HVAC IV
126 PAPE AVE, TORONTO ON M4M 2V8
21 PARK RD, TORONTO ON M4W 2N1

FOR

CITY OF TORONTO
TORONTO SHELTERS AND SUPPORT SERVICES (TSSS)

ISSUED FOR TENDER
30 MAY 2025

TABLE OF CONTENTS

Division 0

00 21 00 Instructions to Bidders
00 41 00 Bid Form

Division 1

01 11 00 Summary of Work
01 14 00 Work Restrictions
01 21 00 Allowances
01 25 00 Alternatives & Substitutions
01 26 00 Contract Modification Procedures
01 29 00 Payment Procedures
01 31 13 Coordination
01 32 00 Construction Progress Documentation
01 33 00 Submittal Procedures
01 40 00 Quality Requirements
01 51 00 Temporary Utilities
01 52 00 Temporary Construction Facilities
01 56 00 Temporary Barriers and Enclosures
01 57 00 Temporary Controls
01 61 00 Common Product Requirements
01 71 00 Examination and Preparation
01 73 00 Execution
01 73 29 Cutting and Patching
01 74 00 Cleaning and Waste Management
01 77 00 Closeout Procedures
01 78 00 Closeout Submittals
01 79 00 Demonstration and Training
01 91 00 General Commissioning Requirements

Division 2 Existing Conditions

02 41 19 Selective Demolition
02 82 13.2 Type 2 Asbestos Abatement
02 82 13.3 Type 3 Asbestos Abatement
02 83 13 Lead Disturbance Precautions
02 84 16 Handling of Mercury Containing Equipment
02 87 13 Silica Disturbance Precautions

Division 4

See Structural drawings for Masonry Materials and Reinforcement specifications

Division 5

See Structural drawings for Masonry Lintels specifications

Division 6

See Structural drawings for Wood Frame, and Structural composite lumber (SCL) specifications

06 10 00 Rough Carpentry

Division 7

07 84 00 Firestopping
07 90 00 Sealants

Division 9

09 22 00 Metal Stud Framing
09 25 00 Gypsum Wall Board
09 27 13 Glass Fibre Reinforced Gypsum Fabrications
09 51 00 Suspended Acoustical Ceilings
09 90 00 Painting

Divisions 22-26

Refer to appended Mechanical and Electrical specifications which are separated by site.

Appendix

Designated Substances and Hazardous Building Materials Assessment Report (HVAC Upgrades Project; Asquith Green Social Housing; 21 Park Road), prepared by Safetech Environmental Limited, (61 pages), issued August 15, 2025

Designated Substances and Hazardous Building Materials Assessment Report (HVAC Upgrades Project; Amelie House; 126 Pape Ave), prepared by Safetech Environmental Limited, (64 pages), issued August 15, 2025

1 General

1.1 DESCRIPTION OF WORK INCLUDES

.1 Work under this Contract covers the following:

Work includes, but is not limited to:

- Upgrades to mechanical ventilation system (HVAC) at 21 Park Road and 126 Pape Avenue.
- Structural modifications as required in service of HVAC upgrades.
- Electrical modifications as required, in service of HVAC upgrades.
- Architectural modifications as required, in service of HVAC upgrades.
- Phasing of work to minimize impact on occupants and maintain intended operation of the building to the greatest extent possible, as further outlined in the documents.

1.2 RELATED SECTIONS

SECTION	
01 11 00	Summary of Work
01 14 00	Work Restrictions
01 21 00	Allowances
01 25 00	Alternatives and Substitutions
01 26 00	Contract Modification Procedures
01 29 00	Payment Procedures
01 31 13	Coordination
01 32 00	Construction Progress Documentation
01 33 00	Submittal Procedures
01 40 00	Quality Requirements
01 51 00	Temporary Utilities
01 52 00	Temporary Construction Facilities
01 56 00	Temporary Barriers and Enclosures
01 57 00	Temporary Controls
01 61 00	Common Product Requirements
01 71 00	Examination and Preparation
01 73 00	Execution
01 73 29	Cutting and Patching
01 74 00	Cleaning and Waste Management
01 77 00	Close Out Procedures
01 78 00	Close Out Submittals
01 79 00	Demonstration and Training
01 91 00	General Commissioning Requirements

1.3 CONTRACTS

.1 Construction Work under single Construction Agreement Contract and Supplemental Conditions if applicable.

