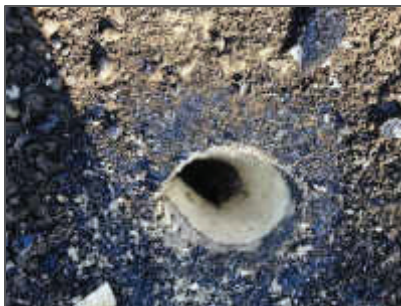
Roof shingles and tar present on the sloped roofs do not contain asbestos (samples S0003A-C).



Non-asbestos roofing material on built-up roof section A (Loc. 1).



Non-asbestos roofing material on built-up roof section E1 (Loc. 1).



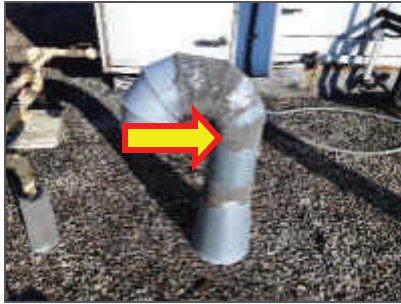
Non-asbestos roofing material on built-up roof section E1 (Loc. 4).



Non-asbestos roof shingles on sloped roof section M (Loc. 5).

4.1.4 Other Building Materials

Black mastic, present on roof penetrations on Roof A (Loc. 1) and Roof E1 (Loc. 4) does not contain asbestos (samples S0004A-C).



Non-asbestos black mastic on roof vent (Loc. 1).



Non-asbestos black mastic on roof penetration (Loc. 4).

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
- Soffit and fascia boards

4.2 Lead

4.2.1 Paints and Surface Coatings

Paint was present on the metal attachment transition associated with Roof M (Loc. 5). The paint was baked on to the steel and well adhered and therefore could not be sampled. Presume the paint to be lead-containing until sampling proves otherwise. There is approximately 10 linear feet of paint present on the metal attachment transition.



Paint, presumed to contain lead, present on metal attachment transition on roof section M (Loc. 5).

4.2.2 Lead Products and Applications

Lead products were not found during the assessment.



4.2.3 *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

4.3 Silica

Crystalline silica is assumed to be a component of the following materials where present in the building.

- Concrete

4.4 Mercury

4.4.1 *Mercury-Containing Devices*

Mercury-containing devices were not found during the assessment.

4.5 Polychlorinated Biphenyls

4.5.1 *Caulking and Sealants*

PCBs were banned in 1980; however, are found to be present in caulking and sealants until 1985. Caulking in the assessed area was installed in 1987 and is not suspected to contain PCBs.

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. Provide this report to the contractor prior to bidding or commencing work.
2. Retain a qualified consultant to specify, observe and document the successful removal of hazardous materials.

5.2 Assessed Area Renovation Work

The following recommendations are made regarding renovation involving the hazardous materials identified.



5.2.1 Asbestos

Remove asbestos-containing materials (ACM) prior to renovation, alteration, or maintenance if ACM may be disturbed by the work. If the identified ACM will not be removed prior to commencement of the work, any potential disturbance of ACM must follow asbestos precautions appropriate for the type of work being performed.

Asbestos-containing materials must be disposed of at a landfill approved to accept asbestos waste.

5.2.2 Lead

For lead-containing or lead-based paints (i.e., greater than the EACC guideline of 0.1% (1,000 mg/kg) for lead-containing paints, and 0.5% (5,000 mg/kg) for lead-based), construction disturbance may result in over-exposure to lead dust or fumes. The need for work procedures, engineering controls and personal protective equipment should be assessed on a site-specific basis to comply with Ministry of Labour, Training and Skills Development regulations and guidelines.

For paints identified as having low levels of lead (i.e., equal to or above 0.009% (90 mg/kg) but less than or equal to the EACC guideline of 0.1% (1,000 mg/kg) for lead-containing paints) special precautions are not recommended unless aggressive disturbance (grinding, blasting, torching) is planned. Exposure from construction disturbance of paints containing lead less than 0.009% (90 mg/kg) is assumed to be insignificant.

5.2.3 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.

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. Consolidated Transportation of Dangerous Goods Regulations, including Amendment SOR/2019-101, Transportation of Dangerous Goods Act.
9. Canada Occupational Health and Safety Regulation, SOR/86-304.





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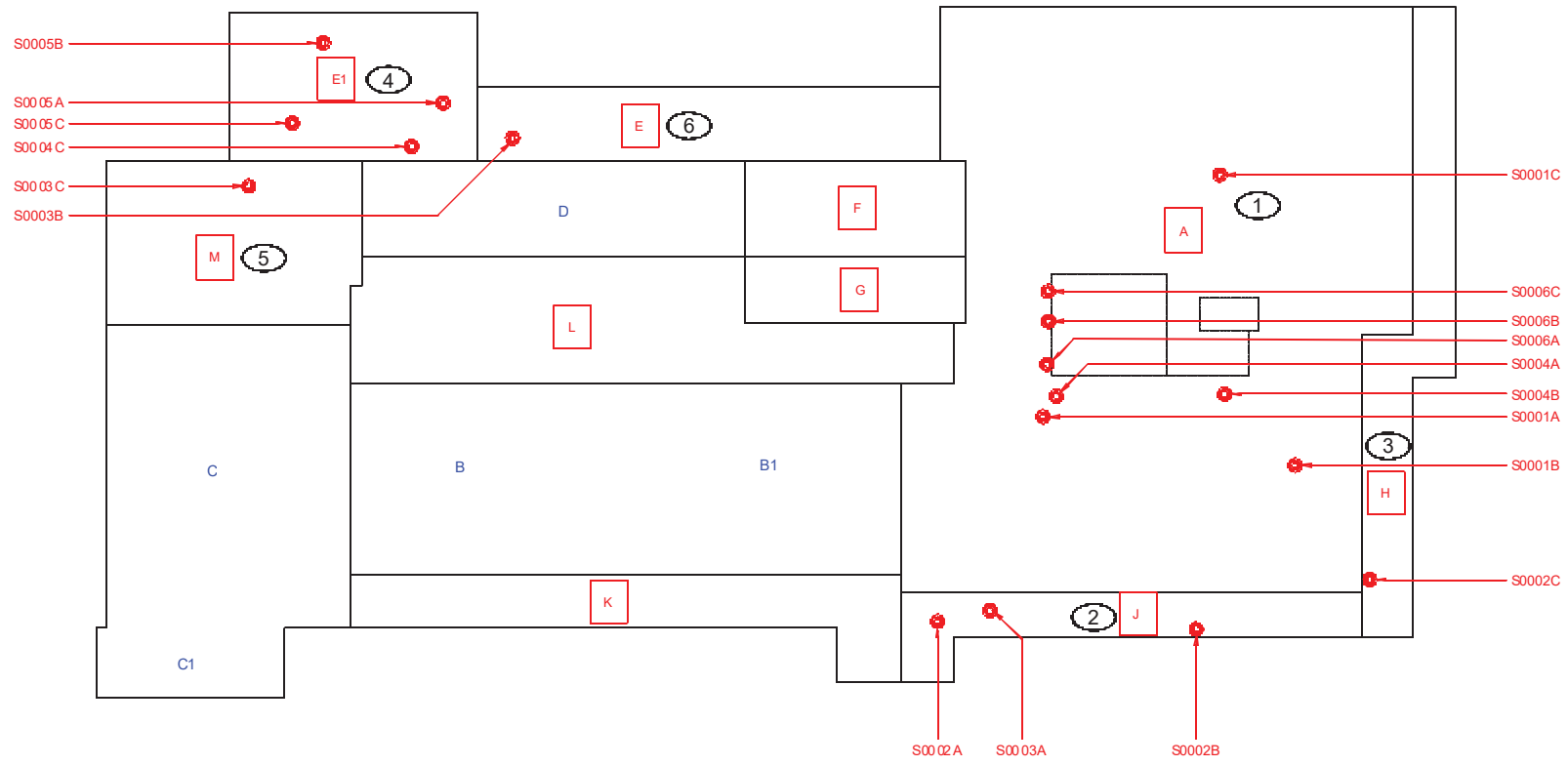
Template: Master Report for Hazardous Materials Assessment (Pre-Construction), HAZ, September 9, 2022

APPENDIX I
Drawing



LEGEND

-  ROOF OF SECTION TO BE REPLACED
-  PINCHIN LOCATION NUMBER
-  ASBESTOS BULK SAMPLE
-  BUILT-UP ROOF REPLACED IN 2014 (NOT ASSESSED)



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

CLIENT NAME
CITY OF MISSISSAUGA

PROJECT LOCATION
ANIMAL SERVICE CENTRE
735 CENTRAL PARKWAY WEST,
MISSISSAUGA, ONTARIO

FIGURE NAME
ROOF PLAN

PROJECT NUMBER: 31326 1.000	SCALE: N.T.S.
DRAWN BY: S.A.C.	REVIEWED BY: A.R.
DATE: SEPT. 2022	FIGURE NUMBER: 1 OF 1

APPENDIX II
Asbestos Analytical Certificates



Pinchin Ltd. Asbestos Laboratory Certificate of Analysis

Project Name: City of Mississauga, 735 Central Parkway West, Mississauga
Project No.: 0313261.000
Prepared For: S. Fernando / A. Rakic **Date Received:** August 31, 2022
Lab Reference No.: b277917 **Date Analyzed:** September 9, 2022
Analyst(s): D. Wright / K. Cockburn
Samples submitted: 12
Phases analyzed: 19

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.

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.

NOTE: *This test report may not be reproduced, except in full, without the written approval of the laboratory. The client may not use this report to claim product endorsement by NVLAP or any agency of the U.S. Government. This report is valid only when signed in blue ink by the analyst. Vinyl asbestos floor tiles contain very fine fibres of asbestos and may be missed by some laboratories using the PLM method. Internal verification studies performed by Pinchin indicate that the chance of missing asbestos in floor tiles is no higher than about 2%. The vinyl tile study and laboratory documentation on measurement uncertainty is available upon request. The analysis of dust samples by PLM cannot be used as an indicator of past or present airborne asbestos fibre levels.*



Pinchin Ltd. Asbestos Laboratory
Certificate of Analysis

Project Name: City of Mississauga, 735 Central Parkway West, Mississauga
Project No.: 0313261.000
Prepared For: S. Fernando / A. Rakic
Lab Reference No.: b277917
Date Analyzed: September 9, 2022

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
S0002A Caulking, Dark Grey Caulking On Roof Edges, Loc:2, Roof J	2 Phases: a) Homogeneous, grey, caulking material.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, black, rocky, tar material.	None Detected	Tar and other non- fibrous material > 75%
S0002B Caulking, Dark Grey Caulking On Roof Edges, Loc:2, Roof J	Homogeneous, grey, caulking material.	None Detected	Non-Fibrous Material > 75%
S0002C Caulking, Dark Grey Caulking On Roof Edges, Loc:3, Roof H	a) Homogeneous, grey, caulking material.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, light grey, caulking material.	None Detected	Non-Fibrous Material > 75%
S0003A Roofing Material, Roof Shingle, Loc:2, Roof J	2 Phases: a) Homogeneous, black, roofing material.	None Detected	Cellulose 5-10% Tar and other non- fibrous material > 75%
	b) Homogeneous, black, tar material.	None Detected	Tar and other non- fibrous material > 75%



Pinchin Ltd. Asbestos Laboratory Certificate of Analysis

Project Name: City of Mississauga, 735 Central Parkway West, Mississauga
Project No.: 0313261.000
Prepared For: S. Fernando / A. Rakic
Lab Reference No.: b277917
Date Analyzed: September 9, 2022

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
S0003B Roofing Material, Roof Shingle, Loc:6, Roof E	2 Phases: a) Homogeneous, black, roofing material.	None Detected	Cellulose 5-10% Tar and other non-fibrous material > 75%
	b) Homogeneous, black, tar material.	None Detected	Tar and other non-fibrous material > 75%
S0003C Roofing Material, Roof Shingle, Loc:5, Roof M	Homogeneous, black, roofing material.	None Detected	Cellulose 5-10% Tar and other non-fibrous material > 75%
S0004A Adhesive/mastic, Black Mastic On Roof Penetrations, Loc:1, Roof A	Homogeneous, black, tar material.	None Detected	Cellulose 0.5-5% Tar and other non-fibrous material > 75%
S0004B Adhesive/mastic, Black Mastic On Roof Penetrations, Loc:1, Roof A	Homogeneous, black, shiny, tar material.	None Detected	Tar and other non-fibrous material > 75%
S0004C Adhesive/mastic, Black Mastic On Roof Penetrations, Loc:4, Roof E1	Homogeneous, black, shiny, tar material.	None Detected	Tar and other non-fibrous material > 75%
S0006A Caulking, Light Grey Caulking On Mechanical Seams, Loc:1, Roof A	2 Phases: a) Non-homogeneous, white with green, caulking material.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, colourless, caulking material.	None Detected	Non-Fibrous Material > 75%



**Pinchin Ltd. Asbestos Laboratory
Certificate of Analysis**

Project Name: City of Mississauga, 735 Central Parkway West, Mississauga
Project No.: 0313261.000
Prepared For: S. Fernando / A. Rakic
Lab Reference No.: b277917
Date Analyzed: September 9, 2022

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
S0006B Caulking, Light Grey Caulking On Mechanical Seams, Loc:1, Roof A	2 Phases: a) Non-homogeneous, white with green, caulking material.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, colourless, caulking material.	None Detected	Non-Fibrous Material > 75%
S0006C Caulking, Light Grey Caulking On Mechanical Seams, Loc:1, Roof A	2 Phases: a) Non-homogeneous, white with green, caulking material.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, colourless, caulking material.	None Detected	Non-Fibrous Material > 75%

Reviewed by:

Digitally signed by
Elizabeth DeCurtis
Date: 2022.09.09
14:58:05-04'00'

Reporting Analyst:

Elizabeth
DeCurtis
2022.09.09 14:
57:48-04'00'

Analyzed by: AW
 Reviewed by: [Signature]
 Account Name: [Signature]

**Pinchin Ltd. - Asbestos Laboratory
 Internal Asbestos Bulk Sample Chain of Custody**

Client Name:	City of Mississauga	Project Address:	735 Central Parkway West, Mississauga
Portfolio/Building No:		Pinchin File:	313261
Submitted by:	Shanilka Fernando	Email:	sfernando@pinchin.com
CC Results to:	Anthony Rakic	CC Email:	arakic@pinchin.com
Date Submitted:	August 31 2022	Required by:	September 7 2022
# of Samples:	18 12 Split 2/2	Priority:	5 Day Turnaround
Year of Building Construction (Mandatory, Years ONLY):	1987		
Do NOT Stop on Positive (Sample Numbers):			
Pinchin Group Company (Mandatory Field):	Pinchin		
HMIS2 Building Reference #:	109778/20227312066109		

To be Completed by Lab Personnel Only:

Lab Reference #:	b277917 CU	Time:	24 hour clock
Received by:	AUG 31 2022	Date:	9/9/22 Month Day Year
Name(s) of Analyst(s):	D Wright / K Cockburn		

Sample Prefix	Sample No.	Sample Suffix	Sample Description/Location (Mandatory)
S	0001	A	Built Up Roofing, Roofing Material, Built-up Roofing Material, Loc:1, Roof A
S	0001	B	Built Up Roofing, Roofing Material, Built-up Roofing Material, Loc:1, Roof A
S	0001	C	Built Up Roofing, Roofing Material, Built-up Roofing Material, Loc:1, Roof A
S	0002	A	Caulking, Dark Grey Caulking On Roof Edges, Loc:2, Roof J a) ND b) ND
S	0002	B	Caulking, Dark Grey Caulking On Roof Edges, Loc:2, Roof J ND
S	0002	C	Caulking, Dark Grey Caulking On Roof Edges, Loc:3, Roof H a) ND b) ND
S	0003	A	Roofing Material, Roof Shingle, Loc:2, Roof J a) ND b) ND

Sample Prefix	Sample No.	Sample Suffix	Sample Description/Location (Mandatory)
S	0003	B	Roofing Material, Roof Shingle, Loc:6, Roof E a) ND b) ND
S	0003	C	Roofing Material, Roof Shingle, Loc:5, Roof M ND
S	0004	A	Adhesive/mastic, Black Mastic On Roof Penetrations, Loc:1, Roof A ND
S	0004	B	Adhesive/mastic, Black Mastic On Roof Penetrations, Loc:1, Roof A ND
S	0004	C	Adhesive/mastic, Black Mastic On Roof Penetrations, Loc:4, Roof E1 ND
S	0005	A	Built Up Roofing, Roofing Material, Built-up Roofing Material, Loc:4, Roof E1
S	0005	B	Built Up Roofing, Roofing Material, Built-up Roofing Material, Loc:4, Roof E1
S	0005	C	Built Up Roofing, Roofing Material, Built-up Roofing Material, Loc:4, Roof E1
S	0006	A	Caulking, Light Grey Caulking On Mechanical Seams, Loc:1, Roof A a) ND b) ND
S	0006	B	Caulking, Light Grey Caulking On Mechanical Seams, Loc:1, Roof A a) ND b) ND
S	0006	C	Caulking, Light Grey Caulking On Mechanical Seams, Loc:1, Roof A a) ND b) ND

b27717



Pinchin Ltd. Asbestos Laboratory Certificate of Analysis

Project Name: City of Mississauga, 735 Central Parkway West, Mississauga
Project No.: 0313261.000
Prepared For: S. Fernando / A. Rakic
Lab Reference No.: b277918
Analyst(s): A. Di Giulio
Date Received: August 31, 2022 **# Samples submitted:** 6
Date Analyzed: September 9, 2022 **# Phases analyzed:** 42

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.

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.

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Pinchin Ltd. Asbestos Laboratory Certificate of Analysis

Project Name: City of Mississauga, 735 Central Parkway West, Mississauga
Project No.: 0313261.000
Prepared For: S. Fernando / A. Rakic

Lab Reference No.: b277918
Date Analyzed: September 9, 2022

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
S0001A Built Up Roofing, Roofing Material, Built-up Roofing Material, Loc: 1, Roof A	7 Phases:		
	a) Homogeneous, black, layered, tar material on paper.	None Detected	Tar and other non-fibrous material > 75%
	b) Homogeneous, brown, layered paper with black tar.	None Detected	Cellulose > 75% Tar and other non-fibrous material 10-25%
	c) Homogeneous, brown, layered paper.	None Detected	Cellulose > 75% Man-made Vitreous Fibres 0.5-5% Tar and other non-fibrous material 0.5-5%
	d) Homogeneous, brown, layered paper (middle).	None Detected	Cellulose > 75% Man-made Vitreous Fibres 0.5-5% Tar and other non-fibrous material 0.5-5%
	e) Homogeneous, black, tar material.	None Detected	Tar and other non-fibrous material > 75%
	f) Homogeneous, black, layered, tar material.	None Detected	Tar and other non-fibrous material > 75%
	g) Homogeneous, black, layered, tar-impregnated, compressed, fibrous material.	None Detected	Cellulose 50-75% Tar and other non-fibrous material 25-50%
Comments:	Foam and cellulose are present on the surface of this sample.		



Pinchin Ltd. Asbestos Laboratory Certificate of Analysis

Project Name: City of Mississauga, 735 Central Parkway West, Mississauga
Project No.: 0313261.000
Prepared For: S. Fernando / A. Rakic

Lab Reference No.: b277918
Date Analyzed: September 9, 2022

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
S0001B Built Up Roofing, Roofing Material, Built-up Roofing Material, Loc: 1, Roof A	7 Phases: a) Homogeneous, black, layered, tar material on paper.	None Detected	Tar and other non-fibrous material > 75%
	b) Homogeneous, brown, layered paper with black tar.	None Detected	Cellulose > 75% Tar and other non-fibrous material 10-25%
	c) Homogeneous, brown, layered paper.	None Detected	Cellulose > 75% Man-made Vitreous Fibres 0.5-5% Tar and other non-fibrous material 0.5-5%
	d) Homogeneous, brown, layered paper (middle).	None Detected	Cellulose > 75% Man-made Vitreous Fibres 0.5-5% Tar and other non-fibrous material 0.5-5%
	e) Homogeneous, black, tar material.	None Detected	Tar and other non-fibrous material > 75%
	f) Homogeneous, black, layered, tar material.	None Detected	Tar and other non-fibrous material > 75%
	g) Homogeneous, black, layered, tar-impregnated, compressed, fibrous material.	None Detected	Cellulose 50-75% Tar and other non-fibrous material 25-50%
Comments:	Foam and cellulose are present on the surface of this sample.		



Pinchin Ltd. Asbestos Laboratory Certificate of Analysis

Project Name: City of Mississauga, 735 Central Parkway West, Mississauga
Project No.: 0313261.000
Prepared For: S. Fernando / A. Rakic

Lab Reference No.: b277918
Date Analyzed: September 9, 2022

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
S0001C Built Up Roofing, Roofing Material, Built-up Roofing Material, Loc: 1, Roof A	7 Phases: a) Homogeneous, black, layered, tar material on paper.	None Detected	Tar and other non-fibrous material > 75%
	b) Homogeneous, brown, layered paper with black tar.	None Detected	Cellulose > 75% Tar and other non-fibrous material 10-25%
	c) Homogeneous, brown, layered paper.	None Detected	Cellulose > 75% Man-made Vitreous Fibres 0.5-5% Tar and other non-fibrous material 0.5-5%
	d) Homogeneous, brown, layered paper (middle).	None Detected	Cellulose > 75% Man-made Vitreous Fibres 0.5-5% Tar and other non-fibrous material 0.5-5%
	e) Homogeneous, black, tar material.	None Detected	Tar and other non-fibrous material > 75%
	f) Homogeneous, black, layered, tar material.	None Detected	Tar and other non-fibrous material > 75%
	g) Homogeneous, black, layered, tar-impregnated, compressed, fibrous material.	None Detected	Cellulose 50-75% Tar and other non-fibrous material 25-50%
Comments:	Foam and cellulose are present on the surface of this sample.		



Pinchin Ltd. Asbestos Laboratory Certificate of Analysis

Project Name: City of Mississauga, 735 Central Parkway West, Mississauga
Project No.: 0313261.000
Prepared For: S. Fernando / A. Rakic

Lab Reference No.: b277918
Date Analyzed: September 9, 2022

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
S0005A Built Up Roofing, Roofing Material, Built-up Roofing Material, Loc: 4, Roof E1	7 Phases:		
	a) Homogeneous, black, tar material on paper.	None Detected	Tar and other non-fibrous material > 75%
	b) Homogeneous, brown, layered paper with black tar.	None Detected	Cellulose > 75% Tar and other non-fibrous material 10-25%
	c) Homogeneous, grey, layered paper.	None Detected	Cellulose > 75% Man-made Vitreous Fibres 0.5-5% Non-Fibrous Material 0.5-5%
	d) Homogeneous, grey, layered paper (middle).	None Detected	Cellulose > 75% Man-made Vitreous Fibres 0.5-5% Non-Fibrous Material 0.5-5%
	e) Homogeneous, black, tar material.	None Detected	Tar and other non-fibrous material > 75%
	f) Homogeneous, black, layered, tar material.	None Detected	Tar and other non-fibrous material > 75%
	g) Homogeneous, black, layered, tar-impregnated, compressed, fibrous material.	None Detected	Cellulose 50-75% Tar and other non-fibrous material 25-50%
Comments:	Foam and cellulose are present on the surface of this sample.		



Pinchin Ltd. Asbestos Laboratory Certificate of Analysis

Project Name: City of Mississauga, 735 Central Parkway West, Mississauga
Project No.: 0313261.000
Prepared For: S. Fernando / A. Rakic

Lab Reference No.: b277918
Date Analyzed: September 9, 2022

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
S0005B Built Up Roofing, Roofing Material, Built-up Roofing Material, Loc:4, Roof E1	7 Phases:		
	a) Homogeneous, brown, layered paper with black tar.	None Detected	Cellulose > 75% Tar and other non-fibrous material 10-25%
	b) Homogeneous, black, tar material.	None Detected	Tar and other non-fibrous material > 75%
	c) Homogeneous, grey, layered paper.	None Detected	Cellulose > 75% Man-made Vitreous Fibres 0.5-5% Tar and other non-fibrous material 0.5-5%
	d) Homogeneous, brown, layered paper (middle).	None Detected	Cellulose > 75% Man-made Vitreous Fibres 0.5-5% Tar and other non-fibrous material 0.5-5%
	e) Homogeneous, black, tar material.	None Detected	Tar and other non-fibrous material > 75%
	f) Homogeneous, black, layered, tar material.	None Detected	Tar and other non-fibrous material > 75%
	g) Homogeneous, black, layered, tar-impregnated, compressed, fibrous material.	None Detected	Cellulose 50-75% Tar and other non-fibrous material 25-50%
Comments:	Foam and cellulose are present on the surface of this sample. Foam and cellulose are present on the surface of this sample.		



Pinchin Ltd. Asbestos Laboratory Certificate of Analysis

Project Name: City of Mississauga, 735 Central Parkway West, Mississauga
Project No.: 0313261.000
Prepared For: S. Fernando / A. Rakic

Lab Reference No.: b277918
Date Analyzed: September 9, 2022

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
S0005C Built Up Roofing, Roofing Material, Built-up Roofing Material, Loc: 4, Roof E1	7 Phases:		
	a) Homogeneous, black, tar material on paper.	None Detected	Tar and other non-fibrous material > 75%
	b) Homogeneous, brown, layered paper with black tar.	None Detected	Cellulose > 75% Tar and other non-fibrous material 10-25%
	c) Homogeneous, grey, layered paper.	None Detected	Cellulose > 75% Man-made Vitreous Fibres 0.5-5% Non-Fibrous Material 0.5-5%
	d) Homogeneous, grey, layered paper (middle).	None Detected	Cellulose > 75% Man-made Vitreous Fibres 0.5-5% Non-Fibrous Material 0.5-5%
	e) Homogeneous, black, tar material.	None Detected	Tar and other non-fibrous material > 75%
	f) Homogeneous, black, layered, tar material.	None Detected	Tar and other non-fibrous material > 75%
	g) Homogeneous, black, layered, tar-impregnated, compressed, fibrous material.	None Detected	Cellulose 50-75% Tar and other non-fibrous material 25-50%
Comments:	Foam and cellulose are present on the surface of this sample.		

Reviewed by:

Digitally signed by
 Elizabeth DeCurtis
 Date: 2022.09.09
 15:10:02-04'00'

Reporting Analyst:

Digitally signed by
 Elizabeth DeCurtis
 Date: 2022.09.09
 15:09:40-04'00'

battair

Assigned by: AD 9/19/22
Analyzed by: KB
Reviewed by: KB
Retested by: RD
Report Sent By: RD

Pinchin Ltd. - Asbestos Laboratory
Internal Asbestos Bulk Sample Chain of Custody

Client Name:	City of Mississauga	Project Address:	735 Central Parkway West, Mississauga
Portfolio/Building No:		Pinchin File:	313261
Submitted by:	Shanilka Fernando	Email:	sfernando@pinchin.com
CC Results to:	Anthony Rakic	CC Email:	arakic@pinchin.com
Date Submitted:	August 31 2022	Required by:	September 7 2022
# of Samples:	15 6 SPLIT 2	Priority:	5 Day Turnaround
Year of Building Construction (Mandatory, Years ONLY):	1987		
Do NOT Stop on Positive (Sample Numbers):			
Pinchin Group Company (Mandatory Field):	Pinchin		
HMIS2 Building Reference #:	109778/20227312066109		

To be Completed by Lab Personnel Only:

Lab Reference #:	b277918^u	Time:	24 hour clock		
Received by:	AUG 31 2022	Date:	Month	Day	Year
Name(s) of Analyst(s):	(112)				

Sample Prefix	Sample No.	Sample Suffix	Sample Description/Location (Mandatory)
S	0001	A	Built Up Roofing, Roofing Material, Built-up Roofing Material, Loc:1, Roof A AND BLD AND DTD AND AND BLD AND
S	0001	B	Built Up Roofing, Roofing Material, Built-up Roofing Material, Loc:1, Roof A AND BLD AND DTD AND AND BLD AND
S	0001	C	Built Up Roofing, Roofing Material, Built-up Roofing Material, Loc:1, Roof A AND BLD AND DTD AND AND BLD AND
S	0002	A	Caulking, Dark Grey Caulking On Roof Edges, Loc:2, Roof J
S	0002	B	Caulking, Dark Grey Caulking On Roof Edges, Loc:2, Roof J (21)
S	0002	C	Caulking, Dark Grey Caulking On Roof Edges, Loc:3, Roof H
S	0003	A	Roofing Material, Roof Shingle, Loc:2, Roof J

Sample Prefix	Sample No.	Sample Suffix	Sample Description/Location (Mandatory)
S	0003	B	Roofing Material, Roof Shingle, Loc:6, Roof E
S	0003	C	Roofing Material, Roof Shingle, Loc:5, Roof M
S	0004	A	Adhesive/mastic, Black Mastic On Roof Penetrations, Loc:1, Roof A
S	0004	B	Adhesive/mastic, Black Mastic On Roof Penetrations, Loc:1, Roof A
S	0004	C	Adhesive/mastic, Black Mastic On Roof Penetrations, Loc:4, Roof E1
S	0005	A	Built Up Roofing, Roofing Material, Built-up Roofing Material, Loc:4, Roof E1 <i>ASLD MND QMS DMS QND FND GND</i>
S	0005	B	Built Up Roofing, Roofing Material, Built-up Roofing Material, Loc:4, Roof E1 <i>ASLD MND QMS DMS QND FND GND</i>
S	0005	C	Built Up Roofing, Roofing Material, Built-up Roofing Material, Loc:4, Roof E1 <i>ASLD MND QMS DMS QND FND GND</i>
S	0006	A	Caulking, Light Grey Caulking On Mechanical Seams, Loc:1, Roof A
S	0006	B	Caulking, Light Grey Caulking On Mechanical Seams, Loc:1, Roof A
S	0006	C	Caulking, Light Grey Caulking On Mechanical Seams, Loc:1, Roof A

6277918

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APPENDIX III
Methodology



1.0 GENERAL

An inspection 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 inspection 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.

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 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%

* 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 was 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	1000

* 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 was identified by visually 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, Arodor or Askarel) in transformers or other equipment were not sampled for PCB content.

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.

Template: Methodology for Hazardous Building Materials Assessment, HAZ, November 23, 2021

APPENDIX IV
Location Summary Report



LOCATIONS LIST



Client: City Of Mississauga
Building Name: Animal Services Centre
Survey Date:

Site: 735 Central Parkway West, Mississauga, ON
Last Re-Assessment:

Location No.	Name or Description	Area ft ²	Floor No.	Bldg. Phase	Notes
1	Roof A	1000	R	A	
2	Roof J	150	R	A	
3	Roof H	200	R	A	
4	Roof E1	200	R	A	
5	Roof M	400	R	A	
6	Roof E	300	R	A	
7	Roof K	200	R	A	
8	Roof L	450	R	A	
9	Roof F	100	R	A	
10	Roof G	100	R	A	

APPENDIX V

Hazardous Materials Summary Report / Sample Log



HAZARDOUS MATERIALS SUMMARY / SAMPLE LOG



Client: City Of Mississauga

Site: 735 Central Parkway West, Mississauga, ON Building Name: Animal Services Centre

Survey Date:

HAZMAT	Sample No	System/Component/Material/Sample Description	Locations	Bldg . Phase	LF	SF	EA	%	Type	Positive	Friability
Asbestos	S0001 ABC	Other Built Up Roofing Roofing Material Built-up Roofing Material	1	A	0	1000	0	0	None Detected	No	
Asbestos	S0002 ABC	Other Caulking Dark Grey Caulking On Roof Edges	2,3	A	0	0	0	0	None Detected	No	
Asbestos	S0003 ABC	Other Roofing Material Roof Shingle	2,3,5,6,7,8,9,10	A	0	1950	0	0	None Detected	No	
Asbestos	S0004 ABC	Other Adhesive/mastic Black Mastic On Roof Penetrations	1,4	A	0	11	0	0	None Detected	No	
Asbestos	S0005 ABC	Other Built Up Roofing Roofing Material Built-up Roofing Material	4	A	0	200	0	0	None Detected	No	
Asbestos	S0006 ABC	Other Caulking Light Grey Caulking On Mechanical Seams	1	A	15	0	0	0	None Detected	No	
Paint	V9500	Other Metal Beige paint	5	A	10	0	0	0	Presumed Lead	Yes	-



HAZARDOUS MATERIALS SUMMARY / SAMPLE LOG



Legend:

Sample number		Units			
S####	Asbestos sample collected	SF	Square feet	NF	Non Friable material.
L####	Paint sample collected	LF	Linear feet	F	Friable material
P####	PCB sample collected	EA	Each	PF	Potentially Friable material
M####	Mould sample collected	%	Percentage		
V####	Material visually similar to numbered sample collected				
V0000	Known non Hazardous Material				
V9000	Material is visually identified as Hazardous Material				
V9500	Material is presumed to be Hazardous Material				
[Loc. No.]	Abated Material				

APPENDIX VI
HMIS All Data Report



ALL DATA REPORT



Client: City Of Mississauga
 Location: #1 : Roof A
 Survey Date: 2022-08-31

Site: 735 Central Parkway West, Mississauga, ON
 Floor: R

Building Name: Animal Services Centre
 Room #:
 Last Re-Assessment: 0000-00-00

Area (sqft): 1000

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Other		Adhesive/mastic, Black mastic on roof penetrations			B	Y		10			SF	S0004AB	None Detected	N. D.	None	
Other		Caulking, Light grey caulking on mechanical seams			B	Y		15			LF	S0006ABC	None Detected	N. D.	None	
Other	Built Up Roofing	Roofing material, Built-up roofing material			B	Y		1000			SF	S0001ABC	None Detected	N. D.	None	

Client: City Of Mississauga
 Location: #2 : Roof J
 Survey Date: 2022-08-31

Site: 735 Central Parkway West, Mississauga, ON
 Floor: R

Building Name: Animal Services Centre
 Room #:
 Last Re-Assessment: 0000-00-00

Area (sqft): 150

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Other		Caulking, Dark grey caulking on roof edges			B	Y						S0002AB	None Detected	N. D.	None	
Other		Roofing material, Roof shingle			B	Y		300			SF	S0003A	None Detected	N. D.	None	



ALL DATA REPORT



Client: City Of Mississauga
 Location: #3 : Roof H
 Survey Date: 2022-08-31

Site: 735 Central Parkway West, Mississauga, ON
 Floor: R

Building Name: Animal Services Centre
 Room #:
 Last Re-Assessment: 0000-00-00

Area (sqft): 200

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Other		Caulking, Dark grey caulking on roof edges			B	Y						S0002C	None Detected	N. D.	None	
Other		Roofing material						200			SF	V0003	None Detected	N. D.	None	

Client: City Of Mississauga
 Location: #4 : Roof E1
 Survey Date: 2022-08-31

Site: 735 Central Parkway West, Mississauga, ON
 Floor: R

Building Name: Animal Services Centre
 Room #:
 Last Re-Assessment: 0000-00-00

Area (sqft): 200

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Other		Adhesive/mastic, Black mastic on roof penetrations			B	Y		1			SF	S0004C	None Detected	N. D.	None	
Other	Built Up Roofing	Roofing material, Built-up roofing material			B	Y		200				S0005ABC	None Detected	N. D.	None	



ALL DATA REPORT



Client: City Of Mississauga
 Location: #5 : Roof M
 Survey Date: 2022-08-31

Site: 735 Central Parkway West, Mississauga, ON
 Floor: R

Building Name: Animal Services Centre
 Room #:
 Last Re-Assessment: 0000-00-00

Area (sqft): 400

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Other		Roofing material, Roof shingle			C	Y		400			SF	S0003C	None Detected	N.D.	None	

Client: City Of Mississauga
 Location: #5 : Roof M
 Survey Date: 2022-08-31

Site: 735 Central Parkway West, Mississauga, ON
 Floor: R

Building Name: Animal Services Centre
 Room #:
 Last Re-Assessment: 0000-00-00

Area (sqft): 400

PAINT										Sample Description	Amount	Hazard
System	Item	Good	Poor	Unit	Sample							
Other ¹	Metal	10		LF	V9500	Beige paint				Presumed Lead		

1 - Paint was baked on and very thin. It was difficult to sample.

Client: City Of Mississauga
 Location: #6 : Roof E
 Survey Date: 2022-08-31

Site: 735 Central Parkway West, Mississauga, ON
 Floor: R

Building Name: Animal Services Centre
 Room #:
 Last Re-Assessment: 0000-00-00

Area (sqft): 300

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Other		Roofing material, Roof shingle			B	Y		300			SF	S0003B	None Detected	N.D.	None	



ALL DATA REPORT



Client: City Of Mississauga
 Location: #7 : Roof K
 Survey Date: 2022-08-31

Site: 735 Central Parkway West, Mississauga, ON
 Floor: R

Building Name: Animal Services Centre
 Room #:
 Last Re-Assessment: 0000-00-00

Area (sqft): 200

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Other		Roofing material			B	Y		200			SF	V0003	None Detected	N. D.	None	

Client: City Of Mississauga
 Location: #8 : Roof L
 Survey Date: 2022-08-31

Site: 735 Central Parkway West, Mississauga, ON
 Floor: R

Building Name: Animal Services Centre
 Room #:
 Last Re-Assessment: 0000-00-00

Area (sqft): 450

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Other		Roofing material			B	Y		450			SF	V0003	None Detected	N. D.	None	



ALL DATA REPORT



Client: City Of Mississauga
 Location: #9 : Roof F
 Survey Date: 2022-08-31

Site: 735 Central Parkway West, Mississauga, ON
 Floor: R

Building Name: Animal Services Centre
 Room #:
 Last Re-Assessment: 0000-00-00

Area (sqft): 100

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Other		Roofing material			B	Y		100			SF	V0003	None Detected	N. D.	None	

Client: City Of Mississauga
 Location: #10 : Roof G
 Survey Date: 2022-08-31

Site: 735 Central Parkway West, Mississauga, ON
 Floor: R

Building Name: Animal Services Centre
 Room #:
 Last Re-Assessment: 0000-00-00

Area (sqft): 100

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Other		Roofing material			B	Y		100				V0003	None Detected	N. D.	None	

Legend:



Sample number		Units		Other	
S####	Asbestos sample collected	SF	Square feet	A	Access
L####	Paint sample collected	LF	Linear feet	V	Visible
P####	PCB sample collected	EA	Each	AP	Air Plenum
M####	Mould sample collected	%	Percentage	F	Friable material
V####	Material is visually identified to be identical to S####	LF	Linear feet	NF	Non Friable material
V0000	Known non hazardous material			PF	Potentially Friable material
V9000	Material visually identified as a Hazardous Material			Pb	Lead
V9500	Material is presumed to be a hazardous material			Hg	Mercury
				As	Arsenic
				Cr	Chromium

Access	
A	Accessible to all building occupants
B	Accessible to maintenance and operations staff without a ladder
C	Accessible to maintenance and operations staff with a ladder. Also rarely entered, locked areas
D	Not normally accessible

Condition	
Good	No visible damage or deterioration
Fair	Minor, repairable damage, cracking, delamination or deterioration
Poor	Irreparable damage or deterioration with exposed and missing material

Visible	
Y	The material is visible when standing on the floor of the room, without the removal or opening of other building components (e.g. ceiling tiles or access panels).
N	The material is not visible to view when standing on the floor of the room and requires the removal of a building component (e.g. ceilings tiles or access panels) to view and access. Includes rarely entered crawlspaces, attic spaces, etc. Observations will be limited to the extent visible from the access points.

Air Plenum	
Yes or No	The material is in a return air plenum or in a direct airstream or there is evidence of air erosion (e.g. duct for heating or cooling blowing directly on or across an ACM). This field is only completed where Air Plenum consideration is required by regulation.

Colour Coding	
	The material is known to contain regulated concentrations of asbestos; either by analytical results or visible identification (use of the V9000 code).
	The material is presumed to contain asbestos; based on visual appearances; typically a material known to historically contain asbestos; however, not sampled due to limited access or the destructive nature of the sampling.



February 4, 2022

City of Mississauga
950 Burnhamthorpe Road West, 2nd Floor
Mississauga, Ontario, L5B 3B4

Re: Asbestos Abatement Completion Letter
Animal Services Centre
735 Central Parkway West, Mississauga, Ontario
Pinchin File: 305272.000

Pinchin Ltd. (Pinchin) was retained by the City of Mississauga (Client) to perform a site review for the completion of asbestos abatement at the Animal Services Centre located at 735 Central Parkway West, Mississauga, Ontario.

Pinchin relied on the following report which was referenced as part of this site review:

- "Asbestos Reassessment, Animal Services Centre – ACC1, 735 Central Parkway West, Mississauga, Ontario", dated April 12, 2021, Pinchin File: 282188.000.

This letter is to confirm that all known asbestos-containing materials present in the building have been abated. The abatement was completed since the most recent 2021 reassessment and included the removal of 10 linear feet of asbestos cement (Transite) rainwater leader piping located in the Front Reception Area (Loc. 8). The Transite pipe was replaced with non-asbestos PVC piping. Transite rainwater leader piping may still be present in inaccessible spaces such as chases, in column enclosures and within shafts.



Photo 1: Non-asbestos PVC piping section which replaced the asbestos-containing Transite pipe that is no longer present in the Front Reception Area (Loc.8).

Pinchin was not involved during the abatement process and can only comment on post-abatement conditions. No debris or deficiencies were observed at the time of this site review.



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.

CLOSURE

Should you have any questions or concerns regarding the contents of this letter, please contact the undersigned.

Yours truly,

Pinchin Ltd.

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\\pinchin.com\Miss\Job\305000\0305272.000 CofMiss, Various, Miss, HAZ, ASB, HAZ\Deliverables\305272 Abatement Completion Letter, Animal Services Centre, City of Mississauga, Feb 4 2022.docx
Template: Asbestos Abatement Completion Letter (Short Version), HAZ, February 7, 2020

APPENDIX C

PART 1 GENERAL

1.1 General and Related Work

- .1 Read this Section in conjunction with all drawings and all other Sections so as to comply with the requirements of Division 1 and the General Conditions of the Contract.
- .2 Related work specified elsewhere:

Section 02 82 00.01 Asbestos Abatement – Type 1 Procedures
- .3 Site Conditions identifies all known asbestos building materials within the Project Area. The information provided is for general reference only. Each Contractor must confirm existing conditions on site prior to tender close.
 - .1 The specification fulfils the requirements of Section 30 of the Ontario Occupational Health and Safety Act.
 - .2 The specification fulfils the requirements of the Section 10 of Ontario Regulation 278/05.
- .4 The Outline of Work identifies the location, condition and quantities of asbestos building materials to be removed as part of this project.
 - .1 It is the intent that work prescribed this Section will result in the removal of all asbestos materials as outlined and the decontamination of all surfaces or materials which may have been or become contaminated by asbestos materials either during or prior to work of this Contract.

1.2 Site Conditions

- .1 Refer to the report entitled “Asbestos and Lead Test Results”, dated November 14, 2023, prepared by Pinchin Ltd., file number 333656, and “Asbestos Reassessment, Animal Services Centre – ACC1”, dated April 12, 2021, file number 282188.
- .2 Asbestos:
 - .1 The following materials have been confirmed to contain asbestos:
 - .1 Caulking, containing chrysotile asbestos, in the paper underpad, around exterior door frames at the back side of the building and exterior window frames throughout the building.
 - .2 The following materials have been confirmed to not contain asbestos, based on sampling or material composition:
 - .1 Acoustic ceiling tiles.
 - .2 Drywall joint compound on drywall walls and ceilings.
 - .3 Vinyl sheet flooring.

- .3 General Building Conditions:
 - .1 Heat and smoke detectors to remain live throughout work.
 - .2 Sprinklers to remain live throughout work.
 - .3 Fire detection and suppression systems in the Work Area are to be disabled and Contractor is responsible to provide fire watch when workers are not present in the Abatement Work Area.

1.3 Outline of Work

- .1 Coordinate the following items with the Owner's Project Manager and the Construction Manager, including but not limited to: electrical isolations, GFI connection, water connections, HVAC and exhaust ventilation system isolation, bin placement, schedule, disconnects, etc.
- .2 Remove and dispose of the following materials as clean waste prior to asbestos abatement work without disturbing asbestos-containing materials:
 - .1 Windows and window hardware.
 - .2 Doors and door hardware.
- .3 Using procedures prescribed in the Sections identified in Related Work, remove and dispose of the following:
 - .1 Asbestos-containing exterior caulking, in the following locations:
 - .1 Grey and off-white caulking around exterior window frames throughout the building.
 - .2 Silver and beige caulking around exterior door frame at the back side of the building.
- .4 Provide and pay for site inspection services specified herein.
- .5 Refer to Specification Sections identified in the Related Work for specified personnel protective measures for the safe handling, removal, clean-up, of asbestos materials in each phase or work area.
- .6 Visit the site prior to tender close to confirm the location and extent of any asbestos building materials.
- .7 Protect surfaces, building fabrics and items remaining within the Abatement Work Area.
- .8 Without disturbing asbestos materials, perform removals where required, prior to abatement work.
 - .1 Maximize waste diversion by use of resale of building materials, or recycling.
- .9 Isolate the Abatement Work Area from adjoining Occupied and Non-Occupied Areas whether present at an interior or exterior location.

- .10 Maintain emergency and fire exits from Abatement Work Area, or establish alternative exits satisfactory to Provincial Fire Marshall and local authorities having jurisdiction. Maintain extra routes from occupied areas. Place emergency exit signs at locations to clearly mark exit route. Seal emergency exit doors so as not to impede use of door during emergency evacuation.
- .11 Remove and dispose of as appropriate waste, building components, materials and items contaminated by asbestos materials that cannot be effectively cleaned.
- .12 Final clean work area to remove visible signs of asbestos and other debris or settled dust.
- .13 Apply lock-down agent to exposed surfaces from which any asbestos materials have been removed.
 - .1 Do not apply lock-down to materials which would be damaged by its application.
- .14 Unless otherwise specified, the handling, removal, clean-up of asbestos materials or surfaces contaminated with asbestos materials is to be performed following wet removal techniques.

1.4 Schedule

- .1 Provide necessary manpower, supervision, equipment and materials to maintain and complete the project on schedule.
- .2 Work Hours:
 - .1 Coordinate all work, scheduling and phasing with the Owner.
- .3 Provide 48 hours written notice to the Abatement Consultant of any request to work outside normal working hours. Obtain written approval before proceeding.

1.5 Definitions

- .1 Abatement Consultant: Owner's Representative providing inspection and air monitoring.
- .2 Abatement Contractor: Contractor or sub-contractor performing work of this section.
- .3 Abatement Work Area: Area where work takes place which will, or may, disturb hazardous materials.
- .4 Amended Water: Water with wetting agent added for the purpose of reducing surface tension to allow thorough wetting of materials.
- .5 Asbestos: Any of the fibrous silicates defined in Regulation 278/05 including: actinolite, amosite, anthophyllite, chrysotile, crocidolite and tremolite.
- .6 Asbestos-Containing Material (ACM): Material identified under Site Conditions including any debris, overspray, fallen material and settled dust.

- .7 Authorized Visitors: Building Owner, Abatement Consultant, or designated representative, and persons representing regulatory agencies.
- .8 Competent Worker: A worker who is qualified because of knowledge, training and experience to perform the work, is familiar with Regulation 278/05 and the Occupational Health and Safety Act, and has knowledge of the potential or actual danger to health and safety in the work.
- .9 Contaminated Waste: Material identified under Site Conditions, including fallen material, settled dust, other debris and materials or equipment deemed to be contaminated by the Abatement Consultant.
- .10 DOP Test: A testing method used to determine the integrity of the Negative Pressure unit or vacuum using a Dispersed Oil Particulate (DOP) or Poly Alpha Olefin (PAO) HEPA filter leak test. This test is to be conducted on site where units are to be installed. Refer to the Environmental Abatement Council of Ontario (EACO) DOP/PAO Testing Guideline 2013 or ANSI/ASME N510-2007.
- .11 Friable Material: Material that when dry can be crumbled, pulverized or powdered by hand pressure and includes such material that is crumbled, pulverized or powdered.
- .12 HEPA: High Efficiency Particulate Aerosol filter that is at least 99.97 percent efficient in collecting a 0.3 micrometre aerosol.
- .13 Milestone Inspection: Inspection of the Abatement Work Area at a defined point in the abatement operation.
- .14 Negative Pressure: A reduced pressure within the Abatement Work Area (> 0.02 inches of water column) established by extracting air directly from Abatement Work Area and discharging it to exterior of building.
- .15 Non-Friable Material: Material that when dry cannot be crumbled, pulverized or powdered by hand pressure.
- .16 Occupied Area: Any area of the building or adjoining space outside the Abatement Work Area.
- .17 Personnel: All Contractor's employees, sub-contractors employees, supervisors.
- .18 Remove: Remove means remove and dispose of (as applicable type of waste) unless followed by other instruction (e.g. remove and turn over to Owner).

1.6 Regulations and Guidelines

- .1 Comply with Federal, Provincial, and local requirements, provided that in any case of conflict among those requirements or with these Specifications, the more stringent requirements shall apply. Work shall be performed under regulations in effect at the time work is performed.

- .2 Where regulations are not present, follow accepted industry standards and applicable Guideline documents.
- .3 Regulations and Guidelines include but are not limited to the following:
 - .1 Ministry of Labour Occupational Health and Safety Act Regulations for Construction Projects including Revised Statutes of Ontario 1990, Chapter 0.1 and Ontario Regulation 278/05.
 - .2 Ministry of the Environment and Climate Change Regulation for the disposal of waste, including R.R.O. 1990, Reg. 347 as amended.
 - .3 Regulation 490/09 Designated Substances.
 - .4 Ministry of Labour, Guideline, Silica on Construction Projects, 2011.

1.7 Quality Assurance

- .1 Removal and handling of asbestos materials is to be performed by persons trained in the methods, procedures and industry practices for Abatement.
- .2 Ensure work proceeds to schedule, meeting all requirements of this Specification.
- .3 Complete work so that at no time airborne dust, visible debris, or water runoff contaminate areas outside the Abatement Work Area.
- .4 Any contamination of surrounding area (indicated by visual inspection) shall necessitate the clean-up of affected area, and in the same manner applicable to an Abatement Work Area at no cost to the Owner.
- .5 All work involving electrical, mechanical, carpentry, glazing, etc., shall be performed by licensed persons experienced and qualified for the work required.

1.8 Supervision

- .1 Provide on site for each work shift, a Shift Superintendent(s), who has authority regarding all aspects related to manpower, equipment and production.
- .2 Supervisory personnel must hold a recognized certificate proving attendance at an asbestos removal training course (2 day minimum duration) and have performed supervisory functions on at least five (5) other asbestos abatement projects of similar size and complexity.
- .3 At all times during work, the Shift Superintendent(s) must be on site. Failure to comply with this requirement will result in a stoppage of all work, at no cost to the Owner.
- .4 Replace supervisory personnel, with approved replacements, within three (3) working days of a written request from the Owner. Owner reserves the right to request replacement of supervisory personnel without explanation.
- .5 Do not replace supervisory personnel without written approval from the Owner.

1.9 Instruction and Training

- .1 Instruction and training must be provided by a competent person.
- .2 All workers completing asbestos abatement must be trained in compliance with Section 19 of O.Reg. 278/05.

1.10 Notification

- .1 Before commencing work, notify orally and in writing, an inspector at the office of the Ontario Ministry of Labour nearest the project site, where required.
- .2 Inform all trades on site of the presence and location of asbestos materials identified in the Contract documents.
- .3 Notify the Owner or Owner's Representative, the Joint Occupational Health and Safety Committee and the Provincial Ministry of Labour, if suspected asbestos-containing materials not identified in the contract documents are discovered during the course of the work. Stop work in these areas immediately.
- .4 Notify Sanitary Landfill site as per O.Reg. 347/90 as amended.

1.11 Submittals

- .1 Submit prior to starting work:
 - .1 Provincial Workers' Compensation Board Clearance Certificate.
 - .2 Insurance certificates.
 - .3 Copy of Company Health and Safety Policy and applicable programs.
 - .4 Ministry of Labour Notice of Project form.
 - .5 Copy of Certificate of Approval for disposal of hazardous materials waste and location of landfill.
 - .6 Pre-removal damage survey of the Abatement Work Area(s), waste transport routes, and bin storage areas
- .2 Submit the following information regarding personnel prior to starting work:
 - .1 Resumes of the supervisory personnel.
 - .2 Proof in the form of a certificate that supervisory personnel have attended a training course on asbestos removal or are certified as supervisors under the Ministry of Training, Colleges and Universities course 253S.
 - .3 Written statement that personnel have had instruction on hazards of exposure to hazardous materials identified within this scope, the use of respirator, protective

- clothing, worker and waste decontamination procedures, and all aspects of work procedures and protective measures.
- .4 WHMIS training certificates for all personnel.
 - .5 Certificate proving that each worker on site has been fit tested for the respirator appropriate for the work being performed.
 - .6 Proof of training for the following site specific hazards or conditions identified:
 - .1 Working at Heights
 - .2 Elevated Work Platform.
 - .3 Submit the following information regarding HEPA filtered devices prior to construction of enclosure or asbestos abatement:
 - .1 Performance data on HEPA filtered vacuums including DOP tests no more than 3 months old.
 - .2 DOP tests to be performed by an independent testing company.
 - .1 DOP testing company is required to submit a detailed technical report of testing protocol, including Introduction, Methodology, Results, Conclusions, and Recommendations, including results of the Air-Aerosol Mixing Uniformity test as per ASME N510-1989 (1995).
 - .2 DOP testing company must also provide calibration certificates from an independent calibration firm or from the manufacturer of the testing equipment for both the aerosol photometer and the pressure gauge on the aerosol generator dated within 1 calendar year from the on-site testing date.
 - .3 DOP testing company must also provide the National Sanitation Foundation (NSF) certification name and number of the on-site technician performing the testing.
 - .3 Proof of calibration of DOP testing equipment.
 - .4 Submit the following prior to isolating the work area:
 - .1 Safety Data Sheets for chemicals or material used in the course of the Abatement Project.
 - .5 Submit the following upon completion of the work.
 - .1 Manifests, waybills, bills of lading etc. as applicable for each type of waste.