1.4 GENERAL REQUIREMENTS

.1 The requirements of the Articles of Agreement, Conditions of the Contract, Division 1 apply to and form all Sections of the Contract Documents and the Work.

.2 Work in this Specification is divided into descriptive sections which are not intended to identify absolute contractual limits between Subcontractors, nor between the Contractor and their Subcontractors. The Contractor is responsible for organizing division of labour and supply of materials essential to complete the Contract. The Consultant assumes no liability to act as an arbiter to establish subcontract limits between Sections or Divisions of Work.

.3 Specifications, Schedules and Drawings are complementary and items mentioned or indicated on one may not be mentioned or indicated on the others.

.4 Contractor shall be responsible for materials, products, operations, or methods mentioned in the specifications or indicated on the drawings and shall provide to the quality or subject to the qualifications noted. Perform, according to the conditions stated, each operation prescribed and provide labour, materials, products, equipment and services to complete the Work.

.5 Where the singular or masculine is used in the Contract Documents, it shall be read and construed as if the plural, feminine or neuter had been used when the context or the statement so requires and as required to complete the Work, and the rest of the sentence, clause, paragraph, or Article shall be construed as if all changes in grammar, gender or terminology thereby rendered necessary had been made.

.6 The terms “exposed” or “exposed to view” refers to surfaces that are within the line of vision of persons from any accessible viewpoint, both within and without the building. Where any part of a surface is exposed to view, all other portions of that surface shall also be considered as exposed to view.

1.5 WORK SEQUENCE

.1 Cooperation with The Owner in scheduling operations to minimize conflict and to facilitate The Owner’s ongoing usage.

.2 All of the Work is to proceed to the schedule submitted by the awarded Construction Manager (hereby referred to as the Contractor or GC) and accepted by the Owner. The Contractor’s schedule will recognize the following restrictions:

.1 The Contractor must perform their activities respecting the requirements set forth in the specifications Division 01 - Section 01 11 00 “Summary of Work” and will safeguard the operations of The Owner. All services are to be left in good repair and operating while the Work is undertaken.

.2 Safe access through the intended Project access route and fire/emergency routes must be maintained. Throughout the construction period, the Contractor is to include for any hoarding, covered walkway, etc., necessary for this purpose. The construction activities are to be scheduled so as to minimize any complete shutdown of the manufacturing/production and delivery areas.

1.6 CONTRACTOR’S USE OF PREMISES

.1 The Contractor shall maximize use of premises as much as possible to allow for:

.2 Assume full responsibility for protection from construction hazards of The Owner’s staff at all times when they are on the site.

.3 Assume full responsibility for the protection of the existing buildings, systems and services, and utilities from damage due to the Work of the Contractor or any

Subcontractors employed on the site. After obtaining the approval of the Consultant, make good all damage to Owner's satisfaction and at no cost to Owner.

.4 Site storage:

.1 Allocate an area on site within the limits of the Work acceptable to The Owner for storage of Products brought to the site by all trades. Materials and equipment to be stored on site in storage containers (i.e. C Can Containers) or on site in a weatherproof storage enclosure.

.2 Do not encumber site with materials or equipment items are stored on site.

.3 Keep storage area tidy at all times and do not use other parts of the property for storage.

.4 Assume full responsibility for protection and safekeeping of products stored on premises.

.5 Move any stored products or equipment which interfere with operations of The Owner at no cost to the Owner.

.5 Refer to Section 01 14 00 for additional work restrictions relevant to the Work.

1.7 DOCUMENTS AT THE SITE

.1 Keep the following documents on Site, stored securely and in good order and available to The Owner and Consultant in hard copy:

.1 Current Contract Documents, including Drawings, Specifications and addenda.

.2 Change Orders, Change Directives, and Supplementary Instructions.

.3 Reviewed Shop Drawings, Product data and samples.

.4 Field test reports and records.

.5 Construction progress schedule.

.6 Meeting minutes.

.7 Manufacturer's certifications.

.8 Permits, inspection certificates and other documents required by authorities having jurisdiction.

.9 Current as-built drawings.

.10 Material Safety Data Sheets (MSDS) for all controlled Products.

1.8 OCCUPANCY AND USE OF PREMISES

.1 The Contractor and all Subcontractors are expected to understand that all areas of the building remain occupied during the Work and that the Work is to be executed in such a manner as to provide the minimum interference with the partial use of the premises by the occupants, and the maximum safety of the occupants during the Work. The Contractor and all Subcontractors will take reasonable measures for the control of noise during working hours.

.2 The Contractor shall maintain normal building operation and traffic flow, with minimum inconvenience from noise and dust to the tenants of the facilities.

.3 The Contractor shall organize the work at each facility so as to minimize any disruption in the ordinary use of the facility by the tenants, ensure minimum interference with the occupation, use and enjoyment of the facility by the tenants and minimize any reduction in comfort at the facility.

.4 All noise and vibration generating operations, such as jack hammering, drilling, compacting and the use of other such equipment, that will interfere with the occupied portions of the building shall be confined to the hours as stipulated in Section 01 14 00.

.5 The Work shall be confined to the area defined on the drawings except that services connections, sanitary and storm connections, and certain portions of landscaping, hard paving and curb work shall be executed on Municipal property under regulations of authorities having jurisdiction

.6 It is essential that the existing building be maintained weather tight at all times. The Contractor shall therefore furnish all temporary protection, enclosures, tarpaulins, etc., as may be required to weatherproof any openings made by the Work. The Contractor and all Subcontractors must seal off or temporarily dam all open roof edges, etc. to prevent any water present on existing roof areas, from entering the occupied floor(s).

.7 The Contractor is to ensure that throughout the duration of the construction, the Owner's power requirements must not be affected by the service of the construction. Provide at minimum, 14 business day advance notice there is any planned utilities shut down in accordance with requirements of Section 01 14 00.

1.9 SETTING OUT

.1 Be responsible for setting out the Work. Prior to setting out the Work, verify dimensions and elevations shown on the Contract Documents and report to Consultant any unsatisfactory conditions that may adversely affect the proper completion of the Work.

.2 Accurately set out the Work from levels and lines. Where Work of this Contract is dependent upon grades and elevations of existing structures or facilities, such grades or elevations shall take precedence over those determined by reference to established elevations. Advise Consultant of any discrepancies.

.3 During any activity of the Work, layout and check all features, including but not limited to the following:

.1 Establish and maintain temporary bench marks set required to perform the Work..

.2 Provide general dimensions, lines and elevations required to perform the Work.

1.10 BUILDING DIMENSIONS

.1 Report any inconsistencies, ambiguities, discrepancies, omissions, and errors between Site conditions and Contract Documents to Consultant prior to the commencement of Work. If inconsistencies, ambiguities, discrepancies, omissions, and errors are not reported and clarified, the most stringent requirement shall govern, as determined by Consultant.

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

.3 Where dimensions are not available before fabrication commences, ensure that dimensions required are agreed upon between the parties concerned.

.4 Prior to commencing work, ensure that clearances required by jurisdictional authorities can be maintained.

.5 Ensure that the necessary job dimensions are taken and Subcontractors are coordinated for the proper execution of the Work. Assume complete responsibility for the accuracy and completeness of all dimensions, and for coordination of all elements of the Project.