1.12 Insurance

- .1 Maintain a Commercial General Liability Policy with an insurance company acceptable to City of Mississauga. The intent of this policy is to hold the City of Mississauga harmless as it relates to claims for Bodily Injury or Property Damage or both, relating to the contract. Commercial General Liability insurance shall be provided on an “occurrence” basis to cover injury or damage (whether detected or not during the policy period) which happens during the policy period.
- .2 Maintain an Automobile or Fleet Policy, and Non-owned Automobile Policy with an insurance company acceptable to City of Mississauga. The intent of these policies is to hold City of Mississauga harmless as it relates to claims for Bodily Injury or Property Damage or both, relating to the contract.
- .3 Maintain a Pollution Liability Policy (or asbestos/lead liability policy or specific coverage under the CGL for asbestos/lead abatement) with an insurance company acceptable to City of Mississauga. The intent of this policy is to hold City of Mississauga harmless as it relates to claims for Bodily Injury or Property Damage or both, relating to the contract. Pollution Liability shall be provided on an “occurrence” basis to cover injury or damage (whether detected or not during the policy period) which happens during the policy period. Without limiting the generality of the foregoing, the policy shall insure the operations of abatement and shall not contain any environmental and/or health hazard exclusions relating to remediation operations.
- .4 Forward all certificates to City of Mississauga before work is commenced, showing City of Mississauga as additional insured as their interest may appear.
- .5 City of Mississauga may request a certified true copy of the policies.
- .6 The limits will not be less than:
 - .1 Commercial General Liability \$5,000,000.00
 - .2 Automobile \$2,000,000.00
 - .3 Pollution Policy \$5,000,000.00

1.13 Inspection

- .1 Provide and pay for site inspection services as specified herein.
- .2 From commencement of work until completion of clean-up operations, the Abatement Consultant will be empowered by the Owner to inspect for compliance with the requirements of governing authorities, adherence to specified procedures and materials, and to inspect for final cleanliness and completion.
- .3 The Abatement Consultant is empowered by the Owner to order a shutdown of work when leakage of asbestos from the controlled work area has occurred or is likely to occur.
- .4 Any deviation from the requirements of the Specifications or governing authorities that is not approved in writing may result in a stoppage of work, at no cost to the Owner.

- .5 Additional labour or materials expended by the Contractor to rectify unsatisfactory conditions, and to provide performance to the level specified, shall be at no additional cost to the Owner.
- .6 Any inspections performed as a result of Contractor's failure to perform satisfactorily regarding quality, safety, or schedule, shall be charged additionally to the Contractor.
- .7 Facilitate inspection and provide access as necessary. Make good work disturbed by inspection and testing at no cost to the Owner.
- .8 Refer to the Sections identified in Related Work for specified milestone inspections which are to take place at defined points throughout the abatement operation specific to each phase or work area.
- .9 Provide 24 hours written notice to the Abatement Consultant of any request for scheduling of milestone inspections or transportation of waste through Occupied Areas.
- .10 The following Milestone Inspections may take place, at the Owner's cost, as outlined in each related specification section:
 - .1 Milestone Inspection – Bulk Removal Inspection
 - .1 Inspection during asbestos removal, monitoring removal methods, site deficiencies, performing occupied air monitoring, etc.
 - .2 Milestone Inspection - Visual Clearance
 - .1 Inspection of Abatement Work Area after completion of all abatement, but prior to application of lock-down agents or dismantling of enclosure.
- .11 Do not proceed with next phase of work until written approval of each milestone is received from the Abatement Consultant.

1.14 Worker Protection

- .1 Instruct workers before allowing entry to the Abatement Work Area. Instruction shall include training in use of respirators, dress, showering, entry and exiting from an Abatement Work Area, and all other aspects of work procedures and protective measures.
- .2 Workers shall not eat, drink, chew gum or tobacco, vape or smoke in the Abatement Work Area.
- .3 Workers shall be fully protected at all times when possibility of disturbance of hazardous materials exists.
- .4 Provide soap, towels and facilities for washing of hands and face, which shall be used by all personnel when leaving the Abatement Work Area.
- .5 Respiratory Protection
 - .1 Refer to each particular Section of the Specification for specified type of respiratory equipment specific to each phase or work area.

- .2 Respirators shall be:
 - .1 Certified by the National Institute of Occupational Safety and Health (NIOSH) or other testing agency acceptable to the Ministry of Labour.
 - .2 Fitted so that there is an effective seal between the respirator and the worker's face. Ensure that no person required to enter an Abatement Work Area has facial hair which affects the seal between respirator and face.
 - .3 Assigned to a worker for their exclusive use.
 - .4 Maintained in accordance with manufacturer's specifications.
 - .5 Cleaned, disinfected and inspected by a competent person after use on each shift, or more often if required.
 - .6 Repaired or have damaged or deteriorated parts replaced.
 - .7 Stored in a clean and sanitary location.
 - .8 Provided with new filters as necessary, according to manufacturer's instructions.
 - .9 Worn by personnel who have been fit checked by qualitative or quantitative fit-testing.
 - .10 Instruction on proper use of respirators must be provided by a competent person as defined by the Occupational Health and Safety Act.
- .3 Provide protective clothing, to all personnel which:
 - .1 Is made of a material that does not readily retain nor permit penetration of asbestos fibres or lead/silica dust.
 - .2 Consists of head covering and full body covering that fits snugly at the ankles, wrists and neck.
 - .3 Once coveralls are worn, treat and dispose of as contaminated waste.
 - .4 Is replaced or repaired if torn or ripped.
- .4 Use hard hats, safety footwear and other protective equipment and apparel required by applicable construction safety regulations.

1.15 Visitor Protection

- .1 Provide clean protective clothing and equipment to Authorized Visitors.
- .2 Instruct Authorized Visitors in the use of protective clothing and Abatement Work Area entry and exit procedures.

1.16 Waste and Material Handling

- .1 Waste bins must be placed on grade or in receiving.
- .2 All bins for asbestos materials must be covered and locked when waste transfer is not being performed.
- .3 Ensure redundant non-ACM, rubble, debris, etc. removed during contaminated work are treated, packaged, transported and disposed of as appropriate waste.
- .4 Clean, wash and apply Post Removal Sealant to metal waste prior to removal from Abatement Work Area. Recycle metals.

- .5 Clean, wash and apply Post Removal Sealant to non-porous materials prior to disposal as clean waste. Obtain prior written approval from the Abatement Consultant for each individual type of material.
- .6 Clean and wash equipment prior to removal from Abatement Work Area if removed prior to completion.
- .7 Place all equipment, tools and unused materials that cannot be cleaned in Abatement Waste Containers.
- .8 As work progresses, and at regular intervals, transport the sealed and labelled waste containers from the Abatement Work Area to waste bin.
- .9 Place items in bins according to waste classification. Place asbestos waste, lead waste, metals, non-asbestos waste, etc. in separate bins.
- .10 Removal of waste containers and decontaminated tools and materials from the Abatement Work Area shall be performed as follows:
 - .1 Remove any visible contamination from the surface of non-porous or cleanable waste being removed from the Abatement Work Area. If the item can be cleaned, remove it from the site as clean waste.
 - .2 Place waste or item in Waste Container and seal closed.
 - .3 Wet wipe outside of Waste Container.
 - .4 Remove waste containers and transport to appropriate bin.
- .11 Transport waste and materials via the predetermined routes and exits. Arrange waste transfer route with Owner. Use a closed, covered cart to transport through Occupied Areas.
- .12 Provide workers transporting waste with means to access full personal protective equipment and all tools required to properly clean up spilled material in the case of a rupture of a Waste Container.
- .13 Pick-up and drop off of garbage bin shall be at pre-approved times and must not interfere with the Owners operations.
- .14 Transport hazardous waste to landfill or waste transfer station licensed by the provincial Ministry of the Environment.
- .15 Cooperate with the provincial Ministry of the Environment inspectors and immediately carry out instructions for remedial work at dump to maintain environment, at no additional cost to the Owner.

PART 2 PRODUCTS AND FACILITIES

2.1 Materials and Equipment

- .1 Refer to the Sections identified in Related Work for specified materials, equipment or facilities specific to each phase or work area.
- .2 Materials and equipment must be in good condition and free of debris and fibrous materials. Disposable items must be of new materials only.
- .3 Airless Sprayer: AC powered pressure washer that allows wetting agent to mix with water, uses no air or compressed air, and has a nozzle to regulate power and pressure.
- .4 Amended Water: Water with wetting agent added for purpose of reducing surface tension to allow thorough wetting of materials.
- .5 Asbestos Waste Container: A container acceptable to disposal site, Ministry of the Environment, and Ministry of Labour, comprised of the following:
 - .1 Dust tight.
 - .2 Suitable for the type of waste.
 - .3 Impervious to asbestos.
 - .4 Identified as asbestos waste.
- .6 Ground Fault Panel: Electrical panel as follows:
 - .1 Ground fault circuit interrupters of sufficient capacity to power temporary electrical equipment and lights in Asbestos Work Area.
 - .2 Interrupters to have a 5 mA ground fault protection.
 - .3 Necessary accessories including main switch disconnect, ground fault interrupter lights, test switch to ensure unit is working, and reset switch.
 - .4 Openings sealed to prevent moisture or dust penetration.
 - .5 Inspected by the Electrical Safety Authority.
 - .6 Panel uses CSA approved parts and been constructed, inspected and installed by a licensed electrician.
 - .7 Provide one Ground Fault Panel for each 5,000 square feet (500 square metres) of Abatement Work Area.
- .7 HEPA Vacuum: Vacuum with necessary fittings, tools and attachments. Discharged air must pass through a HEPA filter.
- .8 Hose: Leak-proof, minimum bursting strength of 500 PSI or greater if required, abrasion resistant covering, reinforcing, and machined-brass couplings. Maintained and tested. Hose to be temperature resistant if it is to carry domestic hot water.
- .9 OSB: Oriented Strand Board.

- .10 Polyethylene Sheeting: 6 mil (0.15 mm) minimum thickness unless otherwise specified, in sheet size to minimize joints.: 6 mil (0.15 mm) minimum thickness unless otherwise specified, in sheet size to minimize joints.
- .11 Post Removal Sealant (or Lockdown): Sealant that when applied to surfaces serves the function of trapping residual asbestos fibres or other dust. Product must have flame spread and smoke development ratings both less than 50. Product shall leave no stain when dry. Post Removal Sealant shall be compatible with replacement insulation or fireproofing where required and capable of withstanding service temperature of substrate. Apply to manufacturer's instructions.
- .12 Protective Clothing: Disposable coveralls complete with head covering and full body covering that fits snugly at the ankles, wrists and neck.
- .13 Rip-Proof Polyethylene Sheeting: 8 mil (0.20 mm) fabric made up from 5 mil (0.13 mm) weave and two (2) layers of 1.5 mil (0.05 mm) poly laminate or approved equal. In sheet size to minimize on-site seams and overlaps.
- .14 Shower Hose: Water lines for supply of hot & cold water to shower facilities to be rated for use at 200 PSI (1380 kPa) or twice the working pressure whichever is greater. Supply lines to be continuous and free of fittings, joints or couplings.
- .15 Sprayer: Garden type portable manual sprayer or water hose with spray attachment if suitable.
- .16 Tape: Duct tape or tape suitable for sealing polyethylene to surfaces under both dry and wet conditions in the presence of Amended Water.
- .17 Wetting Agent: Non-sudsing surfactant added to water to reduce surface tension and increase wetting ability.

PART 3 EXECUTION

- .1 Refer to the Sections identified in Related Work for specified procedures for work area preparation, maintenance, site dismantlement, application of lock-down agent and all other procedures for the safe handling, removal and clean-up of asbestos materials specific to each phase or work area.

END OF SECTION

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PART 1 GENERAL

1.1 General and Related Work

- .1 Read this Section in conjunction with all drawings and all other Sections so as to comply with the requirements of Division 1 and the General Conditions of the Contract.
- .2 Requirements specified elsewhere:
 - .1 Section 02 81 00 Hazardous Materials – General Provisions

1.2 Outline of Work

- .1 Refer to Section 02 81 00 Hazardous Materials – General Provisions for the Outline of Work.
- .2 The intent of this Section is to provide safe work practices and procedures to govern the handling, removal, clean-up and disposal of asbestos-containing materials following Type 1 or Low Risk procedures, and Pinchin and Owner specific requirements.

1.3 Personal Protection

- .1 Protect all personnel at all times when possibility of disturbance of ACM exists.
 - .1 Provide non-powered half-face respirators with P100 high efficiency (HEPA) cartridge filters when requested by personnel.
 - .2 When requested by personnel, provide protective clothing.
- .2 Provide protective clothing, to all personnel entering the Abatement Work Area.
- .3 Wear hard hats, safety shoes and other personal protective equipment required by applicable construction safety regulations.

1.4 Inspections

- .1 Refer to Part 1.13 Inspections in Section 02 81 00 – General Provisions.
- .2 The following Milestone Inspections are to be scheduled:
 - .1 Milestone Inspection – Bulk Removal Inspection
 - .2 Milestone Inspection - Visual Clearance

PART 2 PRODUCTS AND FACILITIES

- .1 Refer to Section 02 81 00.

PART 3 EXECUTION

3.1 Site Preparation

- .1 Moving of equipment, tools, supplies, and stored materials that can be performed without disturbing ACM will be performed by others.
- .2 Remove visible dust and friable material from all surfaces in the work area including those to be worked on, using HEPA Vacuums or wet wiping.
- .3 Install polyethylene drop sheets below areas of work.
- .4 Install polyethylene sheeting on openings in walls and floors (as required) and seal.
- .5 Provide power from ground fault interrupt circuits.
- .6 Without disturbing asbestos-containing materials, remove and dispose of non-hazardous

materials as clean waste prior to asbestos removal work, where possible.

3.2 Maintenance of Abatement Work Area

- .1 Inspect polyethylene sheeting and ensure it is effectively sealed and taped. Repair damage and remedy defects immediately.
- .2 Maintain Abatement Work Area in tidy condition.
- .3 Turn off water supply to any hoses and reduce pressure in hose, prior to leaving the Abatement Work Area at end of shift.

3.3 Asbestos Removal - General

- .1 Do not use powered tools or non-hand held tools.
- .2 Do not use compressed air to clean or remove dust or debris.
- .3 Do not break, cut, drill, abrade, grind, sand or vibrate ACM if it cannot be wetted. Type 2 procedures would be required if the material cannot be wetted due to hazard or damage.
- .4 Wet ACM prior to work and keep ACM wet throughout the removal process.
- .5 Frequently and at regular intervals during the work, clean up dust and waste using HEPA vacuums and/or wet sweeping or mopping.
- .6 Frequently and at regular intervals, place all waste in asbestos waste containers.
- .7 Immediately upon completion of work, clean area with HEPA vacuum and/or wet sweeping or mopping.

3.4 Asbestos Removal - Caulking

- .1 Wet all material to be disturbed. Use only non-powered hand-held tools to remove ACM.
- .2 Wedge a scraper between caulking and substrate as required.
- .3 Heat caulking thoroughly if necessary with a hot air gun until heat penetrates through and softens caulking in areas where scraper will not remove caulking.
- .4 Scrape caulking remaining on substrate with a hand scraper until only a thin smooth film remains.
- .5 Use a hot air gun where deposits are heavy or difficult to scrape.
- .6 Deposit scrapings into asbestos waste disposal bag.
- .7 HEPA vacuum floor on completion of work in area.

3.5 Abatement Work Area Dismantling

- .1 Wash or HEPA vacuum equipment and tools used in contaminated Abatement Work Area to remove all asbestos contamination, or place in Asbestos Waste Containers prior to being removed from Abatement Work Area.
- .2 Place tools and equipment used in contaminated work site but not cleaned in polyethylene bags prior to removal from Abatement Work Area.
- .3 Clean polyethylene sheeting and drop sheets which with HEPA vacuum or wet cleaning methods at completion of work.
- .4 Wet drop sheets and polyethylene sheeting.
- .5 Carefully roll polyethylene sheeting and drop sheets toward the centre. As polyethylene is rolled away, immediately remove visible debris beneath with a HEPA vacuum.

- .6 Remove remaining polyethylene sheeting and tape.
- .7 Place polyethylene sheeting, drop sheets, tape, disposal clothing and other contaminated waste in asbestos waste containers, wet wipe and place in second asbestos waste container.

3.6 Waste and Material Handling

- .1 Refer to Section 02 81 00.

END OF SECTION

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APPENDIX D

**Safety, Quality,
Customer Excellence
since 1989.**



QL-A REPORT: SUBSURFACE UTILITY ENGINEERING (SUE)

735 Central Parkway West, Mississauga, On L5C 4H4

Prepared For:

City of Mississauga

Rev No.	Date	Description	Prepared By	Reviewed by
01	Jan. 22, 2024	Issued for Client Review	Feyza Ogut	Allan Dabu, Civil Engineer, Utilities

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1. DEFINITIONS

Ticket	The notification that multiVIEW sends to the utility owner to inform of any conflict and to prompt the utility owner to provide their record data and as built data of their existing utilities in the project limits.
Right-Of-Way (ROW)	Right-Of-Way refers to subsurface land or property acquired for or intended to be occupied by either a street crosswalk, railroad electric transmission line, oil or gas pipeline, water main sanitary, or storm sewer main, shade trees and/or other special private and public utility facilities.
Locate/ Locating	In this scope of work, Locate, refers to leveraging the surface geophysical methods to interpret the presence of a subsurface utility and to mark its approximate horizontal position (designation) on the ground surface. The process of exposing and recording the precise vertical and horizontal location of a utility is not included in this scope of work.
Utility	A privately, publicly, or cooperatively-owned line, facility, or system for producing, transmitting, or distributing communications, cable television, power, electricity, light, heat, gas, oil, crude products, water, steam, waste, or any other similar commodity, including any fire or police signal system or street lighting system.

2. ABBREVIATIONS

ASCE	American Society of Civil Engineers	QL-A	Quality Level A
BOC	Bottom of Chamber	QL-B	Quality Level B
CB	Catch Basin	QL-C	Quality Level C
CAD	Computer Aided Design	QL-D	Quality Level D
CCTV	Closed Circuit Television	ROW	Right-of-Way
CI	Construction Institute	SUE	Subsurface Utility
GPR	Ground Penetrating Radar	SAN	Sanitary
GPS	Global Positioning System	St	Street
INV	Invert	STM	Storm
MH	Maintenance Hole (Man Hole)	T/G	Top of Grate Elevation
Multiview	multiVIEW Locates Inc.		
N/A	Not Applicable		
OBV	Obvert		

3. REFERENCES

Ref #	Document #	Document Title	Revision date
1	CI/ASCE 38-02	Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data	2006
2	Proposal Project # 49533	multiView Proposal for 735 Central Pkwy W, Mississauga	Sept.12, 2023

4 EXECUTIVE SUMMARY

multiVIEW Locates Inc. was contacted by “City of Mississauga” to complete a Subsurface Utility Engineering (SUE) QL-A investigation to designate, capture and plot the inferred spatial position of targeted underground utilities in the project area. multiVIEW Locates Inc. has performed the SUE investigation; fieldwork Quality level A (QL-A) and completed the investigation for the project area: 735 Central Parkway West, Mississauga, Ontario that is defined in the map and scope of work, shown in Figure 1.1.

Through a combination of record data analysis, mobilization of personnel and equipment, field verification and professional judgement, this SUE investigation helped to identify and confirm the location of the below ground utilities infrastructure and appurtenances as defined in CI/ASCE 38-02, within the work area and project limits.

The QL-A investigation and captured associated data was completed in strict adherence to the CI/ASCE 38-02 standard. This Report outlines the scope of work completed, the equipment and techniques applied, an overview of the collected data and a full photo report that includes utility depth data. For a comprehensive definition of Subsurface Utility Engineering and associated Quality Levels, please refer directly the CI/ASCE 38-02 standard.

The consolidation of the above-mentioned information and investigation results have been integrated into the SUE QL-A Composite CAD Drawing, attached in Appendix -A.

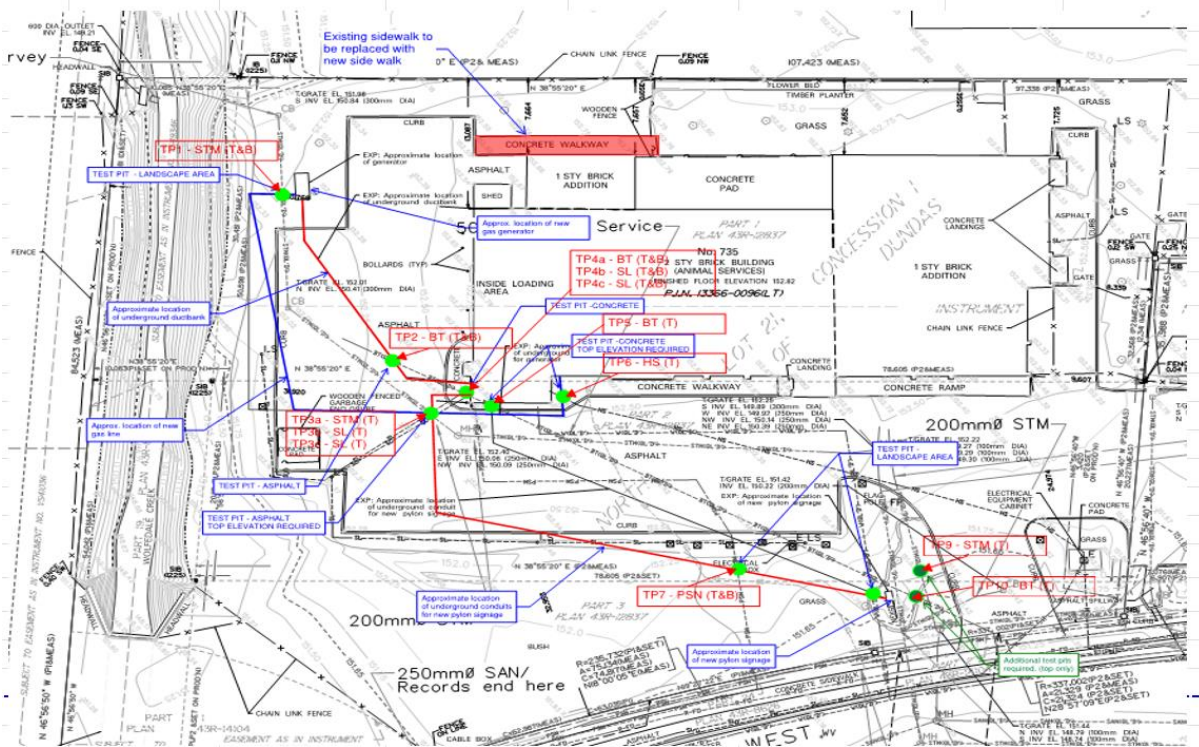


Figure 1.1: 735 Central Parkway W, Mississauga, Ontario

The present report and attached composite drawing will support the detailed design of the project (e.g. utility relocation plans), allow more accurate cost estimation, minimize risks, and support any prioritization of utility conflicts.

4.1 PROJECT AREA

The project area is located at 735 Central Parkway W, Mississauga, Ontario. Refer to Figure 1.2 for reference to the project area. There were twenty-one test pits proposed and seventeen test pits completed in this region.

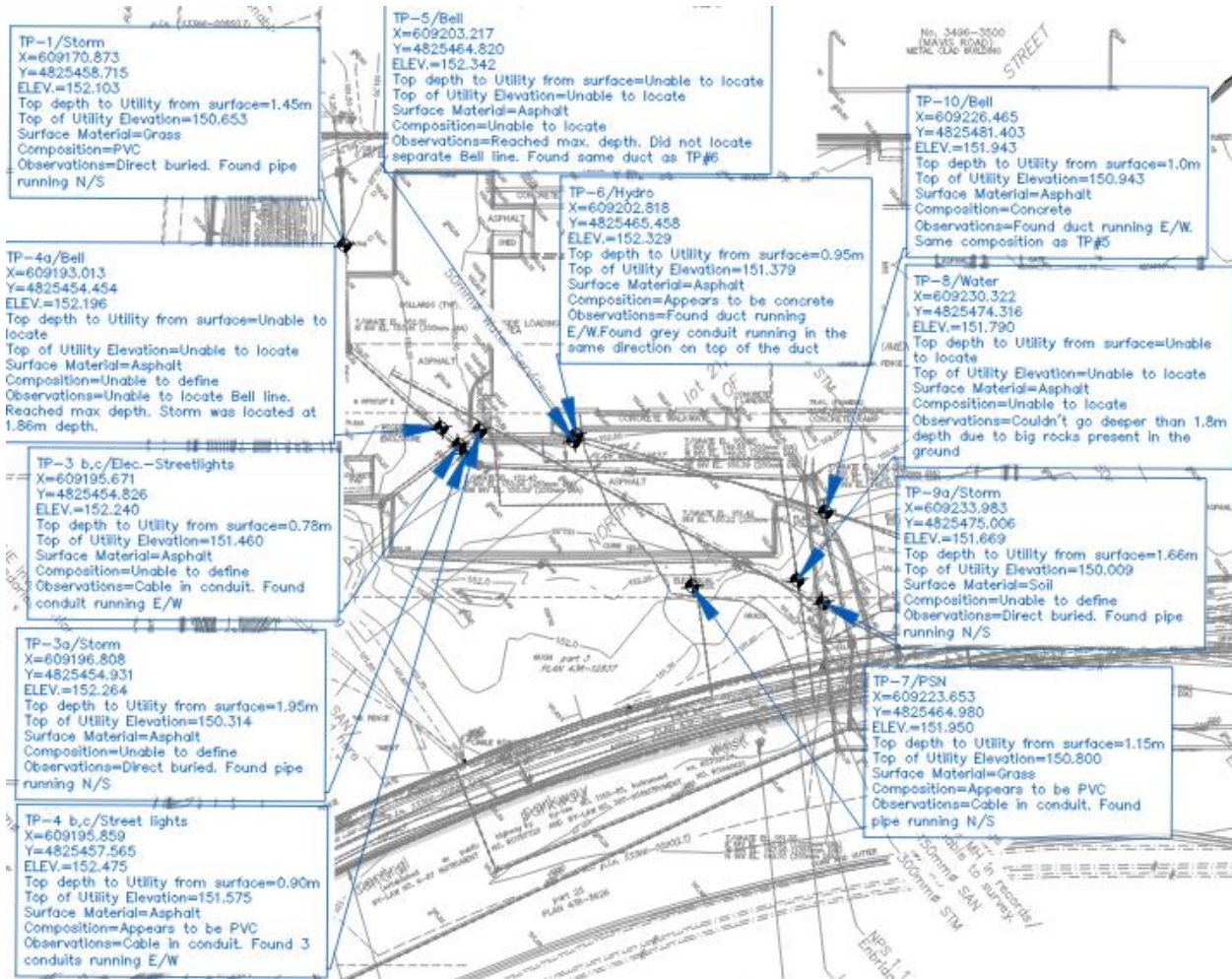


Figure 1.2: Picture depicting the Project Area.

4.2 PROJECT SCOPE OF WORK

A QL-A Investigation was conducted within the limits of the project area to obtain horizontal and vertical information of underground utilities.

The investigation entailed the following activities to complete a maximum of eleven (21) test hole up to 3m max depth:

- I. Using hydro excavation truck and equipment, to complete eleven (21) test pits, eight (8) on soft, thirteen (13) on hard surface to expose underground utilities (exact locations of the test pits to be determined by the client).
- II. Measurement to be captured include vertical measurement from surface to the top of the utility.
Utility Nos
 - Water 2
 - Bell 6
 - SL 6
 - STM 4
 - PSN 2
 - HS 1
- III. Including:
 - Managing Ontario One Call submission.
 - Soft Surface coring activities
 - Test pit Restoration including cold patch asphalt surface cap
 - Proper fill disposal in accordance with Excess Soils regulations
 - Arrange for Road Occupancy and Municipal Cut Permits.
- IV. Deliverables:
 - Test Pit report with photos, depth, coordinate

5. EQUIPMENT/TECHNIQUES

multiVIEW uses the latest vacuum excavation equipment and techniques to daylight a variety of subsurface utilities and underground structures. Quality Level A (QL-A) investigations are carried out in strict adherence to the CI/ASCE 38-02 standard guideline for the collection and depiction of existing subsurface utility.

Vacuum excavation is an ideal technique when performing potholing, daylighting, or test pitting to expose and verify the physical characteristics of a utility or structure housing utilities include its geodetic location. The two most popular methods of completing vacuum excavation are pneumatic excavation and hydro excavation. In pneumatic excavation, high speed air flow is used where required to loosen the material covering the target and the soil is sucked away with the vacuum tube. This soil can be used as native back fill as it is not mixed with any other materials. During hydro excavation, a high-pressure water jet is used and where required, at high temperatures, to loosen the material covering the target. This method is suitable for any soil type. On hard surfaces such as asphalt, concrete or limestone, a process of keyhole cutting techniques are applied using diamond tip cutting equipment in order to access the soft surface underneath. Depending on the requirements of the project, multiVIEW also offers full site restoration services.

For this project, the process of hydro excavation was applied to complete 17 test pits on the project site. A high-pressure water jet was used to penetrate through the soil that was present within the limits of the project site.

6. RESULT/OVERVIEW

Following table provides an overview of the collected data. A full photo report that includes utility depth information is provided in Section 7.0. The “Page Number” column in the table refers to the corresponding page of the photo report for each test pit in Section 7.0

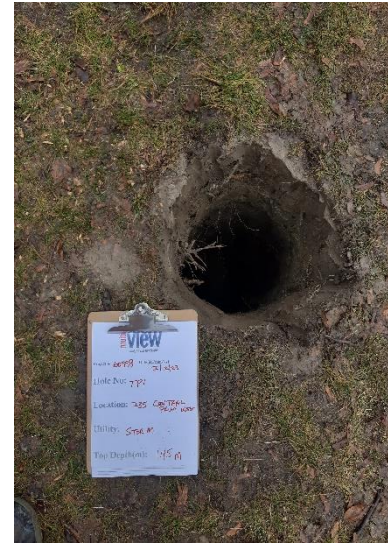
TEST PIT #	TARGETED UTILITY	PAGE NUMBER	COORDINATES		LOCATION	Ground Elevation	SURFACE	COMPOSITION OBSERVATION	EXCAVATION DIMENSIONS (m)		DEPTH TO UTILITY FROM SURFACE (m)		TOP OF UTILITY ELEVATION	COMMENTS
			X	Y					Dia.	Depth	TOP	BOTTOM		
TP-1	Storm	11	609170.873	4825458.715	735 Central Parkway West	152.103	Grass	Unable to define	0.3	2.9	1.45	1.75	150.653	Direct buried. Found pipe running N/S
TP-3a	Storm	12	609196.808	4825454.931	735 Central Parkway West	152.264	Asphalt	Unable to define	0.3	2	1.95	N/A	150.314	Direct buried. Found pipe running N/S
TP-3b,c	Elec./Street light	13	609195.671	4825454.826	735 Central Parkway West	152.240	Asphalt	Unable to define	0.3	1	0.78	N/A	151.460	Cable in conduit. Found conduit running E/W
TP-4a	Bell	14	609193.013	4825454.454	735 Central Parkway West	152.196	Asphalt	Unable to locate	0.3	2	Unable to locate	Unable to locate	Unable to locate	Unable to locate Bell line. Reached max depth. Storm was located at 1.86m depth. See notes.
TP-4 b,c	Streetlights	15	609195.859	4825457.565	735 Central Parkway West	152.475	Asphalt	Appears to be PVC	0.3	2	0.9	0.95	151.575	Cable in conduit. Found 3 conduits running E/W
TP-5	Bell	16	609203.217	4825464.820	735 Central Parkway West	152.342	Asphalt	Unable to locate	0.3	2	Unable to locate	N/A	Unable to locate	Reached max. depth. Did not locate separate Bell line. Found same duct as TP#6. See notes.
TP-6	Hydro	17	609202.818	4825465.458	735 Central Parkway West	152.329	Asphalt	Appears to be Concrete	0.3	1	0.95	N/A	151.379	Found duct running E/W. Found grey conduit running in the same direction on top of the duct
TP-7	PSN	18	609223.653	4825464.980	735 Central Parkway West	151.950	Grass	Appears to be PVC	0.3	1.3	1.15	1.2	150.800	Cable in conduit. Found pipe running N/S
TP-8	Water	19	609230.322	4825474.316	735 Central Parkway West	151.790	Asphalt	Unable to locate	0.5	1.8	Unable to locate	Unable to locate	Unable to locate	Couldn't go deeper than 1.8m depth due to big rocks present in the ground
TP-9a	Storm	20	609233.983	4825475.006	735 Central Parkway West	151.669	Soil	Unable to define	0.5	2	1.66	N/A	150.009	Direct buried. Found pipe running N/S
TP-10	Bell	21	609226.465	4825481.403	735 Central Parkway West	151.943	Asphalt	Appears to be Concrete	0.3	1.2	1.0	N/A	150.943	Found duct running E/W. Same composition as TP#5. See notes.

*Note: 1. Test Pits TP-4a, TP-5, and TP-8 selected locations by the client were on QL-D lines. QL-D depicted utility lines in the “QL-B” deliverable were based on records.

7. SUE QL-A PHOTO REPORT

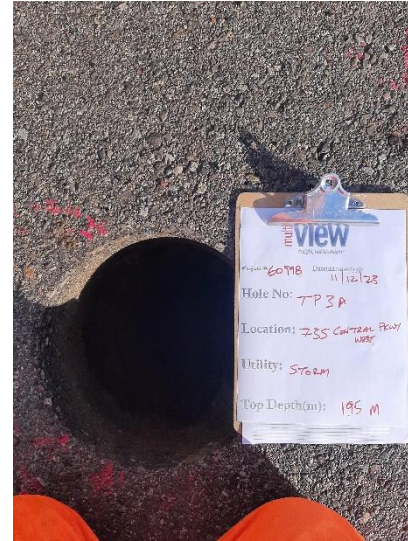
SUE QL-A PHOTO REPORT

Date: December 12, 2023
Hole No.: TP-1
Location: 735 Central Parkway West
Utility: STM
Surface Material: Soil/Grass
Composition: Unable to define
Top Depth (m): 1.45m
Bottom Depth (m): 1.75m
Size of Hole (m): 0.3 dia. & 2.9m depth
Observation: Direct buried, pipe running N/S



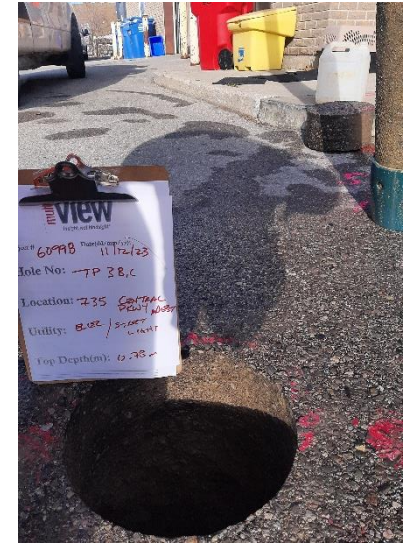
SUE QL-A PHOTO REPORT

Date: December 12, 2023
Hole No.: TP-3a
Location: 735 Central Parkway West
Utility: STM
Surface Material: Asphalt
Composition: Unable to define
Top Depth (m): 1.95m
Size of Hole (m): 0.3 dia. & 2.0m depth
Observation: Direct buried, pipe running N/S



SUE QL-A PHOTO REPORT

Date: December 12, 2023
Hole No.: TP-3b & c
Location: 735 Central Parkway West
Utility: Elec/Street Light
Surface Material: Asphalt
Composition: Unable to define
Top Depth (m): 0.78m
Size of Hole (m): 0.3 dia. & 1.0m depth
Observation: Direct buried, conduit running E/W



SUE QL-A PHOTO REPORT

Date: December 12, 2023
Hole No.: TP-4a
Location: 735 Central Parkway West
Utility: Bell
Surface Material: Asphalt
Composition: Unable to define
Top Depth (m): 1.86m
Size of Hole (m): 0.3 dia. & 2.0m depth
Observation: Unable to locate Bell line, reached max depth & found storm @1.86m



SUE QL-A PHOTO REPORT

Date: December 13, 2023
Hole No.: TP-4 b,c
Location: 735 Central Parkway West
Utility: Street lights
Surface Material: Asphalt
Composition: Appears to be PVC
Top Depth (m): 0.90m
Bottom Depth (m): 0.95m
Size of Hole (m): 0.3 dia. & 2.0m depth
Observation: Cable in conduit, three conduits running E/W



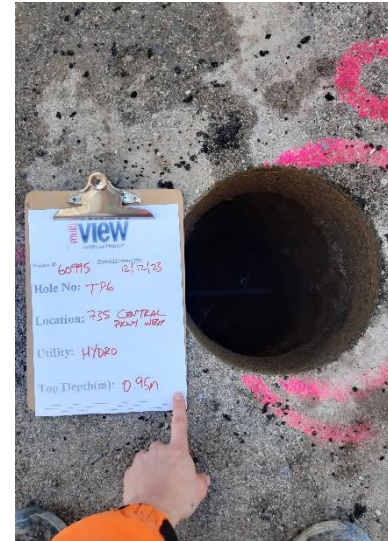
SUE QL-A PHOTO REPORT

Date: December 12, 2023
Hole No.: TP-5
Location: 735 Central Parkway West
Utility: Bell
Surface Material: Asphalt
Composition: Unable to locate
Top Depth (m): Unable to locate
Bottom Depth (m): N/A
Size of Hole (m): 0.3 dia. & 2.0m depth
Observation: Reached max. depth. Did not locate separate Bell line. Found same duct as TP#6



SUE QL-A PHOTO REPORT

Date: December 12, 2023
Hole No.: TP-6
Location: 735 Central Parkway West
Utility: Hydro
Surface Material: Asphalt
Composition: Appears to be concrete
Top Depth (m): 0.95m
Bottom Depth (m): N/A
Size of Hole (m): 0.3 dia. & 1.0m depth
Observation: Found duct running E/W. Found grey conduit running in the same direction on top of the duct



SUE QL-A PHOTO REPORT

Date: December 7, 2023
Hole No.: TP-7
Location: 735 Central Parkway West
Utility: PSN
Surface Material: Asphalt
Composition: Appears to be PVC
Top Depth (m): 1.15m
Bottom Depth (m): 1.20m
Size of Hole (m): 0.3 dia. & 1.3m depth
Observation: Cable in conduit. Found pipe running N/S



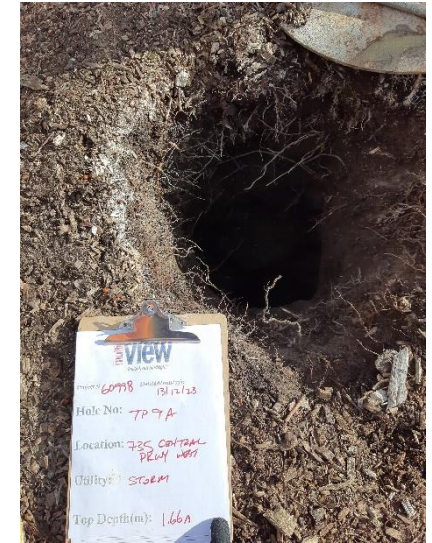
SUE QL-A PHOTO REPORT

Date: December 13, 2023
Hole No.: TP-8
Location: 735 Central Parkway West
Utility: Water
Surface Material: Asphalt
Composition: Unable to locate
Top Depth (m): Unable to locate
Bottom Depth (m): Unable to locate
Size of Hole (m): 0.5 dia. & 1.8m depth
Observation: Couldn't go deeper than 1.8m depth due to big rocks present in the ground



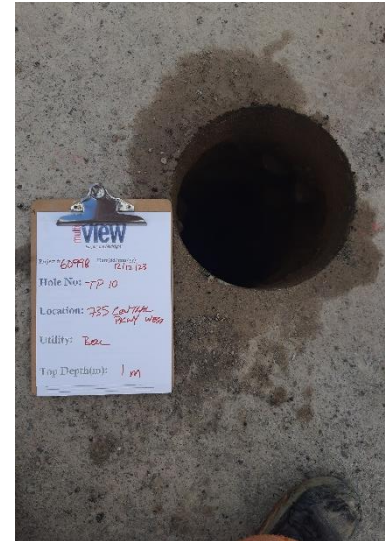
SUE QL-A PHOTO REPORT

Date: December 13, 2023
Hole No.: TP-9a
Location: 735 Central Parkway West
Utility: Storm
Surface Material: Soil
Composition: Unable to define
Top Depth (m): 1.66m
Bottom Depth (m): N/A
Size of Hole (m): 0.5 dia. & 2.0m depth
Observation: Direct buried. Found pipe running N/S



SUE QL-A PHOTO REPORT

Date: December 13, 2023
Hole No.: TP-10
Location: 735 Central Parkway West
Utility: Bell
Surface Material: Asphalt
Composition: Concrete
Top Depth (m): 1.0 m
Bottom Depth (m): N/A
Size of Hole (m): 0.3 dia. & 1.2m depth
Observation: Cable in duct, duct running E/W, composition as TP5



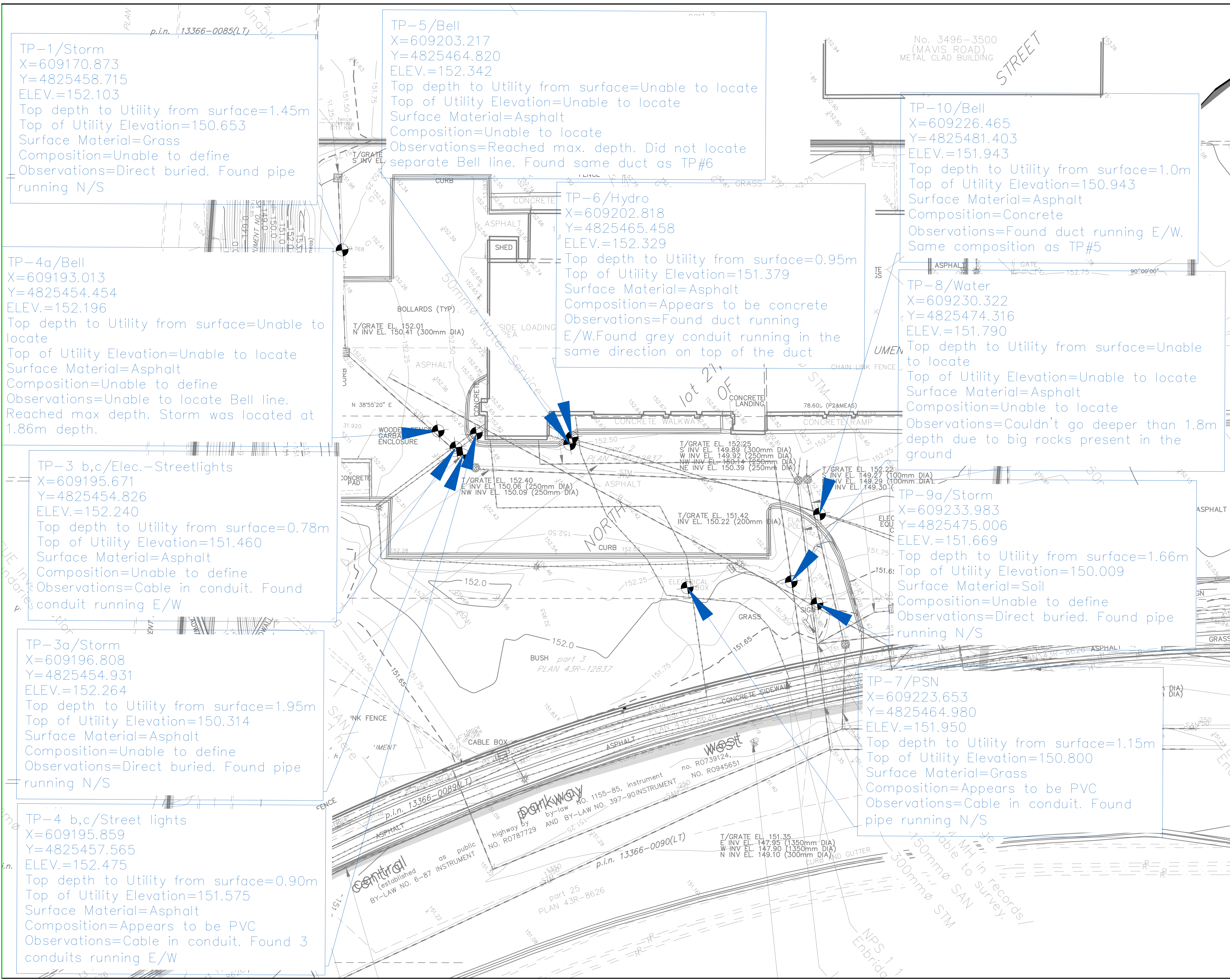
8. APPENDIX - COMPOSITE CAD DRAWING LEVEL A + PUBLIC LOCATES FILE

Doc 1	Composite CAD Drawing Level A	
P	Public Locate Package	
L	Locate Sheet	
M	Test Pit Marking	



multi view
*Insight, not hindsight**

APPENDIX E



TP-1/Storm
 X=609170.873
 Y=4825458.715
 ELEV.=152.103
 Top depth to Utility from surface=1.45m
 Top of Utility Elevation=150.653
 Surface Material=Grass
 Composition=Unable to define
 Observations=Direct buried. Found pipe running N/S

TP-5/Bell
 X=609203.217
 Y=4825464.820
 ELEV.=152.342
 Top depth to Utility from surface=Unable to locate
 Top of Utility Elevation=Unable to locate
 Surface Material=Asphalt
 Composition=Unable to locate
 Observations=Reached max. depth. Did not locate separate Bell line. Found same duct as TP#6

TP-10/Bell
 X=609226.465
 Y=4825481.403
 ELEV.=151.943
 Top depth to Utility from surface=1.0m
 Top of Utility Elevation=150.943
 Surface Material=Asphalt
 Composition=Concrete
 Observations=Found duct running E/W. Same composition as TP#5

TP-4a/Bell
 X=609193.013
 Y=4825454.454
 ELEV.=152.196
 Top depth to Utility from surface=Unable to locate
 Top of Utility Elevation=Unable to locate
 Surface Material=Asphalt
 Composition=Unable to define
 Observations=Unable to locate Bell line. Reached max depth. Storm was located at 1.86m depth.

TP-6/Hydro
 X=609202.818
 Y=4825465.458
 ELEV.=152.329
 Top depth to Utility from surface=0.95m
 Top of Utility Elevation=151.379
 Surface Material=Asphalt
 Composition=Appears to be concrete
 Observations=Found duct running E/W. Found grey conduit running in the same direction on top of the duct

TP-8/Water
 X=609230.322
 Y=4825474.316
 ELEV.=151.790
 Top depth to Utility from surface=Unable to locate
 Top of Utility Elevation=Unable to locate
 Surface Material=Asphalt
 Composition=Unable to locate
 Observations=Couldn't go deeper than 1.8m depth due to big rocks present in the ground

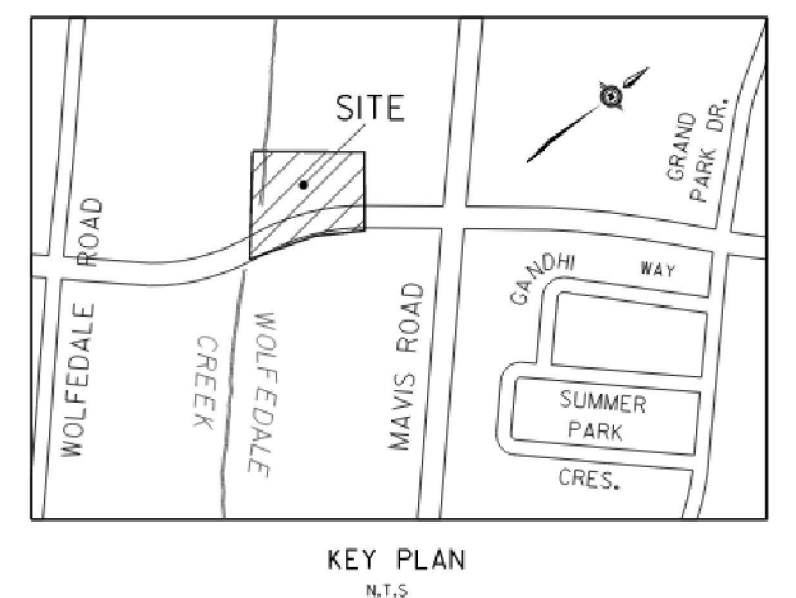
TP-3 b,c/Elec.-Streetlights
 X=609195.671
 Y=4825454.826
 ELEV.=152.240
 Top depth to Utility from surface=0.78m
 Top of Utility Elevation=151.460
 Surface Material=Asphalt
 Composition=Unable to define
 Observations=Cable in conduit. Found conduit running E/W

TP-9a/Storm
 X=609233.983
 Y=4825475.006
 ELEV.=151.669
 Top depth to Utility from surface=1.66m
 Top of Utility Elevation=150.009
 Surface Material=Soil
 Composition=Unable to define
 Observations=Direct buried. Found pipe running N/S

TP-3a/Storm
 X=609196.808
 Y=4825454.931
 ELEV.=152.264
 Top depth to Utility from surface=1.95m
 Top of Utility Elevation=150.314
 Surface Material=Asphalt
 Composition=Unable to define
 Observations=Direct buried. Found pipe running N/S

TP-7/PSN
 X=609223.653
 Y=4825464.980
 ELEV.=151.950
 Top depth to Utility from surface=1.15m
 Top of Utility Elevation=150.800
 Surface Material=Grass
 Composition=Appears to be PVC
 Observations=Cable in conduit. Found pipe running N/S

TP-4 b,c/Street lights
 X=609195.859
 Y=4825457.565
 ELEV.=152.475
 Top depth to Utility from surface=0.90m
 Top of Utility Elevation=151.575
 Surface Material=Asphalt
 Composition=Appears to be PVC
 Observations=Cable in conduit. Found 3 conduits running E/W



- GLOSSARY**
- CONFINED SPACE ENTRY
 - SANITARY
 - STORM
 - INVERT
 - OBVERT
 - BOTTOM OF CHAMBER
 - END OF RECORD INFORMATION
 - UTILITY ABANDONED ACCORDING TO UTILITY RECORDS
 - END OF SURFACE GEOPHYSICAL INFORMATION
 - TOP OF GRATE ELEVATION
 - RIGHT OF WAY
 - NOMINAL PIPE SIZE



ALL UTILITIES DEPICTED ARE AT "QUALITY LEVEL B" UNLESS OTHERWISE NOTED

DATE	DATE	DATE	DATE
08/01/2024			

DESIGN BY FEYZA OGUZ	APPROVED BY CHKD. ALLAN DABU
-------------------------	---------------------------------

SUBSURFACE UTILITY ENGINEERING, HYDRO EXCAVATION & CCTV
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 www.multiview.ca
 325 Matheson Blvd East
 Mississauga, ON, L4Z1X8



PROPOSED INDUSTRIAL DEVELOPMENT
 735 CENTRAL PARKWAY WEST, MISSISSAUGA

SCALE 1:200	AREA Z-	PROJECT No. 20199
DRAWN BY FO	CHECKED BY AD	
DATE 06/01/2024	SHEET 1 OF 1	



Animal Services Centre Phase 2 Renovation, Mississauga, ON

Electrical Specifications

Project Number:

MRK-23007421-A0

Prepared By:

EXP Services Inc.
220 Commerce Valley Drive West, Suite 110
Markham, ON L3T 0A8

Date Submitted:

2024-07-05

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

Document	Title	Discipline	Pages
00 01 10	Table of Contents	N/A	1

DIVISION 26 – ELECTRICAL GENERAL

Section	Title	Discipline	Pages
26 05 00	Common Work Results for Electrical	E	39
26 05 19	Low-Voltage Electrical Power Conductors and Cables	E	8
26 05 26	Grounding and Bonding	E	4
26 05 73	Power System Studies	E	9
26 08 00	Commissioning of Electrical Systems	E	7
26 09 23	Lighting Control Devices	E	2
26 24 00	Switchboards and Panelboards	E	11
26 27 26	Wiring Devices	E	5
26 28 00	Low-Voltage Circuit Protective Devices	E	3
26 32 13.16	Gas-Engine-Driven Generator Sets	E	28
26 36 00	Transfer Switches	E	4
26 50 00	Lighting	E	7

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

Section	Title	Discipline	Pages
28 31 00	Fire Detection and Alarm	E	19

DIVISION 33 – UTILITIES

Section	Title	Discipline	Pages
33 71 19	Electrical Underground Ducts, Ductbanks, and Manholes	E	6

END OF DOCUMENT

- 1 General
- 1.1 **REFERENCE**
 - .1 Division 00 and Division 01 apply to and are a part of each Electrical Division Section.
- 1.2 **APPLICATION**
 - .1 This Section specifies requirements that are common to Electrical Divisions work Sections and it is a supplement to each Section and is to be read accordingly. Where requirements of this Section contradict requirements of Divisions 00 or 01, conditions of Division 00 or 01 to take precedence.
 - .2 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section of Electrical Divisions and is to be read accordingly.
 - .3 Be responsible for advising product vendors of requirements of this Section.
- 1.3 **DEFINITIONS**
 - .1 "concealed" – means hidden from normal sight in furred spaces, shafts, ceiling spaces, walls and partitions.
 - .2 "exposed" – means work normally visible, including work in equipment rooms, service tunnels, and similar spaces.
 - .3 "finished" - means when in description of any area or part of an area or a product which receives a finish such as paint, or in case of a product may be factory finished.
 - .4 "provision" or "provide" (and tenses of "provide") – means supply and install complete.
 - .5 "install" (and tenses of "install") – means secure in position, connect complete, test, adjust, verify and certify.
 - .6 "supply" – means to procure, arrange for delivery to site, inspect, accept delivery and administer supply of products; distribute to areas; and include manufacturer's supply of any special cables, standard on site testing, initial start-up, programming, basic commissioning, warranties and manufacturers' assistance to Contractor.
 - .7 "delete" or "remove" (and tenses of "delete" or "remove") – means to disconnect, make safe, and remove obsolete materials including back boxes and exposed piping and raceways; and patch and repair/finish surfaces to match adjoining similar construction; include for associated re-programming of systems and/or change of documentation identifications to suit deletions, and properly dispose of deleted products off site unless otherwise instructed by Consultant.
 - .8 "BAS" – means building automation system; "BMS" – means building management system, "FMS" – means facility management system; and "DDC" means direct digital controls; references to "BAS", "BMS", "FMS" and "DDC" generally mean same.
 - .9 "governing authority" and/or "authority having jurisdiction" and/or "regulatory authority" and/or "Municipal authority" – means government departments, agencies, standards, rules and regulations that apply to and govern work and to which work must adhere.
 - .10 "Mechanical Divisions" - refers to Divisions 20, 21, 22, 23, 25 and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Mechanical Contractor, unless otherwise noted.

- .11 "Electrical Divisions" – refers to Divisions 26, 27, 28 and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Electrical Contractor, unless otherwise noted.
- .12 "Consultant" – means person, firm or corporation identified as such in Agreement or Documents, and is licensed to practice in Place of the Work, and has been appointed by Owner to act for Owner in a professional capacity in relation to the Work.
- .13 Wherever words "indicated", "shown", "noted", "listed", or similar words or phrases are used in Contract Documents they are understood, unless otherwise defined, to mean product referred to is "indicated", "shown", "listed", or "noted" on Contract Documents.
- .14 Wherever words "reviewed", "satisfactory", "as directed", "submit", or similar words or phrases are used in Contract Documents they are understood, unless otherwise defined, to mean that work or product referred to is "reviewed by", "to the satisfaction of", "submitted to", etc., Consultant.

1.4 **DOCUMENTS**

- .1 Documents for bidding include but are not limited to issued Drawings, Specifications and Addenda.
- .2 Specification is arranged in accordance with CSI/CSC 50 Division Sections MasterFormat.
- .3 Drawings and Specifications are portions of Contract Documents and identify labour, products and services necessary for performance of work and form a basis for determining pricing. They are intended to be cooperative. Perform work that is shown, specified, or reasonably implied on the drawings but not mentioned in Specification, or vice-versa, as though fully covered by both.
- .4 Review Drawings and Specification in conjunction with documents of other Divisions and, where applicable, Code Consultant's report.
- .5 Unless otherwise specifically noted in Specifications and/or on Drawings, Sections of Electrical Divisions are not intended to delegate functions nor to delegate work and supply of materials to any specific trade, but rather to generally designate a basic unit of work, and Sections are to be read as a whole.
- .6 Drawings are performance drawings, diagrammatic, and show approximate locations of equipment and materials. Any information regarding accurate measurement of building is to be taken on site. Do not scale Drawings, and do not use Drawings for prefabrication work.
- .7 Drawings are intended to convey scope of work and do not show architectural and structural details. Provide fittings, offsets, transformations and similar items required as a result of obstructions and other architectural and/or structural details but not shown on Drawings.
- .8 Locations of equipment and materials shown may be altered, when reviewed by Consultant, to meet requirements of equipment and/or materials, other equipment or systems being installed, and of building, all at no additional cost to Contract.
- .9 Specification does not generally indicate specific number of items or amounts of material required. Specification is intended to provide product data and installation requirements. Refer to schedules, Drawings (layouts, riser diagrams, schematics, details) and Specification to provide correct quantities. Singular may be read as plural and vice versa.

- .10 Starter/ variable frequency drive (VFD) schedule drawings are both mechanical and electrical, and apply to work of Mechanical Divisions and Electrical Divisions. Be responsible for reviewing starter, MCC, VFD, and motor specification requirements of Mechanical Divisions specifications and drawings, prior to Bid submission. Confirm and coordinate exact scope of work and responsibility of work between Mechanical Divisions and Electrical Divisions.
- .11 Drawings and Specifications are prepared solely for use by party with whom Consultant has entered into a contract and there are no representations of any kind made by Consultant to any other party.
- .12 In case of discrepancies or conflicts between Drawings and Specifications, Documents will govern in order specified in "General Conditions", however, when scale and date of Drawings are same, or when discrepancy exists within Documents, include most costly arrangement.

1.5 **EXAMINATION OF BID DOCUMENTS AND SITE**

- .1 Carefully examine Documents and visit site to determine and review existing site conditions that will or may affect work, and include for such conditions in Bid Price.
- .2 Report to Consultant, prior to Bid Submittal, any existing site condition that will or may affect performance of work as per Documents. Failure to do so will not be grounds for additional costs.
- .3 Upon finding discrepancies in, or omissions from Documents, or having doubt as to their meaning or intent, immediately notify Consultant, in writing.

1.6 **WORK STANDARDS**

- .1 Where any code, regulation, bylaw, standard, contract form, manual, printed instruction, and installation and application instruction is quoted it means, unless otherwise specifically noted, latest published edition at time of submission of Bids adopted by and enforced by local governing authorities having jurisdiction. Include for compliance with revisions, bulletins, supplementary standards or amendments issued by local governing authorities.
- .2 Where regulatory codes, standards and regulations are at variance with Drawings and Specification, more stringent requirement will apply unless otherwise directed by Consultant.
- .3 Supplementary mandatory Specifications and requirements to be used in conjunction with project include but are not limited to following:
 - .1 American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., (ASHRAE);
 - .2 American Standards Association (ASA or ANSI);
 - .3 ANSI/ASHRAE Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings;
 - .4 Building Industry Consulting Services, International (BICSI);
 - .5 Canadian Standards Association (CSA);
 - .6 CSA C282, "Emergency Electrical Power Supply For Buildings";
 - .7 CSA Z432, "Safeguarding of Machinery";
 - .8 CSA Z462, "Workplace Electrical Safety";

- .9 Electrical and Electronic Manufacturers Association of Canada (EEMAC);
 - .10 Electrical Safety Authority (ESA);
 - .11 Electronic Industries Association (EIA);
 - .12 Illuminating Engineering Society (IES);
 - .13 Institute of Electrical and Electronic Engineers (IEEE);
 - .14 National Building Code of Canada (NBC);
 - .15 National Electrical Manufacturers Association (NEMA);
 - .16 National Fire Protection Association (NFPA);
 - .17 Occupational Health and Safety Act - Ontario Regulation 632, "Confined Spaces";
 - .18 Occupational Health and Safety Act (OHSA);
 - .19 Ontario Building Code (OBC);
 - .20 Ontario Electrical Safety Code (OESC);
 - .21 Technical Standards and Safety Authority (TSSA);
 - .22 Telecommunications Industry Association (TIA);
 - .23 Underwriters' Laboratories of Canada (ULC);
 - .24 Material Safety Data Sheets by product manufacturers;
 - .25 local utility inspection permits;
 - .26 codes, standards, and regulations of local governing authorities having jurisdiction;
 - .27 additional codes and standards listed in Trade Sections;
 - .28 Owner's standards.
- .4 Provide applicable requirements for barrier free access in accordance with latest edition of local governing building code.
 - .5 Where any governing Code, Regulation, or Standard requires preparation and submission of special details or drawings for review they are to be prepared and submitted to appropriate authorities. Be responsible for costs associated with these submittals.
 - .6 Unless otherwise specified install, equipment in accordance with equipment manufacturer's recommendations and instructions, and requirements of governing Codes, Standards, and Regulations. Governing Codes, Standards, and Regulations take precedence over manufacturer's instructions.
 - .7 Work is to be performed by journeyman tradesmen who perform only work that their certificates permit, or by apprentice tradesmen under direct on site supervision of experienced journeyman tradesman. Journeyman to apprentice ratio is not to exceed ratio determined by the Board as stated in Ontario College of Trades and Apprenticeship Act or local equivalent governing body in Place of the Work.
 - .8 Journeyman tradesmen are to have a copy of valid trade certificates available at site for review by Consultant at any time.
 - .9 Experienced and qualified superintendent is to be on-site at times when work is being performed.

- .10 Coordinate work inspection reviews and approvals with governing inspection department to ensure that construction schedule is not delayed. Be responsible for prompt notification of deficiencies to Consultant and submission of reports and certificates to Consultant.
- .11 Properly protect equipment and materials on site from damage due to elements and work of trades, to satisfaction of Consultant. Equipment and materials are to be in new condition upon Substantial Performance of the Work.

1.7 **PERMITS, CERTIFICATES, APPROVALS AND FEES**

- .1 Contact and confirm with local authorities having jurisdiction including utility providers, requirements for approvals from such authorities.
- .2 Submit required applications, plan review, shop drawings, electrical distribution system protection device coordination studies, and short circuit calculations, and any other information requested by local authority.
- .3 Be responsible for ensuring that authorities having jurisdiction which require on-site inspection of work, have ample notification to perform inspection, with sufficient lead time to correct deficiencies in a manner that will not impede schedule of completion of Work.
- .4 Submit to Consultant, approval/inspection certificates issued by governing authorities to confirm that Work as installed is in accordance with rules and regulations of local governing authorities and are acceptable.
- .5 Include in each copy of operating and maintenance instruction manuals, copies of approvals and inspection certificates issued by regulatory authorities.
- .6 Where electromagnetic locks are provided whether by this Division or by others, be responsible for obtaining and paying for required certificates of work with regards to such electromagnetic lock work.

1.8 **REQUIREMENTS FOR CONTRACTOR RETAINED ENGINEERS**

- .1 Professional engineers retained to perform consulting services with regard to Project work, i.e. seismic engineer, fire protection engineer or, structural engineer, are to be members in good standing with local Association of Professional Engineers, and are to carry and pay for errors and omissions professional liability insurance in compliance with requirements of governing authorities in Place of the Work.
- .2 Retained engineer's professional liability insurance is to protect Contractor's consultants and their respective servants, agents, and employees against any loss or damage resulting from professional services rendered by aforementioned consultants and their respective servants, agents, and employees in regards to the Work of this Contract.
- .3 Liability insurance requirements are as follows:
 - .1 coverage is to be a minimum of \$1,000,000.00 CDN inclusive of any one occurrence;
 - .2 insurance policy is not to be cancelled or changed in any way without insurer giving Owner minimum thirty days written notice;
 - .3 liability insurance is to be obtained from an insurer registered and licensed to underwrite such insurance in the Place of the Work;
 - .4 Retained consultants are to ascertain that sub-consultants employed by them carry insurance in the form and limits specified above;

- .5 evidence of the required liability insurance in such form as may be required is to be issued to Owner, Owner's Consultant, and Municipal Authorities as required prior to commencement of aforementioned consultant's services.

1.9 **WORKPLACE SAFETY**

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials. Submit WHMIS MSDS (Material Safety Data Sheets) for products where required, and maintain one copy at site in a visible and accessible location available to personnel.
- .2 Comply with requirements of Occupational Health and Safety Act and other regulations pertaining to health and safety, including worker's compensation/ insurance board and fall protection regulations. When working in confined spaces, comply with requirements of Occupational Health and Safety Act - Ontario Regulation 632, "Confined Spaces" and any other applicable Ministry of Labour requirements.

1.10 **PLANNING AND LAYOUT OF WORK**

- .1 Base installation layout, design, terminations, and supply of accessories, on Contract Documents with specific coordination with reviewed shop drawings.
- .2 Plan, coordinate, and establish exact locations and routing of services with affected trades prior to installation such that services clear each other as well as other obstructions. Generally, order of right of way for services to be as follows:
 - .1 piping requiring uniform pitch;
 - .2 piping 100 mm (4") dia. and larger;
 - .3 large ducts (main runs);
 - .4 cable tray and bus duct;
 - .5 conduit 100 mm (4") dia. and larger;
 - .6 piping less than 100 mm (4") dia.;
 - .7 smaller branch ductwork;
 - .8 conduit less than 100 mm (4") dia..
- .3 As confirmed with Consultant, Mechanical Contractor is to determine final locations of major work within ceiling spaces.
- .4 Unless otherwise shown or specified, conceal work in finished areas, and conceal work in partially finished and/or unfinished areas to extent made possible by the area construction. Install services as high as possible to conserve headroom and/or ceiling space. Notify Consultant where headroom or ceiling space appears to be inadequate prior to installation of work.
- .5 Do not use Contract Drawing measurements for prefabrication and layout of raceways, conduits, ducts, bus ducts, luminaires, and other such work. Locations and routing are to be generally in accordance with Contract Drawings, however, prepare layout drawings for such work. Use established bench marks for both horizontal and vertical measurements. Confirm inverts, coordinate with and make allowances for work of other trades. Accurately layout work, and be entirely responsible for work installed in accordance with layout drawings. Where any invert, grade, or size is at variance with Contract Drawings, notify Consultant prior to proceeding with work.

- .6 Prepare plan and interference drawings (at a minimum drawing scale of 1:50 or 1/4"=1' 0") of work for coordination with each trade Contractor. Arrange for preparation of detailed section drawings of ceiling spaces of corridors and any other congested areas. Sections are to be cross referenced with plan drawings so that trades may make use of section drawings. Section drawings to indicate lateral and elevation dimensions of major services within ceiling space. Lateral dimensions are to be from grid lines and elevations from top of floor slab. Obtain from Consultant, engineering drawings for this use. Contractors' interference drawings are to be distributed among other Trade Contractors. Submit drawings to Consultant for review. Failure of General Contractor to prepare and coordinate overall interface drawings of trades does not relieve respective Division Contractor of responsibility to ensure that work is properly planned and coordinated.
- .7 Carry out alterations in arrangement of work that has been installed without proper coordination, study, and review, even if in accordance with Contract Documents, in order to conceal work behind finishes, or to allow installation of other work, without additional cost. In addition, make necessary alterations in other work required by such alterations, without additional cost.
- .8 Control products, products requiring maintenance, junction boxes, and similar products, particularly such products located above suspended ceilings must be located for easy access for servicing and/or removal. Products which do not meet this location requirement are to be relocated to an accessible location at no additional cost.
- .9 Be responsible for making necessary changes, at no additional cost, to accommodate structural and building conditions that were missed due to lack of coordination.
- .10 Where drawings indicate that acoustic tile ceiling is being suspended below plaster ceiling, coordinate design of framework used to support suspended ceiling, lighting, diffusers, and other Divisions components that are mounted within or through ceiling. Do not mount devices to suspended ceiling. Secure and mount to ceiling slab above. Seal ceiling openings to maintain required fire rating.

1.11 PHASING

- .1 Include for scheduling, co-ordination, and construction phasing to suit project as specified in Division 01 and on drawings. Confirm exact phasing requirements with Consultant prior to start of Work.

1.12 COORDINATION OF WORK

- .1 Review Contract Documents and coordinate work with work of each trade. Coordination requirements are to include, but not be limited to following:
 - .1 requirements for openings, sleeves, inserts and other hardware necessary for installation of work;
 - .2 concrete work such as housekeeping pads, sumps, bases, etc., required for work, and including required dimensions, operating weight of equipment, location, etc.;
 - .3 depth and routing of excavation required for work, and requirements for bedding and backfill;
 - .4 wiring work required for equipment and systems but not specified to be done as part of mechanical work, including termination points, wiring type and size, and any other requirements.

- .2 Ensure materials and equipment are delivered to site at proper time and in such assemblies and sizes so as to enter into building and be moved into spaces where they are to be located without difficulty.
- .3 Wherever possible, coordinate equipment deliveries with manufacturers and/or suppliers so equipment is delivered to site when it is required, or so it can be stored within building subject to available space as confirmed with Owner and protected from elements.
- .4 Ensure proper access and service clearances are maintained around equipment, and, where applicable, access space for future equipment removal or replacement is not impeded. Comply with code requirements with regards to access space provision around equipment. Remove and replace any equipment which does not meet this requirement.
- .5 Where work is to be integrated, or is to be installed in close proximity with work of other trades, coordinate work prior to and during installation.

1.13 **COMPONENT FINAL LOCATIONS**

- .1 Owner and Consultant reserve right to relocate electrical components such as receptacles, switches, communication system, outlets, hard wired outlet boxes and luminaries at a later date, but prior to installation, without additional cost to Owner, if relocation per components do not exceed 3 m (10') from original location. No credits will be anticipated where relocation per components of up to and including 3 m (10') reduces materials, products and labour. Should relocations exceed 3 m (10') from original location, adjust contract price for that portion beyond 3 m (10') in accordance with provisions for changes in Contract Documents.

1.14 **SYSTEMS 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. Include for but not be limited to provision of following, as applicable:
 - .1 coordinate with General Contractor and other Subcontractors, various systems of trades which in any way are interfaced with or monitored by or integrated to, or need to be coordinated with;
 - .2 prepare systems coordination drawings detailing related system coordination and integration points being monitored and/or controlled; submit coordination drawings as part of shop drawing submission;
 - .3 coordinate security system requirements with successful door hardware supplier and prepare detailed coordination drawings of component installations, wiring and conduit layouts, division of responsibility between various trades, etc.; review security system requirements with associated door hardware (electromagnetic locks, electric strikes, etc.), to ensure proper sequence of operation and door functionality is provided to suit each door configuration; prepare detailed door functionality of each door configuration and submit for review by Consultant;
 - .4 review systems requirements for component back boxes and conduits; ensure that system of conduits and boxes meet respective system wiring bending radii requirements;
 - .5 review specifications of each trade/Division (i.e. for BAS points, elevator requirements, electrical devices in millwork or prefabricated service consoles, outlet box and back box requirements), to ensure proper power supplies, interconnecting wiring requirements and back box/ outlet box requirements;

- .6 review with manufacturers coordination and integration requirements of their systems;
- .7 review each systems communication protocols to ensure they are compatible and can communicate with each other as required;
- .8 review system shop drawings prior to submission to Consultant, to verify that each system has been coordinated with other systems and that required options and features are selected to meet coordination requirements;
- .9 be present at testing and commissioning functions of each system and provide technical assistance with regards to system operations;
- .10 be "on-site" coordinator of respective system trades with regards to respective system coordination of installation and testing;
- .11 coordinate with Consultant with regards to ensuring that systems coordinate and integrate properly to satisfaction of Owner;
- .12 document coordination and integration requirements and maintain records for submission as part of shop drawings;
- .13 respond to coordination and integration requirements and be responsible for such work;
- .14 where a system integrator has been included for, coordinate integration requirements with system integrator.

1.15

PRODUCTS

- .1 Be responsible for ordering of products (equipment and materials) in a timely manner in order to meet project-scheduling timelines. Failure to order products to allow manufacturers sufficient production/delivery time to meet project-scheduling timelines is an unacceptable reason to request for other suppliers or substitutions.
- .2 Provide Canadian manufactured products wherever possible or required and when quality and performance is obtainable at a competitive price. Products are to be supplied from manufacturer's authorized Canadian representative, unless otherwise noted. Unless otherwise specified, products are to be new and are to comply with applicable respective Canadian standards. References to UL listings of products to include requirements that products are to be also Underwriters Laboratories of Canada (ULC) listed for use in Canada. Products are to meet or exceed latest ANSI/ASHRAE/IES 90.1 standards, as applicable. Do not supply any products containing asbestos materials or PCB materials.
- .3 Systems and equipment of this Project are to be "State of the Art" and be most recent and up to date series/version of product that is available at time of shop drawing review process. Products that have been stored or "on shelf" for an extended period of time will not be accepted. Software is to be of latest version available and be provided with updates available at time of shop drawing review process. Systems are to be designed such that its software is backwards compatible. Future upgrades are not to require any hardware replacements or additions to utilize latest software.
- .4 Products scheduled and/or specified have been selected to establish a performance and quality standard, and, in some instances, a dimensional standard. In most cases, base specified manufacturers are stated for any product specified by manufacturer's name and model number. Where acceptable manufacturers are listed, first name listed is base specified company. Bid Price may be based on products supplied by any of manufacturers' base specified or named as acceptable for particular product. If acceptable manufacturers are not stated for a particular product, base Bid Price on product supplied by base specified manufacturer.

- .5 Documents have been prepared based on product available at time of Bidding. If, after award of Contract, and if successful manufacturer can no longer supply a product that meets base specifications, notify Consultant immediately. Be responsible for obtaining other manufacturers product that complies with base specified performance and criteria and meets project timelines. Proposed products are subject to review and consideration by Consultant and are considered as substitutions subject to a credit to Contract. In addition, if such products require modifications to room spaces, mechanical systems, electrical systems, etc., include required changes. Such changes are to be submitted in detail to Consultant for review and consideration for acceptance. There will be no increase in Contract Price for revisions. Above conditions supplement and are not to supersede any specification conditions in Division 01 with regards to substitutions or failure to supply product
- .6 Listing of a product as "acceptable" does not imply automatic acceptance by Consultant and/or Owner. It is responsibility of Contractor to ensure that any price quotations received and submittals made are for products that meet or exceed specifications included herein.
- .7 If products supplied by a manufacturer named as acceptable are used in lieu of base specified manufacturer, be responsible for ensuring that they are equivalent in performance and operating characteristics (including energy consumption if applicable) to base specified products. It is understood that any additional costs (i.e. for larger starters, larger feeders, additional spaces, etc.), and changes to associated or adjacent work resulting from provision of product supplied by a manufacturer other than base specified manufacturer, is included in Bid Price. In addition, in equipment spaces where equipment named as acceptable is used in lieu of base specified equipment and dimensions of such equipment differs from base specified equipment, prepare and submit for review accurately dimensioned layouts of rooms affected, identifying architectural and structural elements, systems and equipment to prove that equipment in room will fit properly meeting design intent. There will be no increase in Contract Price for revisions.
- .8 In addition to manufacturer's products base specified or named as acceptable, other manufacturers of products may be proposed as substitutions to Consultant for review and consideration for acceptance, listing in each case a corresponding credit for each substitution proposed. However, base Bid Price on products base specified or named as acceptable. Certify in writing to Consultant that proposed substitution meets space, power, design, energy consumption, and other requirements of base specified or acceptable product. It is understood that there will be no increase in Contract Price by reason of any changes to associated equipment, mechanically, electrically, structurally or architecturally, required by acceptance of proposed substitution. Consultant has sole discretion in accepting any such proposed substitution of product. Indicate any proposed substitutions in areas provided on Bid Form. Do not order such products until they are accepted in writing by Consultant.
- .9 Indicate in Supplementary Electrical Bid Form, names of manufacturers for proposed products to be supplied, and which were based specified or scheduled with a manufacturer's name. Names of proposed manufacturers on list must be one of names stated as acceptable for particular products, unless prior written permission from Consultant has been given for use of products by other manufacturers. Submit as directed.

- .10 Where products are listed as "or approved equal", certify in writing that product to be used in lieu of base specified product, at least meets space, power, design, energy consumption, and other requirements of base specified product and is equivalent or better than base specified product. When requested by Consultant, provide full design detail drawings and specifications of proposed products. Acceptance of these "or approved equal" products is at sole discretion of Consultant. It is understood that there will be no increase in Contract Price by reason of any changes to associated equipment, mechanically, electrically, structurally or architecturally, required by acceptance of approved equal product. There must be no increase in Contract price due to Consultant's rejection of proposed equivalent product.
 - .11 Whenever use of product other than base specified product is being supplied, ensure corresponding certifications and product information (detailed catalogue and engineering data, fabrication information and performance characteristics) are submitted to Consultant for review. Failure of submission of these documents to Consultant in a timely manner to allow for review will result in base specified product to be supplied at Consultant's discretion, at no additional cost to Contract.
 - .12 Products supplied by a manufacturer/supplier other than a manufacturer listed as acceptable may be considered for acceptance by Consultant if requested in writing with full product documentation submitted, a minimum of 10 working days prior to Bid closing date.
 - .13 Any proposed changes initiated by Contractor after award of Contract may be considered by Consultant at Consultant's discretion, with any additional costs for such changes if approved by Consultant, and costs for review, to be borne by Contractor.
 - .14 Whenever use of product other than based specified products or named as acceptable is being supplied, allow sufficient time for processing of product submissions and time for Consultant's review , such that there will not be significant impact on contract time or work schedule.
 - .15 Requirements for low voltage systems of this project that are of technology that changes rapidly and are forever evolving and changing, resulting in systems that may be out dated by time of installation, are to include provisions to allow Owner option to select most updated technology. Shop drawings for such systems and equipment are to include provisions for a minimum 6-week review time for Owner to review degree of technology of each system and determine acceptance. Owner will have right to substitute a more advanced technology subject to negotiated pricing.
- 1.16 **SHOP DRAWINGS**
- .1 At start-up meeting confirm with Consultant, products to be included in shop drawing submission. Prepare and submit list of products to Consultant for review.
 - .2 Submit electronic copies of shop drawings unless otherwise directed by Consultant. Confirm exact requirements with Consultant.
 - .3 Submit for review, drawings showing in detail design, construction, and performance of equipment and materials as requested in Specification. Include minimally for preparation and submission of following, as applicable:
 - .1 product literature cuts;
 - .2 equipment data sheets;
 - .3 equipment dimension drawings;
 - .4 system block diagrams;

- .5 sequence of operation;
- .6 connection wiring schematic diagrams;
- .7 functionality with integrated systems.
- .4 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.
- .5 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.
- .6 Ensure proposed products meet each requirement of Project. Endorse each shop drawing copy "CERTIFIED TO BE IN ACCORDANCE WITH ALL REQUIREMENTS". Include company name, submittal date, and sign each copy. Shop drawings that are received and are not endorsed, dated and signed will be returned to be resubmitted.
- .7 Consultant to review shop drawings and indicate review status by stamping shop drawing copies as follows:
 - .1 "REVIEWED" or "REVIEWED AS NOTED" (appropriately marked) – If Consultant's review of shop drawing is final, Consultant to stamp shop drawing;
 - .2 "RETURNED FOR CORRECTION" – If Consultant's review of shop drawing is not final, Consultant to stamp shop drawing as stated above, mark submission with comments, and return submission. Revise shop drawing in accordance with Consultant's notations and resubmit.
- .8 Following is to be read in conjunction with wording on Consultant's shop drawing review stamp applied to each and every shop drawing submitted:
"THIS REVIEW BY CONSULTANT IS FOR SOLE PURPOSE OF ASCERTAINING CONFORMANCE WITH GENERAL DESIGN CONCEPT. THIS REVIEW DOES NOT MEAN THAT CONSULTANT APPROVES DETAILED DESIGN INHERENT IN SHOP DRAWINGS, RESPONSIBILITY FOR WHICH REMAINS WITH CONTRACTOR. CONSULTANT'S REVIEW DOES NOT RELIEVE CONTRACTOR OF RESPONSIBILITY FOR ERRORS OR OMISSIONS IN SHOP DRAWINGS OR OF CONTRACTOR'S RESPONSIBILITY FOR MEETING REQUIREMENTS OF CONTRACT DOCUMENTS. BE RESPONSIBLE FOR DIMENSIONS TO BE CONFIRMED AND CORRELATED AT JOB SITE, FOR INFORMATION THAT PERTAINS SOLELY TO FABRICATION PROCESSES OR TO TECHNIQUES OF CONSTRUCTION AND INSTALLATION, AND FOR CO-ORDINATION OF WORK OF SUB-TRADES."
- .9 Submit each system and each major component as separate shop drawing submissions. Submit together, shop drawings for common devices such as devices of each system.
- .10 Obtain shop drawings for submission from product manufacturer's authorized representatives and supplemented with additional items specified herein.
- .11 Do not order product until respective shop drawing review process has been properly completed by Consultant.
- .12 Where extended warranties are specified for equipment items, submit specified extended warranty with shop drawing submittal.
- .13 Refer to specific requirements in other Sections.

1.17 **EQUIPMENT LOADS**

- .1 Supply equipment loads (self-weight, operating weight, housekeeping pad, inertia pads, etc.) to Consultant, via shop drawing submissions, prior to construction.
- .2 Where given choice of specific equipment, actual weight, location and method of support of equipment may differ from those assumed by Consultant for base design. Back-check equipment loads, location, and supports, and include necessary accommodations.
- .3 Where supporting structure consists of structural steel framing, it is imperative that equipment loads, location, and method of support be confirmed prior to fabrication of structural steel. Be responsible for confirming locations of equipment with Consultant prior to construction.

1.18 **OPENINGS**

- .1 Supply opening sizes and locations to Consultant 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 Consultant. Show required openings on a copy of structural drawings. Identify exact locations, elevations, and size of proposed openings and submit to Consultant 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 Consultant, do not leave any openings unprotected and unfinished overnight.

1.19 **SCAFFOLDING, HOISTING, AND RIGGING,**

- .1 Unless otherwise specified or directed, supply, erect and operate scaffolding, rigging, hoisting equipment and associated hardware required for work, and subject to approval of Consultant.
- .2 Immediately remove from site scaffolding, rigging and hoisting equipment when no longer required.
- .3 Do not place major scaffolding/hoisting equipment loads on any portion of structure without approval from Consultant.

1.20 **CHANGES IN THE WORK**

- .1 Whenever Consultant proposes in writing to make a change or revision to design, arrangement, quantity, or type of any work from that required by Contract Documents, prepare and submit to Consultant for approval, a quotation being proposed cost for executing change or revision.
- .2 Quotation to be a detailed and itemized estimate of product, labour, and equipment costs associated with change or revision, plus overhead and profit percentages and applicable taxes and duties.
- .3 If overhead and profit percentages are not specified in Division 00 or 01, but allowable under Contract as confirmed with Consultant prior to contract signing, then allowable maximum percentages for overhead and profit are to be 7% and 5% respectively.
- .4 Unless otherwise specified in Divisions 00 or 01, following additional requirements apply to quotations submitted:

- .1 when change or revision involves deleted work as well as additional work, cost of deleted work (less overhead and profit percentages but including taxes and duties) is to be subtracted from cost of additional work before overhead and profit percentages are applied to additional work;
 - .2 material costs are not to exceed those published in local estimating price guides;
 - .3 electrical material labour unit costs are to be in accordance with National Electrical Contractors Association Manual of Labor Units at normal level, less 25%;
 - .4 costs for journeyman and apprentice labour must not exceed prevailing rates at time of execution of Contract and must reflect actual personnel performing work;
 - .5 cost for site superintendent must not exceed 10% of total hours of labour estimated for change or revision, and change or revision must be such that site superintendent's involvement is necessary;
 - .6 costs for rental tools and/or equipment are not to exceed local rental costs;
 - .7 overhead percentage will be deemed to cover quotation costs other than actual site labour and materials, and rentals;
 - .8 quotations, including those for deleted work, to include a figure for any required change to Contract time.
- .5 Quotations submitted that are not in accordance with requirements specified above will be rejected and returned for re-submittal. Failure to submit a proper quotation to enable Consultant to expeditiously process quotation and issue a Change Order will not be grounds for any additional change to Contract time.
 - .6 Make requests for changes or revisions to work to Consultant in writing and, if Consultant agrees, will issue Notice of Change.
 - .7 Do not execute any change or revision until written authorization for change or revision has been obtained from Consultant.

1.21 **PROGRESS PAYMENT BREAKDOWN**

- .1 Prior to submittal of first progress payment draw, submit a detailed breakdown of work cost to assist Consultant in reviewing and approving progress payment claims.
- .2 Payment breakdown is subject to Consultant's approval and progress payments will not be processed until an approved breakdown is in place. Breakdown is to include one-time claim items such as mobilization and demobilization, insurance, bonds (if applicable), shop drawings and product data sheets, commissioning including system testing and verification, and project closeout submittals.
- .3 Indicate equipment, material and labour costs for site services (if applicable) and indicate work of each trade in same manner as they will be indicated on progress draw.

1.22 **NOTICE FOR REQUIRED FIELD REVIEWS**

- .1 Whenever there is a requirement for Consultant to perform a field review prior to concealment of any work, to inspect/re-inspect work for deficiencies prior to Substantial Performance of the Work, for commissioning demonstrations, and any other such field review, give minimum 5 working days' notice in writing to Consultant.
- .2 If Consultant is unable to attend a field review when requested, arrange an alternative date and time.

- .3 Do not conceal work until Consultant advises that it may be concealed.
- .4 When Consultant is requested to perform a field review and work is not ready to be reviewed, reimburse Consultant for time and travel expenses.

1.23 **PRELIMINARY TESTING**

- .1 When directed by Consultant, promptly arrange, pay for, and perform site tests on any piece of equipment or any system for such reasonable lengths of time and at such times as may be required to prove compliance with Specification and governing Codes and Regulations, prior to Substantial Performance of the Work.
- .2 When, in Consultant's opinion, tests are required to be performed by a certified testing laboratory, arrange and pay for such tests.
- .3 These tests are not to be construed as evidence of acceptance of work, and it is agreed and understood that no claim for delays or damage will be made for injury or breakage to any part or parts of equipment or system due to test where such injuries or breakage were caused by faulty parts and/or workmanship of any kind.
- .4 When, in Consultant's opinion, tests indicate that equipment, products, etc., are defective or deficient, immediately remove such equipment and/or products from site and replace them with acceptable equipment and/or products, at no additional cost.

1.24 **PROVISIONS FOR SYSTEMS/EQUIPMENT USED DURING CONSTRUCTION**

- .1 Any system or piece of equipment that is specified to be provided under requirements of Documents and is required to be used during construction stages of work prior to issuing of Certificate of Substantial Performance of the Work, are to be provided with special interim maintenance and service to cover systems/equipment during time of use during construction period of project until project has been certified as substantially performed and such systems/equipment are turned over to Owner.
- .2 During this period of construction, such systems/equipment to not become property of Owner or be Owner's responsibility for maintenance or service. Systems/equipment are to remain property of respective manufacturers/suppliers or Contractor, who are responsible for full maintenance and servicing of systems/equipment in order to maintain validity of warranties after turn over to Owner.
- .3 Prior to application for a Certificate of Substantial Performance of the Work and turn over to Owner, such systems/equipment to be cleaned, restored to "new" condition, luminaries re-lamped with "new" lamps, genset "serviced", paint finishes "touched-up", filters cleaned or replaced, etc.

1.25 **TEMPORARY SERVICES**

- .1 Coordinate with General Contractor, requirements for temporary services including but not limited to temporary electrical power, lighting and exit pathways. Locations of exit pathways to be as decided at discretion of General Contractor, and to be illuminated complete with emergency lighting, and provided with exit signage and fire alarm devices in accordance with requirements of local governing building code and local governing inspection authorities.

1.26 **CLEANING**

- .1 During construction, keep site reasonably clear of rubbish and waste material resulting from work on a daily basis to the satisfaction of Consultant. Before applying for a Certificate of Substantial Performance of the Work, remove rubbish and debris, and be responsible for repair of any damage caused as a result of work.

- .2 At time of final cleaning, clean luminaire reflectors, lenses, and other luminary surfaces that have been exposed to construction dust and dirt, including top surface, whether it is exposed or in ceiling space.
- .3 Clean switches, receptacles, communications outlets, coverplates, and exposed surfaces.
- .4 Clean other electrical equipment and devices installed as part of this project.
- .5 For work performed in electrical equipment rooms, electrical closets and communication closets, perform following:
 - .1 HEPA vacuum and clean interiors and buswork of switchboards, panels, cabinets and other electrical equipment of construction debris and dust prior to energization;
 - .2 HEPA vacuum top of switchboards, panels, cabinets, bus ducts, cable trays and conduits in room, followed by a thorough HEPA vacuuming of floors;
 - .3 do not lay permanent switchboard matting in electrical rooms until rooms are re-cleaned, and floors wet mopped and dried just prior to final turn over to Owner.

1.27 **RECORD AS-BUILT DRAWINGS**

- .1 Drawings for this project have been prepared on a CAD system using AutoCAD software of release version confirmed with Consultant. For purpose of producing record "as built" drawings, copies of Contract Drawings can be obtained from Consultant, at expense of \$25.00 CDN plus HST, per drawing, up to first 10 drawings, and \$5.00 CDN plus HST, per any additional drawings thereafter. Drawings may also to be used for preparation of layouts and interference drawings.
- .2 As work progresses at site, clearly mark in red in a neat and legible manner on a set of bound white prints of Contract Drawings, changes and deviations from routing of services and locations of equipment shown on Contract Drawings, on a daily basis. Changes and deviations include those made by addenda, change orders, and site instructions. Use notes marked in red as required. Maintain white print red line as-built set at site for exclusive use of recording as-built conditions, keep set up-to-date, and ensure set is available for periodic review. As-built set is also to include following:
 - .1 dimensioned location of inaccessible concealed work;
 - .2 locations of control devices with identification for each;
 - .3 location and identification of devices in concealed locations such as accessible ceiling spaces and raised floors;
 - .4 for underground piping and ducts, record dimensions, invert elevations, offsets, fittings, cathodic protection and accessories if applicable, and locate dimensions from benchmarks to be preserved after construction is complete;
 - .5 location of concealed services terminated for future extension and work concealed within building in inaccessible locations.
 - .6 location of fire alarm devices and include addresses of devices; identify fire alarm zones;
 - .7 identify routing and location of concealed conduits/ducts of diameter 50 mm (2") and greater;

- .3 Before applying for a Certificate of Substantial Performance of the Work, update a clean copy of Contract Drawing set in accordance with marked up set of "as-built" white prints including deviations from original Contract Drawings, thus forming an "as-built" drawing set. Submit "as-built" site drawing prints to Consultant for review. Make necessary revisions to drawings as per Consultant's comments, to satisfaction of Consultant.
- .4 Use final reviewed "as-built" drawing set to provide CAD files of drawings thus forming true "as-built" set of Contract Drawings. Identify set as "Project Record Copy". Load digital copies of final reviewed by Consultant as-built drawings onto USB type flash drive. Provide 2 complete sets of "as-built" drawings on separate USBs. Submit "as-built" sets of white prints and USBs to Consultant.
- .5 Submitted drawings are to be of same quality as original Contract Drawings. CAD drawing files are to be compatible with AutoCAD software release version confirmed with Consultant.
- .6 Unless otherwise noted in Divisions 00 or 01, failure to maintain accurate record drawings will incur additional 5% holdback on progress claims until drawings are brought up to date to satisfaction of Consultant.
- .7 Prepare and submit for review with record drawings, a neat, clear, properly identified, "as-built" electrical distribution riser diagram record drawing (in AutoCAD format release version confirmed with Consultant) of entire electrical distribution system up to and including line side connections to panelboards. Building and room outlines are to reflect "as-built" outlines. Include in diagrams for feeder types and sizes, conduit sizes, breaker, switchboard and distribution panel sizes, etc. Submit sample version to Consultant for review and comments prior to final manufacturer. Size diagrams same size as issued full Size Drawings. Mount riser diagrams on 10 mm (3/8") thick foam core complete with mylar finish cover, and hardware suitable for wall mounting in main electrical room.
- .8 Include on single lines, panelboard locations identified by room numbers below panel. When specific identified location is not available, nearest available room number to be used followed by a (Δ) triangle to flag approximate location. Encircle various loads by Building Wings (where applicable) for ease of identification. Group lighting loads on panelboards on top of panel. Identify motor control centres and splitters similar to panelboards. Identify fuse sizing including existing equipment where there is no difficulty in obtaining information. Use these requirements for pricing, and confirm exact requirements with Consultant prior to commencing work.

1.28 **OPERATING AND MAINTENANCE MANUALS**

- .1 Submit draft copy to Consultant for review. Incorporate any Consultant's comments in preparation final manuals.
- .2 For each item of equipment for which a shop drawing is required (except for simple equipment), supply minimum 3, project specific, indexed copies of equipment manufacturers' operating and maintenance (O&M) instruction data manuals. Confirm exact quantity of manuals with Consultant. Consolidate each copy of data in an identified hard cover three "D" ring binder. Each binder to include:
 - .1 front cover: project name label; wording – "Electrical Systems Operating and Maintenance Manual"; and date;
 - .2 introduction sheet listing Consultant, 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" or clean, updated "REVIEWED AS NOTED" shop drawing or product data sheet, with manufacturer's/supplier's name, telephone and fax numbers, email address, company website address, and email address for local source of parts and service; when shop drawings are returned marked "REVIEWED AS NOTED" with revisions marked on shop drawing copies, they are to be revised by equipment supplier to incorporate comments marked on "reviewed" shop drawings and a clean updated copy is to be included in operating and maintenance manuals;
- .6 Maintenance data is to include:
 - .1 operation and trouble-shooting instructions for each item of equipment and each system;
 - .2 schedules of tasks, frequency, tools required, and estimated task time;
 - .3 recommended maintenance practices and precautions;
 - .4 complete parts lists with numbers.
- .7 Performance data is to include:
 - .1 equipment and system start-up data sheets;
 - .2 equipment test reports;
 - .3 final verification and commissioning reports.
- .8 explanation of operating principles and sequences;
- .9 inspection certificates issued by regulatory authorities;
- .10 wiring and connection diagrams;
- .11 copies of additional and revised panelboard directories;
- .12 warranties;
- .13 items requested specifically in Section Articles.
- .3 Generally, binders are not to exceed 75 mm (3") thick and not to be more than 2/3 full.
- .4 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.
- .5 Before applying for a Certificate of Substantial Performance of the Work, assemble one copy of O & M Manual and submit to Consultant for review prior to assembling remaining copies. Incorporate Consultant's comments into final submission.
- .6 Provide 2 digital copies of contents of operating and maintenance manuals and load onto separate USB type flash drives and submit to Consultant. Prepare digital copies using version of Adobe Acrobat Portable Document Format or equal as confirmed with Consultant and enhanced with bookmarks and internal document links.

1.29 **COMMISSIONING**

- .1 Commissioning Agent is appointed by Owner to oversee commissioning activities of contract.
- .2 Interface, cooperate and coordinate with Commissioning Agent and attend commissioning meetings. Perform commissioning activities for aspects of work provided in Electrical Divisions and perform corrective work identified by Commissioning Agent.

- .3 Submit copies of submittals such as O&M manuals, shop drawings, schedules and test reports of systems and equipment to Commissioning Agent, prior to start of commissioning activity or as directed by Commissioning Agent.
- .4 Commissioning Agent may also be present for any testing/commissioning activities. Notify Commissioning Agent in advance of these activities.
- .5 Refer to Division 01 for additional commissioning requirements. Refer to Section entitled Electrical Work Commissioning for additional requirements.
- .6 Where commissioning specifications are included as part of Division 01, requirements of Section entitled Electrical Work Commissioning are to supplement commissioning requirements of Division 01. Where variances or contradictions exist, more stringent requirement will apply unless otherwise directed by Consultant.

1.30 **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;
 - .6 identified keys for equipment and/or panels for which keys are required, and other items required to be submitted;
 - .7 other data or products specified.

1.31 **INSTRUCTIONS TO OWNER**

- .1 Refer to equipment and system operational and maintenance training requirements specified in Division 01.
- .2 Train Owner's designated personnel in aspects of operation and maintenance of equipment and systems as specified. Demonstrations and training are to be performed by qualified technicians employed by equipment/system manufacturer/supplier. Supply hard copies of training materials to each attendee.
- .3 Unless where specified otherwise in trade Sections, minimum requirements are for manufacturer/suppliers of each system and major equipment, to provide minimum two separate sessions each consisting of minimum 4 hours on site or in factory training (at Owner's choice), of Owner's designated personnel (for up to 6 people each session), on operation and maintenance procedures of system.
- .4 For each item of equipment and for each system for which training is specified, prepare training modules as specified below. Use Operating and Maintenance Manuals during training sessions. Training modules include but are not limited to:
 - .1 Operational Requirements and Criteria: equipment function, stopping and starting, safeties, operating standards, operating characteristics, performance curves, and limitations;
 - .2 Troubleshooting: diagnostic instructions, test and inspection procedures;
 - .3 Documentation: equipment/system warranties, and manufacturer's/supplier's parts and service facilities, telephone numbers, email addresses, and the like;

- .4 Maintenance: inspection instructions, types of cleaning agents to be used as well as cleaning methods, preventive maintenance procedures, and use of any special tools;
- .5 Repairs: diagnostic instructions, disassembly, component removal and repair instructions, instructions for identifying parts and components, and review of any spare parts inventory.
- .5 Before instructing Owner's designated personnel, submit to Consultant for review preliminary copy of training manual and proposed schedule of demonstration and training dates and times. Incorporate Consultant's comments in final copy.
- .6 Obtain in writing from Consultant, list of Owner's representatives to receive instructions. Submit to Consultant prior to application for Certificate of Substantial Performance of the Work, complete list of systems for which instructions were given, stating for each system:
 - .1 date instructions were given to Owner's staff;
 - .2 duration of instruction;
 - .3 names of persons instructed;
 - .4 other parties present (manufacturer's representative, consultants, etc.).
- .7 Obtain signatures of Owner's staff to verify they properly understood system installation, operation and maintenance requirements, and have received operating and maintenance instruction manuals and "as-built" record drawings.
- .8 Submit to Consultant copy of electronic version of training materials loaded on USB flash drive. Include in operating and maintenance manuals submission.
- .9 Provide universal serial bus (USB) recording of operating and instructions training for following systems:
 - .1 emergency power gensets and control system;
 - .2 fire alarm system;
 - .3 security systems;
 - .4 lighting control system;
- .10 Provide custom video in USB format that details on site systems and equipment operations and includes following:
 - .1 professional videographer on site to capture training session; use wireless lavalier microphone to capture crystal clear audio of trainer in association with video footage; edit video to remove unnecessary footage;
 - .2 USB to include custom site specific system/equipment screens that outline key information about system/equipment and devices used on site only;
 - .3 USB to also include custom site specific video that details programming procedures in conjunction with a voiceover from on-site technician;
 - .4 USB created with a main menu screen and authored with chapters to allow operator to access specific areas of training instantly.
- .11 Supply minimum quantity of 3 copies of DVDs for each system/equipment. Owner to have option of such information loaded and submitted on USB flash drives.

1.32 **FINAL INSPECTION**

- .1 Submit to Consultant, written request for final inspection of systems. Include written certification that:
 - .1 deficiencies noted during job inspections have been completed;
 - .2 field quality control procedures have been completed;
 - .3 maintenance and operating data have been completed and submitted to, reviewed and accepted by Consultant;
 - .4 tags and nameplates are in place and equipment identifications have been completed;
 - .5 clean-up is complete;
 - .6 spare parts and replacement parts specified have been provided and acknowledged by Consultant;
 - .7 as-built and record drawings have been completed and submitted to, reviewed and accepted by Consultant;
 - .8 Owner's staff has been instructed in operation and maintenance of systems;
 - .9 commissioning procedures have been completed.

- 1.33 **SUBMITTALS**
 - .1 Submit shop drawings for products of this Section.
 - .2 Additionally as part of shop drawing submission process, submit following to Consultant for review:
 - .1 sample of each proposed type of access door if supplied under work of this Division, as well as electronic copies of reflected ceiling plan drawings and wall elevation drawings showing proposed access door locations;
 - .2 dimensioned location drawings indicating required sleeves and formed openings in structural poured concrete or precast concrete construction or in roofing, and locations of cutting or drilling required for Electrical Divisions work;
 - .3 samples of materials and any other items as specified in succeeding Sections of Electrical Divisions;
 - .4 weight loads of selected equipment (upon request);
 - .5 equipment nameplate and warning sign proposed nomenclature, print type, symbols, sizing and colours;
 - .6 fire stopping installation drawings with ULC certifications;
 - .7 copies of prior to start of construction approvals from local governing authorities having jurisdiction.
 - .3 Prior to application for Substantial Performance of the Work, submit following to Consultant for review (note: funds will be withheld until each of following items have been completed and documented to satisfaction of Consultant):
 - .1 fire alarm system testing and verification report of each component of work; devices to be certified working and in proper order;
 - .2 final distribution system testing and arc flash study performed and documented to satisfaction of Consultant;
 - .3 structured network cabling system tested and verified to be operating and performing in accordance with specified standards.

1.34 **CONTINUITY OF SUPPLY FOR STANDARDIZATION**

- .1 Utilize materials of one manufacturer for aspects of work, where practical. Utilize one common manufacturer for wiring devices, such as switches and receptacles, whether installed loose or in a pre-manufactured component. Coordinate with each supplier and ensure conformance with this requirement. Identify deviations to Consultant and obtain approval of change prior to proceeding with work.

1.35 **PRODUCT REQUIREMENTS IN SPECIAL AREAS**

- .1 Products in non-climate controlled areas are to include weatherproof provisions such as gasketed covers, corrosion resistant hardware, weatherproof finishes, etc. Devices to be manufactured to operate in extreme temperatures.
- .2 Products in public areas such as exterior areas and in parking areas are to also be vandal-proof and impact resistant.

1.36 **ADDITIONAL WORK ITEMS**

- .1 Following description of work includes labour, material, payroll burden, small tools, overhead, profit, and specific tax. Amounts for Work are to include applicable programming, testing, and verification. Harmonized Sales Tax (HST) is not included in amount, but is to be identified separately. Work described below is included in Bid Price:
 - .1 provision of 5 ceiling mounted smoke detectors;
 - .2 provision of 5 duct type smoke detectors and assemblies;
 - .3 provision of 10 recessed ceiling EVC speakers, each with 15 m (50') of conduit and wire;
 - .4 provision of 10 exit lights, each with 15 m (50') of conduit and wire;
 - .5 provision of 150 m (495') of basket cable tray;
 - .6 provision of 25-15A duplex receptacles and circuits, each with outlet box, 15 m (50') of conduit and power wire to receptacle panel;
 - .7 provision of 10-20A duplex receptacles and circuits, each with outlet box, 15 m (50') of conduit and power wire to receptacle panel;

2 Products

2.1 **CONDUITS**

- .1 EMT (Thinwall), galvanized electrical metallic tubing to CSA C22.2 No. 83, complete with factory made bends where site bending is not possible and joints and terminations made with steel couplers and steel set screw type connectors with insulated throats, and concrete tight where required.
- .2 Galvanized steel flexible liquid tight metallic conduit to CSA C22.2 No. 56, complete with Ideal "Steel Tough" liquid-tight flexible conduit connectors at terminations.
- .3 Galvanized steel flexible metallic conduit to CSA C22.2 No. 56, complete with proper and suitable squeeze type connectors at terminations.
- .4 CSA approved and labelled, FT-4 rated, rigid plastic (PVC) conduit complete with site made heat gun bends on conduit to 50 mm (2") diameter, factory made elbows in conduit larger than 50 mm (2") diameter, solvent weld joints, factory made expansion joints where required, and terminations made with proper and suitable connectors and adaptors.

- .5 Medium density CSA certified polyethylene flexible plastic conduit in a continuous coil of proper length.
- .6 ENT – electrical non-metallic tubing to CSA C22.2 No. 227.1 and No 85, complete with matching ENT fittings and boxes; concrete tight and constructed of heavy duty impact resistant PVC; tubing of flexible corrugated construction; acceptable manufacturer is IPEX "Cor-Line" tubing with "Kwikon" fittings.

2.2 **OUTLET BOXES**

- .1 CSA approved stamped galvanized steel outlet boxes.
- .2 Crouse-Hinds Canada Ltd., CSA certified, "FS" or "FD" Series cast Feraloy and aluminium
- .3 CSA certified rigid plastic (PVC) outlet boxes.
- .4 Standard general purpose service floor boxes: CSA approved, UL scrub water compliant, fully adjustable angular and vertically, formed steel/cast iron, round single gang / rectangular or square multi-gang as required, flush in concrete floor installation, boxes complete with conduit knockout openings, adjustable collars, hinged flip open brass covers with provisions for mounting of duplex power receptacles, telephone jacks and data jacks. Provide barriered boxes when boxes contain both power and communication outlets and different voltage levels. Size boxes to suit thickness of floor slab as confirmed with Consultant and also to suit required bending radii of conductors. Refer to drawings for number of gang requirements. Acceptable manufacturers are Hubbell, Legrand and Thomas & Betts. Special floor boxes are specified elsewhere in another Section.
- .5 Each outlet box and back box to be suitable in respects for application and complete with suitable securing lugs, connectors suitable for connected conduit, knockouts and, where necessary, suitable plaster rings, concrete rings, covers, carpet flanges and any other required accessory.
- .6 Electrical boxes exposed exterior of building or in non-climate controlled locations to be weatherproof boxes complete with gasketed covers/faceplates.