.6 Verify that the Work, as it proceeds, is executed in accordance with dimensions and positions indicated which maintain levels and clearance to adjacent Work, as set out by requirements of the Contract Documents, and ensure that Work installed in error is rectified without extra cost to the Owner before construction continues.

.7 Verify dimensions of shop fabricated portions of the Work at the site before shop drawings and fabrications are commenced. The Owner will not accept claims for extra expense by reason of non-compliance with this requirement.

.8 Check and verify dimensions referring to Work and interfacing of services. Dimensions, when pertaining to the Work of other Sections (Subcontractors), shall be verified with the Section (Subcontractor) concerned. Ensure that Subcontractors performing various Sections cooperate for the proper performance of the Work.

.9 Do not scale directly from the Drawings. If there is ambiguity or lack of information, immediately inform Consultant. Any change through the disregarding of this clause shall be the responsibility of the Contractor.

.10 All details and measurements of any Work which is to fit or conform to Work installed shall be taken at the site.

.11 Leave areas clear where space is indicated to be reserved for future equipment, including access to such future equipment.

.12 Whether shown on the Drawings or not, leave adequate space and provision for servicing of equipment and removal and reinstallation of replaceable items such as motors, coils and tubes as recommended by equipment manufacturer.

1.11 EXISTING SITE CONDITIONS

.1 Make a careful examination of the site and investigate and be satisfied as to all matters relating to the nature of the Work to be undertaken, as to the means of access and egress thereto and therefrom, as to the obstacles to be met with, as to the extent of the Work to be performed and any and all matters which are referred to in the Contract Documents. Claims for additional costs will not be entertained with respect to conditions which could reasonably have been ascertained by an inspection prior to tender closing.

.2 Report any inconsistencies, ambiguities, discrepancies, omissions, and errors between Site conditions and Contract Documents to the Consultant prior to the commencement of Work. If inconsistencies, ambiguities, discrepancies, omissions, and errors are not reported and clarified, the most stringent requirement shall govern, as determined by the Consultant.

1.12 SUPPLEMENTARY DEFINITIONS

.1 In the Specifications, references such as “shown on the Drawings”, “specified”, “scheduled”, “called for” and the like shall be deemed to include work required by any of the Contract Documents.

.2 In the Specifications the expression Section(s) is synonymous with Subcontractor(s) if the context permits. The expression “all Sections” shall be deemed to include the Contractor.

1.13 EXAMINATION

.1 Each Section (Subcontractor) shall examine surfaces prepared by other Sections (Subcontractors) which affect its work and shall ensure that defects are corrected. Commencement of Work shall imply acceptance of prepared Work.

.2 All Sections (Subcontractors) shall check and verify with the Contractor all dimensions, especially those pertaining to work of more than just their Section (Subcontractors work).

.3 All details and measurements of any work which is to fit to, or conform with, work already installed by other Sections (Subcontractors, shall be taken at the job site by the Sections (Subcontractors) concerned.

1.14 SUPPLY AND/OR INSTALLATION

.1 Unless the word “only” suffixes “supply” or “install” or other variations of those words according to the Section wherein they are used, it is the express intent of this Contract that “supply and install” is implied.

.2 Unless otherwise specified, Work shall be installed in accordance with the manufacturer’s printed directions and recommendations.

1.15 SATISFACTION / APPROVAL

.1 The expression “to the satisfaction or approval of The Owner” shall be implied throughout the Specifications in regard to all materials and workmanship.

.2 “Submit for approval” means that the item in question is to be submitted to The Owner for approval and that a written acceptance of it is authorization for its use in the Work shall be obtained before it is incorporated in the Work. Sections (Subcontractors) shall submit items for approval to The Owner via the Contractor.