2.3 **PULLBOXES AND JUNCTION BOXES**

- .1 Galvanized or prime coat plated steel, suitable in respects for application and complete with screw-on or hinged covers as required, and connectors suitable for connected conduit.
- .2 Cooper Crouse-Hinds, "Condulet", threaded cast Feraloy outlet boxes of an exact type to suit application, each complete with screw-on gasketed cover.
- .3 Rigid plastic (PVC), CSA certified, junction boxes and access fittings with solvent weld type joints and screw-on PVC covers.
- .4 Physical size of pullboxes to be as required by local governing electrical code to suit number and size of conduits and conductors.
- .5 Each box to be suitable in respects for application and complete with suitable securing lugs, connectors suitable for connected conduit, knockouts and, where necessary, suitable plaster rings, concrete rings, covers and any other required accessory.
- .6 Boxes exposed exterior of building or in non-climate controlled locations to be weatherproof boxes complete with gasketed covers.

2.4 **SLEEVES**

- .1 Galvanized steel sleeves as follows:

- .1 No. 24 gauge with an integral flange at one (1) end to secure sleeve to formwork construction;
- .2 Schedule 40 pipe;
- .2 Schedule 40 PVC sleeves.

2.5

FIRESTOPPING AND SMOKE SEAL MATERIALS

- .1 Asbestos-free, elastomeric materials and intumescent materials, tested, listed and labelled by ULC in accordance with CAN 4-S115-M85, and CAN/ULC-S101-M for installation in ULC designated firestopping, and smoke seal systems to provide a positive fire, water and smoke seal and a fire resistance rating (flame, hose stream and temperature) no less than fire rating for surrounding construction.
- .2 Fire stopping and smoke seal material system to be specifically ULC certified with designated reference number for its specific installation. As part of shop drawing submission, submit copies of firestopping drawings with ULC certificate and number for each specific installation. Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance ratings.
- .3 Systems to consist of both elastomeric and intumescent materials that are compatible with abutting dissimilar materials and finishes. Coordinate material requirements with trades supplying abutting areas of materials.
- .4 Typically, for openings of up to 250 mm (10") in diameter, provide putty pad type firestop materials equivalent to Specified Technologies Inc. "SpecSeal" intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibres or silicone compounds.
- .5 Typically, for openings of greater than 250 mm (10") in diameter, and for rectangular openings, provide pillow type firestop materials equivalent to Specified Technologies Inc. "SpecSeal" re-enterable, non-curing, mineral fibre core encapsulated on six sides with intumescent coating contained in a flame retardant poly bag.
- .6 Supply products of a single manufacturer for use on work of this Division.
- .7 Installer to be manufacturer trained and certified on specific product. Submit copy of certificate with shop drawings.
- .8 Include for manufacturer's authorized representative to inspect and verify each installation and application. Submit test report signed and verified by system installer's authorized representative and manufacturer's representative.
- .9 Acceptable certification to also include certification by Underwriters Laboratories of Northbrook IL, using tests conforming to ULC-S115 and given cUL listing published by UL in their "Products Certified for Canada (cUL) Directory".
- .10 Acceptable manufacturers are:
 - .1 Specified Technologies Inc.;
 - .2 3M Canada Inc.;
 - .3 Tremco;
 - .4 A/D Fire Protection Systems;
 - .5 Nelson;
 - .6 Hilti Canada.

2.6 **FASTENING AND SECURING HARDWARE**

- .1 Concrete inserts - Crane Canada Ltd., No. 4-M for concrete work for single or double conduit, cable tray, etc., runs and equipment. Unistrut Ltd. multiple type inserts for runs of three (3) or more conduits etc., or where a grid support system is required.
- .2 Concrete fasteners – "WEJ-IT" anchors, lead cinch anchors and/or "STAR" or "PHILLIPS" self-drilling anchors.
- .3 Masonry inserts – "WEJ-IT" expansion shields and machine bolts or, for light loads, fibre or lead plugs and screws.
- .4 Drywall or plaster wall and/or ceiling fasteners – 2-wing spring toggles.
- .5 Structural steel - Crane Canada Ltd., beam clamps.
- .6 Metal framing channels – 40 mm (1-5/8") width, galvanized steel channels complete with required fittings and ancillary hardware; acceptable manufacturers are:
 - .1 Unistrut;
 - .2 Thomas & Betts;
 - .3 Eaton B-Line.
- .7 Metal "J" hooks or Panduit "J-Pro" cable support systems for communications system cabling in accessible ceiling spaces where conduit or cable tray is not being provided. Obtain written approval of Consultant for use of J-hooks.
- .8 Velcro tie wraps for bundling and securing cables.

2.7 **ACCESS DOORS**

- .1 Access doors to be provided under work of Division 08 by General Trades Contractor.
- .2 Coordinate with Mechanical Contractor and General Trades Contractor to ensure that access doors on project are provided by a single manufacturer, installed as part of work of General Trades Contractor and that work involving both mechanical and electrical services to where possible be accessible from common access door. Coordinate work to ensure that same common location access doors are not supplied by more than one Division.
- .3 Size access door to suit concealed work for which they are supplied and wherever possible they are to be of standard size for all applications, but in any case they are to be minimum 300 mm x 300 mm (12" x 12") for hand entry and 600 mm x 600 mm (24" x 24") for body entry.
- .4 Access doors in fire rated ceilings, walls, partitions, structures, etc., to be ULC listed and labelled and of a rating to maintain fire separation integrity.
- .5 Identify on reflected ceiling plans and wall elevation drawings, coordinated locations of proposed access door locations and submit to Consultant for review.

2.8 **IDENTIFICATION NAMEPLATES**

- .1 Laminated plastic (Lamacoid) black-white-black with bevelled edges, stainless steel screws, and proper identification engraving. Each nameplate to be sized to suit equipment for which it is provided, and required wording. Confirm nomenclature with Consultant. Various colour configurations to be used to differentiate systems. Confirm exact colour scheme with Consultant and/or Owner.
- .2 Brother "P-Touch", portable electronic labelling system complete with self-adhesive, permanent printed labels with required nomenclature.

2.9 **WARNING SIGNS**

- .1 Thomas & Betts Ltd., semi-rigid vinyl panels with drilled holes in each corner, stainless steel screws, pressure sensitive mounting pads on back, and required printed wording. Generally, wording to be red on a white background with black trim confirmed with Consultant.

2.10 **SYSTEM BACKBOARDS**

- .1 FSC (Forest Stewardship Council), G1S (good one side) construction grade fir plywood, containing no added urea formaldehyde, flame retardant prime coat painted on exposed surfaces, minimum 20 mm (3/4") thick, as sized on drawings and with flame spread rating in accordance with local governing building code requirements.

2.11 **MOTOR STARTER PANELS**

- .1 Minimum No. 14 gauge sheet steel panels complete with steel angle reinforcing, framing and suitable splitter trough, fully primed and enamel painted, sized to accommodate starters required with spare space and capacity for at least two additional units.

2.12 **SPRINKLER PROTECTION**

- .1 Provide drip shields for protection of surface mounted equipment enclosures from water spray and dripping of liquids. Features of shields include:
 - .1 factory constructed by respective equipment manufacturers;
 - .2 constructed from non-combustible materials (sheet steel);
 - .3 enamel painted to match equipment;
 - .4 surfaces and edges filled/sanded smooth prior to painting;
 - .5 supported from equipment with structural steel rods/metal framing or other method approved by Consultant;
 - .6 structural support finish painted to match shield.
- .2 Include with equipment shop drawings, detailed dimensions of drip shields and methods of supporting.
- .3 Equipment with top cable/conduit entries to include additional sealing of entries with gasketing and/or waterproof sealant to prevent water from entering enclosure.
- .4 Design ventilation louvers such that live components are not exposed to water spray and dripping liquids.
- .5 Above requirements are additional minimum "sprinkler protection" standards for equipment specified as EEMAC/NEMA 1, 2 or 12.
- .6 Obtain CSA approval where required by local governing authorities.

2.13 **ROOFTOP CONDUIT SUPPORT SYSTEM**

- .1 Cooper B-Line "Dura – Blok" series rooftop support systems with features as follows:
 - .1 CSA approved and/or ULC listed and labelled;
 - .2 non-penetrating of roof;
 - .3 vibration dampening;
 - .4 does not float;

- .5 suitable for outdoor wet and freezing environments without damage caused by weather or freeze and thawing when exposed to de-icing chemicals;
- .6 environmental friendly;
- .7 constructed of recycled rubber.
- .2 Materials:
 - .1 Dura-Blok Curb base made of 100% recycled rubber and polyurethane pre-polymer with a uniform load capacity to suit specific load application of support (minimum 744 kg/m [500 pounds/linear foot]); each base to have a reflective red stripe.
 - .2 DB Series base: Dimensions: 150 mm (6") wide by 125 mm (5") tall by required overall length (minimum 225 mm [9"]); this is to be minimum dimensions, but base requirements must be increased to suit specific applications as recommended by system manufacturer; includes low base steel frame C channel 1.9 mm (14 gauge) – 25 mm (1") high strut galvanized per ASTM A653; and pipe roller assembly.
 - .3 Attaching hardware: Zinc-plated threaded rod, nuts and attaching hardware per ASTM B633.
 - .4 Conduit clamps: single pipe supports constructed of galvanized steel and sized to accommodate sizing of installed conduits.
- .3 Confirm with system manufacturer that selected products provide proper support for application.
- .4 Acceptable manufacturers are as follows:
 - .1 Cooper B-Line;
 - .2 Clearline Technologies (C-Port);
 - .3 Erico (Caddy Pyramid).

3 Execution

3.1 GENERAL CONDUIT INSTALLATION REQUIREMENTS

- .1 Install conduit concealed in finished areas, and concealed to degree made possible by finishes in partially finished and unfinished areas. Conduit may be exposed in unfinished areas such as Electrical and Mechanical Rooms, unless otherwise noted on drawings or specified herein. Refer to and examine architectural drawings and room finish schedules to determine finished, partially finished or unfinished areas of building. Documents do not identify exact routing. Where shown, routing is diagrammatic, identifying general requirements of routing and locations. Include for necessary offsets, fittings, transformations and similar items required as a result of obstructions and other architectural or structural details not shown.
- .2 Where conduits are exposed, arrange them to avoid interference with other work, parallel to building lines and install as high as possible. Do not install conduits within 150 mm (6") of "hot" pipes or equipment unless conduits are associated with equipment. Independently run conduit to be supported from wall/ceiling structure, not from ceiling hangers, ductwork, piping, cable trays, formed steel decking, etc. Do not run conduits within 900 mm (3') of equipment access opening covers.

- .3 Where conduit is proposed to be embedded within structural concrete, obtain Owner's approval and review with Consultant (Structural Engineer). Install such conduit in compliance with requirements of latest edition of CSA Standard CAN3-A23.1, "Concrete Materials, and Methods of Concrete Construction". Confirm and review with Structural Consultant, proper installation practices and methods. In areas where Consultant has directed conduit not to be embedded in concrete, run conduits through beams via sleeved openings pre-coordinated and reviewed with General Contractor and by Consultant (Structural Engineer). Do not embed conduit runs in concrete slab of parking garage areas, unless approved by Owner and reviewed with Consultant.
- .4 So as not to impair required strength of structure, following criteria to be generally followed but which is to be reviewed and coordinated with with Consultant prior to start of Work:
 - .1 where conduits pass by a column, stay at least two times thickness of slab and drop away from column;
 - .2 where conduits terminate adjacent to a column or wall, bring conduit in toward column/wall as close to 90° to face of column as possible within two times thickness of slab and drop away from column;
 - .3 maximum size of conduit in structural slabs is 1/5 of solid portion of slab thickness;
 - .4 where more than two conduits are adjacent to each other, they are to be spaced greater of 3 diameters or 100 mm (4") apart;
 - .5 total of depth of conduits crossing over each other is to be less than one-third thickness of slab;
 - .6 place conduit in middle third of thickness of slab; do not lay conduit directly on reinforcing steel;
 - .7 do not run conduit adjacent to parallel reinforcing bars;
 - .8 do not run conduit longitudinally in beam without approval of Owner and review with Consultant; pass through beams at right angles to span of beam;
 - .9 where conduits pass through beams, maintain at least twice depth of beam separation away from supports;
 - .10 do not run conduits in slab beside a drop or beam within twice depth of slab from edge of drop or beam;
 - .11 do not run conduits through shear walls or columns without approval of Owner and review with Consultant;
 - .12 do not place conduit in structural elements in parking garage structures, water retaining structures or structures subjected to de-icing chemicals, without approval of Owner and review with Consultant.
- .5 For proposed use of conduit runs underground below slab include following provisions:
 - .1 concrete encased ductbank with conduits of non-ferrous materials and sloped to drain properly into pit;
 - .2 proper drain pit;
 - .3 system to be a pull-in system;
 - .4 20% spare conduits (with minimum of at least 1);
 - .5 system proposal to consider and address any effects of magnetic fields.

- .6 Conduits are sized on drawings, but in absence of type and sizing, type and size to suit intended application in accordance with applicable local governing electrical code requirements. Sizes identified on drawings are minimum sizes and are not to be decreased unless approved by Owner and reviewed with Consultant.
- .7 Where chasing of floor slab to run conduit is not acceptable to Owner after review with Consultant, provide fire rated "poke-thru" assembly installed through floor and feed from conduit runs provided in ceiling space of floor below.

3.2 **INSTALLATION OF CONDUIT**

- .1 Provide conduit for conductors except armoured cable and copper sheathed mineral insulated conductors, and except where duct or similar raceway materials are provided.
- .2 Provide conduit as follows:
 - .1 for interior building surface mounted services greater than 600 V – rigid galvanized steel;
 - .2 for exposed conduit outside building, for semi-exterior areas such as loading areas and within parking garage floor areas – rigid galvanized steel (rigid PVC where permitted by local codes and Owner and reviewed with Consultant);
 - .3 for exposed conduit in non-climate controlled areas, in areas of corrosive elements – epoxy coated ridged galvanized steel;
 - .4 for branch circuit conductors underground inside building, and underground outside building beneath concrete, asphalt, and similar paving material-rigid PVC;
 - .5 for branch circuit conductors underground outside building clear of concrete, asphalt and similar paving material-flexible polyethylene plastic conduit;
 - .6 for conductors in surface mounted conduit of parking garage – rigid galvanized steel; conduit not to be embedded in concrete within parking garage areas, unless approved in writing by Consultant; if approval obtained from Consultant, rigid PVC may be used embedded in concrete slabs;
 - .7 for exposed conduit mounted at a height of less than 1200 mm (4') in electrical, mechanical or other service areas – rigid galvanized steel;
 - .8 for short branch circuit connectors to motorized equipment and distribution transformers (minimum length 450 mm (18"), maximum length 600 mm (24") with 180° loop where possible) – galvanized steel flexible liquid-tight conduit;
 - .9 at points, where conductors cross building expansion joints – galvanized steel flexible conduit with no less than 600 mm (24") of extra curve;
 - .10 for branch circuit conductors in poured concrete slab – rigid PVC;
 - .11 for interior conduit above 50 mm (2") diameter containing distribution conductors or communication systems conductors (fire alarm, telephone etc.) (except as noted above) – EMT with separate insulated ground conductor;
 - .12 for conductors except as noted above or elsewhere in this Specification – EMT.
- .3 Run rigid conductors in rigid type conduits suitable for application. Do not use flexible conduit.
- .4 Secure conduit located in poured concrete work in place in a manner such that conduit will not float or move when concrete is poured. Adequately protect such conduit from damage prior to and during concrete pour, and from concrete and water penetration.

- .5 Review with Consultant prior to Start of Work, maximum allowable size of conduit for installation in poured concrete. Placement of reinforcing steel in structural concrete work will take precedence over placement of conduit. Spaced adequately multiple runs of conduit in poured concrete work, as reviewed with Consultant.
- .6 Install flexible polyethylene conduit in continuous lengths wherever possible and "snake" conduit in trench. Where joints are necessary, make same with nylon inserts and stainless steel gear type clamps. Terminate with rigid conduit threadless connectors. Grade bed to provide proper drainage of conduits.
- .7 Support underground conduit on a well-tamped flat bed of earth, free from rocks or protrusions of any kind. Grade and slope bed to provide conduits and ducts with proper drainage. Coordinate with General Trades Contractor for provision of means to carry away drainage water. Obtain required approvals of work from local governing electrical utility and review with Consultant prior to back filling and covering. Provide pull cord in each duct run.
- .8 Provide manufactured expansion joints in rigid PVC plastic conduit at spacing as recommended by conduit manufacturer.
- .9 Provide a separate ground conductor in plastic conduits.
- .10 Support and secure surface mounted and suspended single or double runs of metal conduit at support spacing in accordance with local governing electrical code requirements by means of galvanized pipe straps, conduit clips, ringbolt type hangers, or by other proper manufactured devices.
- .11 Support multiple mixed size metal conduit runs with Unistrut Ltd., Electrovert Ltd. "CANTRUSS" or Burndy Ltd. "FLEXIBLE" conduit racks spaced to suit spacing requirements of smallest conduit in group.
- .12 Unless otherwise noted, provide conduit fittings constructed of same materials as conduit and which are suitable in respects for application.
- .13 Provide proper adaptors for joining conduits of different materials.
- .14 Cut square and properly ream site cut conduit ends.
- .15 Use of ENT is subject to written consent of Owner and review by Consultant. Where use is approved by Owner and reviewed with Consultant, run ENT embedded in concrete floor slabs and install in accordance with local governing electrical code requirements and manufacturer's instructions. Secure runs to maintain them straight and parallel/perpendicular to building lines. Allow for Consultant to inspect installation before concrete pour.
- .16 Provide conduit as sized on drawings. Size conduit not sized on drawings in accordance with latest edition of local governing electrical code with consideration that sizes of branch circuit conductors indicated are minimum sizes and must be increased as required to suit length of run and voltage drop in accordance with voltage drop schedule found on drawings or at end of this section. Where conductor sizes are increased to suit voltage drop requirements, increase scheduled or specified conduit size to suit. Unless otherwise noted on drawings or required by local governing electrical code or specified elsewhere, conduit to be of minimum size 13 mm (1/2") diameter. Structured network cabling system conduit to be of minimum 19 mm (3/4") diameter, unless otherwise noted.
- .17 Site made bends for conduit to maintain full conduit diameter with no kinking, and conduit finishes are not flake or crack when conduit is bent.
- .18 Plug ends of roughed-in conduits which are exposed during construction with approved plugs.

- .19 Ensure that conduit systems which are left empty for future wiring are clean, clear, capped and properly identified at each termination point. Provide end bushing and suitable fish wires in such conduits.
- .20 Provide empty conduits to ceiling spaces from flush mounted panelboards located below and/or near hung ceiling. Refer to drawing detail.

3.3 **EXPANSION FACILITIES FOR CONDUIT CROSSING BUILDING EXPANSION JOINTS**

- .1 Wherever concealed or surface mounted conduits cross building expansion joints, provide expansion facilities to permit free movement without imposing additional stress or loading upon support system, and to prevent excessive movement at joints and connections, in accordance with drawing details.

3.4 **INSTALLATION OF OUTLET BOXES AND BACK BOXES**

- .1 Provide an outlet box or back box for each luminaire, wiring device, telephone outlet, fire alarm system component, communications systems components, and each other such outlet.
- .2 Size boxes to accommodate exact supplied components and for bending radii of installed cables. Confirm requirements with respective system vendors.
- .3 Outlet boxes flush mounted in interior construction, surface mounted in concealed interior locations, and surface mounted in exposed interior locations where connecting conduit is EMT, to be stamped and galvanized steel outlet boxes unless otherwise noted.
- .4 Outlet boxes for surface mounted exterior lighting, receptacles, and other device outlets, boxes flush mounted in exterior building surfaces, and boxes mounted in interior device locations where connecting conduit is rigid and boxes in perimeter wall where insulation and vapour barrier is present, and boxes in non-climate controlled areas to be "FS" or "FD" Series cast boxes unless otherwise noted.
- .5 Provide sealing around boxes in walls where insulation and vapour barrier is present or for walls of rooms that are sealed. Maintain sealing system of wall.
- .6 Outlet boxes in underground plastic conduit systems to be rigid PVC plastic outlet boxes, unless otherwise noted.
- .7 Outlet boxes for flush floor mounted devices to be concrete tight formed galvanized steel fully adjustable flush floor boxes. Locate in to position and install in accordance with manufacturer's instructions. Coordinate installation with trades pouring concrete floor slab or trade responsible for floor construction.
- .8 Provide a barriered outlet box for switches connected to normal and emergency power and share a common faceplate.
- .9 Provide outlet boxes for special wiring devices, for special equipment and special applications. Refer to requirements specified in other Sections and/or on drawings.
- .10 Size and arrangement of outlet boxes to suit device which they serve.
- .11 Mounting heights and locations for outlet boxes are typically indicated on drawings, however confirm exact location and arrangement of outlets prior to roughing-in. Architectural drawings and Consultant's instructions have precedence over electrical drawing diagrammatic layouts and specified mounting heights and locations.
- .12 Do not install outlet or back boxes "back-to-back" in walls and partitions. Stagger such outlets and seal against noise transmission in accordance with drawing details. "Thru-wall" type boxes will not be permitted for any application.

- .13 Provide blank coverplates over boxes left empty for future installation of devices. Clearly identify each box as to its intended use, to Owner's approval and reviewed with Consultant. Generally, provide stainless steel type blank coverplates.

3.5 **INSTALLATION OF PULLBOXES AND JUNCTION BOXES**

- .1 Provide pullboxes in conduit systems wherever shown on drawings, and/or wherever necessary to facilitate conductor installations. Generally, conduit runs exceeding 30 m (100") in length, or with more than two - 90° bends, are to be equipped with a pullbox installed at a convenient and suitable intermediate accessible location.
- .2 Size boxes to accommodate exact supplied system and for bending radii of installed cables. Confirm requirements with respective system vendors.
- .3 Provide junction boxes wherever required and/or indicated on drawings and as required by local governing electrical code.
- .4 Provide sealing around boxes in walls where insulation and vapour barrier is present or for walls of rooms that are sealed. Maintain sealing system of wall.
- .5 Boxes in rigid conduit and EMT inside building to be stamped galvanized or prime coated steel.
- .6 Boxes in exterior rigid conduit and boxes in perimeter wall where insulation and vapour barrier is present, to be "Condulet" cast gasketed boxes, unless otherwise noted.
- .7 Boxes in plastic conduit to be rigid PVC plastic boxes complete with required couplings.
- .8 Pullboxes and junction boxes to be accessible after work is completed.
- .9 Accurately locate and identify concealed pullboxes and junction boxes on "As-built" record drawings.
- .10 Clearly identify main pull or junction boxes (excluding obvious outlet boxes) by painting outside of covers. Spray painting is not permitted unless approved by Owner and reviewed with Consultant. Paint colours to be in accordance with following schedule:
 - .1 lighting-yellow;
 - .2 normal power-blue;
 - .3 essential power-orange;
 - .4 fire alarm-red;
 - .5 telephone-green;
 - .6 miscellaneous signals-brown.
- .11 In addition to painting miscellaneous signal boxes, clearly identify specific system in which box is installed.
- .12 Cover boxes in fire walls with aluminium tape and seal with caulking.

3.6 **INSTALLATION OF SLEEVES**

- .1 Where conduits, round ducts and conductors pass through structural poured concrete, provide sleeves of type suitable for application, and approved by local governing codes.
- .2 Sleeves in concrete slabs, except as noted below, are to be No. 24 gauge or equivalent, with an integral flange to secure sleeves for formwork construction.
- .3 Sleeves in waterproof concrete slabs and in other slabs where waterproof sleeves are required are to be lengths of Schedule 40 pipe sized to extend 100 mm (4") above floor.

- .4 Sleeves in poured concrete walls and foundation are to be Schedule 40 pipe.
- .5 Size sleeves, unless otherwise noted, to leave 13 mm (1/2") clearance around conduit, duct, conductor, etc. Void between sleeves and conduit, duct, conductors, etc., to be packed and sealed for length of sleeves as in accordance with article entitled "Firestopping and Smoke Seal Materials" specified here in this Section. Ensure that sleeves set in exterior walls are packed and sealed with governing authority approved materials suitable for application and that both ends of sleeves are packed watertight with approved permanently flexible and water tight materials. Exact responsibility of work to be coordinated with General Trades Contractor.
- .6 Submit to concrete reinforcement detailer at proper time, drawings indicating required sleeves, recesses and formed openings in poured concrete work. Completely and accurately dimension such drawings and relate sleeves, recesses and formed openings to suitable grid lines and elevation datum.
- .7 Supply sleeves of a water protecting type in accordance with detail found on drawings for installation in following locations:
 - .1 in Mechanical and Fan Room floor slabs, except where on grade;
 - .2 in slabs over Mechanical, Fan, Electrical and Telephone Equipment Rooms or closets;
 - .3 in floors equipped with waterproof membranes.
- .8 "Gang" type sleeving to be permitted only with approval of Owner and reviewed with Consultant.
- .9 Terminate sleeves for work which is exposed, so that sleeve is flush at both ends with wall, partition, or slab surface such that sleeve may be covered completely by escutcheon plates.

3.7 **INSTALLATION OF FIRESTOPPING AND SMOKE SEAL MATERIALS**

- .1 Where electrical work penetrates or punctures fire rated construction, provide ULC certified, listed and labelled firestopping and smoke sealing packing material systems to seal openings and voids around and within raceway and to ensure that continuity and integrity of fire separation is maintained. Submit to Consultant, copies of certificates of compliance from an independent testing agency, attesting that fire stopping and smoke seal materials meet ULC requirements. Openings not in immediate vicinity of working areas are to be firestopped and sealed same day as being opened.
- .2 Examine condition of voids to be filled to ensure suitability for systems. Verify installation of service penetrations and adjacent construction has been completed. Prepare substrates and surfaces to a clean, dry, frost-free condition, and primed to firestop system manufacturer's recommendations to receive firestopping system.
- .3 Install fire stopping and smoke seal materials for each installation in strict accordance with specific ULC certification number and manufacturer's instructions. Comply with local governing building code requirements and obtain approvals from local building inspection department. Ensure that openings through fire separations do not exceed maximum size wall opening, and maximum and minimum dimensions indicated in ULC Guide No. 40 U19 for Service Penetration Assemblies and fire stopping materials.
- .4 Ensure that continuity and integrity of fire separation is maintained and conform to requirements of latest edition of ULC publication "List of Equipment and Materials, Volume II, Building Construction".

- .5 After installation work is complete, arrange for manufacturer's authorized representative to inspect and verify each installation and provide a test report signed by installing trade and manufacturer's representative. Test report to list each installation and respective ULC certification and number.

3.8 **INSTALLATION OF FASTENING AND SECURING HARDWARE**

- .1 Provide fasteners and similar hardware required for conduit, duct, raceway, conductors, etc. and for equipment hanger and/or support material unless otherwise noted.
- .2 Accurately and properly set concrete inserts in concrete framework. Where multiple type inserts are used, space same to suit requirements of smallest conduit, etc., in group.
- .3 Fasten hanger and support provisions to masonry with expansion shields and machine bolts, or, for light loads, use plugs, and screws.
- .4 In drywall or plaster walls and/or ceilings use two wing toggles and for heavy loads, provide steel anchor plates with two or more toggles to spread load.
- .5 Provide beam clamps for attaching hanging and/or support provisions to structural steel, or where approved by Owner and reviewed with Consultant, weld hanging and support provisions to structural steel.
- .6 Explosive powder actuated fasteners are not permitted unless specific written approval for their use and type has been obtained from Consultant.
- .7 Under no circumstances use ceiling suspension hangers or grids for suspension of conduit and conductors. Install supports to permanent structure of building, limited to areas that will not damage structural stability.
- .8 Provide "J" hooks in accessible ceiling spaces where conduit is not provided for structured cabling runs or other telecommunication cabling, as approved by Consultant.
- .9 Comply with J-hook manufacturer's loading limitations and spacing criteria. Do not exceed 1.2 m (4') spacing interval. Add additional J-hooks if cabling sags, at discretion of Consultant. Drill anchors for J-hooks into slab not into post tensioned beams. Do not install more than one system on each J-hook.
- .10 Install Velcro tie wraps on bundled telecommunication cables and do not over tighten. Provide FT6/CMP rated wraps in plenum type spaces as per local building code requirements.
- .11 Comply with Structural Engineer's limitations for maximum penetrations of securing hardware into concrete slabs.

3.9 **INSTALLATION OF IDENTIFICATION NAMEPLATES**

- .1 For each piece of electrical distribution equipment from electrical source of supply up to and including panelboards, for special control panels and cabinets, and for each other piece of electrical equipment, provide engraved Lamacoid identification nameplates secured to apparatus with stainless steel screws. Nameplates to indicate source of electrical supply and include Consultant's equipment identification number.
- .2 Equip large multiple cell or component apparatus such as switchboards and distribution panels with main nameplates identifying equipment, voltage characteristics, capacity and source of supply, and with sub-nameplates clearly identifying each cell or component and its service.
- .3 Panelboard nameplates to identify panelboard number as designated on drawings, unless otherwise instructed. Nameplates for disconnect switches, control panels, and cabinets to outline their service and source of supply.

- .4 In areas where equipment having removable doors that can be commonly installed on different equipment, ensure that each door is identified to which piece of equipment it is associated with, such that nameplates are with correct equipment.
- .5 Nameplates to be mechanically secured lamacoid and be colour coded as follows:
 - .1 Normal Power Black with white letters;
 - .2 Emergency Power Red with white letters;
- .6 Above identification nameplate and nomenclature requirements are for typical requirements for pricing only.
- .7 In pull boxes, junction boxes and at terminations, identify feeders by use of plastic plates indicating system voltage and circuit designations. Plates to be 25 mm (1") in diameter and have letter stamped 9 mm (5/8") high. Colour coding to be:
 - .1 Phase A – red;
 - .2 Phase B – black;
 - .3 Phase C – blue;
 - .4 Neutral – white;
 - .5 Ground - green.
- .8 Confirm print size type and size, colours, sizing and nomenclature of nameplates with Consultant prior to ordering. Submit sample board.

3.10 **INSTALLATION OF TERMINAL BACKBOARDS**

- .1 Provide specified terminal backboards for communication systems and electrical distribution equipment.
- .2 Securely wall mount each backboard with proper fasteners to suit wall construction.
- .3 Unless otherwise noted, size backboards to sufficiently provide adequate terminal space for each system, plus 20% space for future additions.

3.11 **INSTALLATION OF WARNING SIGNS**

- .1 Provide warning signs as applicable for following:
 - .1 on doors into main electrical rooms;
 - .2 for other applications as noted.
- .2 Secure signs to equipment with stainless steel screws. Number of signs required and sign wording, symbols, and colours to be approved by Owner and reviewed with Consultant, and local electrical utility, where applicable.

3.12 **INSTALLATION OF ROOFTOP SUPPORT SYSTEM**

- .1 Install rooftop support system for conduits/raceways in accordance with manufacturer's instructions and recommendations to suit type of raceway and roofing materials.
- .2 If gravel top roof, remove gravel from around and under pipe support. Coordinate work with building roofing vendor confirmed with Owner and reviewed with Consultant.
- .3 Consult existing roofing vendor for roof membrane compression capacities and roof loading limitations. Comply with restrictions.
- .4 Use properly sized clamps to suit conduit sizes. Ensure that installation and use of system does not invalidate existing roof warranties.

- .5 Engage existing roofing vendor to inspect installation and verify that installation has not damaged roof.

3.13 **BRANCH CIRCUIT BALANCING**

- .1 Connect branch lighting and power circuits to panelboards so as to balance actual loads (wattage) within 5%. If required, transpose branch circuits when work is complete to meet this requirement.
- .2 At request of Consultant, perform necessary tests to show compliance with above requirement. Make such tests after building is occupied.

3.14 **EQUIPMENT BASES AND SUPPORTS**

- .1 Provide equipment bases, supports and concrete housekeeping pads for mounting of floor standing equipment and luminaire pole bases.
- .2 Secure floor mounted equipment in place on 100 mm (4") high concrete housekeeping pads, 100 mm (4") wider and longer than equipment base dimensions. Chamfer edges of bases. Include for seismic restrains as required by local governing building code.
- .3 Supply dimensioned drawings, templates, and anchor bolts for proper setting of equipment on bases and pads. Be responsible for required levelling, alignment, and grouting of equipment.
- .4 Submit to Consultant for review, dimensioned shop drawings of structurally designed concrete pads or bases for support of large, heavy equipment. Indicate on shop drawings total weight of pad or base, reinforcement, and equipment for which it is required.
- .5 Unless otherwise noted, support equipment suspended above floor level with suitable welded or bolted prime coat painted structural steel angles or channels bracketed to wall or secured by hanger rods.

3.15 **CONCRETE WORK**

- .1 Provide concrete required for work, including formwork and reinforcing steel.
- .2 Unless otherwise noted in Division 03, concrete to be minimum 20700 kPa (3000 psi) ready mix concrete provided in accordance with latest editions of CAN/CSA-A23.1 "Concrete Materials and Methods of Concrete Construction" and CAN/CSA-A23.2 "Methods of Tests for Concrete".
- .3 Perform work to standards and general requirements of Division 03.
- .4 Comply with local governing authority and local standard practices in providing concrete to compensate for local frost level of Place of Work.

3.16 **EXCAVATION AND BACKFILL**

- .1 Unless otherwise noted, excavation and backfill work required for electrical work is to be done as part of work of Division 02 or 31, except for final hand grading work and backfill to 450 mm (18") above service which is to be done as part of electrical work. Mark out location and routing of excavation required for work as well as required depth. Ensure that bedding is graded to provide proper drainage for ducts as directed by Consultant.
- .2 Inverts and locations of existing site services may have been site surveyed and approximate location may be shown on drawings. Confirm that local utilities have performed locates and marking out. Ensure inverts and locations are correct, prior to commencement of work. Where discrepancies are found, immediately inform Consultant, and await direction.

- .3 Ensure that work is inspected by Consultant before covering and backfilling. Failure to do so prior to backfilling will require re-excavating work and re-backfill at no additional cost to Owner.

3.17 **CUTTING, PATCHING AND CORE DRILLING**

- .1 Unless otherwise noted, General Trades Contractors are responsible for cutting, patching, and core drilling of existing building required for installation of Work.
- .2 Where added conduits and/or conductors penetrate existing construction, identify, and mark out locations for openings. Size openings to leave 13 mm (1/2") clearance around conduit and/or conductors. Coordinate work with General Trades Contractor.
- .3 Ensure that openings in fire rated construction are sealed as per requirements of article entitled "Firestopping And Smoke Seal Materials" specified herein this Section and as per Division 07, as applicable.
- .4 Fire stop and seal openings as specified, and patch as required before end of workday. No openings are to be left open overnight unless approved by Owner and coordinated with Consultant.

3.18 **FINISH PAINTING OF ELECTRICAL WORK**

- .1 Unless otherwise noted, finish painting of exposed Electrical Divisions work is to be performed as part of work of Division 09.
- .2 Provide identification painting for electrical distribution equipment in accordance with application requirements of Division 09. Confirm exact finish colours with Consultant. Equipment requiring special colour identification painting to include but not be limited to following:
 - .1 pull boxes and junction boxes;
 - .2 communication system conduit;
 - .3 genset exhaust piping.
- .3 Spray painting is not permitted unless approved in writing by Owner and reviewed by Consultant.

3.19 **CONDUIT PROVISIONS FOR MISCELLANEOUS SYSTEMS**

- .1 Provide following components to accommodate future installation of various miscellaneous systems by system installers who are to provide equipment and wiring:
 - .1 conduit - diameters as sized on drawings with non-metallic fish wires or pull cords and suitable bushings for conduit terminations, and as specified in Part 2; provide labelling at each end to clearly identify each conduit run with respect to system and path;
 - .2 outlet boxes - standard galvanized steel, each complete with a blank type faceplate, and as specified in Part 2;
 - .3 pull boxes, junction boxes, back boxes and sleeves - and as specified in Part 2.
- .2 Miscellaneous systems are typically as shown on drawings. Unless otherwise noted on drawings, provide dedicated conduit runs for each system. Coordinate sizes of boxes with respective system vendors to ensure proper sizing to accommodate components and that allows for wiring bending radii. Confirm conduit and box requirements also with system vendors.

- .3 Provide pullboxes in conduit runs longer than 30 m (100') or having more than two - 90 bends. Size pullboxes to be at least 8 times entering conduit in length. Pullbox sizes to comply with respective system standards.
- .4 Leave conduits free and clear of all obstructions and terminate as required. Equip terminations with bushing, and clearly identify each run. Provide fish wires in all empty conduits. Run telecommunications conduits to comply with separation from sources of electromagnetic radiation as per standard ANSI/TIA/EIA-569. Site bend telecommunications conduit elbows to comply with system conduit bending radii requirements.
- .5 Confirm exact requirements and locations of equipment with Consultant and respective system installers prior to roughing-in.
- .6 Refer to system riser diagrams on drawings.
- .7 Quantities for outlets to be as per floor plan drawings and not riser diagrams.

3.20 DOOR HARDWARE

- .1 Generally, Division 08 or another Division not under scope of electrical Contractor, is responsible for supply and installation of door alarm contacts, door holders, electric strikes, electromagnetic locks, door operator controls, power supplies, door controllers, central electromagnetic lock release controller and other door hardware. Coordinate and confirm with General Trades Contractor and respective equipment vendors (door hardware / security) exact responsibility of each Division of the Work.
- .2 Confirm product and wiring requirements, back box requirements and wiring installation requirements with door hardware trades and with equipment vendors. Provide required wiring in conduit from each device to respective controllers, between each device, and to central control panel and for power connection to such controls and devices. Provide line level voltage power feeds to equipment as required.
- .3 For controls and interconnections between devices, when such device terminations are responsibility of others, supply and run interconnecting wiring in conduit to devices and allow spare length of 1.8 m (6') coiled wiring at each end for final termination to devices by others.
- .4 For applications of electro- magnetically held closed doors, engage fire alarm system vendor to provide fire alarm type pull station with auxiliary contacts as required for interconnection of electro- magnetic door hardware and fire alarm system for release of doors. Provide required wiring in conduit and connections. Coordinate pull station requirements with fire alarm system vendor.
- .5 Exact type of door alarm contacts to be coordinated with door construction and finishes. Contacts to generally be recessed mounted and wiring be installed in concealed conduits. Confirm exact requirements with door hardware / security vendor and General Trades Contractor.
- .6 Where controls are located remotely from door locations, such as in closets, provide wiring in conduit and extend from local above door junction boxes and devices as required with homeruns back to closet location of equipment and leave slack wiring for terminations by others. Confirm exact requirements with door hardware / security vendor and General Trades Contractor.
- .7 Drawing details issued with electrical drawings are for pricing reference only and are based on assumptions. Obtain detailed design drawings from successful door hardware / security vendors and provide wiring in conduit to coordinate with and accommodate final systems designs. Coordinate with General Contractor.

END OF SECTION

1 General

1.1 **SUBMITTALS**

- .1 Submit shop drawings for products and accessories.
- .2 Submit samples of conductors, when requested by Consultant.

2 Products

2.1 **GENERAL POWER CABLES**

- .1 CSA approved, ULC labelled and certified. Unless otherwise noted, conductors to be copper 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 "TWU" single copper conductor to CSA C22.2 No. 75, 600 volts, maximum 60°C (140°F) conductor temperature, -40°C (-40°F) minimum installation temperature, PVC insulated suitable for wet and buried installations, colour coded.
- .5 "RWU90" CSA certified, single copper conductor to CSA C22.2 No. 38, 1000 volts, maximum 90°C (194°F) conductor temperature, -40°C (-40°F) minimum installation temperature, extra thickness X-link polyethylene (XLPE) insulation suitable for wet and buried installations, colour coded.
- .6 "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).
- .7 "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).
- .8 "NMD90" two or three copper conductors, to CSA C22.2 No. 48, with 90°C rated XLPE (R90) insulation; bare bonding wire and overall jacket of moisture resistant and flame retardant PVC; FT1 rating and rated 300 volts.

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 to be equal to IDI Electric (Canada) Ltd., "Ideal" No. 451, No. 452 and No. 453, "Wing-Nut", 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 **FIRE RATED CABLES**

- .1 Pentair - Pyrotenax, model "System 1850", CSA certified, ULC listed and labelled, FM Specifications tested, 600 V, type "MI", 2 hour fire rated, copper sheathed, copper conductor, highly compressed magnesium oxide mineral insulated power cable. Connectors for copper-sheathed mineral conductors to be cable manufacturer's proper connectors and accessories as recommended by manufacturer to suit specific applications.
- .2 Pentair - Pyrotenax, model "System 1850 Twisted Pair", CSA certified as FAS, FAS 90 and FAS 105 cable, ULC listed and labelled, 300 V, type "MI", 2 hour fire rated, copper sheathed, copper conductor, highly compressed magnesium oxide mineral insulated fire alarm and voice communication cable. Connectors for copper-sheathed mineral conductors to be cable manufacturer's proper connectors and accessories as recommended by manufacturer to suit specific applications.
- .3 Manufacturer's termination kits: Pyropak epoxy sealing compound kits and "Quick Term" connectors; connectors for MI conductors to be cable manufacturer's proper connectors and accessories as recommended by the manufacturer to suit specific applications.
- .4 Cable clips and straps as recommended by cable manufacturer to suit specific installation application. In applications of dissimilar materials, provide tape to insulate cabling and hardware.
- .5 Brass plates for cable openings in ferrous metal enclosures.
- .6 Include for required cable manufacturer's accessories and identification labelling.
- .7 Include for manufacturer's authorized technician to be present on site for initial coordination with installing personnel on review of proper installation of cabling runs and termination of cabling. After completion of Work, manufacturer's technician to review installation work and provide in writing that installation work has been performed to satisfaction of cable manufacturer.
- .8 Acceptable manufacturer of fire rated MI type cables is Pentair Thermal Management.

2.4 **STANDARD CONTROL AND COMMUNICATIONS CABLES**

- .1 ULC listed and labelled, CSA certified to C22.2 No. 127, No. 18 AWG "TEW" thermoplastic insulated, solid copper wire rated for 600 volts service, and 105°C (220°F) conductor temperature, complete with required number of copper conductors and colour coding.
- .2 Nexans, "Securex II", FAS 105, 300 volts, 105°C (220°F) conductor temperature rated fire alarm system flexible armoured cable with solid copper conductor, shielding, flame retardant PVC insulation and red colour outer overall jacket, ULC listed and labelled and CSA certified to C22.2 No. 208.

2.5 **CONDUCTOR PULLING LUBRICANT**

- .1 IDI Electric (Canada) Ltd., "Ideal Yellow 77" or "Wire Lube" as required.

2.6 **CORFLEX CABLES**

- .1 CSA type "RA90" (X LINK) conductors, Nexans Corflex II cable suitable for 600 volt service and consisting of cross linked polyethylene insulated single copper conductors, 90°C (194°F) rated, enclosed by a continuous extruded corrugated aluminum sheath with an overall PVC jacket.
- .2 Acceptable manufacturers are:
 - .1 Nexans;

- .2 Prysmian Cables (Pirelli);
- .3 General Cable;
- .4 Aetna Cables;
- .5 Kerite Company.

2.7 **TECK CABLES**

- .1 Nexans, "Firex II Teck" 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 Prysmian Cables (Pirelli);
 - .3 General Cable;
 - .4 Aetna Cables;
 - .5 Kerite Company.

3 Execution

3.1 **PROJECT CONDITIONS**

- .1 If identified in documents, verify that field measurements and conditions are as identified.
- .2 Cable routing on drawings is schematic and approximate. Route cable as required to meet project conditions. Determine exact routing and lengths on site.
- .3 Confirm fire protection ratings of construction to ensure that rooms and paths of conductors are fire rated in accordance with local governing codes requirements. Include fire rated conductors as required to meet local governing codes requirements.

3.2 **CO-ORDINATION**

- .1 Co-ordinate work with work provided under other electrical work and work of other trades.
- .2 Determine required separation between cable and other work.

- .3 Determine cable routing to avoid interference with other work.
- .4 Submit any alternative cable routing to Consultant for review prior to proceeding with 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 Consultant. 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 residential feeders – "NMD90";
 - .2 underground inside or outside building and for non-climate controlled areas - "TWU" or "RWU90";
 - .3 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";
 - .4 for conductors requiring fire rating by current regulations and local codes including feeders for emergency systems, fire fighter's elevators, fire alarm systems, other life safety systems and for applicable signal and control circuits of these systems - type "MI" CSA approved, ULC listed and labelled, 2 hour fire rated, copper sheathed mineral insulated copper conductors;
 - .5 climate controlled areas branch circuit wiring in accessible ceiling spaces and within stud wall construction consisting of drops down to luminaires and drops down stud walls to devices and in furniture systems - "AC90" flexible armoured cable ("BX") (maximum 6m (20') run permitted);
 - .6 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 Low voltage conductors to typically be No. 18 AWG "TEW" except for use in fire alarm system applications, unless otherwise noted. Provide specified fire alarm cables for fire alarm system applications or security system applications as approved by Code and local governing authorities. Conductors not installed in conduit or raceways to be fire insulated rated in accordance with latest governing Code Flame Spread requirements.
- .6 When installing type NMD90 conductors through metal studs, provide insulating grommets on stud openings to protect conductor insulation.

- .7 Generally, conductor sizes are indicated on drawings. Such sizes are minimum requirements and must be increased, where required, to suit length of run and voltage drop in accordance with applicable conductor voltage drop schedule appended to end of this Section.
- .8 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.
- .9 Colour code conductors throughout to identify phases, neutrals and ground by means of self-laminating coloured tape, coloured conductor insulation, or properly secured coloured plastic discs. Colours, unless otherwise noted, to be as follows:
 - .1 Phase A - red;
 - .2 Phase B - black;
 - .3 Phase C - blue;
 - .4 Ground - green;
 - .5 Neutral - white;
 - .6 Control - orange.
- .10 When pulling wires into conduit use lubricant and ensure that wires are kept straight and are not twisted or abraided.
- .11 Control conductors, in addition, to be numbered with Brady Ltd. or Electrovert Ltd. Z type markers.
- .12 Colour code conductors for communications systems in accordance with system component manufacturer's recommendations.
- .13 Neatly secure exposed wire in apparatus enclosures with approved supports or ties.
- .14 Install low voltage conductors in conduits, unless otherwise noted within Documents.

3.4 **INSTALLATION OF FIRE RATED CONDUCTORS**

- .1 Submit with shop drawings, copy of manufacturer's detailed installation manual and testing procedures. Provide minimum 2 hour fire rated type "MI" CSA approved, ULC listed and labelled, mineral insulated copper conductors for following:
 - .1 emergency feeders from generators to transfer switches;
 - .2 feeders to elevators;
 - .3 feeders to fire pumps and sprinkler pumps;
 - .4 feeders to smoke venting fans;
 - .5 feeders to emergency panel boards;
 - .6 feeders to fire alarm control panels and transponders;
 - .7 fire alarm risers;
 - .8 feeders as required by Code requirements;
 - .9 applicable local governing code required applications for control and signalling conductor circuits of and between life safety equipment and systems;
 - .10 feeders and conductors as noted on drawings.

- .2 Provide fire rated type "MI" conductors for specific feeders as required and as noted. Install type "MI" copper sheathed, mineral insulated conductors for applications noted above and as shown on drawings in strict accordance with the manufacturer's instructions and recommendations. Refer to latest issue of Pyrotenax MI cable Commercial Wiring Installation Manual. Installation must be in a neat and professional manner as per manufacturer's approval. Make arrangements for manufacturer's technician to provide onsite services as specified.
- .3 Provide Unistrut C-channels, clips, wall brackets, etc., as required and as recommended by cable manufacturer to suit the on-site installation conditions. Provide system of Unistrut hangers and rods spaced at minimum 1.2 m (4') but which must be confirmed with cable manufacturer, for running of cables. Where clips and other hardware are in contact with cables, insulate cables/hardware with suitable tape as per cable manufacturer's recommendations for applications of dissimilar metals.
- .4 Make terminations of "MI" conductors with manufacturer's approved components and "Pyropak" or "Quick Term" connectors in accordance with the manufacturer's recommendations. Obtain proper tools for cable terminals from the cable manufacturer. Terminations must be completed immediately once started to avoid moisture ingress from the surrounding air. Connections to ferrous cabinets for single conductor cables shall incorporate brass plates sized as required and as per cable manufacturer's requirements. Brass plates shall be complete with required drilled and tapped holes. For 99°C applications, cable lugs shall be temperature rated as such.
- .5 When pulling cable, apply pulling tension to the conductor not in the sheath of the cable. Limit cable pulling tension to as recommended by cable manufacturer.
- .6 Terminate cable in the equipment with termination kits as per cable manufacturer's instructions.
- .7 Installation of cable terminations to be witnessed by manufacturer's authorized technician. Perform terminations in accordance with cable manufacturer's instructions.
- .8 Ground cabling as per cable manufacturer's instructions and as per local governing electrical code requirements.
- .9 Take necessary precautions when handling cable on reel to ensure that no damage will result in the uncoiling process.
- .10 Where cables penetrates fire rated construction, provide ULC listed and labelled, fire stopping and smoke seal materials or fittings to protect integrity of fire rated construction. Install work in compliance with ULC standards and where required by local governing codes, provide tray type suitable for plenum environments.
- .11 Test MI cables after installation, in strict accordance with cable manufacturer's instructions. Megger terminations to check that insulation resistance is acceptable to cable manufacturer. Prior to completing each termination, test insulation resistance and follow cable manufacturer's drying procedures until resistance reaches cable manufacturer's listed acceptable level.
- .12 Provide for cable manufacturer's authorized representative to review the installation, termination and testing of installed cables. Prepare report consisting of test sheets with results of cables tested and a certificate of verification signed by testing engineer/technician. Report to include copy of cable manufacturer's signed inspection letter documenting that work was performed to satisfaction of manufacturer. Submit minimum 3 hard copies and electronic copy to Consultant.

3.5 **INSTALLATION OF CORFLEX CABLES**

- .1 Provide type RA90 (Corflex II) type cables for applications as required. Handle, install, and terminate in accordance with manufacturer's recommendations and instructions and as herein specified.
- .2 Coordinate provision of Corflex II cables between genset alternator box and control panel, with genset supplier and controls Contractor.
- .3 Provide system of cable tray and Unistrut Corporation channel support system for overhead suspended Corflex II cable. Support system to consist of non-ferrous cable trays supported by channels, supported by suitable threaded steel rods secured to structure with suitable aluminum clips.
- .4 Tie wraps are not acceptable for securing Corflex II cables. Utilize non-ferrous single screw cable clamps.
- .5 Ground and bond single conductor Corflex II cables at both ends where sheath currents do not affect cable ampacity. For certain areas, where sheath currents will reduce cable ampacity, ground and bond cable at supply end and isolate cable at load end as recommended by cable manufacturer, and provide a No. 3/0 green TW ground conductor for each cable run. Refer to requirements of local governing electrical code.

3.6

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.
- .7 No splices are allowed unless justified by cable pulling tension calculations and approved in writing by Consultant. Obtain approval of splice location from Consultant.

END OF SECTION

Appendix – Voltage Drop Schedules

Maximum Branch Wiring Distance for 120 Volt System At 3% Voltage Drop

WIRE SIZE	BREAKER SIZE (AMPERES)	15	20	30	40	50	60	70	80	100
		MAX LOAD AT 80% (AMPERES)	12	16	24	32	40	48	56	68
No. 12	-	24.4	18.3	-	-	-	-	-	-	-
No. 10	-	38.1	29.0	19.1	-	-	-	-	-	-
No. 8	-	59.4	44.2	30.5	22.9	-	-	-	-	-
No. 6	-	91.4	70.1	47.2	35.1	28.2	23.6	-	-	-
No. 4	-	-	109.7	73.2	54.9	42.7	38.1	32.0	27.4	-
NO. 2	-	-	-	114.3	85.3	68.6	57.9	50.3	41.1	35.0
No. 1	-	-	-	-	103.6	85.3	73.2	61.0	54.9	43.4
No. 1/0	-	-	-	-	128.0	102.9	85.3	73.2	64.0	48.8
No. 2/0	-	-	-	-	-	121.9	100.6	86.9	74.7	60.9
No. 3/0	-	-	-	-	-	-	118.1	102.1	88.4	70.1
No. 4/0	-	-	-	-	-	-	-	120.4	102.9	83.8
250 MCM	-	-	-	-	-	-	-	-	114.3	91.4
300 MCM	-	-	-	-	-	-	-	-	-	103.6

Note: Distances indicated in metres from panel to load for single phase.

END OF APPENDIX

- 1 General
- 1.1 **SUBMITTALS**
 - .1 Submit shop drawings for products and accessories.
- 2 Products
- 2.1 **BASIC MATERIALS**
 - .1 Ground Rods: Copper-clad steel, 20 mm (3/4") diameter circular cross-sectionalized, with driving cap and bronze tip, overall length of 3 m (10') long.
 - .2 Ground Conductors: Solid copper, insulated and bare to suit application and code requirements; and bond conductors.
 - .3 Ground Busbar: Solid copper busbar, predrilled for two-hole lug connections, of size of 50 mm x 9 mm x 900 mm (2" x 3/8" x 36"), for wall and backboard mounting using standoff insulators.
 - .4 Ground Connections:
 - .1 Below Grade: Cadweld as supplied by Erico Products or approved equal, exothermic-welded type connectors.
 - .2 Above Grade or in Manholes: Compression type connectors; Exothermic connections permitted above grade if approved by Consultant.
 - .3 When making ground and bonding connections, apply a corrosion inhibitor to contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between metals used.
 - .5 Ground Pit: Flush in grade grounding pits with following features:
 - .1 removable cast concrete cover with recessed lifting handle;
 - .2 cast iron or precast concrete pit;
 - .3 ground rod, ground clamps and grounding conductors as required;
 - .4 clay sewer tile for proper drainage.
 - .6 Gravel/Stones: Provide gravel and crushed stones as required by local governing authorities to suit application. Layers to be of thickness not less than required by local governing authorities.
 - .7 Miscellaneous ancillary components to complete grounding and bonding work to requirements of local governing electrical authority and codes.
- 2.2 **TELECOMMUNICATIONS**
 - .1 Telecommunications Equipment Rack And Cabinet Ground Bars: solid copper ground bars designed for mounting on framework of open or cabinet-enclosed equipment racks with minimum dimensions of 6 mm (1/4") thick by 20 mm (3/4") wide; At any equipment mounting location (e.g., backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide screw lug-type terminal blocks. Where bolting to painted surfaces, use paint piercing type washers.
 - .2 LAN Room Ground Bus: 50 mm x 9 mm x 300 mm (2" x 3/8" x 12") copper ground bus with eight (8) drilled taped holes; mounted on walls with standoff insulators.
 - .3 Ground Conductor for Grounding Grid and Associated Connections: Number 3/0 AWG bare, 7-strand medium hard-drawn copper unless indicated otherwise.

- .4 Ground Braid: constructed from flat 98% conductivity tinned copper grounding braid.

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. Confirm requirements with local governing electrical utility.
- .2 Perform ground resistivity testing of soil to determine measurement expressed in ohm meters as defined by IEEE 80-2000 - IEEE Guide for Safety in A.C. Substation Grounding. Use 4-point method with Model 4610 or Model 4500 Ground Tester or equal, and insertion of four equally spaced and in-line electrodes into test area.
- .3 Provide applicable high voltage grounding requirements in accordance with local governing electrical code and requirements identified in issued Documents.
- .4 Provide a ground electrode consisting of minimum four (4) ground rods (unless otherwise detailed or otherwise required by local governing electrical code) driven into grade in an arrangement as required and interconnected with minimum No. 3/0 bare copper conductor.
- .5 Drive and bury ground rods at depth in accordance with local governing electrical code.
- .6 Connect station equipment to ground electrode with 2 runs of minimum No. 3/0 bare copper conductor.
- .7 Provide 50 mm x 9 mm x 900 mm (2" x 3/8" x 36") electrical grade copper ground bus on perimeter wall of electrical rooms, 300 mm (12") above finished floor level. Secure ground bus on 20 mm (3/4") standoff insulators. Connect electrical rooms ground grid with ground bus with minimum 3/0 copper ground conductor in conduit. Connect each electrical room perimeter ground electrode system back to main electrical room ground electrode with minimum No. 3/0 copper conductors.
- .8 Ground and bond other equipment such as transformers, switchboards, panelboards, and similar metal work to perimeter ground bus. Provide minimum No. 3/0 insulated ground wire from ground bus in electrical rooms to switchboards, transformers, structure, floor, etc.
- .9 Extend conductors to metal piping of main water service and connect ground conductor to street side of water meter. If piping is not metallic, make necessary connections as required by local governing electrical utility.
- .10 Effectively bond metallic pipe services such as, gas mains, water mains, and dry risers, to main grounding terminal at their point of entry. Make connections to services with purpose-made grounding clamps.
- .11 When buses are in place, bolts have been tightened, and lugs have been installed, coat entire installation with two (2) 100% covering coats of suitable shellac to prevent bus from oxidizing.
- .12 Throughout complex, solidly ground systems and make required grounding connections to electrical devices and apparatus. Ground conductors to be insulated copper wire connected with approved fittings in accordance with local governing electrical code.
- .13 Effectively bond building structures to main grounding system (grid).

- .14 Connect grounding conductors to motors 10 hp and above or circuits 20A or above, with a solderless terminal and a bolt tapped to motor frame or equipment housing. Connect to smaller motors or equipment by fastening terminal to a connection box. Connect junction boxes to equipment grounding system with grounding clips mounted directly on box or with machine screws. Completely remove paint, dirt, or other surface coverings at grounding conductor connection points so good metal-to-metal contact is made.
- .15 Ground metal sheathing and any exposed metal vertical structural elements of buildings. Ground metal fences enclosing electrical equipment. Bond any metal equipment platforms which support electrical equipment to equipment ground. Bond rooftop equipment.
- .16 Provide separate ground connection for bathtubs.
- .17 Provide service conductors exceeding 400 amperes with minimum No. 3/0 AWG grounding conductors, unless otherwise noted.
- .18 Ground and bond various telecommunications, audio visual systems, security, life safety and control systems in accordance with respective system manufacturers recommendations and in accordance with local governing electrical code requirements.
- .19 Make ground connections in slab or buried underground using local governing electrical authority approved welded copper connections.
- .20 Provide minimum no. 3/0 AWG insulated copper ground conductors and LAN Room copper ground bus mounted on walls with standoff insulators in each LAN room. Connect ground bus to computer equipment racks and to building ground system.
- .21 Ground conductors not sized on drawings are to be sized in accordance with local governing electrical authority requirements. Ground conductor size is to be no smaller than requirements specified herein this article or on drawings.

3.2 **ADDITIONAL TELECOMMUNICATIONS GROUNDING**

- .1 Comply with TIA/EIA-607 grounding and bonding requirements.
- .2 Provide wire and hardware required to properly ground, bond, and connect communications raceway, cable tray, metallic cable shields, and equipment to a ground source.
- .3 Ground bonding jumpers to be continuous with no splices. Use shortest length of bonding jumper possible.
- .4 Provide ground paths which are permanent and continuous with a resistance of 1 ohm or less from raceway, cable tray, and equipment connections to building grounding electrode. Resistance across individual bonding connections to be 10 milliohms or less.
- .5 Bonding Jumpers:
 - .1 Use insulated ground wire of size and type if identified on Drawings if not identified, comply with local governing code, but which is to be a minimum of No. 6-AWG insulated copper wire.
 - .2 Assemble bonding jumpers using insulated ground wire terminated with compression connectors.
 - .3 Use compression connectors of proper size for conductors specified. Use connector manufacturer's compression tool.
- .6 Bonding Jumper Fasteners:

- .1 Conduit: Fasten bonding jumpers using screw lugs on grounding bushings or conduit strut clamps, or clamp pads on push-type conduit fasteners. When screw lug connection to a conduit strut clamp is not possible, fasten plain end of a bonding jumper wire by slipping this plain end under conduit strut clamp pad; tighten clamp screw firmly. Where appropriate, use zinc-plated external tooth lockwashers.
- .2 Wireway and Cable Tray: Fasten bonding jumpers using zinc-plated bolts, external tooth lockwashers, and nuts. Install protective cover; e.g., zinc-plated acorn nuts, on any bolts extending into wireway or cable tray to prevent cable damage.
- .3 Ground Plates and Busbars: Fasten bonding jumpers using two-hole compression lugs. Use tin-plated copper or copper alloy bolts, external tooth lockwashers, and nuts.
- .4 Unistrut and Raised Floor Stringers: Fasten bonding jumpers using zinc-plated, self-drill screws and external tooth lockwashers.
- .7 Building Ground Busbars:
 - .1 Provide busbar hardware at each communications room and connect to pigtail extensions of building grounding ring.
 - .2 Verify that ground ring pigtail is same type and size conductor used for main building grounding ring.
- .8 Telecommunications Ground Busbars:
 - .1 Provide communications room telecommunications ground busbar hardware at cable tray height.
 - .2 Connect busbar to building ground busbar located in same room using two-hole compression lugs and a grounding jumper of same size as pigtail extension of main building grounding ring (usually 3/0 AWG).
- .9 Ground metallic conduits, wireways, and other metallic equipment located away from equipment racks or cabinets to cable tray pan or telecommunications ground busbar, whichever is closer, using insulated No. 6-AWG ground wire bonding jumpers.
- .10 Ground metallic conduit at each end using No. 6-AWG bonding jumpers.
- .11 Comply with cable tray manufacturer's grounding and bonding recommendations. Bond metallic structures of wireway to provide 100% electrical continuity throughout wireway system.

END OF SECTION

- 1 General
- 1.1 **SUBMITTALS**
 - .1 Submit as part of shop drawing submission, copies of:
 - .1 electrical distribution system protective device coordination study and short circuit calculations;
 - .2 arc flash analysis report.
 - .2 Submit electrical distribution system coordination study and short circuit calculations reports prior to or with proposed shop drawings of major electrical distribution equipment. Allow in shop drawing process, sufficient time for Consultant to review and make comments and for Contractor and equipment vendors to incorporate Consultant comments, necessary revisions and results of reports into equipment shop drawings. Do not order equipment until shop drawings are acceptable to Consultant. Time for this shop drawing review process will be at Consultant's discretion, but typically allow for 15 working days for initial review submission with additional 10 working days added to accommodate each resubmission.
 - .3 If formal completion of studies and reports may cause delay in equipment manufacture, approval from Consultant may be obtained for preliminary submittal of sufficient data to ensure that selection of device ratings and characteristics will be satisfactory. Subsequently, provide formal studies and reports to verify preliminary findings.
 - .4 Submit after completion of factory testing, copies of completed product testing reports.
 - .5 Submit after installation and testing, copies of:
 - .1 completed testing reports with completed test results sheets;
 - .2 certificate of approvals from local governing authorities, manufacturers' of systems and equipment and testing companies.
 - .6 Verify form of submittals (submission procedures, number of hard copies and requirements for electronic copies) with Consultant at project start-up. For pricing assume minimum 3 hard coloured copies bound and electronic pdf copy.
- 2 Products
- 2.1 **GENERAL SCOPE OF WORK**
 - .1 Include for but not be limited to following:
 - .1 preparing and submitting preliminary coordination study and short circuit calculations and recommendations on required relays, sensors and CT's for proper system coordination and protection;
 - .2 preparing and submitting arc flash study with calculations for use in determining required electric shock and arc flash protection;
 - .3 product manufacturers providing equipment inspection, testing, start-up, adjustments and verification;
 - .4 independent 3rd party testing of electrical distribution system equipment and associated products;
 - .5 independent 3rd party testing of systems and equipment as noted;

- .6 electricians/trades people on site to handle equipment, make temporary connections, operate equipment and make repairs and adjustments and assist manufacturer's / testing organization's personnel during on-site inspection, testing, calibration, start-up, verification work and where supplementary commissioning;
- .7 coordination of work with testing company and equipment/system manufacturer's authorized technician in performing adjustments and start-up procedures to equipment/systems;
- .8 preparing testing reports and documentation for submission to Consultant.

3 Execution

3.1 **PRELIMINARY COORDINATION STUDY AND SHORT CIRCUIT CALCULATIONS**

- .1 Immediately after award of Contract liaise with local electrical supply authority for information on relays and other protective devices installed on their system and substations which affect co-ordination of site electrical distribution system.
- .2 Immediately after award of Contract liaise with proposed manufacturer of electrical distribution equipment to obtain appropriate information and recommended devices to obtain co-ordination of electrical distribution system.
- .3 Prepare preliminary coordination study and calculate available fault currents. Combine into preliminary report and submit minimum one hard copy and electronic copy to Consultant for review.
- .4 Prepare report to typical standards as specified in respective coordination study and short circuit calculation report articles in this Section.

3.2 **DISTRIBUTION SYSTEM COORDINATION STUDY AND SHORT CIRCUIT CALCULATIONS**

- .1 Prepare coordination study and short circuit calculations (available fault currents) of system. Perform work to standards of applicable local governing authorities, local electrical inspection authority and CSA Standards.
- .2 Submit coordination study and short circuit calculations reports as part of shop drawing submission as specified in Part 1 article - Submittals. Ensure that results and Consultant's reviewed comments from these reports are incorporated into electrical distribution equipment shop drawings.
- .3 Protective system devices have been selected such that protection is adequate and good coordination is possible, however, since differences do exist between manufacturers, some changes in trip ratings or relay settings may be necessary and are to be carried out. Obtain local electrical utility information on their protective devices and include requirements as necessary.
- .4 Provide and carry out following:
 - .1 prepare a set of coordination curves on K.E. No. 336E Time Current Characteristic graph paper;
 - .2 this is to be accompanied by supporting symmetrical as well as asymmetrical fault current calculation data with tabulations to verify protection of various elements of systems under maximum and minimum fault conditions at various points in systems.
 - .3 Plot time-current characteristic curves for following:

- .1 main and feeder protective devices at voltage levels used in distribution system;
 - .2 protective devices associated with largest motor in each MCC, refrigeration machine compressors and largest device in each distribution panel;
 - .3 motor generator protective devices, damage curves and current decrement curves.
- .5 Cooperate with and obtain from other manufacturers a list of equipment requiring protective devices to be used in distribution system and prepare coordination curves as soon as possible. Be responsible, along with other manufacturers' equipment connected to distribution system, to ensure that proper control and protective devices are selected such that they coordinate with protective devices.
- .6 It is responsibility of equipment manufacturers to examine plans and specifications to ensure that relays and protective devices being installed in distribution system provide satisfactory coordination.
- .7 Where automatic transfer switches are provided, submit coordination results available fault current values at locations of transfer switches, to transfer switch manufacturer to ensure that transfer switches provided are of suitable withstand current ratings.
- .8 Document testing, coordination study and arc flash analysis in a report signed by a Professional Engineer licensed in the Place of Work and authorized by testing company. Include for minimum 3 hard copies and electronic copy of report to be submitted to Consultant for review. Report to include test results with properly plotted curves, identified trouble areas of coordination, extensive comments regarding test results and recommendations on best course of remedial action.
- .9 Acceptable companies to provide this work are to be successful manufacturer of electrical distribution system equipment and include:
- .1 Eaton Electric Services Division;
 - .2 Schneider Electric Services Division;
 - .3 Siemens Electric Services Division.

3.3 GENERAL ELECTRICAL WORK TESTING

- .1 In addition to tests required by local governing authorities having jurisdiction, local codes and regulations, perform following:
- .1 after luminaires, switches, receptacles, motors, signals, etc., are installed, whether same are installed as part of this Division or by other Divisions (telephone systems excepted), test work to ensure that there are no leaks, grounds or crosses;
 - .2 establish and ensure proper motor rotation - measure full load running currents and check overload elements - report to Consultant any discrepancies which are found; existing motors which have been worked on (disconnected and reconnected) must be checked with rotation meter to ensure proper rotation; be responsible for any damage caused by reverse rotation;
 - .3 demonstrate to Consultant that branch circuit voltage drop is within specified units;
 - .4 ensure that devices are commissioned and operable.

- .2 Document results into distribution system testing report. Report must state that testing was successful and Work complies with project documents, applicable CSA standards, and other applicable governing codes and requirements.

3.4 **SYSTEMS INSPECTION, TESTING, START-UP AND VERIFICATION**

- .1 When each system and each major piece of equipment installation is complete and ready for acceptance, include for system and equipment manufacturer or manufacturer's authorized representative to visit site to provide system inspection, testing, start-up, and verification. Perform following:
 - .1 check component connections and overall installation;
 - .2 adjust sound systems for high quality, distortion free performance, free from noise, cross-talk, hum or other interference;
 - .3 test and adjust system and ascertain that components are as specified and ensure that products operate as designed;
 - .4 provide start-up procedures for systems and equipment;
 - .5 verify and certify system component operations;
 - .6 prepare, document and evaluate test results;
 - .7 authenticate test results with signature of authorized testing Engineer/Technician;
 - .8 check and verify nameplates;
 - .9 provide maintenance and operating instructions to Owner's personnel.
- .2 Perform work properly documented, and in accordance with manufacturer's instructions and recommendations.
- .3 Perform work under presence of Owner/Consultant/Commissioning Agent at times approved by Owner and reviewed with Consultant.
- .4 Provide these requirements after each phase (as applicable) to allow Owner option to use area of phase of work. These requirements are also to be provided prior to applying for Certificate of Substantial Performance of the Work of project.
- .5 Include for manufacturers authorized technicians of equipment/systems integrated to equipment/systems being tested to be onsite during full integration testing. Coordinate with each manufacturer.
- .6 When system inspection, testing, start-up and verification specified above is complete, obtain from supplier/manufacturer (or where specified, independent inspection company) a test report with test sheets, and covering verification letter signed by authorized testing technician, stating that system or equipment has been inspected and tested, performs as specified and is ready for acceptance. Include date and time of testing, testing technician's name and specification section number test fulfilled.
- .7 Bind documents under cover and submit minimum one hard copy and electronic copy to Consultant.

3.5 **GROUND POTENTIAL RISE STUDY**

- .1 Prepare a ground potential rise (GPR) study to ensure that ground system complies with requirements of local governing electrical code, for protection of personnel and equipment. GPR study to include but not be limited to:
 - .1 site review of ground system;
 - .2 soil resistivity test;

- .3 computer modelled ground system design;
- .4 safety calculations and recommendations;
- .5 GPR calculations and written report.
- .2 Perform ground resistivity testing of soil to determine measurement expressed in ohm-meters as defined by IEEE 80-2000 - IEEE Guide For Safety In A.C. Substation Grounding. Use 4-point method with Model 4610 or Model 4500 Ground Tester or approved equal, and insertion of four equally spaced and in-line electrodes into test area.
- .3 Include date and time of testing, testing technician's name and signature. Bind documents under cover with distribution system testing report and submit minimum one hard copy and electronic copy to Consultant.
- .4 Acceptable companies to prepare study to be as listed for distribution system testing and coordination study work.

3.6 **ELECTRICAL DISTRIBUTION SYSTEM TESTING AND VERIFICATION**

- .1 Provide services consisting of on-site engineering inspection, testing and verification of electrical distribution equipment and other systems and equipment. Perform work to standards of applicable local governing authorities, local electrical inspection authority and CSA Standards.
- .2 Services to be performed by an approved independent testing company and be initially conducted prior to system/equipment being energized and further testing when energized, and include following items, where applicable:
 - .1 testing, cleaning when necessary, and calibrating relays and circuit breaker trip devices (calibration of protective devices to conform to requirements of approved coordination curves);
 - .2 function test of associated control devices;
 - .3 replacement of fuses destroyed during testing;
 - .4 an acceptance test in presence of Consultant;
 - .5 presence, for length of time required, of qualified and competent equipment manufacturer's service representative during start-up;
 - .6 carry out insulation resistance testing of outgoing feeders with respect to ground;
 - .7 inspection and testing of cables, power panels, lighting panels, transformers, power receptacles and switches;
 - .8 inspection and testing of electrical system auxiliary systems and devices such metering, power factor capacitors, transfer switches, generators sets and load banks;
 - .9 inspection and testing of starters and variable frequency drives;
 - .10 inspection and testing of lighting control systems including central control systems, low voltage relays, sensors and dimming controls; ensure that devices perform in conformance with ASHRAE 90.1 requirements;
 - .11 verification and certification work of equipment and systems;
- .3 Perform services procedures properly documented, and in accordance with manufacturer's instructions and recommendations.
- .4 Forward to Consultant for review, minimum 3 hard copies and electronic file of engineering and testing report.

- .5 Where relays, breakers, etc., do not perform to Consultant reviewed coordination curves, revise as part of work.
- .6 Test high voltage cable installation before placing in regular service. Work includes phase verification, grounding verification, hi-pot test of insulation strength to IPCEA Specifications (Leakage Curves to be obtained), and time domain reflectometer tests to give records of cable impedance profiles to draw attention to cable damage. Reference cable manufacturers testing procedures and do not exceed maximum test voltage levels and durations.
- .7 Testing organization to report high voltage cable defects directly to Consultant as soon as such defects are discovered. Re-test affected cables after proper repair. Also, re-test cables in cases where cable damage after installation is suspected. On completion of satisfactory testing of installation, submit a report by testing organization stating that cables concerned have satisfactorily passed required tests and are suitable for service. Submit report for Consultant's review. Submit recorded test data (properly bound) with report, in each case.
- .8 Test main power transformers before placing in regular service. Work to include voltage ratio test, phase angle test, insulation resistance, oil sampling (liquid type transformer), start-up and other manufacturer's recommended tests.
- .9 Provide testing and coordination of emergency power distribution system to ensure that system performs in accordance to latest requirements of CSA Standard C282. Ensure that engine-generator set manufacturer and testing and coordination companies co-operate to ensure that CSA requirements are fulfilled. Provide necessary adjustments and coordination to ensure that emergency power distribution system transfers essential loads to emergency power within required response time of loss of normal power.
- .10 Provide visual and mechanical inspection of ground system and verify that it is in compliance with issued documents and local governing electrical code requirements.
- .11 Perform fall-of-potential test or alternative in accordance with IEEE Standard 81 on main grounding electrode or system in order to determine current status, possible grounding contamination and proper ground resistance value. Perform point-to-point tests to determine resistance between main grounding system and major electrical equipment frames system neutral, and/or derived neutral points. Resistance between main grounding electrode and ground is not to be greater than 5 ohms for commercial or industrial systems and 1 ohm or less for generating or transmission station grounds unless otherwise specified. (Reference: ANSI/IEEE Standard 142). Investigate point-to-point resistance values which exceed 0.5 ohm.
- .12 Additionally, perform testing of lighting control systems and devices to ensure conformance with ASHRAE 90.1 requirements.
- .13 Document testing, coordination study and arc flash analysis in a report signed by a Professional Engineer licensed in the Place of Work and authorized by testing company. Include for minimum 3 hard copies and electronic copy of report to be submitted to Consultant for review. Report to include test results with properly plotted curves, identified trouble areas of coordination, extensive comments regarding test results and recommendations on best course of remedial action.
- .14 Acceptable companies to provide this work are to be independent of successful manufacturers providing distribution system equipment and include:
 - .1 Eaton Electric Services Division;
 - .2 Schneider Electric Services Division;
 - .3 Siemens Electric Services Division.

3.7 SHOCK AND ARC FLASH PROTECTION

July 05, 2024

- .1 General:
 - .1 Provide for electric shock and arc flash protection as required by local governing electrical code and local governing authorities.
 - .2 Determine severity of potential exposure, planning safe work practices and selecting personal protective equipment under general guidelines of governing edition of CSA Z462.
 - .3 Design safety signs and labels for applications to equipment under general guidelines of ANSI Z535.4.
 - .4 Determine arc flash hazard distance and incident energy that workers may be exposed to from electrical equipment under general guidelines of IEEE 1584.
 - .5 Incorporate documentation with distribution system testing and coordination study report.
 - .6 Acceptable companies to provide this work are to be successful manufacturer of electrical distribution system equipment and include:
 - .1 Eaton Electric Services Division;
 - .2 Schneider Electric Services Division;
 - .3 Siemens Electric Services Division.
- .2 Arc Flash Hazard Analysis:
 - .1 Perform Arc Flash Hazard analysis according to IEEE 1584 equations that are presented in NFPA70E, Annex D.
 - .2 Retrieve short circuit calculations and clearing times of phase overcurrent devices from short circuit and coordination study specified previously.
 - .3 Calculate flash protection boundary and incident energy at significant locations in electrical distribution system (switchboards, switchgear, panelboards, busway and splitters) where work could be performed on energized parts.
 - .4 Arc-Flash Hazard Analysis to include significant locations in 240 V and 208 V systems fed from transformers equal to or greater than 125 kVA.
 - .5 Specify safe working distances for calculated fault locations based upon calculated arc flash boundary considering incident energy of 1.2 cal/cm².
 - .6 Include Arc Flash Hazard analysis calculations for maximum and minimum contributions of fault current magnitude. Minimum calculation to assume that utility contribution is at a minimum and a minimum motor load. Conversely, maximum calculation to assume a maximum contribution from utility and motors to be operating under full-load conditions. Other switching scenarios are to be included as necessitated by power system design and layout.
 - .7 Arc Flash computation to include both line and load side of main breaker calculations, where necessary.
 - .8 Base Arc Flash calculations to be based on actual overcurrent protective device clearing time. Cap maximum clearing time at 2 seconds based on IEEE 1584 section B.1.2.
- .3 Arc Flash Warning Labels:
 - .1 Provide minimum 90 mm x 127 mm (3.5" x 5") thermal transfer type label of high adhesion polyester for each work location analysed.
 - .2 Label to have an orange header with wording, "WARNING, ARC FLASH HAZARD", and include following information:

- .1 location designation;
- .2 nominal voltage;
- .3 flash protection boundary;
- .4 hazard risk category;
- .5 incident energy;
- .6 working distance;
- .7 engineering report number, revision number and issue date.
- .3 Machine print labels with no field markings.
- .4 Provide Arc Flash labels for following equipment (as applicable to project and required by codes and standards) and base labels on recommended overcurrent device settings:
 - .1 panelboards;
 - .2 VFDs;
 - .3 distribution transformers;
 - .4 switchboards;
 - .5 transfer switches;
 - .6 genset control equipment;
 - .7 switchgear;
 - .8 medium voltage switches and breakers;
 - .9 other equipment as required by local governing authorities.

3.8 INFRARED SCANNING

- .1 Provide infrared scanning of Work and connections to electrical distribution equipment as noted.
- .2 Infrared scanning process to include but not be limited to following:
 - .1 use of latest technology infrared fast scanning thermal imaging camera with colour digital conversion thermographic imaging capabilities; camera to be capable of determining temperature differences using generated isotherms;
 - .2 scanning distribution system with ability to detect 1°C between subject area and reference at 30°C;
 - .3 equipment to detect emitted radiation and convert detected radiation to visual image;
 - .4 infrared surveys to be performed during periods when equipment is under intended full operating load;
 - .5 perform scanning of essential power equipment when gensets are in operation and essential power is on line.
- .3 Some guidelines for interpretation of temperature gradients are:
 - .1 temperature gradients of 3°C to 7°C indicate possible deficiency and warrant investigation;
 - .2 temperature gradients of 7°C to 15°C indicate deficiency; required repair as time permits as directed by Consultant;

- .3 temperature gradients of 16°C and above indicate major deficiency; requires repair immediately.
- .4 Document testing in a report signed by a Professional Engineer licensed in the Place of Work and authorized by testing company. Include for minimum 3 hard copies and electronic copy of report to be submitted to Consultant for review. Report to include but not be limited to include:
 - .1 indication of problem area (location of "hot spot");
 - .2 indication of temperature rise between "hot spot" and normal or reference area;
 - .3 indication of cause of heat rise;
 - .4 indication of phase unbalance, if present;
 - .5 indication of areas scanned;
 - .6 colour photographs and thermograms of deficient area as seen on imaging system;
 - .7 summary of work;
 - .8 list of test equipment;
 - .9 faults, corrections required, recommendations;
 - .10 retesting of corrected faults.
- .5 Acceptable infrared scanning companies:
 - .1 Predictive Technology;
 - .2 GT Wood;
 - .3 Pelikan Inc.

END OF SECTION

- 1 General
- 1.1 **APPLICATION**
 - .1 This Section specifies commissioning requirements that are common to electrical work Sections of Specification and it is a supplement to each Section and is to be read accordingly.
- 1.2 **REFERENCE**
 - .1 Refer to commissioning requirements specified in Division 01.
- 1.3 **COMMISSIONING AGENT INVOLVEMENT VERSUS WARRANTY OBLIGATIONS**
 - .1 Involvement of Commissioning Agent performing duties as described in this Section is not in any way to void or alter any Contractual warranty obligations.
- 1.4 **SUBMITTALS**
 - .1 Submit to Commissioning Agent, at same time as submittal to Consultant, one copy of each shop drawing or product data sheet associated with equipment or systems to be commissioned.
 - .2 Submit for review, a Commissioning Plan with schedule, commissioning procedures for commissioning events, and a copy of Commissioning Agent's commissioning data sheets for equipment/systems to be commissioned.
 - .3 Submit a list of commissioning instruments and for each instrument, indicate purpose of instrument and include a recent calibration certificate.
 - .4 Submit equipment and system manufacturer's start-up and test report sheets for review a minimum of one month prior to equipment and system start-up procedures.
 - .5 After start-up and successful pre-functional performance testing and submittal of completed forms, submit, for each system or subsystem, a letter to confirm that pre-functional performance testing has been successfully completed and system or subsystem is ready for functional performance testing and commissioning process to commence.
- 1.5 **DEFINITIONS**
 - .1 Commissioning: process of demonstrating to Owner and Consultant, for purpose of final acceptance, by means of successful and documented functional performance testing, that systems and/or subsystems are capable of being operated and maintained to perform in accordance with requirements of Contract Documents, as further described below.
 - .2 Commissioning Agent: commissioning authority who will supervise commissioning process, and who will recommend final acceptance of commissioned electrical work.
 - .3 Start-Up and Adjusting: process of equipment manufacturer's/supplier's technical personnel, with Contractor, starting and operating equipment and systems, making any required adjustments, documenting process, and submitting manufacturer's/supplier's start-up reports to confirm that equipment has been properly installed and is operational as intended.

- .4 Pre-Functional Performance Testing: testing, adjusting and operating of components, equipment, systems and/or subsystems, by Contractor, after start-up but before functional performance testing, to confirm that components, equipment, systems and/or subsystems operate in accordance with requirements of Contract Documents, including modes and sequences of control and monitoring, interlocks, and responses to emergency conditions, and including submittal of pre-functional performance testing documentation sheets.
- .5 Functional Performance Testing: a repeat of successful pre-functional performance testing by Contractor, in presence of Commissioning Agent and Consultant with completed Commissioning Agent's commissioning documentation sheets to document, validate, and verify that equipment, systems and subsystems are complete in all respects, function correctly, and are ready for acceptance.
- .6 Commissioning documentation sheets: prepared sheets for pre-functional performance testing and for functional performance testing supplied by Commissioning Agent for each piece of equipment/system to be commissioned, each sheet or set of sheets complete with Project name and number, date of commissioning, equipment/system involved, equipment/system name and model number, equipment identification as per drawings, and, for each commissioning procedure listed, a column giving expected data as per Contract Documents, a column to fill in observed data during commissioning, and space for signatures of Contractor and Commissioning Agent.
- .7 Systems Operating Manual: a manual prepared by Commissioning Agent to present an overview of building electrical systems and equipment to be used by building maintenance personnel to assist them in daily operation of systems.
- .8 Validate: to confirm by examination and witnessing tests correctness of equipment and system operation.

1.6 **COMMISSIONING AGENT**

- .1 Retain services of a qualified Commissioning Agent.

1.7 **QUALITY ASSURANCE**

- .1 Commissioning work is to be in accordance with requirements of following:
 - .1 Z320, Building Commissioning Standard & Check Sheets;
 - .2 ASHRAE Guideline 0, The Commissioning Process;
- .2 Commissioning Agent is to meet following qualifications:
 - .1 be a member of Professional Engineers Association in the Province of the Work;
 - .2 be a member of Building Commissioning Association, and a Certified Commissioning Professional (CCP) as designated by Building Commissioning Association;
 - .3 have a minimum of five years of successful documented commissioning experience on projects of similar size and complexity as this Project;
 - .4 supply a qualified P. Eng. and a Building Commissioning Association Certified Commissioning Professional (CCP) or an ASHRAE Commissioning Project Management Professional (CPMP) on site to supervise commissioning process.

1.8 **COMMISSIONING OBJECTIVES**

- .1 Objectives of commissioning process are as follows:
 - .1 to support quality management by means of monitoring and checking installation;

- .2 to verify equipment/system performance by means of commissioning of completed installation;
- .3 to move completed equipment/systems from "static completion" state to "dynamic" operating state so as to transfer a complete and properly operating installation from Contractor to Owner.

1.9 **TESTING EQUIPMENT**

- .1 Supply instruments and test equipment required to conduct start-up, testing and commissioning procedures.

2 Products

2.1 **NOT USED**

3 Execution

3.1 **COMMISSIONING**

- .1 Commission work in accordance with requirements of this Section and as required by Commissioning Agent.
- .2 Prerequisites to successful completion of commissioning are as follows:
 - .1 submittal of signed start-up and test reports;
 - .2 completion of electrical distribution system testing and coordination study;
 - .3 permanent electrical and control connections of equipment;
 - .4 successful completion and documentation of pre-functional performance testing;
 - .5 submittal of letters to Consultant certifying that systems and subsystems have been started, tested, adjusted, successfully pre-functional performance tested, are ready for functional performance testing, and are in accordance with requirements of Contract Documents.

3.2 **DEFICIENCIES LISTED DURING COMMISSIONING**

- .1 Correct deficiencies listed by Consultant and Commissioning Agent during commissioning process within 15 calendar days of notification unless agreed otherwise with Consultant, and when deficiencies have been corrected, notify Consultant and Commissioning Agent.

3.3 **SYSTEMS TO BE COMMISSIONED**

- .1 Electrical systems to be commissioned include systems as specified in Electrical Divisions of Specification. Specific commissioning procedures are to be as directed by Commissioning Agent. General commissioning procedures for typical equipment and systems include but are not limited to:
 - .1 Distribution Cables:
 - .1 Check for correct cable installation and termination.
 - .2 Check and record cable sizes, types and method of installation.
 - .3 Check and confirm installed cable sizes are of adequate rating, taking into consideration of type of cable, method of installation, correction factors and any other Code requirements.

- .4 Grounding test to ensure equipment, conduit and cable armour/sheath, if applicable, are properly grounded.
- .5 Perform tests as required by Commissioning Agent.
- .2 Gensets:
 - .1 Check and record alternator, engine, control panel, switchboard, and battery nameplate data.
 - .2 Check and ensure that generator installation, grounding system, associated supply and exhaust air system, fuel system and room are completed prior to carrying out test.
 - .3 Complete generator installation is to be completed prior to carrying out generators site tests. Installations include generators, electrical installation, fuel supply system, ventilation system, exhaust system, automatic control and indication systems, and interface with other systems installations.
 - .4 Test protective devices and circuits on site by actually simulating a fault condition on devices.
 - .5 Test interfaces with transfer switches for correct starting, power transfer, retransfer, and shut down of generators after power is restored.
 - .6 Test interface controls and indications with building management system, fire alarm system, elevator control system and any other systems as specified.
 - .7 Dummy load test at full load operation.
 - .8 Test paralleled units, with dummy loading on generators to be shared amongst generators.
 - .9 Load test generators in accordance with CSA C282, Z32 (for Heathcare projects) and Z8001.
 - .10 Check sound level at various loads.
 - .11 Perform tests as required by Commissioning Agent.
- .3 Auto Transfer Switches:
 - .1 Check and record nameplate data.
 - .2 Check and test switch for correct alignment and correct mechanical operation of switch in different positions.
 - .3 Test electrical control, indication and interface signals with generators, fire alarm panel, elevator control panels, building management panel or other interface panels.
 - .4 Test for correct phase sequence and voltage.
 - .5 Perform interface test with generator for starting and stopping, in accordance with CSA Z32 (Healthcare projects).
 - .6 Perform tests as required by Commissioning Agent.
- .4 Distribution Panelboards and Branch Circuit Panelboards:
 - .1 Check and record nameplate data.
 - .2 Check and test to verify panelboard directory is correct.

- .3 Include directory in test records. Directory to contain size of each breaker, equipment served, cable type and size.
- .4 Check and test voltage drop is within specified limit from service entrance switchboard to branch panelboards.
- .5 Test branch circuits voltage drop is within requirements.
- .6 Megger test branch circuits.
- .7 Perform tests as required by Commissioning Agent.
- .5 Coordination Study and On-Site Testing:
 - .1 Independent Third Party Testing Agent to prepare coordination study as specified in Specification.
 - .2 Independent Third Party Testing Agent to carry out on site testing.
 - .3 Check and measure and record prospective fault level at service entrance switchboards, motor control centres, transformers, auto transfer switches, generator switchboard and control panels; distribution panels and branch circuit panelboards.
 - .4 Record and set breakers, fuse ratings, and protection devices to ensure discrimination of electrical distribution system.
 - .5 Provide test records for measured prospective fault level and indicate fault ratings of installed equipment such as switchboards, panels, switches, breakers for above systems to confirm adequacy of fault rating of installed equipment.
 - .6 Perform tests as required by Commissioning Agent.
- .6 Lighting Systems:
 - .1 Check and verify central lighting control systems and dimming systems.
 - .2 Check and verify lighting fixtures are connected and switched properly.
 - .3 Check and verify automatic controls are connected and functioning properly.
 - .4 Check and verify emergency lighting system, including battery lighting system, are connected and functioning properly.
 - .5 Carry out lighting level tests as required and directed by Commissioning Agent.
 - .6 Perform tests as required by Commissioning Agent.
- .7 Security System and CCTV:
 - .1 Check main panels for proper installation, wiring identification, wire harnessing, and emergency power feed.
 - .2 Test and document each type of alarm from each station, noting station number(s) at which signal has been received.
 - .3 Check field devices for proper operation.
 - .4 Check for integration to other systems.
 - .5 Perform tests as required by Commissioning Agent.
- .8 Fire Alarm System:
 - .1 Check and record nameplate data.

- .2 Check and report panel enclosure is suitable for environment in which it is installed.
- .3 Perform system verifications and tests according to CAN/ULC-S536 and S537.
- .4 Perform tests as required by Commissioning Agent.
- .9 Other Systems:
 - .1 Check and record nameplate data.
 - .2 Perform tests on following systems, where applicable.
 - .1 intercom system;
 - .2 network structured cabling system;
 - .3 electric heat tracing.
 - .3 In addition to requirements of Electrical Divisions, test and commission following items:
 - .1 electrical devices supplied in equipment under work of Divisions other than Electrical Divisions;
 - .2 Owner's supplied equipment as noted or directed by Consultant and/or Owner.
 - .4 Perform tests as required by Commissioning Agent.

3.4 COMMISSIONING PROCESS

- .1 Perform commissioning process in stages and include, but not be limited to, following:
 - .1 Stage 1: Commissioning of equipment/systems as listed in this Section, which is a prerequisite to an application for Substantial Performance of the Work and includes supervising and validating results of functional performance testing, and submittal of reviewed Systems Operating Manual.
 - .2 Stage 2: Commissioning work to be performed 12 months after issue of a Certificate of Substantial Performance of the Work and which includes supervision of Contractor's "fine tuning" of equipment/systems through seasonal occupancy, and any other such work to achieve optimal comfort and performance conditions.
 - .3 Stage 3: Successful completion of satisfactory equipment/system operation during first month after issue of a Certificate of Total Performance of the Work.
 - .4 Stage 4: Successful completion of satisfactory equipment/system operation during third month after issue of a Certificate of Total Performance of the Work.
 - .5 Stage 5: Successful seasonal commissioning of building.

3.5 RESPONSIBILITIES OF COMMISSIONING AGENT

- .1 During construction phase Commissioning Agent is to:
 - .1 review Contractor's shop drawings for commissioning related issues, and report any such issues to Consultant;
 - .2 as soon as possible after project start-up, prepare and issue a Commissioning Plan based on Contractor's construction schedule;
 - .3 prior to tests, supply pre-functional performance test commissioning data sheets for all equipment and systems to be commissioned to Contractor;

- .4 monitor and inspect installation on a regular basis throughout construction stages, issue reports identifying any issues which may have an impact on commissioning process, and work with project team to expeditiously resolve any problems that may arise due to site conditions;
 - .5 arrange with Contractor for on-site commissioning meetings on an as-required basis, to be attended by Contractor and applicable subcontractors, Owner, and Consultant, chair meetings, and prepare and distribute meeting minutes to all attendees;
 - .6 witness and validate tests, identify deficiencies, and issue progress reports;
 - .7 coordinate commissioning scheduling with Contractor;
 - .8 review pre-functional performance test commissioning data sheets submitted by Contractor, then witness and supervise functional performance testing and supervise and direct commissioning process, validate commissioning procedures, witness completion of commissioning data sheets by Contractor, and sign completed data sheets;
 - .9 perform a preliminary review of Contractor's O & M Manuals, before they are issued to Consultant, and issue any comments to Consultant;
 - .10 coordinate with Contractor and Owner training and instructions by Contractor and his equipment and system manufacturers/suppliers to Owner's operating and maintenance personnel, and comment on quality of training and instructions to Consultant;
 - .11 prepare and issue Systems Operation Manual to Owner prior to equipment and system training by Contractor.
- .2 During post construction phase Commissioning Agent is to:
- .1 prepare and issue final report on commissioning, identifying any deficiencies that remain outstanding;
 - .2 recommend any training and/or instructions to be given to Owner's operating and maintenance personnel in addition to training and instructions already given;
 - .3 after Substantial Performance of the Work, witness system checks and validate documentation by Contractor as follows:
 - .1 once during first month of building operation;
 - .2 once during third month of building operation;
 - .3 once between fourth and tenth month of building operation but during a season opposite to first or third month visits.
 - .4 ensure any deficient work resulting from system checks described above are corrected;
 - .5 3 months after Substantial Performance of the Work, attend a question and answer session(s) with Contractor to answer any questions and concerns related to commissioning work from Owner's operating personnel.

END OF SECTION

- 1 General
- 1.1 **SUBMITTALS**
 - .1 Submit shop drawings for products specified in this Section.
- 1.2 **PRODUCT COMPATIBILITY**
 - .1 Lighting controls and luminaires when integrated together for control purposes must be 100% compatible with each other. Coordinate with ballast/driver and lamp manufacturers, LV relay panel manufacturers and dimmer/occupancy control manufacturers to ensure that components are compatible with each other and that interconnections do not affect performance, life or any warranties.
 - .2 These products shall be coordinated with switching devices in Section 26 27 26 which must be in the same line up and have similar appearances.
- 2 Products
- 2.1 **SWITCHES**
 - .1 Switches to be CSA approved, ULC listed and labelled devices.
 - .2 Hubbell Canada Inc., HBL 1221 Series, CSA approved, heavy duty, industrial grade, back, and side wired, AC quiet action toggle type, 20 ampere, 120-277 V switches. Switches to include steel-nickel plated bridge, nylon toggle, one piece rivetless copper alloy spring contact arm and terminal plate, silver cadmium oxide contacts, brass binding head screws, one piece integral grounding terminal and stainless steel automatic grounding clips. Provide single way, 2-way, 3-way, and key type to suit specific application requirements.
 - .3 Hubbell Canada Inc., DS120 "Style Line" decorator series, CSA approved, specification grade, back and side wired, A.C. rocker type, 20 ampere, 120-277 V switches. Switches to include steel-nickel plated bridge, nylon rocker, one piece rivetless copper alloy spring contact arm and terminal plate, silver cadmium oxide contacts, brass binding head screws, one piece integral grounding terminal and stainless steel automatic grounding clips. Provide single way, 2-way, 3-way, and pilot type to suit specific application requirements.
 - .4 Acceptable manufacturers are;
 - .1 Legrand-Watt Stopper;
 - .2 Hubbell;
 - .3 Acuity Brands;
 - .4 Leviton;
 - .5 Lutron;
 - .6 GE Lighting.

3 Execution

3.1 INSTALLATION OF SWITCHES

- .1 Provide switches and install in electrical outlet boxes. Refer to drawings to determine flush or surface mounting requirements. Generally, flush mount devices in finished areas. Size electrical boxes to suit device requirements as per device manufacturer's recommendations. Properly ground device to box and ground system as per code requirements and manufacturer's instructions.
- .2 For pricing only, switches to be ivory for devices connected to normal power circuits, red for devices connected to essential power circuits.
- .3 Ensure that switches located adjacent to doors are located at strike side of door. Confirm door swing requirements on architectural drawings, not on electrical drawings.
- .4 Confirm final switch finishes with Consultant as per sample board submission specified in Part 1. Do not order any devices unless final finishes have been approved by Consultant.
- .5 Additionally, refer to testing and verification requirements in Section entitled Electrical Work Analysis and Testing and include applicable requirements.

END OF SECTION

- 1 General
- 1.1 **SUBMITTALS**
 - .1 Submit shop drawings for products specified in this Section.
- 1.2 **BREAKERS**
 - .1 Breakers to be NEMA rated types, and for switchboards and distribution panelboards, breakers when frame sized 225 amperes and greater, to be provided with solid state adjustable trip units with long time, short time and instantaneous time (LSI) functions and time delays. Set trip units at ratings as per coordination study as required for proper coordination. Provide ground fault alarm and trip functions at breaker trip rating above 1000A, as coordinated with results of coordination study and as confirmed with Consultant.
 - .2 Size breakers as per drawings and/or schedules, but in absence of direction, size breakers to suit intended application, to suit coordination study requirements and in accordance with local governing electrical safety code.
- 2 Products
- 2.1 **STANDARD SWITCHBOARDS**
 - .1 Eaton (Cutler-Hammer), "Pow-R-Line C", indoor, metal enclosed, standardized service entrance switchboard for use in a solidly grounded system with a short circuit capacity as scheduled. Switchboard is shown and scheduled on drawings and complies with latest editions of following:
 - .1 EEMAC Standard G8 2;
 - .2 CSA Standard CAN/CSA C22.2 No. 31;
 - .3 NEMA Standard *B-2;
 - .4 UL 891.
 - .2 Switchboard conforms to local governing electrical authority requirements.
 - .3 Structure:
 - .1 Switchboard consists of individual sections bolted together to form an enclosed, self-contained, self-supporting structure with necessary facilities for proper ventilation. Switchboard is front accessible type needing no access from rear. Each section is of modern welded construction, fabricated from sheet steel in accordance with EEMAC, NEMA and CSA requirements and reinforced wherever necessary to provide adequate strength. Front panels or doors are formed type, fabricated with cold rolled sheet steel. Unless otherwise required, rear, top and side panels are bolt-on and secured suitably to a channel type base. After fabrication, switchboard is factory cleaned and finished with ANSI grey enamel.
 - .2 Entire enclosure to be in accordance with NEMA 1 or NEMA 2 requirements with additional sprinkler proof requirements. Top of each cell to be complete with a "drip-shield" designed to shed water without dripping on cell. Ventilation louvers to be designed to prevent penetration of water spray from activated sprinklers, onto live components. Doors and component openings to be gasketed.
 - .4 Future Cells:

- .1 Where shown, provide bus terminations for future extensions and gasketed water-tight removable side panels to accommodate installation and connection of future cells.
- .5 Bus Bars:
 - .1 Main bus bars are constructed of top quality, 98% pure, rectangular copper bars, silver flashed or silver plated at joints with lap type joints bolted using high strength steel bolts and extra wide, extra thick washers to ensure maximum pressure and even current distribution at each joint. Bus and connections are designed so that maximum temperature rise in any part of switchboard will not exceed 65C° (117F°) over an ambient temperature of 40°C (104°F). Bus is properly isolated and designed to carry currents as required.
 - .2 Ground bus not less than 6 mm (1/4") x 50 mm (2") cross section area extending length of switchboard and is solidly bolted to steel framework. Ground bus is constructed of same material as main bus and is complete with suitable lugs for grounding connections outlined on drawings. Ground bus is rated for momentary current rating equal to or greater than that of apparatus in switchboard.
 - .3 Supply required bolts, nuts, and washers for field connection of bus joints between cells.
- .6 Control Wiring:
 - .1 Each cell to be complete with required control wiring and terminal blocks. Control wiring is type "SIS", minimum size No. 14, extra flexible wire with thermoplastic insulation. Neatly harness and suitably secure control wiring.
 - .2 Terminal blocks are of pressure type and complete with removable marking strips.
- .7 Switchboard Arrangement and Components:
 - .1 Switchboard cell arrangement and components are as detailed on drawings.
- .8 Metering:
 - .1 Power Xpert Meter 2000 series (PXM 2260) microprocessor based multifunction, power and energy meters with features as follows:
 - .1 accuracy of +/- 0.1% or better for volts and amps, and 0.2% for power and energy functions; meet accuracy requirements of IEC687 (class 0.2%) and ANSI C12.20 (Class 0.2%);
 - .2 provide per phase % THD (Total Harmonic Distortion) monitoring to the 40th order for voltage (reference to neutral only) and current , and provide Volts, Amps, kW, kVAR, PF, kVA, Frequency, kWh, kVAh, kVARh and 1 KYZ pulse output, on board meter limit exceeded alarms, and 512 Megabytes for data logging;
 - .3 include a three-line, bright red LED display;
 - .4 include serial communications: RS-485; of Modbus RTU, Modbus ASCII, DNP 3.0 protocols;
 - .5 include network communications: RJ-45 10/100 Base-T Ethernet Network port; Ethernet TCP/IP, Modbus TCP, BACnet/IP, SNMP v1 & v3 (Network), SMTP (email), HTTP, HTTPS, Atom Feed protocols;
 - .6 Historical trend logging for graphical viewing from an embedded WEB server;

- .7 to be configured and viewed from the on-board web server without the need for external software;
- .8 I/O expandability through option card slot.
- .9 Utility Metering Provisions:
 - .1 Confirm with and coordinate local electrical utility requirements and provide as required.
 - .2 Metering cells for utility metering and current and potential transformers and associated fuses to suit utility requirements and respective applications. Supply CT's/PT'S to switchboard manufacturer, for factory installation into metering cells, and secondary to be connected to terminal blocks. Provide minimum 38 mm (1-1/2") diameter conduit stub in bottom of each metering cell for site extension of conduit to meters.
- .10 Current and Potential Transformers:
 - .1 Potential transformers are of compartment type and incorporate current limiting fuses.
 - .2 Current transformers have ratios to suit application, a mechanical rating equal to momentary rating of circuit breakers, and insulated for full voltage rating of switchgear.
 - .3 Current and potential transformers for local governing electrical utility metering are supplied by local governing electrical utility and are shipped to switchboard manufacturer's factory for factory mounting and connection. Provide manufacturer's shipping address to local governing electrical utility.
- .11 Main Breakers:
 - .1 Series "C", frame type as scheduled and as required for application, sized as scheduled, fixed mounted, solid state moulded case circuit breaker with adjustable trip unit as specified in Part 1. Provide minimum interrupting capacity as scheduled.
 - .2 Breakers to be complete with "Digitrip-310" RMS sensing solid state trip unit having following adjustable tripping functions: long time pick-up, long time delay; short time pick-up; short time delay; instantaneous pick-up; ground fault pick-up; and ground fault delay. Trip settings to be as determined by distribution system testing and coordination study. Tripping unit to have three (3) sensors, one (1) on each phase conductor, arranged such that a trip signal from any sensor opens all three (3) poles of breaker.
 - .3 Breaker to be ULC listed for application of 100% of its trip setting and is be capable of carrying its full rated ampere capacity, indefinitely without tripping.
- .12 Circuit Breaker Distribution Section:
 - .1 Circuit breaker distribution section consists of Series "C" moulded case, bolt on circuit breakers with an interrupting capacity as scheduled and frame size to suit application. Refer to Part 1 for requirements of breakers to be provided with solid state adjustable trip units.
- .13 Surge Protective Devices (SPD):

- .1 Switchboards to be complete with integral SPD unit installed in dedicated cell. Unit to be factory installed and connected onto bussing through integral disconnect as recommended by manufacturer. Unit to include diagnostic package with status indicators on each phase, LCD surge counter display, audible alarm with silence button and Form C alarm contacts. Unit to be maintenance free. Additional features include following:
 - .1 Type 1;
 - .2 In accordance with ANSI/UL 1449 3rd Edition, IEEE C62.41, C62.45, UL 1283, and CSA Standards;
 - .3 Maximum voltage protection rating to not exceed 700 V (120/208 V) or 1500 V (600/347V); (L-N, L-G, N-G);
 - .4 Minimum nominal discharge current rating of 10 kA;
 - .5 Minimum short circuit current rating of 65 kA;
 - .6 Peak surge current 250 KA per phase;
 - .7 High-performance EMI/RFI noise rejection filter;
 - .8 Standard manufacturer's minimum 5 years parts and labour warranty;
 - .9 Flush mounting onto switchboard enclosure.
- .14 Incoming and Outgoing Conductor Connection Facilities:
 - .1 Provide required facilities and hardware including cubicle for incoming feeder, and outgoing cable in conduit feeders as shown and scheduled.
- .15 Mimic Bus and Nameplates:
 - .1 Red, single line vinyl bus approximately 3 mm (1/8") thick x 9 mm (3/8") wide, representing internal bussing and components, riveted to front of switchboard and extending through handles of respective breakers; engraved Lamacoid nameplates to be secured with stainless steel screws, adjacent each panel component and identifying each component.
 - .2 Finish colours, sizes, and nomenclature to be confirmed with Consultant.
- .16 Accessories:
 - .1 Manufacturer's standard accessories, spare parts and maintenance tool kit.
 - .2 Manufacturer's installation drawings.
- .17 Testing, Start-up, Verification and Training:
 - .1 Assist installing Contractor in installation of equipment and to inspect installation, test equipment, perform start-up and verify equipment. Coordinate work with Contractor.
 - .2 Be present to assist during third party testing.
 - .3 Perform testing at times coordinated with Consultant.
 - .4 Provide instructions on system operating and maintenance.
- .18 Acceptable Manufacturers:
 - .1 Eaton (Cutler-Hammer);
 - .2 Schneider Electric (Square D);
 - .3 Siemens Electric Ltd.

2.2 DISTRIBUTION PANELBOARDS

- .1 Eaton (Cutler-Hammer), "Pow-R-Line" series factory assembled dead front panelboards as per drawing schedules, manufactured to CSA Standard C22.2. No. 29. Generally, interrupting capacities are scheduled, but in absence of direction, provide to capacity to suit intended application to suit local governing electrical code.
- .2 Circuit breaker type "PRL4B" distribution panelboards to be single or double row as required and complete with moulded case, bolt-on circuit breakers calibrated for 40°C (104°F) ambient temperature and conforming to CSA Standard C22.2 No. 5 (Note No. 1). Locate both main lugs and neutral bar at same end. Shield main lugs through a removable cover. Identify each circuit breaker adjacent breaker handle. Refer to Part 1 for requirements of breakers to be provided with solid-state adjustable trip units. Group mount circuit breakers.
- .3 Distribution panelboards of rating greater than 1200 amperes rating to be series "Pow-R-Line C" switchboard types as specified in Section entitled Switchboards.
- .4 Panelboard interior to have three flat bus bars stacked and aligned vertically with insulators laminated between phases. Insulators support and provide phase isolation to entire length of bus. A solidly bonded equipment ground bar and a neutral bar to be provided.
- .5 Bus bars (phases, grounds and neutrals) to be hard drawn electrical grade copper, silver plated and extend throughout panel.
- .6 Interior trim to be of dead-front construction to shield user from energized parts. Main circuit breaker and main lug interiors to be field convertible for top or bottom incoming feed.
- .7 Panelboard boxes to be constructed of code gauge, hot zinc dipped galvanized steel constructed in accordance with UL 50 requirements, complete with removable ends and wiring gutter space on sides in accordance with CSA requirements.
- .8 Floor mounted enclosures to be free-standing type, reinforced as required to provide adequate strength.
- .9 Include main breakers for panelboards as scheduled. Main breakers to be automatic moulded case breakers with solid state trip units as specified in Part 1 article.
- .10 Enclosures located in climate controlled areas to be minimum NEMA 1. Surface mounted panelboards to be complete with drip shield. Ventilation louvres to be designed to prevent penetration of water spray onto live components. Conduit entries to be sealed watertight. Units to be factory painted in ANSI grey enamel. Recessed backboxes (tubs) need not be finished painted.
- .11 Distribution panelboards sized 600 A and less and panelboards not located in secured electrical rooms/closets require doors. Panelboards sized up to 600A and panelboards located in unsecure areas to be complete with doors, latches, and keyed alike locks. Locks to be cylindrical tumbler type with larger enclosures requiring sliding vault locks with 3-point latching. Supply 2 keys with each lock.
- .12 Panelboards to include for future breaker provisions as noted on schedules. Make provision for space for breakers, bussing for full panel size and where spare breakers are scheduled, breakers with required connector kits. Unused spaces provided, unless otherwise specified, to be fully equipped for future devices, including appropriate connectors and mounting hardware.

- .13 Panelboards as scheduled to be complete with integral surge protective devices (SPDs). Unit to be factory installed and connected onto bussing through integral disconnect/breaker as recommended by manufacturer. Unit to include diagnostic package with status indicators on each phase, audible alarm and Form C alarm contacts. Unit to be maintenance free. SPD features include:
- .1 Type 1;
 - .2 in accordance with ANSI/UL 1449 3rd Edition, IEEE C62.41, C62.45, UL 1283, and CSA Standards;
 - .3 maximum voltage protection rating to not exceed 700 V (120/208 V) (L-N, L-G, N-G);
 - .4 minimum nominal discharge current rating of 10 kA;
 - .5 minimum short circuit current rating of 50 kA;
 - .6 peak surge current 150 KA per phase;
 - .7 indicator LED on units to identify protection integrity status of metal-oxide varistors; indicator to be visible on front of panelboard;
 - .8 high-performance EMI/RFI noise rejection filter;
 - .9 standard manufacturer's minimum 5 years parts and labour warranty.
- .14 Acceptable manufacturers are:
- .1 Eaton (Cutler-Hammer);
 - .2 Schneider Electric (I-Line Series);
 - .3 Siemens Electric Ltd.

2.3 **BRANCH CIRCUIT PANELBOARDS**

- .1 Eaton (Cutler-Hammer), "Pow-R-Line" series, factory assembled dead front panelboards as per schedules, manufactured to CSA Standard C22.2 No. 29 and local governing electrical code, and designed for sequence phase connection of branch circuit breakers.
- .2 As scheduled, panelboards are of types:
 - .1 "Pow-R-Line 1", 120/208 V, 3-phase and single phase with minimum "BAB" frame, bolt-on moulded case circuit breakers with a minimum interrupting capacity of 22 KA symmetrical at 208 V, unless otherwise scheduled. Where panelboards are schedule to include series rated provisions, provide breakers as recommended by panel manufacturer;
 - .2 "Pow-R-Line 2" 347/600 V, 3-phase panelboards with minimum "GBH" frame, bolt-on moulded case circuit breakers with an interrupting capacity as scheduled or in absence of direction to be of capacity for intended application to local governing electrical code requirements.
- .3 Where ground fault circuit interrupting (GFCI) type breakers are required by code and/or scheduled, provide "Quicklag" ground fault, CSA Class "A", Group 1, combination thermal magnetic bolt-on circuit breakers with solid-state ground fault interrupters.
- .4 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.
- .5 Panelboards are to be complete with:
 - .1 NEMA 1, box constructed of code gauge galvanized steel with removable box ends, wiring gutter space on sides; conduit entries sealed water-tight;

- .2 dead-front construction to shield user from energized parts;
 - .3 enclosure constructed of code gauge, hot zinc dipped galvanized steel constructed in accordance with UL 50 requirements; trim for flush or surface wall mounting as shown; front panel to not be removable with the door locked;
 - .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 current-carrying parts be insulated from ground and phase-to-phase by high dielectric strength thermoplastic;
 - .12 isolated ground bus for panelboards feeding electrically sensitive equipment;
 - .13 filler plates covering unused mounting space;
 - .14 non-automatic and automatic main breaker to function as an isolating switch, where shown and as required;
 - .15 ground fault circuit interrupting (GFCI) type breakers to feed devices as scheduled and for applications required by local governing codes;
 - .16 arc fault circuit interrupter (AFCI) type breakers to feed devices as scheduled and for applications required by local governing codes.
- .6 Panels, doors and trim are to be factory painted with ANSI grey enamel finish. Recessed backboxes (tubs) need not be finished painted.
 - .7 Equip breakers of frame size 225 amperes and greater, with solid state adjustable trip units.
 - .8 Equip circuit breakers connected to dedicated equipment or devices with handle locks.
 - .9 Include spare breakers as sized on schedules and future breaker provisions as noted on schedules. Future breaker provisions to include space for breakers, bussing for full panel size and where future breaker sizes are scheduled, required breaker connector kits.
 - .10 Unless otherwise scheduled or noted, include a of minimum three (3) 15A-1P breakers to feed BAS panels.
 - .11 Acceptable manufacturers are:
 - .1 Eaton (Cutler-Hammer);
 - .2 Schneider Electric (Square D);
 - .3 Siemens Electric Ltd.

2.4 LOAD CENTRES

- .1 Eaton (Cutler-Hammer), CSA approved, type BR load centres as follows:
 - .1 NEMA 1 enclosure manufactured from cold rolled 16 gauge steel and complete with ANSI grey enamel finish;

- .2 front panel with hinge door and locking operator; front cover with trim to mount flush with wall onto recessed enclosure;
 - .3 single phase, 3-wire, 120/208 VAC; 10 KA IC;
 - .4 copper bussing and bars;
 - .5 main non-automatic breaker;
 - .6 plug in type BR series breakers;
 - .7 100 amp main bussing rating;
 - .8 minimum sized to accommodate at least 20 breakers;
 - .9 Type BR-AFCI arc fault circuit interrupting type breakers to feed devices as scheduled and as required by local governing codes;
 - .10 Type BR-GFCI ground fault circuit interrupting type to feed devices as scheduled and as required by local governing codes;
 - .11 twin neutral with insulated cross strap for bonding applications as required by Code;
 - .12 drip shield for surface mounted panels;
 - .13 typed circuit directing card.
- .2 Acceptable manufacturers are:
- .1 Eaton (Cutler-Hammer);
 - .2 Schneider Electric (Square D);
 - .3 Siemens Electric Ltd.

3 Execution

3.1 **INSTALLATION OF SWITCHBOARDS**

- .1 Provide switchboards and locate into positions. Base layout, design, connections and requirements for supplied accessories from documents and reviewed shop drawings. Carefully examine drawings and site conditions to ensure that equipment can be positioned into their designated positions, without difficulty. Ensure adequate clearance is provided as per code requirements and as required for access for operation and maintenance.
- .2 Coordinate cable entry location to match incoming conductors. Allow sufficient space for required cable bending radii and connections.
- .3 Assemble individual sections of switchboard in accordance with manufacturer's recommendations and instructions, and secure assembly to concrete base. Ensure that bus joint bolts are torqued to manufacturer's prescriptions.
- .4 Provide seismic restraints as required by local governing authorities and codes.
- .5 Coordinate delivery and installation of local electrical utility supplied metering transformers.
- .6 Arrange for switchboard manufacturer to provide necessary drawings for erection and installation of switchboard. In addition, if required, obtain from manufacturer necessary copies of detail, erection, etc., drawings required for approval of installation from local electrical utility and any other authority having jurisdiction. Obtain required approvals.
- .7 Install controls and displays at height of between a minimum 1200 mm (4') to a maximum of 1800 mm (6') above finished floor level.

- .8 Ground and bond equipment to ground electrode grids as per local governing electrical code and inspection authority requirements. Refer also requirements of grounding and bonding article.
- .9 Install and test SPD as per manufacturer's instructions.
- .10 Test key operator locks and sequence of operation.
- .11 Arrange switchboard in configuration as indicated on drawings and as per reviewed shop drawings.
- .12 Make necessary incoming and outgoing power cable connections to equipment in strict accordance with equipment and cable manufacturer's recommendations. Ensure connections, bus flanges and terminations are suitable for specific incoming and outgoing cables/bus ducts.
- .13 Arrange for switchgear manufacturer's personnel to provide inspection and testing of switchboard prior to energizing system.
- .14 Provide engraved Lamacoid nameplates with nomenclature confirmed with Consultant.
- .15 Additionally, refer to testing, coordination and verification requirements in Section entitled Electrical Work Analysis and Testing and include applicable requirements.

3.2 **INSTALLATION OF DISTRIBUTION PANELBOARDS**

- .1 Provide distribution panelboards and install into locations and connect complete. Ensure adequate clearance is provided as per code requirements and as required for access for operation and maintenance.
- .2 Install floor mounted panelboards on concrete housekeeping pads. Provide seismic restraints as required by local governing authorities and codes. Surface wall mount other panelboards, unless otherwise noted, independent of connecting conduit.
- .3 Equip each panelboard with suitable lugs to accommodate main and branch conductors as scheduled. Identify panelboard and breakers with Lamacoid identification nameplate with nomenclature to Consultant's approval.
- .4 Connect SPD in accordance with manufacturer's instructions and with dedicated breaker.
- .5 Ground and bond equipment as per local governing electrical code and inspection authority requirements. Refer also to requirements of grounding and bonding article.
- .6 Additionally, refer to testing, coordination and verification requirements in Section entitled Electrical Work Analysis and Testing and include applicable requirements.

3.3 **INSTALLATION OF PANELBOARDS**

- .1 Provide factory assembled branch circuit panelboards and install into locations and connect complete. Ensure adequate clearance is provided as per code requirements and as required for access for operation and maintenance. Load panels with breakers as scheduled.
- .2 Support cabinets and enclosures independent of connecting conduit, and accurately install with reference to wall finishes.
- .3 Equip panelboards with suitable lugs or provisions to accommodate main and branch conductors scheduled.
- .4 Coordinate with Mechanical Division trades and Consultant to determine extra mechanical loads and BAS panels requiring use of specified additional 15A circuits and connect complete.

- .5 Ground and bond equipment as per local governing electrical code and inspection authority requirements. Refer also requirements of Section entitled – Grounding and Bonding.
- .6 Turn over to Consultant, prior to application for a Certificate of Substantial Performance of Work, a quantity of two (2) panelboard cabinet or enclosure keys per panelboard.
- .7 Where two (2) or more panelboards are installed in one (1) cabinet, equip panelboards with double lugs and increase gutter capacity to accommodate additional cabling.
- .8 Identify panelboard breakers in a permanent manner, and complete typed panelboard circuit directories identifying circuit number and type and location of loads supplied from each breaker to Consultant's approval.
- .9 Include for spaces for future breakers, spare breakers and additional breakers for miscellaneous mechanical loads are included as per schedules and as specified.
- .10 Test and verify ground fault circuit interrupting breakers as follows:
 - .1 demonstrate in presence of Consultant that protected circuits will "trip" when a simulated ground fault is applied to "load" side of each circuit breaker/ground fault interrupter combination;
 - .2 megger load side neutral on GFCI protected branch circuits to ensure that neutral is not grounded on load side of GFCI;
 - .3 verify GFCI operation with a temporary load (100 watt lamp in an insulated socket with pigtail leads);
 - .4 provide a written report confirming that tests have been performed and that system is functioning properly.
- .11 Ground and bond panel as per local electrical code requirements. Refer also to requirements of grounding and bonding article.
- .12 Additionally, refer to testing, coordination and verification requirements in Section entitled Electrical Work Analysis and Testing and include applicable requirements.

3.4 **INSTALLATION OF LOAD CENTRES**

- .1 Provide factory assembled load centres and connect complete. Ensure adequate clearance is provided as per code requirements and as required for access for operation and maintenance. Load panels with breakers as scheduled.
- .2 Support enclosures independent of connecting conduit, and accurately install with reference to wall finishes.
- .3 Equip enclosures with suitable lugs or provisions to accommodate main and branch conductors scheduled.
- .4 Identify breakers in a permanent manner, and complete typed panelboard circuit directories identifying circuit number and type and location of loads supplied from each breaker to Consultant's approval.
- .5 Include for spaces for future breakers and spare breakers as per schedules.
- .6 Test and verify ground fault interrupting breakers as follows:
 - .1 demonstrate in presence of Consultant that protected circuits will "trip" when a simulated ground fault is applied to "load";
 - .2 side of each circuit breaker/ground fault interrupter combination;
 - .3 megger load side neutral on GFI protected branch circuits to ensure that neutral is not grounded on load side of GFI;

- .4 verify GFI operation with a temporary load (100 watt lamp in an insulated socket with pigtail leads);
- .5 provide a written report confirming that tests have been performed and that system is functioning properly.
- .7 Ground and bond panel as per local electrical code requirements. Refer also to requirements of grounding and bonding article.
- .8 Additionally, refer to testing, coordination and verification requirements in Section entitled Electrical Work Analysis and Testing and include applicable requirements.

END OF SECTION

1 General

1.1 **SUBMITTALS**

- .1 Submit shop drawings for products specified in this Section.
- .2 Submit samples of each typical wiring device, faceplates, finishes and colours. Mount to sample board, clearly labelling devices and finishes. Submit for review by Owner and Consultant. Do not order any device unless finishes have been reviewed and approved by Consultant.

2 Products

1.1 **SWITCHES**

- .1 Switches to be CSA approved, ULC listed and labelled devices.
- .2 Hubbell Canada Inc., HBL 1221 Series, CSA approved, heavy duty, industrial grade, back, and side wired, AC quiet action toggle type, 20 ampere, 120-277 V switches. Switches to include steel-nickel plated bridge, nylon toggle, one piece rivetless copper alloy spring contact arm and terminal plate, silver cadmium oxide contacts, brass binding head screws, one piece integral grounding terminal and stainless steel automatic grounding clips. Provide single way, 2-way, 3-way, and key type to suit specific application requirements.
- .3 Acceptable manufacturers are:
 - .1 Hubbell Canada Inc.;
 - .2 Cooper Wiring Devices (Arrow Hart);
 - .3 Legrand - Pass & Seymour;
 - .4 Leviton.

1.2 **RECEPTACLES**

- .1 Receptacles to be CSA approved, ULC listed, certified and labelled devices.
- .2 Hubbell Canada Inc., No. HBL5262 / HBL5362 CSA approved, ULC listed, extra heavy duty, specification grade, back and side wired, flush, nylon face/body construction, duplex U-ground, 15/20 ampere, 125 V, 2-pole, 3-wire grounding receptacles complete with one piece nickel-plated brass mounting strip with integral grounding clips, ground retention clips, nickel-plated brass wiring clamps with nickel-plated brass screws, front circuit identification area and reinforced thermoplastic base.
- .3 Hubbell Canada Inc., No. HBL 5361 series, extra heavy duty, specification grade, flush, nylon face, single, 20 ampere, 125 V, 3-wire grounding receptacles.
- .4 Hubbell Canada Inc., No. HBL 5461 series, extra heavy duty, specification grade, flush, nylon face, single, 20 ampere, 250 V, 2-pole 3-wire grounding receptacle.
- .5 Hubbell Canada, No. HBL5262SA / HBL5362SA "CIRCUITGUARD" Series, specification grade, 15/20 ampere, 125 V, duplex, surge suppression receptacles in blue finish, complete with light and alarm, 240 joules/15000A per mode.

- .6 Hubbell Canada, No. IG5262SA / IG5362SA "CIRCUITGUARD" Series, specification grade, 15/20 ampere, 125 V, duplex, isolated ground, surge suppression receptacles in blue finish, complete with light and alarm, 240 joules/15000A per mode.
- .7 Hubbell Canada Inc., No. BR15TR series, commercial specification grade, 15 ampere, 125 V, 2-pole, 3-wire grounding, tamper-resistant (safety shutter) duplex receptacles.
- .8 Hubbell Canada, No. GFR 5262TR / GFR 5362TR "CIRCUIT GUARD" Series, extra heavy duty grade, 15/20 ampere, 125 V, duplex, ULC Class "A", Group One, tamper resistant, weather resistant ground fault circuit interrupting receptacles complete with red ground fault LED and 10ka short circuit current rating.
- .9 Hubbell Canada Inc., No. USB 15AC "Style Line" series, CSA approved, ULC listed, tamper resistant, back and side wired, 15 ampere, 125 V
- .10 Where noted that 20 A receptacles are required, include for "T" slot type of respective series of receptacles.
- .11 Colour of special switches and receptacles (unless specified above), to be as specified in PART 3 of this Section of Specification.
- .12 Special switches and receptacles not specified above are to be specified on drawings. Low voltage lighting controls are specified in Section entitled Lighting Control.
- .13 Acceptable manufacturers are:
 - .1 Hubbell Canada Inc.;
 - .2 Cooper Wiring Devices (Arrow Hart);
 - .3 Legrand - Pass & Seymour;
 - .4 Leviton.

1.3 **FACEPLATES**

- .1 Grade 18 8, type 430, 1 mm (0.032") thick stainless steel, satin, brushed or natural finish, complete with a peel off protective plastic film, and stainless steel screws.
- .2 Hubbell Canada Inc., No. WP8E / WP8EH, NEMA 3R rated, CSA approved, ULC listed and labelled, single gang, vertical/horizontal mounting, weather-proof in-use, gasketed, cast aluminium faceplates for standard duplex receptacles in wet locations.
- .3 Hubbell Canada Inc., No. WP26E/WP26EH, NEMA 3R rated, CSA approved, ULC listed and labelled, single gang, vertical/horizontal mounting, weather-proof in-use, gasketed, cast aluminium faceplates for GFI receptacles in wet locations.
- .4 Hubbell Canada Inc., No. HBL1795, ULC listed and labelled, single gang, vertical mounting, weather proof in-use, gasketed, clear bubble plate, silicone rubber faceplates for standard AC toggle switches in wet locations.
- .5 Galvanized steel stamped faceplates.
- .6 Colours and finishes of faceplates are specified in Part 3 of this Section.
- .7 Acceptable manufacturers are as per switches and receptacles.

1.4 PUSHBUTTONS OPERATORS

- .1 Rockwell Automation (Allen-Bradley) Ltd., 800T Series operators as follows:
 - .1 emergency off pushbuttons: oversized 60 mm (2-1/2") diameter red plastic mushroom head pushbutton with shroud, thrust washer, and an aluminum faceplate with "EMERGENCY POWER OFF" identification lettering or other nomenclature as required to suit application;
 - .2 pushbuttons: standard 30 mm (1-1/4") diameter plastic pushbuttons in Red/Green colours as required for application, momentary/maintained/2 position push-pull operations as required, flush/extended/mushroom heads; non-illuminated/illuminated, with aluminum faceplate with identification lettering nomenclature as required to suit application;
 - .3 selector switches: 30 mm (1-1/4") diameter standard knob selector switches, 2/3 position maintained contact operations; non-illuminated, with aluminum faceplate with identification lettering nomenclature as required to suit application;
 - .4 key operated switches: standard 30 mm (1-1/4") diameter key cylinder lock operator, 2 or 3 position operations; non-illuminated, with aluminum faceplate with identification lettering nomenclature as required to suit application;
 - .5 pilot lamps: 30 mm (1-1/4") diameter illuminated LED pilot lights, red/green/amber/white/clear colours as required to suit application; of voltage ratings as required to suit application; with contact block; with aluminum faceplate with identification lettering nomenclature as required to suit application; push to test feature where required;
 - .6 with enamel painted steel or stainless steel faceplate for flush mounting onto recessed wall boxes or in millwork, suitable for mounting of devices;
 - .7 with NEMA 1 box for surface mounting applications in climate controlled areas, CSA approved for application and of size suitable for mounting of devices;
 - .8 with minimum NEMA 3R box for surface mounting applications in non-climate controlled areas, CSA approved for application and of size suitable for mounting of devices;
 - .9 with STI type flip open polycarbonate tamper-proof cover and audible alarm device activated when cover is open, and custom labelling.
- .2 Exact type and ratings of devices are to suit specific applications.
- .3 Acceptable manufacturers:
 - .1 Rockwell Automation (Allen-Bradley);
 - .2 Eaton (Cutler-Hammer);
 - .3 Square D;
 - .4 GE.

3 Execution

1.1 INSTALLATION OF SWITCHES

July 05, 2024

- .1 Provide switches and install in electrical outlet boxes. Refer to drawings to determine flush or surface mounting requirements. Generally, flush mount devices in finished areas. Size electrical boxes to suit device requirements as per device manufacturer's recommendations. Properly ground device to box and ground system as per code requirements and manufacturer's instructions.
- .2 For pricing only, switches to be ivory for devices connected to normal power circuits, red for devices connected to emergency power circuits.
- .3 Ensure that switches located adjacent to doors are located at strike side of door. Confirm door swing requirements on architectural drawings, not on electrical drawings.
- .4 Confirm final switch finishes with Consultant as per sample board submission specified in Part 1. Do not order any devices unless final finishes have been approved by Consultant.
- .5 Additionally, refer to testing and verification requirements in Section entitled Electrical Work Analysis and Testing and include applicable requirements.

1.2 **INSTALLATION OF RECEPTACLES**

- .1 Provide receptacles and install in electrical outlet boxes. Refer to drawings to determine flush or surface mounting requirements. Generally, flush mount devices in finished areas. Size electrical boxes to suit device requirements as per device manufacturer's recommendations. Properly ground device to box and ground system as per code requirements and manufacturer's instructions.
- .2 For pricing only, receptacles to be ivory for devices connected to normal power circuits, red for devices connected to emergency power circuits.
- .3 Install USB charger receptacles in extra deep boxes in accordance with manufacturer's recommendations.
- .4 Install exterior receptacles located in landscaped grounds in accordance with drawing detail.
- .5 Confirm receptacle finishes via submission of sample board to Consultant. Do not order any devices unless final finishes have been approved by Consultant.
- .6 Where receptacles are indicated in counters and benches, box cut-out to be provided in counter and bench. Provide a box, receptacle, plate and branch circuit wiring. Branch circuit wiring within counters and benches to be flexible armoured cable, under requirements of local governing electrical code and standards. Install and connect complete.
- .7 Confirm final receptacle finishes with Consultant as per sample board submission specified in Part 1. Do not order any devices unless final finishes have been approved by Consultant.
- .8 Additionally, refer to testing and verification requirements in Section entitled Electrical Work Analysis and Testing and include applicable requirements.

1.3 **INSTALLATION OF FACEPLATES**

- .1 Provide each switch and receptacle with a faceplate with an opening or openings suitable for device it conceals and covers openings around boxes. Secure faceplates to device frames with screws to match faceplates. Provide larger than standard type faceplates for devices that require engraved nomenclature to define special purpose for that device.
- .2 Provide nylon type faceplates for switches and receptacles circuited to emergency power sources. For flush mounted devices, provide oversized faceplates as required to properly cover wall openings around recessed boxes. Provide faceplates with suitable identification label. Colour finish to be red, but to be confirmed with Consultant.
- .3 Provide galvanized stamped steel faceplates in service areas and equipment rooms where devices are surface mounted.
- .4 Provide faceplates for housekeeping receptacles with label printed with "Housekeeping Only" lettering.
- .5 Provide weatherproof insulated faceplates with hinged and gasketed receptacle access flaps for weatherproof receptacles denoted "WP" on drawings.
- .6 Generally, oversized faceplates to be provided where engraved lettering is required.
- .7 Faceplates for flush floor mounted receptacles to be forged brass rectangular faceplates.
- .8 Confirm exact material, finish, and colour of faceplates for devices in any particular area with Consultant prior to ordering. Submit sample board as per requirements of Part 1.
- .9 Provide faceplates with printed self-adhesive label on inside face identifying circuit number and panel feeding device. Turn over label maker to Consultant prior to application for Certificate of Substantial Performance of the Work.

1.4 **INSTALLATION OF PUSHBUTTON OPERATORS**

- .1 Provide specified and suitable pushbutton operators and pilot lamps to suit various applications.
- .2 Where flush mounted, provide faceplate for mounting onto recessed boxes.
- .3 Where surface mounted climate controlled areas, provide suitable NEMA 1 box. In non-climate controlled areas, surface mounted devices to be mounted within minimum NEMA 3R rated boxes.
- .4 Install devices in accordance with manufacturer's instructions to suit application requirements of Owner. Connect complete to respective equipment being controlled. Provide required wiring in conduit.
- .5 Test and verify operation of each device. Provide engraved lamacoid nameplate to identify system being operated and any special instructions. Confirm exact nomenclature with Consultant prior to ordering.

END OF SECTION

- 1 General
- 1.1 **SUBMITTALS**
 - .1 Submit shop drawings for products specified in this Section.
- 2 Products
- 2.1 **DISCONNECT SWITCHES**
 - .1 Eaton (Cutler-Hammer), heavy duty, CSA approved, disconnect (safety) switches. Features include:
 - .1 front operated with a handle suitable for padlocking in "OFF" position and arranged so that enclosure cover cannot be opened while handle is in "ON" position;
 - .2 operating mechanisms: quick-break, positive acting with visible blades and a line terminal shield;
 - .3 fusible units with fuse clips suitable for HRC fuses, unless otherwise noted;
 - .4 ampere rating, number of poles and fuse requirements as indicated on drawings;
 - .5 factory primed and painted switch enclosures.
 - .2 Disconnects for variable speed drives to be suitable for use with such drives and include auxiliary switch/contact to de-energize control power circuit, as required and as applicable.
 - .3 Enclosures for disconnects mounted in interior climate controlled areas and standard non-climate controlled areas to be NEMA 3R . For corrosive environmental applications, enclosures to be minimum NEMA 4X.
 - .4 Acceptable manufacturers are:
 - .1 Eaton (Cutler-Hammer);
 - .2 Siemens Electric Ltd.;
 - .3 Schneider Electric (Square D).
- 2.2 **FUSES**
 - .1 Unless otherwise indicated, fuses to be Form I, Class "J" HRC fuses for constantly running equipment, and Form II, Class "C" HRC fuses for motorized equipment that cycle "ON" and "OFF".
 - .2 Fuses to be of type suitable for applications as required by local governing electrical codes and in coordination with respective equipment manufacturer's recommendations in which fuses are required. Coordinate also with Mechanical Division Contractor for requirements for Mechanical Division equipment.
 - .3 Fuses to be of product of one manufacturer.
 - .4 Acceptable manufacturers are:
 - .1 Mersen (Ferraz Shawmut);
 - .2 English Electric Ltd.;
 - .3 Noram;

.4 Cooper Bussmann.

2.3 **ENCLOSED CIRCUIT BREAKERS**

- .1 Eaton (Cutler-Hammer), moulded case, front operated, surface mounted, automatic circuit breakers sized on drawings, each secured in NEMA 3R wall mounting enclosure with steel front panel and arranged so that circuit breaker can be padlocked in OFF position. Cover interlocked such that cover cannot be opened if breaker is in ON position.
- .2 Eaton (Cutler-Hammer), moulded case, front operated, flush mounted, automatic circuit breakers sized on drawings, each secured in NEMA 1 wall mounting enclosure with steel front panel and arranged so that circuit breaker can be padlocked in OFF position. Cover interlocked such that cover cannot be opened if breaker is in ON position.
- .3 Acceptable manufacturers are:
 - .1 Eaton (Cutler-Hammer);
 - .2 Schneider Electric (Square D);
 - .3 Siemens Electric Ltd.

3 Execution

3.1 **INSTALLATION OF DISCONNECT SWITCHES**

- .1 Provide disconnects switches and install into locations and connect complete. Ensure adequate clearance is provided as per local code requirements and as required for access for operation and maintenance. Install as follows:
 - .1 wherever shown on drawings and/or specified herein;
 - .2 wherever required by MCC/VFD/starter schedule drawings;
 - .3 for motorized equipment which cannot be seen from motor starter location or is more than 9 m (30') from starter location (in accordance with local governing electrical code requirements);
 - .4 for "packaged" equipment fed from a motor starter panel.
- .2 Ensure enclosure ratings are suitable for intended applications.
- .3 Provide engraved Lamacoid nameplate with nomenclature reviewed with Consultant.

3.2 **INSTALLATION OF FUSES**

- .1 Install fuses in mounting devices immediately before energizing circuit.
- .2 Ensure correct fuses fitted to physically matched mounting devices.
- .3 Ensure correct fuses fitted to assigned electrical circuit.
- .4 Provide a complete set of fuses for each fusible disconnect, motor starter, and similar fusible equipment provided or supplied.
- .5 Supply 3 spare fuses of each size and type used on project, mount fuses in cabinet. Secure cabinet in wall location as reviewed with Consultant.

3.3 **INSTALLATION OF ENCLOSED CIRCUIT BREAKERS**

- .1 Provide wall mounted enclosed, circuit breakers for equipment. Include required accessories. Secure to wall construction and connect complete.
- .2 Confirm exact locations prior to roughing-in.

- .3 Ground and bond equipment as per local governing electrical code and inspection authority requirements. Refer also to requirements of grounding and bonding article.
- .4 Provide a lamacoid identification nameplate for each enclosure. Confirm exact nomenclature with Consultant prior to manufacturer.
- .5 Additionally, refer to testing, coordination and verification requirements in Section entitled Electrical Work Analysis and Testing and include applicable requirements.

END OF SECTION

1 General

1.1 **SUBMITTALS**

- .1 Submit shop drawings for products specified in this Section, including but not be limited to following:
 - .1 engine generator set (genset) with accessories;
 - .2 genset control panel and related controls;
 - .3 integration drawings identifying various integration points of other systems of building;
 - .4 genset enclosure;
 - .5 enclosure accessories and components;
- .2 Include following with shop drawings:
 - .1 full design detail drawings and layouts, including dimensions of complete generator set mounted inside enclosure and associated major components;
 - .2 wiring schematics;
 - .3 electrical characteristics;
 - .4 power data;
 - .5 equipment capacities;
 - .6 fuel consumption data;
 - .7 integrated systems;
 - .8 a point by point description of control system software sequence of operation:
 - .1 Automatic starting and transfer to load and back to normal power, including time in seconds from start of cranking until unit reaches rated voltage and frequency.
 - .2 Manual starting.
 - .3 Automatic shut down on:
 - .1 Overcranking
 - .2 Overspeed
 - .3 High engine temp
 - .4 Low lube oil pressure
 - .5 Short circuit
 - .6 Lube oil high temperature
 - .7 Low coolant level
 - .8 Low coolant temperature
 - .4 Manual remote emergency stop.
 - .9 Manufacturer's certification of prototype testing.
 - .10 Manufacturer's published warranty documents.
 - .11 Interconnection wiring diagrams showing all external connections required; with field wiring terminals marked in a consistent point to point manner.

.12 Manufacturer's installation instructions.

1.2 **TYPICAL DETAILS**

.1 Refer to typical details found on drawings for references to products and/or execution required in this Section.

1.3 **WARRANTY**

.1 Provide a written guarantee stating that the genset is warranted against defects in material and workmanship for a period of two (2) years or 1500 operating hours, whichever comes first, from the date of the Final Certificate of Completion.

.2 Include for 24 hours around clock service by manufacturer/supplier.

.3 Include with warranty, following:

.1 first year routine maintenance service including parts and labour;

.2 at least one complete oil and filter change;

.3 manufacturer's recommended maintenance and servicing to maintain validity of warranty.

1.4 **NOISE AND EMISSIONS APPLICATIONS**

.1 Coordinate with emissions Consultant and provide necessary technical data and assistance for obtaining required approvals and/or certifications from and/or registration with Ministry of Environment (MOE) for Environmental Compliance Approval.

2 Products

2.1 **ENGINE GENERATOR SETS-GENERAL**

.1 Engine generator sets (gensets) to be factory assembled and tested, radiator cooled, natural gas engine driven electric gensets including necessary controls and accessories as outlined herein, to comprise a continuous, standby electric generating plant for operation in conditions stipulated below. Gensets to be equipped with necessary operating accessories such as radiator fan, lubricating oil pump, governor, alternating current generator and other specified and required engine driven components and accessories.

.2 Genset shall comply with specification requirements and drawing requirements, and which may be customized to meet herein specified requirements.

.3 All components shall be CSA and/or ULC approved listed and labelled. Gensets to be constructed to and to perform in accordance with local governing authority enforced edition of CSA Standard CAN/CSA C282, "Emergency Electrical Power Supply of Buildings".

.4 Where requirements of preceding standards and specification are in variance, more stringent requirement is to apply unless otherwise approved by Consultant.

.5 Genset emissions to meet required EPA exhaust Tier limits based upon engine maximum horsepower rating and any other required Ministry of Environment regulations.

- .6 Gensets to comply with mechanical systems base design parameters (ie. fuel consumption, cooling operating data, air/exhaust operating data, etc.) to ensure that design minimum standards and performance criteria for units are met. Review room dimension and layouts and ensure that proposed gensets and associated equipment can be accommodated and also allow for sufficient space for maintenance, repairs, and safety as per applicable code requirements. Advise Consultant of any changes due to manufacturer's changes in equipment, and/or changes in manufacturers. Be fully responsible for provision and co-ordination of a designed solution that can meet design intent, space limitations, and performance requirements with no additional costs to Contract. Co-ordinate changes with Mechanical Division, as required.
- .7 Base designed performance criteria include:
 - .1 cooling system airflow (max. @ rated speed for radiator arrangement): 285.4 m³/min;
 - .2 exhaust system combustion air inlet flow rate: 12.8 m³/min;
 - .3 exhaust system exhaust gas flow rate: 45.4 m³/min;
 - .4 heat rejection to coolant: 788 Btu/hr;
 - .5 coolant capacity with radiator: 71.9 litres.
- .8 Ensure that genset driven radiator fan is capable of overcoming a minimum of 0.5" water column pressure drop in an ambient temperature of 40°C (104°F). Be responsible for reviewing complete air intake and exhaust system design with regards to air restrictions and if required, provide oversized fans with blades of extra strength to overcome additional pressure drop through fresh air intake, discharge silencers, and other related factors, as applicable. Identify clearly on shop drawings that this requirement has been met.
- .9 Where eventual supplied genset(s) provides performances that are different from base designed genset, and such differences exist only due to differences in product manufacturers, be responsible for providing required revisions, i.e. increasing sizing of exhaust piping, air dampers, etc., and related architectural and structural changes. At shop drawing submission stage, submit detailed genset performance data to Mechanical Division contractor to confirm mechanical equipment sizing and to make necessary revisions. Be responsible for costs for such revisions.
- .10 Genset ratings:
 - .1 Rating of engine generator is as noted on drawings, which is at 0.8 power factor and includes 10% overload.
 - .2 Rating to be nameplate rating.
 - .3 Capable of operating at 100% of nameplate rating at rated RPM in an ambient temperature of 50°C (122°F) without overheating, or suffering any other detrimental effects, at rated generator RPM when set is equipped with necessary operating accessories.
 - .4 Capable of handling a single full load step for nameplate kilowatt rating within voltage and frequency regulation requirements of CSA 282/CSA Z32 without stalling and without voltage dropping below 60% of nominal.
- .11 Genset to meet frequency and voltage performance requirements specified in CSA 282.
- .12 Genset to be fully integrated to comprise a standby power system which automatically does following:
 - .1 start in event of a commercial power failure;
 - .2 stop when commercial power has been restored;

- .3 be capable of operating at light loads for an extended period of time as normal power failure may occur when only part of full output of genset is required;
- .13 Moving parts such as flywheels, pulleys, belts, etc., to be enclosed with suitable guards to protect persons from injury. Guards to be easily removable for servicing equipment and are to comply with local governing authority and code requirements.
- .14 Genset supplier to obtain torsional approval of entire assembly from engine manufacturer. Align and mount genset on a common fabricated steel base of sufficient rigidity to maintain adequate alignment. Set manufacturer to supply adjustable steel spring vibration isolators. Include also for seismic restraints to comply with local governing authority and code requirements. Provide torsional vibration analysis and critical vibration analysis of genset and submit results to Consultant for review.
- .15 Genset manufacturer to review engine exhaust system design and confirm in writing that back pressure will not impair operation and output of sets. Forward a copy of confirmation letter to Consultant.
- .16 Genset supplier is responsible for but not limited to provide following:
 - .1 genset(s) and control panels;
 - .2 system sequence of operation complete with software;
 - .3 coordination with other trades and systems to ensure proper integration;
 - .4 genset and full systems demonstration, testing and verification work;
 - .5 operating and maintenance instructions.
- .17 Arrange for supplier to review electrical distribution system and ensure that genset grounding provisions are compatible and meet local governing electrical code requirements.

2.2

ENGINES

- .1 The prime mover shall be liquid cooled, turbocharged after-cooled engine. The prime mover shall be liquid cooled, natural gas fuelled, internal combustion engine. The 150KW unit shall have a minimum displacement of 14.2 L.
- .2 Engines to be a multi cylinder, 4-cycle, engine capable of operating at a nominal speed of 1800 RPM when directly connected to generator and free from critical vibrations throughout its entire operation range. Engines to operate satisfactorily on natural gas fuel and produce specified rated output.
- .3 The engine is to be water cooled with a unit mounted radiator, fan (with guard), water pump, and closed coolant recovery system providing low coolant level alarm. The radiator shall be designed for operation in 40 degrees Celsius ambient temperature.
- .4 Full pressure lubrication shall be supplied by a positive displacement lube oil pump. The engine shall have a replaceable oil filter(s) with internal bypass and replaceable element(s).
- .5 The engine shall have (a) unit mounted, thermostatically controlled water jacket heater(s) to aid in quick starting. The wattage shall be as recommended by the manufacturer. The contractor shall provide proper branch circuit from normal utility power source.
- .6 Equip engines with individual safety devices to shut down engine and to sound an alarm in event of conditions specified in this Section. Provide contacts to pre-alarm for conditions specified in this Section. Refer to control panel requirements specified elsewhere in this Section and requirements as detailed on drawings for additional requirements. Provide sensors to connect to electronic controls to monitor and display various engine performance characteristics.

- .7 Sensing elements to be located on the engine for:
 - .1 Low oil pressure alarm/shutdown
 - .2 High coolant temperature alarm/shutdown
 - .3 Low coolant level shutdown
 - .4 Overspeed shutdown
 - .5 Overcrank shutdown
 - .6 Emergency stop shutdown
 - .7 Low coolant temperature alarm
 - .8 Low battery voltage alarm
 - .9 High battery voltage alarm
 - .10 Control switch not in auto alarm
 - .11 Battery charger failure alarm.
- .8 Sensors are to be connected to the control panel using a wiring harness, each connector to be sealed to prevent corrosion and all wiring to be run in flexible conduit for protection from the environment and any moving objects.
- .9 Engine speed shall be controlled by isochronous governor, regulated during steady state operation to +/- 0.2 Hz.
- .10 Generator set shall be capable of accepting a block load of 100% of nameplate rating block load.
- .11 Generator set performance shall meet the requirements of CSA282 latest edition, as applicable.
- .12 Equip engines with 12/24 volt D.C. electric starting motors, with starting pinion arranged to disengage automatically when respective engine starts.
- .13 Filters on air intake to engine are of dry element type with replaceable elements.
- .14 An integral shock isolated mounted emergency lock out stop pushbutton, oil temperature gauge, oil pressure gauge and engine coolant temperature gauge are provided on engine.
- .15 Engine mounted accessories are readily removable without dismantling engine alternator, or any other accessories.
- .16 Provide lube oil level gauge switch on side of oil pan in easily accessible location.

2.3

ALTERNATORS

- .1 Alternator features include following:
 - .1 Voltage rating as noted on drawings;
 - .2 2/3 pitch;
 - .3 maximum total harmonic distortion of voltage waveform is not to exceed 5.0% under any given load;
 - .4 excitation boost not less than three (3) times rated current for 10 seconds;
 - .5 photosensitive components will not be permitted in the rotating exciter;

- .6 direct connected brushless exciters; rotating brushless permanent magnet pilot exciter to provide power via automatic voltage regulator to main exciter, and with dynamically balanced rotor permanently aligned to engine by SAE flexible disc coupling;
 - .7 full amortisseur windings;
 - .8 windings of Class H rating;
 - .9 temperature rise standards for Class "H" insulation;
 - .10 operate within Class "F" standards for extended life;
 - .11 all leads must be extended into an AC connection panel;
 - .12 grounding provisions to suit electrical distribution system;
 - .13 generator mounted space heater.
 - .14 meet or exceed CSA 22.2 No. 100, EEMAC MG 122 and current IEEE Standards;
- 2 Voltage regulation systems are to maintain regulation within limits previously specified and include regulator and manual voltage adjustment potentiometer. Regulator to be a Basler type SR4 or Newage-Stamford no. MX321 or equivalent as recommended by genset manufacturer, static voltage regulator with 3 phase sensing, radio suppression module, frequency choke to prevent damage to voltage regulator in case of lower than nominal engine speed, and adjustable stability circuit.
- 3 Equipment is designed to minimize Radio Frequency Interference (RFI) under all operating conditions. "Balanced Telephone Influence Factor" (TIF) is not exceed fifty (50).
- 4 Extend alternator ground out to base.
- 5 Alternator is equipped with Resistor Temperature Detectors (RTD) type thermistors complete with required relays/contacts as required to send trouble signal to control panel. Control panel to monitor warning signal of high temperature of windings.
- 2.4 **ENGINE EXHAUST SYSTEM**
- .1 The exhaust silencer(s) and flexible, seamless, stainless steel exhaust connection shall be mounted inside the enclosure.
 - .2 Silencer shall be provided of the size as recommended by the manufacturer and shall be of sufficient grade to meet overall enclosure dBA rating. All other hardware, for the rest of exhaust system to be provided by contractor.
 - .3 All components must be properly sized to ensure operation without excessive back pressure when installed.
 - .4 Be responsible for coordination with mechanical trades, exact silencer and exhaust system design requirements to comply with local governing noise and emission regulations. Height of stack to be provided to suit local air and noise limitations.
 - .5 Ensure that Mechanical Division provides fittings, offsets, transformations and similar items as a result of obstructions and other Architectural or Structural details whether shown or not on drawings.

2.5 **JACKET COOLANT HEATERS**

- .1 Engine jacket coolant heaters to be complete with silicone hoses, immersion type thermostats, pressure switches and ball type-isolating valves on engine water connections. Size of heaters to be sufficient to maintain coolant in engine at genset manufacturer's rated temperature requirements with unit operating at rated loads and conditions (approximately 6 kW, per engine at 208 V, 1-phase. Confirm with genset vendor and revise to suit).
- .2 Jacket heaters to be automatically disconnected when engines are running via engine run relay.
- .3 Heaters to be KIM "Hotstart" or approved equal, that connect to each engine with high temperature coolant rubber hoses and clamps, specifically used for and approved by governing authorities for such applications.

2.6 **COOLANT SYSTEM**

- .1 Cooling system for engines consists of unit mounted air water radiator system with protective screen and a 50% water/50% ethylene glycol coolant solution. Radiator is equipped with integral fuel cooler complete with fuel lines, power conductors, control conductors, and ancillary devices as required.
- .2 Thermostat maintains coolant temperature at manufacturer's rated temperature with genset operating at rated load. Radiator is sized to maintain these conditions and is complete with high performance static pusher fan, fan motors, radiator core guard, duct adapter flange, mounting frame, expansion tank, thermostatic controls, disconnect switch, a suitable open mesh fan guard and shroud.
- .3 Gate drain brass ball valves are provided for draining coolant from each engine block and radiator. Wire braided hoses, piping and fittings to be silicone and are to extend into drain containment pan under genset.

2.7 **STARTING SYSTEM**

- .1 Supply a complete starting system for engine, including:
 - .1 cranking starter motors;
 - .2 batteries;
 - .3 battery disconnect switch;
 - .4 battery heater;
 - .5 battery stand with insulation board;
 - .6 battery cable;
 - .7 battery chargers;
 - .8 cranking motor cut-out switch (crank for three (3) attempts with intervening periods during a period of no less than 45 seconds and no more than 75 seconds).
- .2 Batteries features include:
 - .1 fully sealed, long life lead acid;
 - .2 Exide, Delco, Surette or equivalent with sufficient capacity in an ambient room temperature of 0°C (32°F) to crank each unit at engine manufacturer's recommended cranking starting speed for a period of 60 seconds;
 - .3 voltage measured at starting motor terminals at end of cranking period specified above, with cranking current flowing, to not be less than 1.75 volts per cell;

- .4 sized on basis of engine and battery manufacturer's published data;
- .5 type and performance ratings as recommended by genset supplier and approved by Consultant to best meet starting requirements of specified genset.
- .3 Submit shop drawings and reasons to substantiate choice of batteries.
- .4 Batteries to be provided on a floor standing, corrosion resistant finished, steel rack, complete with following:
 - .1 hydrometer;
 - .2 syringe;
 - .3 jumper cables;
 - .4 mounting bracket for accessories;
 - .5 plywood base;
 - .6 PVC tray.
- .5 Battery chargers to be Mechron, Vulcan Electric Ltd. or equivalent as recommended by genset supplier, with features as follows:
 - .1 remote wall mounting, totally enclosed enclosure;
 - .2 fully automatic operation;
 - .3 operating voltage of 115 volt, 60 cycle AC;
 - .4 an AC switch and overload protection isolating voltage ratio transformer, silicon controlled rectifier assembly and DC protection, all suitable for two (2) rates of charging (trickle charge and high rate of charge for use after engine start);
 - .5 DC ammeter and DC voltmeter gauges, each with 2% accuracy;
 - .6 AC power "on" indicating light;
 - .7 AC power failure alarm;
 - .8 float voltage adjustment;
 - .9 equalize circuit;
 - .10 overload protection;
 - .11 DC output protection;
 - .12 maximum charge rate to suit application;
 - .13 necessary contacts for connection of common alarm signal to control system.
- .6 Battery chargers to recharge a battery discharged by two cranking cycles (30 seconds each) to 80% of capacity within 4 hours and to full capacity in maximum 12 hours.

2.8 ENGINE GENERATOR MOUNTINGS

- .1 Engine flywheel housing to be connected rigidly to generator housing with an SAE adaptor. Unit to be mounted on a common, heavy duty, stress relieved, fabricated steel baseplate. Torsional approval of entire assembly to be obtained and submitted in duplicate to Consultant for review. Report to also outline critical speeds of assembly.
- .2 Baseplates to be of sufficient rigidity to maintain alignment of engine generator shafts and frames under all conditions during shipping, installation and service and be of all welded construction without bolt on components.
- .3 Engine generator feet and baseplate sole plates to be machined parallel and true. Shimming to be of steel type and only be permitted underneath generator feet.

- .4 Genset supplier to obtain torsional approval of entire assembly from engine manufacturer. Align and mount genset on a common fabricated steel base of sufficient rigidity to maintain adequate alignment. Set manufacturer to supply adjustable steel spring vibration isolators. Include also for seismic restraints to comply with local governing authority and code requirements. Provide torsional vibration analysis and critical vibration analysis of genset and submit results to Consultant for review.

2.9 **UNIT MOUNTED CONTROL PANELS**

- .1 Control panels consist of a microprocessor based controller with LCD displays featuring multiple metering displays and graphics, with full options and features as specified herein, and is suitable for operating on system voltage rating noted on drawings, with short circuit capacities to suit maximum short circuit output of alternator.
- .2 Control panel in enclosure is unit mounted on I-beam support base, vibration isolated from genset, and is complete with monitoring devices, meters, indicators, display and interconnecting/interfacing devices. Digital metering and displays are mounted at eye level. Control panel enclosure is painted with enamel to match genset finish.
- .3 Controls and monitoring include but are not be limited to following components:
- .1 under frequency/over voltage control module with adjustable relay to trip main breaker on settings of $\pm 12\%$ of normal;
 - .2 ammeter $\pm 1\%$ accuracy;
 - .3 voltmeter $\pm 1\%$ accuracy;
 - .4 power factor meter;
 - .5 frequency meter $\pm 1\%$ accuracy;
 - .6 elapsed time $\pm 1\%$ accuracy;
 - .7 engine gauges for oil temperature, oil pressure and engine coolant temperature;
 - .8 kW meter $\pm 1\%$ accuracy;
 - .9 control system to initiate genset starting and stopping sequence, and annunciate any fault condition (local or remote indication); an electronic control module monitors and provides digital display of genset functions; an operator interface alpha numeric display provides for viewing of genset data and provides setup, controls and adjustments; a LED bar graph AC data display or approved equivalent is included;
 - .10 engine selector switch for "OFF AUTO MANUAL" operation; operation of engine in manual position, when selected, bypasses automatic control system and causes an alarm to occur; switch in "OFF" position causes an alarm to occur; switch in either "OFF" or manual position causes amber indicator lamp identifying "NOT IN AUTO" to illuminate when alarm occurs;
 - .11 alarm horn with silencing button, and an annunciator to flash when any audible alarm is silenced until trouble has been cleared and reset;
 - .12 miscellaneous controls as shown on drawings and as required including voltage and speed control, emergency stop, fault reset, lamp test, engine start, engine stop and indicating lights;
 - .13 engine alarm and shut down lamps with signals for conditions specified later in this Section and/or as shown on drawing and as required by local governing authorities having jurisdiction; provide engraved lamacoid identification nameplate for each lamp; provide panel with lamp test button;

- .14 required secondary and control wiring, type "TEW" 105°C rated, extra flexible wire with thermoplastic insulation and an overall flame retarding cotton braid, neatly harnessed, suitably secured and identified with slip on identification markers; Wiring to be colour coded to suit application and standards; wiring for DC supply to control panel, wiring for cranking circuits and wiring for air box damper to be minimum number 10 AWG stranded; wiring within control panel to be number 16 AWG stranded; and wiring between control panel and engine generator set and transfer switch to be number 14 AWG stranded; provide separate junction boxes for AC and DC wiring;
 - .15 ground fault relay to alarm on control panel in event of a ground fault on windings of generator; current sensor to be mounted in generator connection box, and generator leads to pass through zero sequence circuit in connection box ; no internal ground connection in generator is permitted, and an annunciator light to be provided on control panel face to indicate operation of this device; ground fault setting to be determined by genset manufacturer to suit specific application;
 - .16 current transformers as required of appropriate size for local metering;
 - .17 current transformers as required for electronic governor;
 - .18 24 volt DC control system with fusing centrally located;
 - .19 required potential transformers;
 - .20 auxiliary contacts on all devices to allow for functions required in controls system and interconnection to integrated systems such as fire alarm and building automation system;
 - .21 other components as shown on drawings and as required.
- .4 Breakers mounted in control panel integral with genset include following features:
- .1 moulded case type main breaker: Fixed mounted moulded case circuit breaker as shown on drawings and as required, with solid state adjustable trip unit. In absence of direction, size and ampacity of breaker to be to suit application based on code requirements and genset manufacturer's recommendations. Breaker setting to be such that generator short circuit output will trip breaker. Trip unit to include adjustable long, short, instantaneous, time delay and ground fault alarming. Exact settings to be determined by genset manufacturer to meet specific applications. Exact breaker type to be as recommended by breaker and genset manufacturer to meet such applications and be approved by Consultant;
 - .2 power air circuit type main breaker: Eaton 'Magnum DS' type or equivalent Schneider 'Masterpact NW' or Siemens 'RL' type, fixed mounted electrically operated air circuit breakers as shown on drawings and as required, with solid state adjustable trip unit. In absence of direction, size and ampacity of breaker to be to suit application based on code requirements and genset manufacturer's recommendations. Breaker setting to be such that generator short circuit output will trip breaker. Trip unit to include adjustable long, short, instantaneous, time delay and ground fault alarming. Exact settings to be determined by genset manufacturer to meet specific applications. Exact breaker type to be as recommended by breaker and genset manufacturer to meet such applications and be approved by Consultant;
 - .3 moulded case load bank breaker: Non automatic type, of same frame size as main breaker, to be provided interconnected to system to allow for connection of a load bank during regular testing of genset; provide shunt trip and relays as required to interconnect in manner such that if load bank breaker is closed and loss of normal power occurs, load bank breaker will open and main genset breaker will close;

- .4 fire pump breaker: Moulded case type with solid state trip unit; refer to drawings;
- .5 auxiliary automatic breaker (typically 30A-3P, but refer to drawings for exact requirements) to feed damper controls; confirm exact requirements with Consultant prior to ordering.
- .5 Electronic controls to be capable of monitoring various engine performance characteristics including, but not limited to, following:
 - .1 oil and fuel temperature;
 - .2 timing of engine;
 - .3 coolant pressure and level;
 - .4 oil and fuel pressure;
 - .5 running hours;
 - .6 air temperature;
 - .7 battery voltage;
 - .8 engine overspeed.
- .6 Provide controls, contacts and annunciation of shut downs (red) and warnings (amber) alarms for following conditions, conditions as per applicable CSA Standards and conditions as detailed on drawings:
 - .1 high oil temperature – red;
 - .2 high oil temperature warning – amber;
 - .3 high coolant temperature – red;
 - .4 low oil pressure warning – amber ;
 - .5 low oil pressure – red;
 - .6 overcrank – red ;
 - .7 overspeed – red;
 - .8 over voltage – red;
 - .9 low DC voltage – amber (alarm lamp complete with DC voltage sensor);
 - .10 cool down period – white;
 - .11 reverse power – red;
 - .12 undervoltage – red;
 - .13 low frequency – red;
 - .14 high frequency – red;
 - .15 low coolant level – amber;
 - .16 low fuel level – amber;
 - .17 battery charger failure – amber;
 - .18 water in fuel – amber;
 - .19 emergency bus alive – blue;
 - .20 generator bus alive – amber;
 - .21 ECS not in auto – amber;
 - .22 low engine temperature – amber;

- .23 alarm silence – amber;
- .24 alternator winding and bearing high temperature – amber;
- .25 fuel leakage – amber;
- .26 ground fault – amber;
- .27 ancillary building alarms as required;
- .28 two spares for future.
- .7 Utilize high brilliant cluster type LED's for indicating lights that are continuously illuminated "ON".
- .8 Provide required type of contacts, wiring and connections to auxiliary building systems for applications as noted in Part 3.
- .9 Provide engraved lamacoid nameplate of each control operator, device, and indicating light. Obtain Consultant's approval of exact nomenclature.
- .10 Designer/manufacturer of entire control system is required to:
 - .1 supply complete design, erection and layout drawings for system, indicating all wiring requirements, interfacing or interconnection provisions required to completely integrate controls with all remote apparatus;
 - .2 assemble, wire and pre-test system components prior to shipment to site; such tests to be witnessed by Consultant at their discretion; all defects noted and corrected, and system retested prior to leaving plant;
 - .3 assist in installation and oversee work to ensure that it meets with requirements;
 - .4 carry out a site test of system in conjunction with other components in standby power system and demonstrate its power operation to satisfaction of Consultant.

2.10 **ADDITIONAL ENGINE GENERATOR SET REQUIREMENTS**

- .1 Supply with engine generator set, a soldered galvanized steel drip pan to be placed beneath engine to catch any leakage from set.
- .2 Supply tools and spare parts required for normal maintenance and adjustment of genset, including:
 - .1 one (1) complete set of fuel oil filter elements complete with gaskets;
 - .2 one (1) complete set of lubricating oil filter elements complete with gaskets;
 - .3 one (1) complete set of air filters;
 - .4 two (2) complete sets of spare fuses;
 - .5 two (2) complete sets of spare lamps for all indicating and warning lights;
 - .6 one (1) complete set of spare belts;
 - .7 one (1) steel cabinet for storage of manuals and spare parts; cabinet to be wall mounting complete with shelves, hinged doors, lock and key set.
- .3 Submit sound pressure levels for engine generator set to Consultant for review and acceptance, prior to units being shipped to site.
- .4 After on-site successful testing, touch up paint genset(s) with manufacturers supplied paint. An additional one (1) litre of touch up paint must be shipped loose with each unit and turned over to Owner. Paint control panel with corrosion resistant enamel paint to match genset finish. Note: exact finishes are to be confirmed with Consultant prior to ordering of paint.

- .5 Genset manufacturer/supplier is responsible for factory testing and on-site testing of genset, as specified in Part 3 of this Section.
- .6 Include costs for provisions to duct/drain/filter all waste emissions/leaks, to satisfaction of Consultant. Under no circumstances are waste emissions or waste fluids to be released into room. Provide proper ducting/piping/filtering.

2.11 **GENSET ENCLOSURE**

- .1 "Skin-tight" type genset enclosure to be provided to house genset complete with silencers, control panel, batteries and accessories. General features include but are not limited to following:
 - .1 outdoor, weatherproof, corrosion resistant;
 - .2 sound attenuated;
 - .3 non-combustible fire-rated construction designed to required local governing authority and code requirements;
 - .4 heavy duty aluminium outer skin over heavy duty steel framework construction and primed and finished with corrosion resistant paint finish;
 - .5 sound insulated panels;
 - .6 exhaust silencer;
 - .7 dry type distribution transformer and breaker panelboard, sized to accommodate loads of enclosure components requiring power feeds; factory prewired breaker panelboard to be 120/208 VAC with main breaker and branch breakers for feeding genset and enclosure components and accessories; include three (3) additional spare 15A-1P breakers installed in panel;
 - .8 locking access panels;
 - .9 flexible coolant and lubricating oil drain lines, that extend to exterior of enclosure, with internal drain valves;
 - .10 external radiator fill provision;
 - .11 radiator guard;
 - .12 heavy duty steel beam mounting base;
 - .13 insulated ventilation louvers and dampers;
 - .14 insulated enclosure with non-hydroscopic materials;
 - .15 pitched roof;
 - .16 corrosion resistant stainless steel door hardware, hinges and locks;
 - .17 locking compartments for storage of manuals, spare parts and tools;
 - .18 warning signs;
 - .19 vandal proof construction;
 - .20 finish painted in colour as approved by Consultant;
 - .21 GFI receptacles inside enclosure, and a weatherproof GFI receptacle on outside of enclosure;
 - .22 switches controlling AC lamps mounted in vapour tight and gasketed fixtures;
 - .23 switched controlled vapour tight, gasketed DC light connected to main batteries, provide 60 minutes adjustable timer;

- .24 external AC weatherproof and vandal proof HID type fixture with photocell control over panel access door;
 - .25 thermostatically controlled forced air internal heater to keep interior temperature at minimum temperature as per CSA C282;
 - .26 exhaust fan for internal high temperature heat removal from enclosure and include modulating thermostat control;
 - .27 emergency power off (EPO) station consisting of minimum 38 mm (1-1/2") diameter mushroom head, mounted in weatherproof enclosure with break glass cover for emergency access and locking operator for authorized access; typically mount recessed or semi-recessed in exterior wall of enclosure at each walk-in door; lock operator to be keyed to Owner's requirements; provide "EMERGENCY POWER OFF" identification lettering; confirm exact nomenclature with Consultant prior to ordering;
 - .28 storage cabinet for O&M manuals and spare parts;
 - .29 seismic restraints as required by local governing building code;
 - .30 emergency power off (EPO) station consisting of minimum 38 mm (1-1/2") diameter mushroom head, mounted in weatherproof enclosure with break glass cover for emergency access and locking operator for authorized access; typically mount recessed or semi-recessed in exterior wall of enclosure at each walk-in door; lock operator to be keyed to Owner's requirements; provide "EMERGENCY POWER OFF" identification lettering; confirm exact nomenclature with Consultant prior to ordering.
- .2 Enclosure to meet applicable codes and standards enforced by local governing authorities, including but not limited to:
- .1 CSA C282;
 - .2 ULC Standards;
 - .3 local applicable building codes;
 - .4 local applicable electrical codes;
 - .5 Technical Standards and Safety Authority (TSSA).
- .3 Enclosure assembly to be designed such that genset components needing routine maintenance and servicing are easily accessible from access doors. Access doors to be locking, hinged type with retainers to hold doors open during service.
- .4 Intake and exhaust louvers to be located at height to minimize effects from flood waters and accumulated snow levels. No roof penetrations except for exhaust stack.
- .5 Provide motorized intake louvers to minimize air flow through enclosure when generator set is not operating. Louvers to include provisions to prevent accumulation of ice or snow that might prevent operation. Louvers to be spring open, power close operation.
- .6 Enclosures to include weatherproof cable stub and openings for connection cabling through underside of base. Provide load bank cabling entry and temporary genset connections via openings with flexible boots behind a gasketed locking hinged door. Boots to prevent egress of any precipitation into enclosure when cables are run into enclosure. Exterior components and parts to be corrosion resistant and weatherproof. Coordinate location of cable access openings to suit structural base. Provide cable connection box with copper bussing.
- .7 Sound-attenuated housing rated to allow generator set to operate at full rated load in an ambient temperature of up to 40°C (104°F).

- .8 Acoustics:
 - .1 Maximum permissible sound emissions criteria for enclosure at engine full load rating to be net 70 dBA at 7m (23') including provisions for reverberations from neighbouring walls.
 - .2 Selection of silencer (muffler) to be coordinated with design of enclosure to meet sound level requirements.
 - .3 Submit with shop drawings, certification letter from a recognized acoustical authority certifying factory testing acoustical performance of enclosure housed genset, with genset operating at full load rating in accordance with specification requirements.
 - .4 Include for a qualified acoustical engineer to perform an acoustical field test during onsite genset testing, to certify performance and provide documented test report. Measure noise levels at 10 different locations as coordinated by Consultant.
 - .5 Obtain and submit required approvals from local governing authorities having jurisdiction.
 - .6 Materials of construction to be to general accepted trade standards unless more stringent requirements are required by any recent codes or regulations by local governing authorities. Ensure that most recent applicable standards are met.
- .9 Provide complete grounding and bonding conductor system in compliance with code requirements, complete with conductors from equipment and exterior ground rods or for connection to main building grounding system. Refer to Section entitled Grounding and Bonding for additional grounding and bonding requirements.
- .10 Engine exhaust system features are as follows:
 - .1 Engine exhaust system to be full factory installed within enclosure and consists of lengths of flexible stainless steel exhaust pipe, flange, and exhaust silencers. Size length of flexible piping for thermal expansion and engine vibration and to suit enclosure height restriction. Silencers to be based on Silex "Hospital Plus" series JDDPR type to provide highest degree of noise reduction and to suit respective size of genset and to be coordinated with enclosure design to suit spacing and overall noise criteria. Both flexible pipe and silencer to be suitable in all respects for application and be as recommended by genset supplier. Acceptable manufactures of silencers are Silex Inc., Vibron Ltd., Nelson, and Maxim.
 - .2 Custom manufacturer heavy duty steel exhaust flange to extend from silencer to roof thimble. Exhaust system exhausts out of enclosure roof through an insulated roof thimble designed for application and with weatherproof sealed pre-fabricated flashed roof curb. Thimble to be of heavy duty galvanized steel corrosion resistant construction.
 - .3 Terminate exhaust pipe flange minimum 450 mm (18") above roof line and top with required temporary weatherproof cap. Exhaust stack stub assembly to be capable of supporting an on-site installation of a vertical exhaust stack up to 10' (3m) high. Provide guy wires as required for proper support. Interior exhaust piping to be insulated with Rockwool type insulation suitable for application. Exact height of exhaust stack to suit MOE Certificate of Air and Noise Approval criteria coordinated with noise and emissions consultant and drawing requirements.
 - .4 Coordinate routing, dimensions, and configuration of exhaust system with enclosure dimension restrictions and equipment layout as detailed and as noted.

- .5 Ensure that exhaust stack is positioned in location such that emissions do not become drawn into enclosure during operation.
- .6 Where required to suit exhaust configuration of respective gensets, provide properly sized black steel pipe welded "Y" connector.
- .11 Lightning protection requirements to at least include:
 - .1 system components to be extension of roof/building system;
 - .2 16 mm (5/8") diameter solid copper air terminals; of lengths to suit application;
 - .3 25 mm (1") x no. 17 gauge copper grounding straps;
 - .4 minimum 4 ounce braided stranded copper "lightning conductor" down lead conductors;
 - .5 minimum 20 mm (3/4") diameter and minimum 3 m (10') long (sectionalized 1.2 m (5') lengths) circular cross section copper bond type ground rods;
 - .6 inspection pit with test coupling, earth equipotential bar, die cast brass connectors, die cast brass clamps and ground rods;
 - .7 ancillary devices as required.
- .12 Fire alarm provisions:
 - .1 Enclosure to include provisions of empty conduits with fish cord and boxes for installation of future detectors and associated fire alarm devices provided by main building fire alarm vendor. Coordinate work with fire alarm vendor.
 - .2 Provide fire extinguishers of CO2 type, minimum 10 pounds (4.5 kg), and mounted within enclosure. Exact type of fire extinguisher to be as recommended by genset vendor to suit application. Provide mounting bracket and install on interior wall adjacent door. Include identification label on outside of door identifying location of extinguisher.
- .13 Access and security signs:
 - .1 Corrosion resistant, weatherproof and resistant to fading from sunshine.
 - .2 Red lettering on a white background.
 - .3 Permanently affixed.
 - .4 Nomenclature to be confirmed with Consultant prior to manufacturer.
- .14 Testing, Start-up, Verification and Training:
 - .1 Perform standard factory testing as specified in Part 3 and submit copy of detailed reports to Consultant for review.
 - .2 Onsite after installation inspection, testing, start-up, and verification to be as specified in Part 3. Assist installing Contractor in installation of equipment and to inspect installation, test equipment, perform start-up and verify equipment. Coordinate work with Contractor.
 - .3 Be present to assist during third party testing.
 - .4 Perform testing at times coordinated with Consultant.
 - .5 Provide instructions on system operating and maintenance.
- .15 Acceptable enclosure manufactures are as recommended by genset vendors/suppliers.

2.12 **TESTING, START-UP, VERIFICATION AND TRAINING**

- .1 Refer to Part 3 for additional requirements.
- .2 Assist installing Contractor in installation of equipment and to inspect installation, test equipment, perform start-up and verify equipment. Coordinate work with Contractor.
- .3 Be present to assist during third party testing.
- .4 Perform testing at times coordinated with Consultant.
- .5 Provide instructions on system operating and maintenance.

2.13 **ACCEPTABLE MANUFACTURERS/SUPPLIERS**

- .1 Selected engine-generator sets to be provided from listed approved genset suppliers and be packaged sets that are factory assembled, factory type tested and warranted together.
- .2 Acceptable genset suppliers are:
 - .1 Cummins Eastern Canada LP;
 - .2 Toromont Cat. Ltd.;
 - .3 Kohler Co.;
 - .4 Generac.
- .3 Acceptable alternator manufacturers are:
- .4 Acceptable engine manufacturers are:
 - .1 Cummins;
 - .2 Caterpillar;
 - .3 MTU – DDC.
- .5 Main breakers to be of same manufacturer as accepted switchboard supplier of Section entitled Secondary Switchboards to maintain continuity of supply for standardization.
- .6 Products to be provided must be CSA approved and labelled, or inspected and approved by Electrical Safety Authority.

2.14 **LOAD BANK CONNECTION BOX**

- .1 Load bank box to be provided to accommodate easy exterior connections to emergency power distribution system and to be as detailed on drawings and as follows:
 - .1 CSA approved, minimum NEMA 3R weatherproof steel construction, with corrosion resistant enamel finish of colour to Consultant's direction;
 - .2 with hinged gasketed door with 3-point latch and key lock with provisions for safety padlocks; key can only be removed when door is closed and locked;
 - .3 conduit entries with proper bushings and sealed to prevent egress of precipitation;
 - .4 tin plated copper bussing for cable tap off provisions with holes in each bus to accommodate feeders from distribution system; each lug on feeders to be dual annular crimped, long barrel and two hole type, bolted to bussing with 13 mm (1/2") bolts with lock washers, nuts and flat washers; bus to be angled to properly facilitate connection of cabling;
 - .5 temporary cable connections to include minimum 8-13 mm (1/2") diameter holes in each buss to accommodate single hole lugs;

- .6 provide engraved lamacoid nameplate and signage on enclosure with appropriate instructions regarding use; submit proposed scheme and nomenclature with shop drawings.
- .2 Mounting requirements to be coordinated with Consultant to suit wall construction where box is to be installed. Obtain direction from Consultant whether box is to be surface or flush mounted. Where flush mounted include flush trim.
- .3 Complete assembly to be approved by local governing electrical authorities and suitable for intended application.

3 Execution

3.1 **INSTALLATION OF GENSET**

- .1 Prior to start of Work, prepare schedule of Work and submit to Consultant for review. Manufacturer/supplier to upon successful factory witness testing of unit, arrange and coordinate delivery and transporting of unit to site.
- .2 Perform a factory test of engine generator sets prior to delivery to job site. Include for and arrange for Owner and Consultant to witness factory tests and schedule tests at a time acceptable to Owner and Consultant. Include "out of town" expenses such as transportation, lodging, meals, etc., for Owner and Consultant to witness factory testing. Notify Owner and Consultant at least two (2) weeks in advance of tests. Should additional tests be required due to failure to comply with conditions specified in this article, costs (all travel expenses, accommodation if required, plus seven hundred and fifty dollars [\$750.00] per day) for Consultant to witness these additional tests are to be borne by genset manufacturer/supplier. genset manufacturer/supplier to be responsible for full arrangements. Tests to include period(s) of minimum 4 hours continuous operation under full load conditions as directed by Consultant. Number of periods of testing to be quantity as required until successful testing of specified requirements to satisfaction of Consultant and Owner. Ensure that proper 100% capacity resistive type artificial load banks are available for tests. Factory testing to include use of strip chart recording instruments to confirm that engine generator set complies to specified requirements in frequency, voltage and current regulation as specified herein this Section. Testing to also be performed to demonstrate successful synchronization and paralleling. Submit reports for Consultant's review and obtain Consultant's approval prior to shipping gensets to site.
- .3 Review site conditions, accessibility, dimensions, etc. and note applicable restrictions. Disassemble genset if required to move into installation space. Each disassembled part must be labelled, numbered, and documented. Engage genset manufacturer to supervise and perform disassembling and reassembly work and to provide necessary technical assistance.
- .4 Provide hoisting of gensets as required to locate into position.
- .5 Coordinate controls work both at factory and on site and include for required interface work to existing equipment on site.
- .6 Provide gensets and system control components where required to generate emergency power. Transport/hoist gensets into location.
- .7 Secure genset on vibration isolation springs to its base by means of 13 mm (1/2") diameter "Rawstud" high tensile strength steel anchor bolts. Ensure that set is plumb and level. Check engine generator alignment when mounting is complete. If necessary, realign in accordance with manufacturer's recommendations.
- .8 Install a galvanized steel drip pan under each engine. Supply pans loose with sets.

- .9 Secure various control panels and switchboard in place on concrete housekeeping pads. Connect complete. Connect alarm/trouble contact points to respective genset and other equipment alarm contacts, with required wiring in conduit. Include for Work to ensure interconnections for control, alarm, monitoring, and supervision of all functions of control panel and systems. As applicable, make necessary interconnections to transfer switches to initiate emergency power sequence of operation. Check and test control panel functions. Provide breakers as required and check and test switchboard, breakers and control panel functions. Adjust as required. Programme PLCs as required. Refer to installation requirements of switchboards in secondary switchboards article.
- .10 Provide power panel with dedicated breakers and feeders in conduit to serve various genset equipment, accessories and integrated components controlling auxiliary building systems. Exact breaker ratings and power requirements to suit final installed equipment. Connect complete with required wiring in conduit. Provide engraved nameplates for each control panel and component. Provide detailed operational and warning signage. Confirm exact nomenclature in writing with Consultant prior to manufacture.
- .11 Provide required power feeders, control wiring, communications wiring and make required connections to genset with suitable cabling and lugs. Connect to building distribution system as coordinated with Consultant. Extend required feeders to genset. Connect and ground unit with proper copper ground conductors. Connect feeders to panel and ensure that all components and accessories that require external power are fed from panel breakers, as required. Identify breakers in panel. Extend control/communications wiring in conduit to BAS and fire alarm system, as required.
- .12 Provide system of cable tray and Unistrut Corporation channel support system for overhead-suspended "Corflex II" cable. Support system consists of cable trays supported by channels, supported by suitable threaded steel rods secured to structure with suitable aluminium clips. Tie wraps are not acceptable for securing "Corflex II" cables. Utilize non-ferrous single screw cable clamps. Provide required cable support system accessories which are not specified herein or shown on drawings but are required for proper installation.
- .13 Provide "Corflex II" conductors as specified from alternator to control panel. Ensure that conductors are properly isolated from engine generator sets and that final connections are made with flexible couplers.
- .14 Ground and bond single conductor "Corflex II" cables at both ends where sheath currents do not affect cable ampacity. For certain areas, where sheath currents will reduce cable ampacity, ground and bond cable at supply end and isolate cable at load end as recommended by cable manufacturer, and provide a No. 3/0 green TW ground conductor for each cable run. Ground and bond equipment as per local electrical code requirements. Refer also to requirements of grounding and bonding article.
- .15 Refer to and provide additional applicable testing requirements of distribution system testing and coordination study article.
- .16 Extend control wiring from engine generator set control panel to starter and control panel for fuel oil pumps such that when engine starts, pump starts and runs continuously for length of time engine is in operation, and such that when engine shuts down pump stops. Check and test starting battery assembly low voltage alarm and monitoring system. Adjust as required.
- .17 For initiating start-up upon loss of normal power of electrical distribution system, provide fire rated MI wiring from genset control panel to appropriate transfer switch contacts or to other designated control system loss of normal power signal as confirmed with Consultant, to initialize engine start-up upon loss of normal power.

- .18 Extend control wiring from engine generator set control panel to generator room fresh air intake dampers such that when engines start dampers open to a minimum setting to provide combustion air to engines.
- .19 Provide control wiring in conduit runs, unless MI is used. Comply with local code requirements regarding fire rated conductor applications.
- .20 Provide starting batteries, rack, jumper cables, hydrometer, syringe, etc. Connect batteries to engine starting system. Locate where directed by Consultant. Provide mechanical support utilizing metal C-channel framing or conduits to support all cables between batteries, genset and charger.
- .21 Check and test battery charge operations and adjust as required. Ensure that batteries are properly charged and have been serviced. Provide dedicated power circuits from designated panel serving area, as required to power devices.
- .22 Fill radiator with a solution of 50% clean water and 50% permanent type ethylene glycol. Check specific gravity of engine coolant. Add glycol and/or water if required.
- .23 Check level of engine lubricating oil and add if required. Check and test operation of engine starting system, and jacket coolant heaters. Include acoustical testing to verify sound levels during operation at full load.
- .24 Coordinate installation of exhaust system with Mechanical Divisions. Arrange for manufacturer of engine generator set to review engine exhaust system design and confirm in writing that exhaust system back pressure will not impair operation and output of set. Forward a copy of confirmation letter to Consultant.
- .25 Check and test operation of engine starting system, and jacket coolant heaters.
- .26 Wall mount storage cabinet complete with tools and spare parts.
- .27 Ensure that conduit connections to generator set are made with liquid tight flexible conduits.
- .28 Provide and connect control panel wiring between fire alarm system and building management system, and if necessary, provide all required low voltage relays, wiring in conduit and contactors from generator control panel to fire alarm system control panel for supervision and annunciation of "Generator Running", "Generator Failure To Start", "Low Voltage Generator Battery" and "Low Fuel Level". Extend and connect these points to BAS. Subject to approval of Consultant, these alarm points may be a common alarm at interconnected fire alarm and BAS systems panels.
- .29 Provide wall mounted "EMERGENCY POWER OFF" (EPO) pushbuttons with tamper flip cover, in outlet boxes in locations confirmed with Consultant. Confirm exact locations prior to roughing-in. Connect complete to genset controls as required to shut down genset.
- .30 Carefully coordinate installation of set with:
 - .1 power and heat generation Work of Mechanical Divisions where fuel oil storage and pumping system and installation of fuel oil flexible connections is specified;
 - .2 insulation Work of Mechanical Divisions where exhaust system insulation is specified;
 - .3 air distribution Work of Mechanical Divisions where plenum connection to engine radiator is specified;
 - .4 exhaust piping Work of Mechanical Divisions where exhaust piping and stack work is specified.

- .31 Prepare and submit with engine generator set shop drawings, necessary design, erection and layout drawings, wiring, piping and control diagrams as required for proper execution and completion of Work.
- .32 Notify Owner and Consultant minimum 2 weeks in advance of onsite testing. Under direction and in presence of Owner and Consultant, genset manufacturer's authorized technician to provide tests at site on engine generator set when installation is complete, but before acceptance of same. Coordinate with independent distribution system testing company specified in distribution system testing and coordination study article, to ensure that engine generator set performs with emergency power distribution system in accordance to requirements of all applicable CSA Standards.
- .33 Coordinate and arrange for manufacturer's trained mechanic to conduct such tests and to make all required changes and adjustments found necessary by such tests. Repeat tests until defects are corrected and equipment operates properly to Consultant's satisfaction. Perform general operational testing and other testing as per CSA Standards and requirements herein specified. Perform full load test, which is to include period(s) of minimum 4 hours continuous operation under full load conditions as directed by Consultant. Number of periods of testing to be as required to successfully demonstrate that genset complies with specified parameters to satisfaction of Consultant and Owner. Testing to also be performed to demonstrate successful synchronization and paralleling. Perform testing with load banks prior to testing with building loads.
- .34 Onsite testing to be performed at times acceptable to Owner. Be responsible for costs of additional testing due to failure of genset to perform to specified standards, with additional expenses in effect as specified previously for factory testing. Supply variable load banks and cables sized for 100% capacity of plant, for testing procedure indicated herein.
- .35 Include for license electrician to be on site for testing, verification and commissioning Work, to make any required distribution system changes necessitated by Work. Arrange for genset supplier's controls contractor to be present for testing and commissioning.
- .36 Upon completion of installation of equipment, by Contractor, equipment manufacturers to inspect installation of each complete equipment assembly and certify in writing to Consultant satisfactory installation and operations of same. Submit detailed list of deficiencies to Consultant.
- .37 Obtain approvals from local governing authorities including Technical Standards and Safety Authority (TSSA).
- .38 Equipment manufacturers to include for a site visit to inspect, test, perform start-up and verify installation to ensure that installation and Contractor is in compliance with Contract Documents.
- .39 Upon acceptance of emergency power plant, arrange for manufacturer's mechanic to instruct Owner's operating personnel in correct operation and maintenance of plant. Provide CD/DVD recording of such instruction.
- .40 Perform test procedures in accordance with test sheets found at end of this Section. Submit reports signed and bound to Consultant using these typical sheets.
- .41 Refer to details and schedules on drawings for further specifications on genset.

3.2 **INSTALLATION OF GENSET ENCLOSURE**

- .1 Coordinate installation requirements with requirements of Section entitled Power Generation.
- .2 For roof installations: Coordinate structural mounting requirements with Structural Consultant. Coordinate roofing work with trades responsible for roofing. Provide required roof structural steel work to accommodate installation of containerized genset.

- .3 Provide required vibration isolation and seismic restraints in accordance with Specification, Structural documents and as per local governing building code requirements.
- .4 Provide shore power feeders in conduit from dedicated breakers in panelboards in building, serving container genset, and connect to integral power panel and devices as required. Connect feeders to panel and ensure that components and accessories that require external power are fed from panel breakers, as required. Identify breakers in panel. Refer to notes on drawings. Applicable distribution equipment to be provided to general standards of electrical products specified in other Sections. Exterior feeders in conduit to be RWU90 or TWU in rigid galvanized steel conduit, unless otherwise noted.
- .5 Provide exhaust stack extension and mount to enclosure as per genset supplier's instructions. Secure as required. Provide lightning protection air terminal, down conductors and extend to grade ground rod driven into grade, as per code requirements.
- .6 Connect and ground unit with proper copper ground conductors. Ground and bond equipment as per local electrical code requirements. Refer also to requirements of grounding and bonding article.
- .7 Refer to and provide additional applicable testing requirements of distribution system testing and coordination study article.
- .8 Coordinate fire alarm device installation work with main building fire alarm vendor. Extend fire alarm circuits from enclosure to main building and connect to local transponder/control panel designated by fire alarm vendor. Provide required low voltage relays, wiring in conduit and contactors from generator control panel to fire alarm system control panel for common supervision and annunciation of genset alarms. Coordinate with Mechanical Division BAS vendor to ensure that genset alarm points are connected to BAS as a common alarm. Extend control wiring of type suitable for specific applications and as recommended by vendor of system being connected to and terminate at panel designated by system vendor. Include for additional spare 3m (10') coiled length at end. Include for system vendor to make required connections to panel and required programming.
- .9 Coordinate and arrange for main building security system vendor to provide security devices, wiring and connections. Extend circuits from common junction box in genset enclosure to main building and connect to main security system to annunciate as separate zones/points. Provide wiring and conduit of type to suit application in accordance with local governing codes and as recommended by system manufacturer.
- .10 Test and verify functions of enclosure with genset testing.
- .11 Obtain local governing technical standards and safety authority and other required local governing authority approvals and certifications.
- .12 Additionally, refer to testing, coordination and verification requirements in Section entitled Electrical Work Analysis and Testing and include applicable requirements.

3.3 **GENERAL TESTING REQUIREMENTS FOR GENSETS**

- .1 In additional to requirements specified in this Section, refer to requirements of Section entitled Electrical Work Analysis and Testing.
- .2 Following are general typical guidelines for testing of gensets and controls. Confirm exact requirements Consultant and Commissioning Agent prior to start of work. Additionally, contact genset manufacturer and obtain their recommended testing procedures for specific gensets of this Project. Coordinate with genset supplier.
- .3 Refer to and provide additional applicable testing requirements of distribution system testing and coordination study article.

- .4 Operational Tests:
 - .1 With engine in a "cold start" condition and emergency load at its normal operating level, simulate a power failure by means acceptable to Consultant. Do not interrupt existing services unless approved in writing by Consultant. Test load to be load which is normally served by emergency power system. Unless instructed by or approved in writing by Owner and Consultant, do not use building loads for testing. Provide variable load banks sized for loads as required.
 - .2 Continue operational test for 1 hour, after which time, restore normal power, and demonstrate satisfactory transfer of load and shutdown of emergency generating sets.
 - .3 Observe and record following data:
 - .1 time delay on start;
 - .2 cranking time until engine starts and runs;
 - .3 time required to come up to operating speed;
 - .4 time required to achieve a steady-state condition with all switches Transferred to emergency position;
 - .5 voltage, frequency, and amperes at start-up and at any observed change in load;
 - .6 engine oil pressure, water temperature where applicable, and battery charge rate at 5 min intervals for first 15 minutes and at 15 minute intervals thereafter;
 - .7 time delay on retransfer for each transfer switch; and
 - .8 time delay on engine cool down and shutdown.
 - .4 Full Load Test
 - .1 Following operational test, subject genset to a 4 hour 100% load test.
 - .2 Provide variable load bank for testing, unless use of building load is permitted in writing by Owner and Consultant.
 - .3 Full load test may be initiated by any method that will start engine and, immediately upon reaching its rated speed, pick up full load in one-step.
 - .4 Record data for items listed above, at first load acceptance and every 15 minutes thereafter until completion of test period.
 - .5 Cycle Crank Test:
 - .1 Prevent engine from running by utilizing any method recommended by manufacturer. Place control switch in "run" position to cause engine to crank.
 - .2 Engage engine starting system to provide a cranking cycle consisting of:
 - .1 30 seconds of continuous cranking; or
 - .2 three (3) 10 seconds crank attempts separated by 10 seconds rest periods;
 - .3 repeat crank cycle a second time to demonstrate that batteries have sufficient capacity for a total cranking time of 60 seconds;
 - .4 demonstrate time required to recharge batteries to meet requirements.

- .6 Safety Shutdown and Alarms:
 - .1 Test gensets as recommended by manufacturer and as described herein this Section to ensure that safety shutdowns and alarms are fully functional.
- .7 Ventilation:
 - .1 During testing of gensets, demonstrate that sufficient ventilation is provided for room housing gensets, in accordance with requirements of CAN/CSA-C282.
- .8 Voltage and Frequency:
 - .1 Perform this test in accordance to CAN/CSA-C282/Z32.
- .9 Oil Analysis:
 - .1 Perform this test in accordance to CAN/CSA-C282/Z32.

3.4 **NOISE EMISSIONS TESTING**

- .1 Provide testing and required equipment and personnel to verify that complete genset assembly complies with issued documents and requirements with respect to MOE Perform required operating and maintenance of gensets during testing.

3.5 **INSTALLATION OF LOAD BANK CONNECTION BOX**

- .1 Install box as required and secure to main building wall with proper fasteners to suit application. Confirm location prior to roughing-in. Confirm finishes with Consultant prior to manufacturer.
- .2 Cut and patch openings in walls as required to accommodate feeders and conduits. Provide required feeders in conduit sleeve through wall. Provide proper sleeving and weatherproof firestopping materials to maintain fire rating of building wall surfaces and caulking to seal openings. Coordinate work with General Trades Contractor.
- .3 Extend connection cabling in conduit from box to designated electrical distribution system equipment and connection point. Connect complete.
- .4 Confirm instruction labelling nomenclature with Consultant prior to manufacturer.
- .5 Test installed assembly to satisfaction of Consultant. Confirm exact location with Consultant prior to roughing-in. Obtain required certificates of approvals and submit copy to Consultant.

END OF SECTION

Appendix: Engine-Generator Test Report

PROJECT:	_____	Job No:	_____
	_____	Date:	_____

OWNER:	_____		
ARCHITECT:	_____		
CONSULTING ENGINEERS:	_____		
LOCATION:	_____		

PRESENT:	_____		

ENGINE DATA:	_____	SERIAL NUMBER:	_____

A. UNIT – GENERAL			
B. CONTROL PANEL – GENERAL			
C. VIBRATION CONTROL			
D. START-UP TIME			
	COLD UNIT:	_____	
	HOT UNIT:	_____	

E. SAFETY DEVICES AND TIME DELAY OPERATION			
SHUT-DOWN OPERATION	ALARM	BELL	LIGHT
LOW OIL PRESSURE			
HIGH COOLANT TEMP			
OVERSPEED			
OVERCRANK			
OTHERS			
SHUT-DOWN T/D	4 MIN. AFTER NORMAL POWER RESTORED		
F. HOUR METER READINGS			
START:			
CONCLUSION:			
G. RECORDING INSTRUMENTS (SPEED OF CHART)			
1. VOLTAGE (REGULATOR)	ALLOWABLE VARIATION:		
	ACTUAL VARIATION @ 0-1/4 LOAD =		
	ACTUAL VARIATION @ 0-1/2 LOAD =		
	ACTUAL VARIATION @ 0-3/4 LOAD =		
	ACTUAL VARIATION @ 0-1/1 LOAD =		
2. FREQUENCY (GOVERNOR)	ALLOWABLE VARIATION:		
	ACTUAL VARIATION @ 0-1/4 LOAD =		
	ACTUAL VARIATION @ 0-1/2 LOAD =		
	ACTUAL VARIATION @ 0-3/4 LOAD =		
	ACTUAL VARIATION @ 0-1/1 LOAD =		
3. RECOVERY TIME			
H. VOLTAGE ADJUSTMENT (SPECIFY):			
I. EXHAUST PRESSURE:			

J. GENERAL OBSERVATIONS:

K. INCOMPLETE ITEMS AND/OR DEFICIENCIES:

L. METHOD OF LOADING (SPECIFY):

TIME IN MINUTES

LOADING

AMPS – PHASE 1

AMPS – PHASE 2

AMPS – PHASE 3

VOLTS – PHASE 1

VOLTS – PHASE 2

VOLTS – PHASE 3

FREQUENCY (HZ)

OIL PRESSURE. (PSI)

OIL TEMP (C°)

WATER IN TEMP (C°)

WATER OUT TEMP (C°)

JACKET TEMP (C°)

EXHAUST TEMP (C°)

ENGINE SPEED (RPM)

CHARGER

POWER FACTOR

GENERATOR TEMP (C°)

ROOM TEMP (C°)

EXHAUST SMOKE

KW RATING

VACUUM (GAS UNITS ONLY)

Date: _____ Per: _____

END OF APPENDIX

- 1 General
- 1.1 **SUBMITTALS**
 - .1 Submit shop drawings for products specified in this Section.
- 2 Products
- 2.1 **AUTOMATIC TRANSFER SWITCHES**
 - .1 ASCO Power Technologies Canada, 300 Series CSA approved, automatic transfer and bypass isolation switch, double-throw, electrically operated, mechanically held, fully protected, complete with voltage sensing relays, a manual transfer facility incorporating spring handles, current ratings as indicated, arc chutes, magnetic blow-out coils and components necessary to provide proper performance and operation. Automatic transfer and bypass isolation switch to conform to CSA requirements including latest edition of CSA Standard, C22.2 No. 178, "Automatic Transfer Switches" and be sized on drawings.
 - .2 Transfer switches to be of withstand current ratings meeting available short circuit currents at location of each transfer switch as determined by electrical distribution system coordination study prepared as part of scope of Work.
 - .3 Automatic transfer and bypass-isolation switch to be provided to manually permit convenient electrical bypass and isolation of automatic transfer that could not otherwise be tested and maintained without interrupting load. Bypass of load to either normal and emergency power source with complete isolation of automatic transfer switch to be possible regardless of status of automatic transfer switch. Bypass isolation to permit proper operation by one (1) person through movement of a maximum of two (2) handles at a common dead front panel. Entire system to consist of two (2) elements, automatic transfer switch and bypass-isolation switch, which is to be furnished completely factory interconnected and tested.
 - .4 Automatic transfer switch to consist of a power transfer module and a control module, interconnected to provide complete automatic operation. Automatic transfer switch to be mechanically held and electrically operated by a single solenoid mechanism energized from source to which load is to be transferred. Switch to be rated for continuous duty and be inherently double throw. Switch to be mechanically interlocked to ensure only one (1) of two (2) possible positions - normal or emergency. Automatic transfer switch to be suitable for use with emergency sources such as an engine or turbine driven generator source or another utility source.
 - .5 300 series control panel consists of a digital microprocessor controller with LCD display. Panel to be supplied with a protective cover and be mounted separately from transfer switch for ease of maintenance. Interconnecting wiring harness to include a keyed disconnect plug to enable control panel to be disconnected from transfer switch for routine maintenance. Sensing and control logic to be provided on printed circuit boards. Interfacing relays to be industrial grade plug-in type with dust covers.
 - .6 Main contacts to transfer in 70 milliseconds or less and to be protected by separate arcing contacts with arc barriers between poles. Inspection of contacts (movable and stationary) and coils to be possible from front of switch without disassembly of operating linkages and without disconnection of power conductors. A manual operating handle to be provided for maintenance purposes. Handle to permit operator to stop contacts at any point throughout entire travel to properly inspect and service contacts when required.

- .7 Automatic transfer switches and bypass isolation switches utilizing components of moulded case circuit breakers, contactors, or parts thereof which have not been intended for continuous duty or repetitive load transfer switching are not acceptable.
- .8 Sensing and control logic panel to utilize solid-state sensing to initiate emergency mode of operation upon reduction of normal source to below 90% of nominal voltage and retransfer to normal when normal source restores to 90% and above of nominal. Pick-up voltage to be adjustable from 85%-100% of nominal and dropout voltage to be adjustable from 75%-98% of pick-up value.
- .9 Transfer switch to be complete with following features:
 - .1 time delay one (1) to override momentary normal source outages to delay transfer switch and engine starting signals; adjustable from 0.5-6 seconds and initially set at 1 second;
 - .2 time delay (2B) for controlled time of load transfer to emergency; adjustable from 0-8 minutes and initially set at 0 minutes;
 - .3 time delay (2E) for unloaded running time delay for emergency generator cool-down; adjustable from 0-30 minutes and initially set at 5 minutes;
 - .4 time delay (3A) on retransfer to normal source set to automatically by-pass if emergency source fails and normal source is available; adjustable from 0-30 minutes and initially set at 5 minutes;
 - .5 an engine start contact which closes on normal power failure to initiate engine start-up;
 - .6 selector switches to perform "TEST", "AUTO", "RESET", "MANUAL(or OFF)" and "ENGINE START" functions;
 - .7 pilot lights (P/L) to indicate switch positions;
 - .8 suitable connections for conductors specified;
 - .9 frequency relay to prevent emergency load transfer until frequency of emergency source has reached its set value;
 - .10 in-phase monitoring of motor load with generator for transfer from normal to emergency and vice versa, by means of a monitor to sample relative phase angle and frequency different and to signal transfer switch to close when two (2) voltages are at required phase angle;
 - .11 two-way bypass isolation switch to permit load to be connected to either normal or emergency source, to permit transfer switch to be removed from service without power feedback to transfer switch connections, and to provide a transfer test position to enable testing transfer switch operation under no load conditions;
 - .12 overlapping neutral contacts as required;
 - .13 auxiliary contacts as required to operate connected systems such as alarms, with provision of at least two (2) normally open and two (2) normally closed auxiliary contacts;
 - .14 indicators to show switch position;
 - .15 momentary contact switch to allow built-in time delay on retransfer to normal to be bypassed;
 - .16 pilot light to illuminate when load is connected to emergency source;
 - .17 engraved Lamacoid nameplates identifying switch and components.

- .10 Automatic transfer switches supplying power for elevators to be equipped with a selective load disconnect and time delay control circuit to inhibit transfer for a preset amount of time to allow elevator controls to sense contact position of transfer switch to program itself to accommodate up-coming transfer. (ASCO accessory No. 31 Z).
- .11 Transfer switch enclosure to be free standing enamelled steel, minimum NEMA 1 cubicle with sprinkler-proof provisions including drip shield, ventilation louvers designed to protect live components from water spray from activated sprinklers and gasketed doors and openings. Units to be finished in ANSI grey enamel.
- .12 Include for manufacturer's authorized representative to provide after installation onsite inspection, testing, start-up, verification, and user training of transfer switches.
- .13 Acceptable manufacturers are:
 - .1 ASCO Power Technologies Canada;
 - .2 Cummins Onan;
 - .3 Caterpillar;
 - .4 Russelectric.

3 Execution

3.1 **INSTALLATION OF AUTOMATIC TRANSFER SWITCHES**

- .1 Provide transfer switches as required for each application. Refer to drawings for transfer switch ratings and mounting locations. Advise transfer switch manufacturer of coordination study available fault current results to ensure transfer switches are provided of withstand current rating meeting available fault current at location of each transfer switch.
- .2 Install in accordance with manufacturer's instructions to suit specific applications. Mount stand-alone units to concrete bases. Provide seismic restraints as required. Ensure adequate clearance is provided as per code requirements and as required for access for operation and maintenance. Connect complete.
- .3 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.
- .4 Restoration to normal operation commences when phases of normal service have returned to 95% of nominal for an adjustable period of up to 2 minutes maximum. Transfer switch re-transfers to its normal position, and system is then ready for next normal service failure without any manual resetting.
- .5 Where required in emergency power distribution system connected to gensets, provide wiring in conduit from genset control panel to appropriate transfer switches contacts to initialise engine start-up upon loss of normal power and provide signals to transfer switches to initiate appropriate operations. Provide MI fire rated conductors to transfer switches used for life safety applications. Where load banks are connected to genset control system during testing, include for required interconnection wiring in conduit for loss of normal power signal to load bank controllers to initiate dropping load bank to pick-up essential building loads.
- .6 Review electrical systems, fire alarm system and elevator requirements with respective equipment vendors and coordinate required power and control interconnections. Provide required wiring in conduit between system equipment allowing for respective system equipment trades to make final connections to their own equipment. Provide MI fire rated conductors to equipment used for life safety applications.

- .7 Ground and bond switches as per local electrical code requirements. Refer also to requirements of grounding and bonding Section.
- .8 When installation is complete, arrange for system manufacturer to visit site to check, test, start-up, and certify system. In presence of Consultant, perform a complete operational test of system to ensure that system operates satisfactorily under operating conditions specified.
- .9 Coordinate transfer switch testing with engine-generator set testing to ensure that complete emergency power plant operates correctly. Adjust as required.
- .10 Arrange for manufacturer to provide a letter certifying compliance with requirements of this Specification. Certification to identify, by serial number(s), equipment involved.
- .11 Provide engraved Lamacoid nameplates with nomenclature confirmed with Consultant.
- .12 Additionally, refer to testing, coordination and verification requirements in Section entitled Electrical Work Analysis and Testing and include applicable requirements.

END OF SECTION

1 General

1.1 **SUBMITTALS**

- .1 Submit shop drawings for products of this Section, and on Schedule of Luminaires on drawings.
- .2 Include photometric data, lamp, and ballast information for each luminaire. Include ballast data identifying maximum circuit loading limitations.
- .3 Photometric data to include: total input watts, candlepower summary, candela distribution zonal lumen summary, luminaire efficiency, CIE type, coefficient of utilization, lamp type and lumen rating in accordance with IESNA testing procedures.
- .4 Include copy of certification that lenses and louvers comply with local governing building code requirements for flame spread ratings.
- .5 For poles, submit documentation that poles supplied are suitable for steady wind velocity and gust velocity of area of installation, and suitable for total effective projected area of mounted lighting equipment.
- .6 For exterior site areas or parking areas, where luminaires are proposed that are not from based specified manufacturer, provide luminaire manufacturer's computer prepared detailed photometric layout drawings with complete photometry showing performance levels of proposed luminaires. Clearly identify lighting levels, quantity, locations, mounting heights, etc. Identify variances from base design.

1.2 **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 unless otherwise noted, solid state ballasts for a period of five (5) years from date of acceptance of Work by Owner for its intended use;
 - .3 include costs for personnel, equipment and labour for replacing lamps and ballasts covered under warranty;

1.3 **SPARE LAMPS**

- .1 In addition to including lamps except for LED types for each luminaire, provide spare lamps and turn over to Owner based on following criteria:
 - .1 one (1) spare lamp for each type of luminaire used for site lighting;
 - .2 a quantity of ten percent (10%) of each type of lamp used for luminaires on this project rounded up to manufacturer's standard whole case if quantity is less than a case;
 - .3 each type to be provided in separate identified containers.

1.4 **SUBSTITUTIONS**

- .1 Provide luminaires as specified in Schedule of Luminaires and as per documented List of Manufacturers, where applicable. During construction period, no substitutions are permitted unless compelling reasons are given and accepted by Owner and Consultant. A delay caused by Contractor's failure to order luminaires to meet construction schedule is not a valid reason.
- .2 Make requests for proposed substitutions as per requirements of Section entitled Electrical Work General Instructions and Division 01.
- .3 Consideration of any proposed substitutions after Bid Period to be at Consultant's sole discretion.

2 Products

2.1 **LUMINAIRES**

- .1 Provide luminaires in accordance with Schedule of Luminaires found on drawings. Luminaires are to be CSA approved or have special local electrical authority approval.
- .2 Provide thickness of metal as indicated in Schedule of Luminaires and details, or as required so that luminaires are rigid, stable and resists deflection, twisting, warping or bending under normal installation procedures, re-lamping etc., or no less than requirements specified herein the specifications.
- .3 Unless otherwise noted, linear and continuous linear architectural LED luminaires bodies to be constructed of extruded aluminum and of rigid construction. Unless otherwise noted, provide body finishes of corrosion resistant, chemically treated and electrostatically applied post powder coat finish. Efficiency not to be less than 69%.
- .4 Unless otherwise noted, vandal resistant luminaires to be constructed of heavy duty extruded aluminum rails and die cast end caps, complete with stainless steel torx with centre reject pin and Allen head set screws. Screw heads to be mounted and concealed under lens. Lens to be extruded UV stabilized polycarbonate lens with internal linear ribbed design.
- .5 Provide neoprene or silicone gasketing, barriers and stops where required to prevent light leaks or water/water vapour penetration.
- .6 Fabricate housings to allow for easy accessibility and replacement of parts.
- .7 Fabricate fixtures with a minimum number of joints. Make unexposed joints by acceptable method such as welding, brazing, screwing or bolting. Soldered joints are unacceptable. Do not use blind metal tapping methods or rivets for fastening parts which must be removed during service, or for fastening electrical components and supports. Cast parts, including die-cast members, to be of uniform quality, close grained, rigid, true to pattern, free from blow holes, pores, discoloration, hard spots, shrinkage defects, and cracks or other imperfections that affect strength and appearance or are indicative of inferior metals or alloys.
- .8 Reflectors and reflecting cones or baffles to be free of any tooling marks, spinning lines or marks by other assembly techniques. For fluorescent sources, iridescence to be low. Finishes to be equal to first quality polished, baffled, and anodized "Alzak".
- .9 Lamp sockets to be suitable for indicated lamps and be set so that lamps are positioned in optically correct relation to all luminaire components. Preset adjustable sockets at factory for lamp specified.
- .10 Lenses and louvres to comply with local governing building code and other local governing code flame spread rating requirements.

- .11 Unless otherwise noted, construct acrylic lens from 100% virgin acrylic and not less than 3.22 mm (0.125") thick. Fluorescent K12 acrylic lenses to have recessed prismatic pattern with no fade-outs or streaks and be of strain-free and uniform production. Glass lenses to be minimum 9.5 mm (0.375") thick.
- .12 Recessed luminaires with replaceable/serviceable parts such as ballasts, lamps, sockets, etc., must be accessible from lens side (ie. room side) of fixtures to allow for proper accessibility.
- .13 Luminaires to be factory assembled and tested prior to delivery on site.
- .14 Exposed parts and hardware of luminaires located in non-climate controlled areas to be corrosion resistant and weather resistant. Hardware to be tamper-proof. Manufacturer exterior luminaire poles with corrosion resistant finish and construction. Pole suppliers to ensure that poles supplied are suitable for steady wind velocity and gust velocity of area of installation, and suitable for total effective projected area of lighting equipment. Submit verification of this with shop drawings.
- .15 When requested, submit luminaire samples.
- .16 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.
- .17 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.
- .18 Confirm exact colours and finishes of luminaires with Consultant after award of contract but prior to ordering. Obtain information in time to meet installation schedule.
- .19 Coordinate with ballast manufacturers and dimmer/occupancy control manufacturers to ensure that components are compatible with each other and that interconnections do not affect performance, life or any warranties.
- .20 Products of same specified type to be of same manufacturer.

1.2

LEDS AND DRIVERS

- .1 General features include:
 - .1 CSA approved, ULC listed and labelled;
 - .2 Operating temperature:
 - .1 Luminaires for applications in non-climate controlled area: operating temperature range through -40°C (-40°F) to 60°C (140°F);
 - .2 Luminaires for applications in climate controlled area: 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 Specification standards to meet requirements of IES LM 79 and LM-80.
 - .5 Be 100% compatible with connected dimmer controls to provide dimming down to 5%.
- .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;
 - .4 Total harmonic distortion less than 20%;
 - .5 Class A sound rating;
 - .6 Comply with ANSI C62.41 Category A for transient protection.
- .4 Acceptable manufacturers to be as recommended by luminaire manufacturers.

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 ceiling types, finishes and construction details; verify ceiling types with latest Architectural Drawings; order luminaires to suit correct ceiling type;
 - .3 ensure that required mounting assemblies, frames, rings and similar features are included;
 - .4 confirm colours and finishes with Consultant.
- .3 Include for assembly and mounting of luminaires and lamps, complete with:
 - .1 wiring and connections;
 - .2 fittings and hangers;
 - .3 aligners;
 - .4 box covers;
 - .5 other accessories required for a complete, safe and fully operational assembly.
- .4 Where outlet boxes locations are shown on drawings, they are diagrammatic only. Position outlet boxes to coincide with suspension hangers and knockouts.
- .5 Install ceiling fixtures in centre of tiles unless dimensioned otherwise on Reflected Ceiling Plans. Locate hangers on tile centres or intersections. Mount recessed downlights, troffers, and surface mounted luminaires in or on full tiles. Install fixtures in and on acoustical tile ceilings in alignment with tile joints.
- .6 Cut holes for recessed luminaires to exact size so that gaps are not visible or luminaire trims cover gaps.
- .7 Mount surface ceiling luminaires perfectly level or plumb, tightly to ceiling without showing a space or light leak between frame and ceiling.

- .8 Carefully align linear luminaires shown in continuous lines or rows, so that rows appear as straight lines. Variation in alignment not to exceed 6 mm (1/4") for any 5 m (16') run.
- .9 Provide spacers for fixtures mounted on low density ceiling material.
- .10 Provide plaster frames for recessed fixtures in plaster or gypsum board ceilings.
- .11 Prepare fixtures, trim and poles and standards required to be painted.
- .12 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.
- .13 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.
- .14 Support luminaires directly by ceiling slab structure and not to formed steel decking, ceiling hangers, ductwork, piping, cable trays, etc.
- .15 Do not tighten wing nuts, bolts, or screws that allow fixture adjustment for recessed adjustable fixtures.
- .16 Install spread lenses only where called out on Schedule of Luminaires and Specifications.
- .17 Use cloth gloves when handling reflector cones, louvers, halogen lamps, glass, sconces and all exposed surfaces of fixtures.
- .18 Co-ordinate luminaire installation with work of other trades to ensure that necessary recessing depths and mounting spaces are provided.
- .19 Install luminaires in accordance with applicable architectural drawing reflected ceiling plans and/or wall elevations and/or field instructions issued by Consultant. Confirm luminaire locations prior to roughing-in. In equipment rooms, shafts and similar secondary areas, install luminaires after mechanical and other major work is roughed in and adjust luminaire locations as required.
- .20 Align and position all adjustable luminaires, and ensure that luminaires with adjustable lamp holders are properly positioned to correspond to lamps specified.
- .21 Comply with requirements of local governing electrical code regarding support of luminaires in suspended ceilings.
- .22 Independently suspend luminaires in suspended ceilings from ceiling slab. For each luminaire, provide minimum two (2) cable supports secured to ceiling slab and to luminaire. Confirm with local governing authorities and review with Consultant if a variance to this requirement can be made for specific luminaires of low weight.
- .23 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.
- .24 Locate exit signs in final locations confirmed with Consultant and approved by local building code authority. Connect to power circuits as required. Where applicable for emergency power requirements, connect to emergency battery units. Relocate exit sign and re-direct direction arrows to suit local building code authority requirements and Consultant's directions.
- .25 Notify Consultant immediately and relocate if necessary as directed by Consultant, if:
 - .1 fixture placement is in conflict with a structural beam, mechanical duct, plumbing pipe, etc.;

- .2 space above ceiling is not sufficient;
- .3 any reason that a fixture cannot be located where it is dimensioned or shown on construction documents.
- .26 Concrete Bases:
 - .1 Secure poles for pole mounted, exterior type luminaires to concrete bases as detailed.
 - .2 Co-ordinate required work including excavation/backfilling/concrete work to provide bases as shown.
 - .3 Provide anchor bolt covers and anchor bolt templates for proper positioning of anchor bolts in concrete.
 - .4 Refer to concrete base detail found on drawings; this detail is for general requirements only.
 - .5 Include costs for and engage Professional Structural Engineer licensed in Place of Work and with liability insurance, to review and endorse final base design work; review exact details with Consultant; grade levels may be different in various areas.
- .27 Extend ground conductors from metal parts of poles to building grounding provisions. Generally locate devices in locations on drawings, but base exact locations on coordination and review with Consultant and governing authorities. Confirm luminaires and pole finishes with Consultant prior to ordering. Run wiring in conduit.
- .28 Provide seismic restraints to suspended luminaires, in accordance with latest local governing building code requirements.
- .29 Provide dimming ballasts in luminaries to be dimmed. Coordinate between dimming system vendor and luminaire vendors to ensure 100% compatibility.
- .30 Ground and bond luminaires as per local governing electrical code requirements.
- .31 If requested, demonstrate operation of luminaires intended for special applications such as building floodlights and other decorative purposes. Adjust their locations within a reasonable distance to obtain effects desired.
- .32 Test and adjust exterior luminaires at times after sunset, in presence of Consultant and at times acceptable to Consultant.
- .33 Prior to turn over of Work to Owner, clean luminaires in manner recommended by manufacturer and to satisfaction of Consultant.
- .34 Additionally, refer to testing and verification requirements in Section entitled Electrical Work Analysis and Testing and include applicable requirements.

END OF SECTION

1 GENERAL

1.01 SUBMITTALS

- .1 Submit shop drawings for products specified in this Section. Include annunciator schedules and sample of graphic annunciator layout and nomenclature.

1.02 SOFTWARE NOMENCLATURE REPROGRAMMING

- .1 Include additional costs for system manufacturer to make necessary on site final changes to applicable system/equipment software. Make such changes after successful testing and verification of systems, but prior to turn over to Owner. After successful final verification of work, confirm and obtain approval of final nomenclature in writing from Owner and Consultant. Software revisions to incorporate final room names/area names/building names and equipment identification.

2 PRODUCTS

2.01 FIRE ALARM SYSTEM (BASIC ADDRESSABLE)

- .1 Notifier ONYX Series, CSA approved and ULC listed and labelled components for a fully electrically supervised, addressable, microprocessor based, single stage, zoned, modular, fire alarm system.
- .2 System components to be listed as products of a single manufacturer under appropriate category, by Underwriter's Laboratories of Canada and bear ULC label. system components and work in conjunction with system installation to meet specific application requirements of local governing authorities, codes, standards, regulations and requirements of following:
 - .1 CAN/ULC-S524;
 - .2 CAN/ULC-S527;
 - .3 CAN/ULC-S537;
 - .4 local governing building code;
 - .5 local governing electrical code;
 - .6 local governing building permit applications for approvals;
 - .7 other requirements of local governing authorities.
- .3 Devices to be ULC listed and labelled devices suitable for fire alarm applications. Power supplies and other components to be CSA approved where required by local governing authorities and codes.
- .4 System to include following components:
 - .1 main control panel with liquid crystal display (LCD) and integral light emitting diode (LED) annunciator and system software; capacity for required schedule of zones, system points plus minimum additional spare 25% zones and points;
 - .2 remote annunciators;

- .3 alarm initiating devices;
- .4 alarm signalling devices;
- .5 batteries and battery chargers, end-of-line devices and required ancillary devices;
- .6 wiring in conduit.
- .5 Exact type of device to be used in each area of installation to be as recommended by system manufacturer to suit specific applications and to be approved for such use as per ULC standards. Devices in non-climatic controlled areas to be weatherproof, corrosion resistant and ULC listed for use in below freezing temperatures. System manufacturer to be responsible for ensuring compliance with these requirements.
- .6 Control Panel:
 - .1 Control panel features:
 - .1 surface mounted when installed in unfinished areas;
 - .2 recessed mounted when installed in finished areas;
 - .3 solid-state microprocessor based technology with LCD and integral LED annunciator with alarm and trouble LED's for each scheduled zone; annunciator provisions to be common with remote annunciator;
 - .4 dead front, modular cabinet assembly with trim, a hinged door with full glazing, a lock, and keys; door provides access to operator controls, but does not expose live electrical connections; controls, indicators, and operating instructions clearly visible through a viewing window; electrical connections are front access through a removable inner protective cover.
 - .2 Panel allows for loading or editing of special instructions and operating sequences as required and is capable of on-site programming to accommodate expansion and changes required by local codes. Software operations and instructions are stored in a non-volatile programmable memory in event of loss of primary and secondary power.
 - .3 On site programming changes to fire alarm system is password protected. During construction stage, obtain approval in writing from Consultant and local governing fire authority, of programming (system sequence of operation) and custom label changes. System software to be custom programme as required.
 - .4 Include for system programming changes required for duration of project and as required for final acceptance and certification of entire system and project work, by local governing fire and buildings authorities. Include for additional one (1) onsite system reprogramming sessions (duration minimum 4 hours) for any required revisions, after system verification/commissioning. Provide re-burning as required by local governing fire authority.
 - .5 Ability to selectively program input/output control functions based on ANDing, ORing, NOTing, Timing, and Special Coded Operations is also to be incorporated in resident software programming of system.
 - .6 System to have ability to manually disable and enable any device/circuit individually, via software, for maintenance or testing purposes.

- .7 System can program selected or all smoke sensors for alarm verification operation.
- .8 System can program an adjustable time delay circuit for each water flow initiating circuit to prevent false alarms that may be caused by erroneous pressure surges in sprinkler system.
- .9 Wiring to any remote annunciator to be supervised for open and ground conditions
- .10 Properly ground and bond control panels and remote annunciator cabinets to building ground. Conduit ground will not be acceptable. Provide green coloured grounding loop, a minimum #10 AWG. insulated copper run in conduit. Connect ground loop to main building ground system source. Do not run ground wire in same conduit as fire alarm and communication wiring.
- .11 Control panel LCD indicates alarms, supervisory service conditions and troubles. Panel includes but is not limited to following:
 - .1 8 lines by 21 character LCD display;
 - .2 2500 addressable point capacity;
 - .3 15 hardwired circuit capacity;
 - .4 local energy, shunt master box, or reverse polarity remote station connection;
 - .5 form C trouble contact;
 - .6 earth ground supervision circuit;
 - .7 front panel ground fault isolation control;
 - .8 8 amp intelligent power supply;
 - .9 automatic battery charger;
 - .10 standby batteries;
 - .11 resident non-volatile programmable operating system memory for operating requirements;
 - .12 five programmable multi-function keys with status LED's;
 - .13 red fire alarm LED and acknowledge button;
 - .14 red priority 2 LED;
 - .15 yellow supervisory service LED and acknowledge button;
 - .16 yellow trouble LED and Acknowledge button;
 - .17 green power on LED;
 - .18 alarm/signal silence LED and button;
 - .19 system reset button;

- .20 operator interface keypad for manual control and system information access;
 - .21 addressable interface control modules (as required);
 - .22 serial DACT module;
 - .23 supervised annunciator circuit.
- .12 Control Panel is capable of chronologically logging and storing minimum 300 events in an alarm log and minimum 300 events in a trouble log. Historical logs are stored in CPU's memory and are protected by a lithium battery that is supervised for a low battery condition. Each recorded event includes time and date of that event's occurrence. Alarm log file is separate from trouble log file. User to be able to generate a report of both logs upon request.
- .13 Hardwired initiation and control circuits to be individually configurable, on site, in any combination, to provide initiating circuit, signal circuit, or auxiliary control circuit operation. These circuits include a Ground Fault Isolation Relay, allowing them to be isolated via front panel keyboard without having to remove any field wiring.
- .14 Initiation circuits/addresses are individually configurable on site to provide either alarm/trouble operation, alarm only, trouble only, current limited alarm, no alarm, normally closed device monitoring, a non-latching monitoring circuit or an alarm verification circuit.
- .15 Notification appliance circuits (NAC), (speaker/strobe circuits), are independently supervised and fused such that a fault on one circuit does not affect operation of any of other circuits. NACs are configured as follows:
- .1 Class "B" wiring, current limited;
 - .2 rated at two amps of continuous power;
 - .3 capable of powering polarized 24 VDC audible/visual signalling appliances;
 - .4 supply two NAC s per floor.
- .16 Auxiliary control circuits are as follows:
- .1 central Station alarm output;
 - .2 central station trouble output;
 - .3 SPDT Form C relays fused at 2 Amp @ 24 VDC.
- .17 System Expansion Modules connected by ribbon cables are supervised for module placement. Should a module become disconnected system trouble indicator illuminates and audible trouble signal sounds.
- .18 Fire Alarm Control Panel supports 2 RS-232-C I/O ports. CPU data output to I/O ports are in a parallel ASCII format at field adjustable baud rates of 220, 300, 1200, 2400 and 4800.
- .19 System is of modular design to allow future expansion with a minimum of hardware additions and system interruptions.

- .20 Isolators to be provided between building dividing walls, where required by local governing authorities and codes and as recommended by system vendor.
 - .21 Control panel to have minimum 25% spare supervisory and annunciating capacity and provide following functions:
 - .1 fire alarm control;
 - .2 fire alarm annunciation;
 - .3 supervisory and trouble annunciation.
 - .22 Panel to include circuitry and devices to transmit an alarm signal to device(s) provided by others (Owner's arranged monitoring company) to send alarm signal to Fire Department or to an outside private protection company, in accordance with CAN/ULC-S561. Exact requirements to be coordinated with monitoring company and and/or security company.
 - .23 A serial digital alarm-communicating transmitter (SDACT) is a module that mounts internally to and communicates directly with fire alarm control panel. SDACT monitors status of host fire alarm control panel and its connections to central station-monitoring receiver. When status changes require information to be reported, SDACT provides a per point message, (i.e. every addressable device within system on an individual basis), that can assist central station in more accurately implementing required response. Typical information reports include alarms, troubles, and supervisory conditions with specific point identification.
 - .24 Amplifiers and tone generators supply required signals for tones to audible devices and are sized to accommodate audible device loads (assume 1watt tapping for determination of amplifier capacity). Amplifiers to be continuously supervised for proper operation. Amplifiers to be sized to include 20% power output spare future capacity.
- .7 Walktest with History Logging:
- .1 Provide necessary software and programming to provide one-man system testing, as follows:
 - .1 initiating walk-test mode automatically disconnects auxiliary control circuit relays, and creates a system trouble indication on control panel;
 - .2 alarm activation of any initiating device causes audible signals to pulse one round of code over alarm signal circuits identifying zone of alarm to testing technician without having to return to control panel. alarm-initiating zone is silently logged as being tested in historical data file. panel automatically resets itself after logging of alarm;
 - .3 any momentary opening of an initiating or indicating appliance circuit causes audible signals to sound for 4 seconds to indicate trouble condition. trouble condition is silently logged as a trouble condition in historical data file. panel automatically resets itself after logging of trouble condition;
 - .4 if walktest feature is on for an inappropriate, (programmable), amount of time, system reverts to normal mode automatically;

- .5 actuation of walktest program not to require any special tools or programming knowledge by Owner or operator.
- .8 Power Supply:
 - .1 Control panel accepts 120 volts, 60 Hz as primary source of power for system and additionally provides 24 volts regulated output, current limited distributed system power. Primary power failure or power loss (less than 102 volts) activates common trouble sequence.
 - .2 Direct current (dc) emergency power supply consists of battery power source to supply sufficient standby capacity to operate entire system upon loss of normal power. Emergency power supply controls, battery charger, and batteries provide an automatic un-interruptible transfer of power to loads during primary power failure or loss. During normal operating conditions a fault in battery charging circuit or a short or open in battery leads, to activate common trouble sequence. Continuous supervision of wiring for initiating and alarm circuits to be maintained during power failure.
 - .3 Size batteries in accordance with latest requirements of local governing building code. Batteries to be maintenance free, dual-sealed gelled cell type equipped with charging circuits capable of recharging fully depleted batteries to within 70% of their maximum capacity within 12 hours. ampere-hour capacity to be adequate to operate system under supervisory conditions for a minimum of 24 hours with AC power disconnected, and to provide emergency power under full load for local governing building code required length of time but which must be at least 30 minutes at end of this period. Confirm exact requirements with local governing fire authority. Test, verify, and demonstrate these requirements as specified in Part 3 of this Section. system automatically transfers to standby batteries upon power failure. Battery charging and recharging operations are automatic.
 - .4 Power supply and control equipment include transient voltage surge protective device as recommended and provided by fire alarm system manufacturer.
- .9 Addressable Device Network:
 - .1 System provides communication with addressable initiating devices. These devices are annunciated on control panel's main LCD/LED display. Annunciation includes following conditions for each point:
 - .1 Zone/Device Location;
 - .2 Type of Device;
 - .3 Detector Status (Normal/Alarm/Trouble);
 - .4 Device Missing/Failed.
 - .2 A minimum of 100 addressable devices may be multi-dropped from a single pair of wires. Systems that require factory reprogramming to add or delete devices are unacceptable.
 - .3 Communication format is completely digital poll/response protocol. A high degree of communication reliability is obtained by using parity data bit error checking routines for address codes and check sum routines for data transmission portion of protocol.

- .4 Each addressable device to be uniquely identified by an address code entered on each device at time of installation. Use of jumpers to set address is not acceptable due to potential of vibration and poor contact.
- .5 System supports 100% of addressable devices in alarm or operated at same time, under both primary (AC) and secondary (battery) power conditions. Systems which cannot support 100% of their point capacity in alarm simultaneously are not acceptable.
- .6 System to allow a line distance of up to 2,500 feet to furthest addressable device on a Class A communications circuit. Run each addressable loop wired Class A, and run in a Class A conduit system with return run separated by a minimum of 600 mm (24") from primary run. Appropriate quantity of isolator modules to be installed so that a wiring fault (short, open, or ground) within one floor area does not prevent normal operation of other addressable devices on other floor areas.
- .10 Remote Trouble Indicator:
 - .1 Remote trouble indicator unit includes a yellow LED that illuminates and a low frequency piezo that sounds upon a trouble condition being received at main control panel. unit resets when controlling contact is reset.
- .11 Remote Annunciators:
 - .1 Remote active annunciator to be flush wall mounted with baked enamel finish to Architect's direction, and be complete with following features:
 - .1 alarm LED for each fire zone;
 - .2 supervisory LED for each sprinkler and standpipe zone;
 - .3 each zone shown separately and identified by different colour;
 - .4 alarm and supervisory zones identified with white lamacoid plate with black lettering;
 - .5 LCD display indicating address of device in alarm and details of system operating conditions;
 - .6 LED of high intensity types and are supervised;
 - .7 trouble buzzer;
 - .8 tamper resistant mounting hardware.
 - .2 Multi coloured passive graphic display as follows:
 - .1 electronically stored floor and zone outline, printed on dimensionally stabilized clear film with 3 mm (1/8") thick clear acrylic shield with UV protection;
 - .2 floor outline and zone area designation depicted by a black border with each zone area represented by a separate colour; egress corridors illustrated with black dotted design with zone colour shown behind pattern; colours and outlines to be confirmed with and approved by Consultant;

- .3 exit doors, fire hose cabinets, Siamese connections, elevators, sprinkler pump, gas shut off valves, etc. indicated;
- .4 "YOU ARE HERE" notation in red;
- .5 a minimum of 6 colours utilized in display;
- .6 anodized aluminum frame (minimum 600 mm x 1 m [2' x 3']) to match finish of remote annunciator; finishes to approval of Consultant;
- .7 tamper resistant mounting hardware;
- .8 approved by local fire authority, where required.

.12 Addressable Modules:

- .1 Addressable modules to be used for monitoring of water flow, valve tamper, non-addressable detectors, and for control of fans or dampers that require shutdown or manual control in an alarm condition.
- .2 Addressable modules to monitor any N/O contact device and be capable of powering 2-wire smoke detectors. Addressable modules will communicate zone's status (normal, alarm, trouble) to transponder. Addressable modules zone address to be set at time of installation via a dip switch package. Where multiple addressable modules are required within a room, (for example a sprinkler room), cabinet mount addressable modules in a locked box, keyed to match fire alarm control panel. Neatly arrange addressable modules for easy contractor connection and label each addressable module with a lamacoid plate providing zone, device address and custom label.
- .3 Addressable modules to be able to provide supervised or non-supervised control of any control function. Addressable modules will communicate zone's status (normal, trouble) to transponder. Addressable modules to provide a double pole double throw relay for switching loads of up to 120 VAC. Each common leg of relay to be equipped with a replaceable 2 AMP fuse. Addressable modules zone address to be set at time of installation.

.13 Manual Pull Stations:

- .1 Manual pull stations to be addressable, single stage, dual action, non-coded type. Pull stations are of injection moulded Lexan construction with red enamel finish and "LIFT AND PULL HANDLE IN CASE OF FIRE" lettering. Stations include break-glass rod, key reset function and one set of sealed N/O contacts. Activation requires initially lifting cover and then pulling down handle to cause contacts to close, breaking glass rod and activating a fire alarm condition. Reset station with key switch.

.14 Thermal Detectors:

- .1 Surface ceiling mounted addressable automatic thermal detectors with features as follows:
 - .1 low silhouette design and twist-lock mounting to base;
 - .2 integral microprocessor with non-volatile memory, automatic device mapping, electronic addressing, self-diagnostics and history log;

- .3 LED status indication;
 - .4 field configurable mounting mechanism to prevent unauthorized removal;
 - .5 combination 135°F (57°C) fixed temperature and 15°F (9°C) rate-of-rise type;
 - .6 135°F (57°C) fixed temperature type.
- .2 Each detector to be complete with a base plate for mounting to a standard 4" (100 mm) outlet box and cast guards for detectors. Where required, provide an additional alarm relay (Form C, SPDT), normally open contact, for auxiliary functions.
- .15 Ceiling Mounted Products of Combustion Detectors:
- .1 Surface ceiling mounted photoelectric type, addressable, products of combustion (smoke) detectors with features as follows:
 - .1 low silhouette design and plug-in mounting to base;
 - .2 integral microprocessor with non – volatile memory, automatic device mapping, electronic addressing, self-diagnostics and history log;
 - .3 sensitivity range from 0.6% to 1.9% per foot;
 - .4 environmental compensation;
 - .5 identification of dirty or defective detectors;
 - .6 an integral LED alarm lamp;
 - .7 locking feature to prevent unauthorized removal of unit head from base.
 - .2 Each detector to be complete with a base plate equipped with wiring terminals, for mounting to a standard 4" (100 mm) octagon box. Provide cast guards for detectors where identified on drawings. Where required, provide an additional alarm relay (Form C, SPDT), normally open contact, for auxiliary functions.
 - .3 Detectors tied to hold open devices to be complete with required auxiliary set of contacts. Co-ordinate work with supplier of hold open devices.
 - .4 Equip detectors with a dust cover, to be removed at time of verification to prevent dust and dirt entering smoke chamber during construction work.
- .16 Detector Bases:
- .1 Various types of bases are required to suit each respective application. Confirm with system manufacturer, and provide required type for each application. Types include:
 - .1 standard type equipped with wiring terminals, for mounting to a standard 100 mm (4") octagon box and complete with tamper-resistant mechanism to prevent unauthorized removal of unit head from base;
 - .2 relay type with features similar to standard type but includes auxiliary relay;

- .3 audible type with features similar to standard type but includes an audible alarm sounder;
 - .4 isolator type with features similar to standard type but includes line fault isolator.
- .17 Duct Mounting Products of Combustion Detectors:
- .1 Duct type smoke sensor units with features as follows:
 - .1 addressable photoelectric detector features;
 - .2 duct air sampling tube of suitable required length;
 - .3 magnetic activated test switch;
 - .4 status LEDs;
 - .5 Form C auxiliary alarm relays;
 - .6 remote alarm indicator assembly with LED type lamp and single gang stainless steel faceplate;
 - .7 remote test station for detectors in locations not easily accessible to test.
 - .2 Duct housing assembly consists of an airtight housing mounted on side of duct, and contains sensor base into which photoelectric sensor head is inserted.
 - .3 For units located within ductwork as shown on drawings and for units within air intake ductwork, provide weather resistant and corrosion resistant housing complete with integral heater and power supply, and thermostat controller with alarm contacts for monitoring and annunciation of low temperature. Provide system wiring in conduit back to transponder/control panel.
- .18 Flame Detectors:
- .1 Ultraviolet type flame detectors as follows:
 - .1 flame detector to be suitable for intended application of area of coverage;
 - .2 compact unitized package consisting of detection tube, encapsulated solid state circuitry, dry contact Form C alarm relay;
 - .3 spectral sensitivity range: 1700 to 2900 angstroms;
 - .4 temperature range: -25°C to 60°C (-14°F to 140°F);
 - .5 general purpose painted steel enclosure with protective cage guard;
 - .6 explosion proof housing for applications in designated hazardous locations;
 - .7 ancillary relays and accessories as required for connection to system panel.
- .19 Audible/Visual Devices:

- .1 Devices include bells, horns/speakers, strobes and combination units. Devices to mount on wall back boxes. Back boxes to be supplied by system manufacturer to suit specific devices and type of installation. Finish colours to be confirmed with Consultant or Owner prior to ordering.
- .2 For finished areas: L-series re-entrant type horn and horn/strobe units with features as follows:
 - .1 flush mounting;
 - .2 temporal or continuous tones to meet local governing authority requirements;
 - .3 minimum 94 dBA @ 3m (10') at low setting;
 - .4 faceplate of impact resistant and weather-resistant Noryl construction;
 - .5 integral synchronized strobe to be complete with Lexan lens, field changeable "FIRE" markings and candela output intensity as approved by local fire authority (range from 15 cd to 110 cd);
 - .6 back box suitable for flush wall mounting applications.
- .20 Visual Notification Appliances (Strobe Lights):
 - .1 Visual notification appliances to be ULC listed and labelled, equal to Wheelocks L-Series, synchronized, suitable for intended application with input polarized for standard reverse polarity supervision by fire alarm controls and designed with zero inrush current at 15, 30 and 110 candela intensities. Exact intensities to be to fire authority requirements and as approved by Consultant. Exterior mounted units or units mounted in non-climate controlled areas to be equal to type RSSWP weatherproof type strobes with weatherproof backbox.
- .21 Remote Lamp Units:
 - .1 Single gang stainless steel faceplate with LED indicating lamp, suitable for mounting on standard wall box; unit to be remotely connected to any smoke detector located in position where detector activated LED cannot be seen, such as under raised floors, in drop ceilings, above or in ductwork, etc.; smoke detectors to include auxiliary connections to suit connection requirements as per system manufacturer's recommendations; provide suitable identification labelling on faceplate.
- .22 Fire Signs:
 - .1 "FIRE DO NOT ENTER" custom nomenclature, illuminated, flashing, 24 volt D.C., slim line satin aluminium housing and with black face and red letters; upper and lower rows of long life LED illuminators rated for at least 100,000 hour life, flasher and Lexan guard; lettering of minimum letter size - "FIRE" – 50 mm (2") high, "DO NOT ENTER" – 38 mm (1-1/2") high; lettering not visible until sign is energized.
- .23 Wiring:
 - .1 CSA approved and ULC listed wire and cable, approved for fire alarm circuits; with colour coded, insulated solid copper conductors; of type as per local governing electrical code and local governing fire authority requirements; sized and installed in accordance with system manufacturer's instructions.

- .2 Pentair "Pyrotenax" type "MI" ULC listed and labelled and 2 hour fire rated, mineral insulated, copper sheathed, copper conductors for power wiring to and between each transponder/control panel and applications as required by local governing codes and authorities.
- .24 End-of-Line Resistors:
 - .1 End-of-line resistors for standard alarm and signalling circuits, sized to ensure correct supervisory current flows in each circuit.
 - .2 Mount end-of-line resistors on a stainless steel plate suitable for mounting on a standard single gang wall box.
- .25 Isolators:
 - .1 Isolators to be provided in accordance with code requirements and installed as per system manufacturer's requirements to isolate/monitor zones, loops, group of devices within building and between buildings.
- .26 Warranty:
 - .1 Warranty to include following:
 - .1 a one (1) year repair or replacement warranty on components; full labour costs and no deductible;
 - .2 warranty to begin upon Substantial Acceptance of Project, or where applicable, phase of Project; provide extended warranty for system if used during construction stages and to cover period of construction before turn over to Owner;
 - .3 support of an operational remote maintenance capability;
 - .4 repair response times for problems defined as routine to be addressed and corrected within 24 hours, excepting statutory holidays and weekends;
 - .5 repair response times for problems defined as major to be addressed and corrected within 4 hours, excepting statutory holidays and weekends;
 - .6 requirement to have at least one (1) full system of each model provided available in installation area for immediate installation, in case of an entire system failure or catastrophe; such undertaking to be set out in an acceptable plan;
 - .7 manufacturers of major components to provide written confirmation of full warranty, extended warranty and service back-up in case of failure to perform or insolvency of successful supplier.
- .27 System Inspection, Testing and Verification:
 - .1 Include for system manufacturer's onsite system inspection, testing, verification and certification work, as per requirements specified in Part 3 of this Section. Note that failure to perform such work to complete requirements specified, may at Owner's discretion, affect progress draws and holdbacks.

- .28 Acceptable Manufacturers(products and work to be provided directly from manufacturer, unless otherwise noted):
 - .1 Notifier (from Vipond);
 - .2 Edwards-UTC (from Chubb Edwards);
 - .3 Tyco-SimplexGrinnell (from Tyco Integrated Fire & Security);
 - .4 Siemens Building Technologies (from Siemens);
 - .5 Mircom Group of Companies (from Mircom Engineered Systems).

3 EXECUTION

3.01 INSTALLATION

- .1 Prior to start of Work as part of shop drawing submission process, review with system manufacturer following:
 - .1 device types to ensure that selected type is suitable for intended application on project;
 - .2 locations of devices to ensure proper operation and coverage are in compliance with requirements of local fire authorities;
 - .3 device mounting heights to ensure proper operation and coverage are in compliance with requirements of local fire authorities;
 - .4 device back box requirements to ensure size and depth suit system manufacturer's recommendations for specific devices;
 - .5 proposed system sequence of operation.
- .2 Immediately advise Consultant of any requirements of above that may necessitate revisions to design documents.
- .3 Obtain required training from manufacturer's representative on any special installation procedures. Install devices and perform work in accordance with the manufacturer's instructions and requirements and in accordance to applicable codes of the governing authorities having jurisdiction.
- .4 Provide fire alarm system for building in accordance with issued documents and to approval of local governing authorities. Install, test, verify, and certify system as per latest recognized standards indicated herein, local governing building code and as required by local governing fire authority.
- .5 Work in conjunction with this installation to meet requirements of latest editions of local governing building code, local governing electrical code, ULC Installation Standard CAN/ULC-S524, and any applicable local codes. If any requirements of these specifications are different, omitted or contrary to ULC-S524 Standard, then ULC Standard governs and overrides these specifications, but in no instance will standards established by drawings and specifications be reduced by any of Codes referred to previously. Control units and annunciators to be in accordance to latest requirements of ULC Standard CAN/ULC-S527 "Control Units For Fire Alarm Systems.

- .6 Include for system manufacturer's authorized technician to perform system programming work, work within control equipment and final equipment connections. Include for manufacturer's authorized representative to perform specified on site software programming sessions for Owner's changes, to system after total completion of work and verification of system.
- .7 Provide sequence of operation for fire alarm system as approved by local fire authority and Consultant. Contact Owner's fire Consultant with regards to requirements of sequence of operation and any other requirements of system. Submit sequence of operation and proposed graphic displays to local fire authority and Consultant for review during shop drawing submissions. Refer to additional requirements on drawings.
- .8 Upon completion of Work, demonstrate system to local Fire Department and obtain their approval for complete system.
- .9 Custom programme sequence of operation with provisions to allow authorised Owner's users to make revisions easily. Following sequence of operation to be considered for Bid Pricing purposes. Exact sequence must be approved by local fire authority and Consultant prior to start of work. Refer to drawing schedule of operations. Submit proposed sequence with shop drawings. Actuation of any alarm initiating device to cause following single stage sequence of operations:
 - .1 zone and address of device in alarm condition to be indicated at control panel annunciator and remote annunciator;
 - .2 activation of circuitry to transmit an alarm signal to device(s) provided by others (Owner's arranged monitoring company) to send alarm signal to Fire Department or to an outside private protection company; this work to comply with CAN/ULC-S561;
 - .3 designated air handling equipment to start-up or shut-down by means of control wiring from control panel to equipment starters;
 - .4 release door holders.
- .10 Install control panel and remote annunciators in locations. Mount equipment and connect complete in accordance to manufacturer's instructions and requirements. Arrange for manufacturer's authorized representative to program system with required sequence of operation. Confirm exact sequence of operation with Consultant prior to programming.
- .11 Where required by Code and/or local authorities, that power and control wiring connections to control panel and annunciators and from control panel to annunciators are to be fire rated, provide fire rated, ULC listed, conductors (MI) to provide code required fire rating.
- .12 Install required devices. Do not install devices in locations that may hamper proper operation of devices including adjacent devices.
- .13 Install wall mounting fire alarm panel pull stations in locations and connect complete. Install flush mounted units in a standard 100 mm (4") recessed outlet box with plaster cover. Coordinate type and size of backboxes and outlet boxes with system manufacturer prior to ordering. Install surface mounted units in manufacturers supplied surface boxes.

- .14 Provide ceiling mounted products of combustion detectors in locations and connect with wiring. Secure baseplate of each detector to a 100 mm (4") outlet box or surface mounted as required. Where applicable, provide wiring in conduit and connections from smoke detector auxiliary relays to door hold open devices. Co-ordinate work of respective trades.
- .15 Generally, do not install rate-of-rise type of detectors in areas subject to sudden changes in temperatures. Confirm with system manufacturer for recommended type of detector for each application.
- .16 Mount each duct mounted products of combustion detector on duct in question and connect with smoke sampling tubes which extend into duct air stream. Install a remote alarm lamp assembly for each duct mounted detector. Wall mount each lamp assembly on a standard 100 mm (4") outlet box as close as possible or practicable to detector. Do not locate duct detectors within 1 m (3') of duct size increaser or decreaser fittings or any duct elbow. Provide wiring in conduit and extend to connect back to system control unit.
- .17 Provide alarm bells on standard device boxes in locations. Ensure that sound levels are in accordance to requirements of applicable local Codes and as required by on site audibility coverage tests. Provide required sound meters and personnel to perform tests. Relocate audible devices to suit, or provide additional devices, as required to provide audibility levels to satisfy testing.
- .18 Provide alarm horns/strobes on standard device boxes in locations. Ensure that sound levels are in accordance to requirements of applicable local Codes and as required by on site audibility coverage tests. Provide required sound meters and personnel to perform tests. Adjust tapping, or relocate audible devices to suit, or provide additional devices, as required to provide audibility levels to satisfy testing and governing authority requirements.
- .19 Provide strobes on standard device boxes in locations. Ensure that light intensity levels are in accordance to requirements of applicable local Codes and as required by on site coverage tests. Provide required meters and personnel to perform tests. Adjust settings, or relocate devices to suit, or provide additional devices, as required to provide levels to satisfy governing authority requirements.
- .20 Install devices in stairwells to suit audible/visual coverage requirements and local code requirements. Circuit as required by local code requirements.
- .21 Install fire signs in locations and connect such that activation of fire alarm system illuminates sign and when system is reset and alarm has been silenced, sign is de-energized.
- .22 Devices in non-climate controlled areas to be weatherproof, corrosion resistant, ULC listed for operation in below freezing temperatures, and as recommended by system manufacturer for use for each specific application. Where electronics are not recommended for cold temperature applications, include for manufacturer's recommendations and directions in remotely locating addressable modules in closest heated areas and connecting to respective device in non-climate controlled areas.
- .23 Provide remote annunciator and adjacent graphic annunciator in location. Unless otherwise noted, install in main entrance vestibule. Co-ordinate backbox installation with general trades work of wall structure. Submit annunciator schedule with shop drawings. Verify zone nomenclature with Consultant prior to installation. Provide proposed drawing and sample of graphic display to Consultant for approval before manufacturing.

- .24 In application with hold open devices on doors, ensure compliance with NFPA regarding smoke detectors tied to hold open devices such that a signal received directly from smoke detector must cause release of door. Where electromagnetic locks are used on doors of egress, provide required automatic release of locks upon activation of fire alarm. Provide required connections to fire alarm system and to electromagnetic locks, and provide required contactors and/or relays for connection to control panel.
- .25 Provide voltage-sensing relays in each phase, line side, of fire pump controller and standpipe system excess pressure pump starters to sense loss of line voltage. relays are to be energized from 15A-1P breakers and are to be complete with "C" contacts, one (1) per phase, which, if any one (1) phase voltage drops below 90% of nominal, trouble alarm to signal in fire alarm system indicating "Fire Pump Loss of Voltage" or "Standpipe Excess Pressure Pump Loss of Voltage" at annunciators.
- .26 Provide an auxiliary N.O. contact in fire pump controller and connect to fire alarm annunciators, powered from fire alarm system to indicate "Fire Pump Running".
- .27 Perform required fire alarm system wiring connections to mechanical equipment and other building systems to perform required interrelated functions. Provide required wiring, relays and/or contactors between fire alarm system and various equipment to achieve automatic or manual control of equipment, to perform required integrated to fire alarm system functions. Provide shunt trip breakers as required. Provide ULC listed fire rated conductors where required by local codes and local authorities.
- .28 In addition to wiring connections to fire alarm system components, extend control wiring in conduit to (where applicable):
 - .1 fire protection system piping supervised valves and flow switches for alarm initiation;
 - .2 fire protection system piping supervised valves and flow switches for trouble indication;
 - .3 fire protection piping pressure sensors for loss of pressure trouble indication;
 - .4 fan equipment starters;
 - .5 pumps;
 - .6 dampers;
 - .7 fire suppression systems;
 - .8 door holders/releases and electromagnetic locks master release/reset;
 - .9 telephone system key switch for connection to offsite central monitoring station;
 - .10 fire pump transfer switch;
 - .11 security systems;
 - .12 BAS system;
 - .13 dimming systems;
 - .14 genset control panel;

- .15 central inverter;
- .16 devices as shown on drawings.
- .29 Unauthorized closure of a fire protection system piping supervised valve to cause location of closed signal (audible and visual) to sound and illuminate, and a trouble signal to be transmitted (via a future connection) to Fire Department or to an outside protection agency.
- .30 Low pressure in fire protection piping mains (wet and dry), fire protection system pumps (fire pumps-standpipe system excess pressure pump-sprinkler pump, sprinkler system excess pressure pump) loss of power, or operation of fire pumps to also activate audible and visual trouble alarm as specified above for supervised alarms.
- .31 Provide end-of-line resistors to electrically supervise wiring. Generally, locate end-of-line resistors at ceiling lines above a pull station location. Provide isolators and install in accordance with ULC standards. Properly label and identify. Do not locate end-of-line resistors and isolators in concealed locations. Generally install in equipment rooms.
- .32 Refer to drawing riser diagram. Quantities of components to be as per floor plans and not riser diagram.
- .33 Confirm exact location of components and devices prior to roughing-in. Where applicable, confirm component finishes with Consultant prior to ordering.
- .34 Install wiring in conduit. Perform wiring connections associated with fire alarm system on terminal strips in junction boxes. When pulling wires into conduit, use lubricant and ensure that wires are kept straight and are not twisted or abraded. Neatly secure exposed wires in apparatus enclosures with approved supports or ties. Clearly label and identify wires at termination points. In addition, number wires with Brady Ltd. or Electrovert Ltd. Z-type markers. Colour conductors for each part of system in accordance with system equipment manufacturer's recommendations.
- .35 Run alarm signalling circuits (horns/strobes/speakers) and alarm receiving circuits (pullstations, detectors) in separate conduits from each other. Perform wiring connections on terminal strips in junction boxes. Paint conduit couplings for fire alarm system in red enamel.
- .36 Where required by local governing codes and/or local governing authorities, provide ULC listed, fire rated conductors (MI) for connections to and interconnections between equipment for life safety applications requiring fire rating.
- .37 Provide engraved Lamacoid identification nameplates for each equipment or wiring housing and secure to front of housing. Exact wording designations and sizes to be reviewed and confirmed with Consultant prior to manufacture.
- .38 Verify nomenclature of annunciator identification with Consultant and obtain necessary approvals prior to ordering.
- .39 Arrange sprinkler system alarm valve alarm zones to be separate from manual station, thermal detector and products-of-combustion detector device zones, which may be connected together into zones.

- .40 Provide required double voltage relays for fire alarm wiring work. Provide double voltage relays, with multiple contacts as required, to shut down designated fans. Arrange relays to be energized at all times from fire alarm system to ensure that they are fail-safe.
- .41 Ground and bond system as required by local governing electrical code and authority and system manufacturer.

3.02 SYSTEM TESTING AND VERIFICATION

- .1 Submit to Consultant for approval, proposed schedule for testing and verification of system. Obtain such approvals prior to start of testing. Consultant and/or other Owner's representatives to have option to witness all or part of testing and verification work. Notify Consultant and Owner minimum seven (7) working days in advance of testing.
- .2 When system work is complete and ready for acceptance, arrange for fire alarm system manufacturer's authorized technician to inspect, test, verify, and certify equipment, including initiating devices, signalling devices, control devices, and wiring. Inspection to comprise of an examination of such equipment in accordance with latest editions of CAN/ULC-S537, for following:
 - .1 to ensure that entire system functions in accordance with sequence of operations on drawings and as specified;
 - .2 to ensure that type of equipment installed is that designated by contract documents;
 - .3 to ensure that wiring connections to equipment components show that installer observed applicable ULC and CSA requirements;
 - .4 to ensure that equipment was installed in accordance with ULC S524 and manufacturer's recommendations, and that signalling devices of whatever manufacture were operated or tested to verify their operation;
 - .5 to ensure that supervisory wiring of those items of equipment connected to a supervised circuit is operating and that governmental regulations, if any, concerning such supervisory wiring, have been met to satisfaction of inspecting officials;
 - .6 to ensure that system backup batteries provide sufficient backup power as per local governing building code and local fire authority requirements;
 - .7 to ensure that system audible devices provide alarm sound levels in each area as per local governing building code and local fire authority requirements; be responsible to site adjust tap settings of audible devices as required to achieve required audibility levels;
 - .8 to ensure that system visual display devices are located in areas as per local governing building code and local fire authority requirements;
 - .9 to ensure that each device is commissioned and operable.
- .3 Include for full demonstration to Consultant that system batteries and audible devices comply with specification and code requirements.
- .4 Arrange for local fire authority inspector to review system and Work. Make any necessary revisions and verify. Pay necessary fees and obtain required approval certificate and turn over to Consultant. Perform necessary re-verifications of Work.

- .5 Arrange for manufacturer to supply reasonable amounts of technical assistance with respect to any changes to sub-paragraphs above. During period of inspection and verification, make electricians available to do any required correction work and to assist during inspections.
- .6 On completion of verification, inspection and testing of system, obtain from manufacturer and forward to Consultant, a verification certificate together with detailed inspection reports listing each and every system component, its location in building and its acceptability. Manufacturer's technician to prepare and sign verification certificates and inspection reports, confirming that system is installed, is working in accordance with requirements specified above and that system has been approved and accepted by local governing fire authority.
- .7 Obtain from system manufacturer and forward to Consultant a certificate of liability insurance of minimum amount of Two Million Dollars (\$2,000,000.00), that is to be registered for this project to show satisfactory proof of manufacturer's liability coverage for both their product and personnel.
- .8 Include for re-verification of any failed device repaired or replaced.
- .9 Do not use open flame and/or smoke for testing unless approved by Owner.
- .10 System manufacturer to employ technicians certified and approved for fire alarm system testing and verification by Canadian Fire Alarm Association (CFAA) and Ontario Fire Marshall, as applicable.
- .11 Submit with test reports, copies of valid certification of testing technician.
- .12 Additionally, refer to testing, coordination and verification requirements in Section entitled Electrical Work Analysis and Testing and include applicable requirements.

3.03 TRAINING

- .1 Manufacturer's trained technician to perform onsite training of each user (including the provision of user guides) prior to project completion to ensure that users are properly trained in the operation and maintenances of system.
- .2 Refer to Instructions to Owner specified in Section entitled Electrical Work General Instructions.

END OF SECTION

- 1 General
- 1.1 **SUBMITTALS**
 - .1 Submit shop drawings for products specified in this Section.
- 2 Products
- 2.1 **DUCT FOR CONCRETE ENCASEMENT**
 - .1 CSA approved, Canron Inc., PVC Type II plastic or FRE Composites Inc., "FRE" fibreglass reinforced epoxy conduit suitable for concrete encasement.
 - .2 Synthetic polypropylene fibre (plastic) twine cord or 19 mm (3/4") diameter polyethylene rope.
- 2.2 **CONCRETE HANDHOLES**
 - .1 Handhole types for splices, pulls and junction applications:
 - .1 Cast-in-place concrete handholes;
 - .2 Pre-cast concrete handholes;
 - .3 Pre-fabricated handholes made of semi-concrete or non-concrete materials polymer concrete.
 - .2 Handholes to be CSA approved and in accordance with following, as applicable:
 - .1 OPSS 602;
 - .2 ASTM C857;
 - .3 ANSI/SCTE 77.
 - .3 Concrete to be in accordance with CSA A23.1 and CSA A23.2. Minimum compressive strength to be of 32MPa (4600 psi), 6-8% air entrainment, and be suitable for installation and use through a temperature range of minus 40°C to 70°C. (-40°F to 158°F).
 - .4 Polymer concrete to consist of aggregates in combination with polymer resin, and reinforced with fibreglass. Non-conductive and non-flammable. Stable under freeze / thaw conditions.
 - .5 Enclosures to be designed and installed to withstand loads likely to be imposed and be of size, with wiring/duct entries, covers and bottoms (as noted) and of type to suit specific applications.
 - .6 Steel Handhole Cover:
 - .1 Galvanized steel according to CAN/CSA-G40.20/G40.21 and CAN/CSA-G164M92 (R2003);
 - .2 Checkered tread on top side for skid resistance ;
 - .3 Tamper-proof, stainless steel head bolts recessed into cover;
 - .4 Area for logo;
 - .5 Flush mounted with gaskets to prevent ingress of water;
 - .6 Minimum thickness of cover is 10 mm (3/8").
 - .7 Polymer Concrete Cover:

- .1 Flush mounted with gaskets to prevent ingress of water;
- .2 Skid resistant;
- .3 Tamper-proof, stainless steel head bolts recessed into cover;
- .4 Area for logo;
- .5 Minimum thickness of cover is 20 mm (3/4").
- .8 Cable termination hardware to accommodate cables and required grounding hardware. Hardware to be corrosion resistant and in accordance with code requirements.
- .9 Provide PVC seals on cable entry openings.
- .10 Identification:
 - .1 Identification markings on each handhole embedded on outside vertical surface of handhole, showing manufacturer's name or trademark, and date of manufacture.
 - .2 Top surface of handhole cover permanently marked, showing manufacturer's name or trademark, and date of manufacture; this marking embedded into top surface of handhole cover, or embedded into a corrosion-resistant metal plate securely cemented to top surface of handhole cover.
- .11 Refer to drawings for handhole dimensions.
- .12 Acceptable manufacturers are:
 - .1 Armtex Ltd (Brooklin Concrete);
 - .2 Industrial Cast Stone Ltd.;
 - .3 Utility Structures Inc.;
 - .4 Hanson Pipe and Pre-cast;
 - .5 Hubbell.

2.3 **MANHOLES**

- .1 Manholes to be provided for concrete encased ductbank runs. Provide manholes complete with cast iron covers and collars/frames, ladders, cable pulling eyes, cable management trays, etc. Sizing and locations to suit design requirements and applications.
- .2 Comply with CSA/CAN A23.1 and 23.4 requirements and other required CSA Standards.
- .3 Precast or cast in place concrete manholes to generally be as follows:
 - .1 sized as per drawing detail;
 - .2 concrete of minimum strength of 32 MPa (4600 psi) at 28 days (6-8%) which is to suit specific applications and code requirements;
 - .3 steel reinforced;
 - .4 cable openings coordinated with duct bank entry.
- .4 Provide accessories as follows:
 - .1 minimum 800 mm (32") diameter, minimum 10 mm (3/8") thick cast iron cover with warning text on cover; confirm nomenclature with Consultant prior to ordering;
 - .2 tamper proof corrosion resistant cover bolts;

- .3 minimum 150 mm (6") thick cast iron frame;
 - .4 concrete levelling collars;
 - .5 aluminum access ladders;
 - .6 galvanized steel cable pulling eye loops;
 - .7 galvanized steel cable racks and trays;
 - .8 structural lifting hooks on pre-cast units;
 - .9 drainage: storm sewer connection with cast iron service saddle with oil resistant gasket, stainless steel clamp and oil resistant O ring;
 - .10 drainage pit: 300 mm x 300 mm 125 mm (12" x 12" x 5") suitable for sump pump operation.
- .5 Exact drainage requirements to be as coordinated with General Contractor and/or Mechanical Contractor to suit project design requirements and on site provisions.
- .6 Acceptable manufacturers are:
- .1 Armtec Ltd (Brooklin Concrete);
 - .2 Industrial Cast Stone Ltd.;
 - .3 Utility Structures Inc.;
 - .4 Hanson Pipe and Pre-cast.

2.4 DECORATIVE CONCRETE BASES

- .1 Art Forms International Inc. (905-642-3225), Model No. NEWAVEA 510R, high/low cast-in-place architectural concrete bases for pole mounted exterior luminaires. Bases include but not be limited to following:
- .1 breakaway construction forms;
 - .2 vertical steel reinforcing rods and horizontal steel reinforcing ties;
 - .3 cast and cured as per Division 03 requirements;
 - .4 co-ordinated with installation of poles/bollards and conduits;
 - .5 self-locking, vandal resistant wrap around aluminium band of finish confirmed with Consultant.
- .2 Confirm exact finishes with Consultant prior to ordering. Install bases in strict accordance with manufacturer's instructions. Coordinate work with general trades work.

3 Execution

3.1 INSTALLATION OF DUCT FOR CONCRETE ENCASED DUCTBANK

- .1 Provide ducts and concrete encasement shown and as required, in accordance with applicable local governing authority codes and standards. Coordinate Work with trades responsible for performing excavation, backfill, and concrete Work. Confirm requirements with local authority having jurisdiction. Refer to Section entitled Common Work Results for Electrical for excavation, concrete, and backfilling work requirements.
- .2 Use standard duct lengths and fittings as much as possible and practicable. When cutting is necessary, carefully taper duct ends with special field tapering machine. Make joints by means of standard couplings. Maintain minimum bending radius of 1 m (3.3').

- .3 Make concrete encased duct joints with use of couplings which provide a smooth water tight joint between ducts, using suitable cement that is specifically designed for use with duct pipe being used.
- .4 Separate ducts by means of plastic 75 mm (3") spacers and placed 75 mm (3") away from wooden forms on both sides ensuring that there is 75 mm (3") of concrete between ducts and a 75 mm (3") concrete envelope around duct assembly. Elevations and slopes of ducts to be as shown on drawings and as required, or based on minimum 760 mm (30") below finished grade and minimum 1% slope. Separate ducts with spacers at distance as required by local authority and as per duct manufacturers' instructions. Do not locate spacers of vertical rows of ducts directly above each other. Maintain minimum 150 mm (6") separation. Where ducts cross roads, paved areas, disturbed ground, new or future, concrete envelope to have 15 mm (5/8") diameter reinforcing steel bars laid longitudinally along trench with 100 mm (4") lateral spacing and 50 mm (2") above base of concrete. Provide an overlap of 600 mm (2') on reinforcing bars, where necessary. Extend reinforcing 1.5 m (5') beyond backfilled areas, driveways, roadways etc. Reinforce duct runs at all building entries for a distance of 1.5 m (5') out from such entry walls, bars being embedded in walls.
- .5 Do not place concrete around ducts, and do not backfill until duct line is inspected and approved by Consultant. If concrete is poured around ducts or if trenches are backfilled before ducts have been approved, be responsible for removing and replacing concrete at no extra cost to allow for approval inspections.
- .6 When conduit has been laid and duct banks work completed and set, draw a steel test mandrel through each duct in presence of Consultant. Diameter of mandrel to be 13 mm (1/2") less than inside diameter of duct. Remove obstruction found in duct to satisfaction of Consultant, and leave duct system completely clear. No conduit will be accepted as being ready for installation of feeders until this is done.
- .7 Whenever Work is suspended, protect ends of ducts by means of suitable plugs and leave such plugs in use as long as may be necessary. When conduit is installed for future extension, plug ducts and end of duct bank boxes for protection.
- .8 Do not lay defective ducts under any circumstances.
- .9 Include for provision of following requirements:
 - .1 concrete used for encasing ducts to have a minimum compressive strength of 20.7 mPa (3000 psi);
 - .2 compact and cover bottom of trench with a freshly poured concrete bed 75 mm (3") thick, for full width of trench;
 - .3 lay lowest row of ducts on concrete bed, completely enclosed in concrete; install subsequent layers in a similar manner; space ducts 150 mm (6") centre to centre both vertically and horizontally; fill spaces between ducts with concrete;
 - .4 enclose ducts in a minimum 75 mm (3") thick envelope of concrete for full width of trench;
 - .5 fill entire space between ducts with concrete; do not use concrete which has started to set to a point that it will not properly pour to smoothly fill spaces between and around ducts;
 - .6 use of monolithic method (i.e. placing all ducts and pouring concrete around complete installation) is subject to approval of Consultant and/or local authority;
 - .7 exercise with care when placing concrete around ducts to ensure that ducts remain in correct position with proper spacing and that no concrete enters any of ducts;

- .8 reinforce duct where duct crosses filled or disturbed ground;
- .9 there must be no metallic reinforcing rods or other conducting material encircling a single conduit in a duct bank (entire duct bank may be encircled);
- .10 maximum size of aggregate in concrete to be 10 mm (3/8");
- .11 provide reinforcing rods and dowels in ductbank at building wall as detailed;
- .12 provide sloping and drainage of ducts to prevent pooling of water within ducts; coordinate exact requirements with Consultant prior to start of Work;
- .13 unless drainage provisions have been provided within building for duct draining, seal openings where ducts enter building with elastomeric, fire rated, waterproof sealing material to prevent egress of water and that can easily be removed for access to ducts;
- .14 provide marking tape and marking pavers as required by local governing authorities;
- .15 provide one (1) continuous length of polyethylene rope or Brantford twine in each duct indicated as spare or for future use.
- .10 Allow Consultant or local authority representative (as applicable) access and opportunity to witness Work, prior to covering.
- .11 Refer to requirements of drawing detail.

3.2 **INSTALLATION OF HANDHOLES**

- .1 Coordinate installation work with trades responsible for excavation and backfilling work.
- .2 Install handholes plumb, true to alignment and grade, and firmly bedded on drainage pocket backfill.
- .3 During installation, duct entry holes to be oriented in required direction. Enlarging of duct entry holes is prohibited.
- .4 Coordinate connection of ducts to ensure that proper sloping is maintained to suit designed elevations and slope of duct run and required drainage.
- .5 Refer to drawing detail for additional requirements.
- .6 Obtain required approvals of work from Consultant prior to back filling and covering.
- .7 Refer to Section entitled Common Work Results for Electrical for excavation, concrete, and backfilling work requirements.

3.3 **INSTALLATION OF MANHOLES**

- .1 Provide specified manholes. Coordinate required excavation, backfill, and concrete work. Arrange and coordinate work to prepare ground to provide a level and good draining foundation for manholes. Coordinate cable entry opening with location of duct bank.
- .2 Provide grade levelling collars/neck such that cover is flush with finished grade in paved areas and 38 mm (1-1/2") above grade in unpaved areas. Provide extension collars as required. Confirm final grade level with General Contractor.
- .3 Confirm drainage provisions with General Contractor. Connect drains.
- .4 Coordinate connection of ducts and duct bank to ensure that proper sloping is maintained to suit designed elevations and slope of duct bank and required drainage.
- .5 Work to be performed under general supervision of General Contractor.

- .6 Obtain required approvals of work from Consultant prior to back filling and covering.
- .7 Refer to Section entitled Common Work Results for Electrical for excavation, concrete and backfilling work requirements.

END OF SECTION