.3 The terms “approved”, “review”, “reviewed”, “accepted”, “acceptance”, “acceptable”, “satisfactory”, “selected”, “directed”, “instructed”, “required”, “submit”, “permitted”, “approved alternative”, “approved equal”, or similar words or phases are used in standards or elsewhere in Contract Documents, it shall be understood, that words “by (to) The Owner” follow, unless context provides otherwise.

.4 The term ‘or approved alternate’ or similar language following a list of products, systems, or manufacturers used in the Contract Documents shall be construed to mean approved by Consultant. Specified products to be Base Bid. Contractor to follow substitution procedures specified in this Section for submitting proposed products, systems, and manufacturers and obtain Consultant’s approval of the same prior to proceeding with ordering proposed products and systems or engaging manufacturers. Contractors who purchase products and systems or engage manufacturers prior to Consultant’s review and acceptance do so at their own risk.

.5 An “approved method” means that which has the manufacturer’s recommendation or which is generally accepted as good trade practice.

1.16 EXISTING SERVICES

.1 The Contractor is responsible for ensuring all “Existing Services” (including but not limited to structural elements, water pipes, drains, electrical cables and fixtures, communications cables and fixtures, security cables and fixtures, HVAC ducting, cables and fixtures, etc.) are not interrupted and / or damaged by the construction work. The Contractor must take all precautions to ensure that services buried underground or contained in a floor or contained in other elements are identified on the drawings provided by The Owner and have been clearly identified on the Work Site.

.2 The Owner will not be liable for any loss, damage, delay or claim whatsoever resulting or arising from the absence in whole or part of services not shown on drawings.

1.17 EMERGENCIES

.1 Notify The Owner's Project Team immediately should an emergency arise on the Site, including personal injuries and accidents. This notification shall be by telephone or email immediately after the occurrence.

.2 Provide an incident report including complete details on extent of emergency, cause and the action being taken.

1.18 FIELD MARKING

.1 Do not use wick pen to mark face of products to be installed in the Work. Such pen marks will show through applied paint or vinyl coatings and the like in due course. The Contractor will be held responsible and required to remedy such defects, classified as "latent defects" regardless of when they occur.

1.19 SECURITY

.1 Be responsible for security of all areas affected by Work of this Contract until taken over by The Owner. Take steps to prevent entry to the Work by unauthorized persons and guard against theft, fire and damage by any cause. Provide safe and secure access to and egress from existing premises at all times.

.2 Take acceptable precautions to guard Work site, premises, materials and the public during and after working hours due to the Work of this Contract.

END OF SECTION

1 GENERAL

1.1 NORMAL BUSINESS HOURS

.1 The building is occupied and is to be considered “fully operational”, 24 hours per day, 7 days per week.

.2 Normal working hours are from 9am-5pm, Monday to Friday. Any work proposed outside of these hours must be approved in advance by the Owner with a minimum of 7-days prior written notice.

.1 Written notice shall include a summary of the proposed work, including proposed start time/duration and impacts on base building operations and systems.

.3 Except as permitted in item 1.2 below, at the end of each working day the building shall be returned to a “fully operational” condition, including but not limited to all functioning building services (life safety, power, water, heating, cooling).

1.2 ZONES OF WORK

.1 “Zones” have been identified within the building – refer to drawings.

.2 Upon acceptance by the Owner, the Contractor shall be granted full access to 1 Zone of work at a time.

.1 No more than 1 Zone shall be taken offline at a single time.

.2 While under the Contractor’s control, each Zone shall be secured to prevent access with Temporary Barriers and Enclosures as per Specification 01 56 00. Exiting requirements shall be maintained.

.3 When a Zone is under the Control of the Contractor, normal working hours shall still apply to said Zone, however the Zone does not need to be returned to “fully operational condition” at the end of each working day.

.4 A minimum of fourteen (14) days notice is required prior to being granted access to a Zone.

.5 Prior to being granted access to a Zone, Contractor shall present a complete work plan outlining the duration of Work within the Zone.

1.3 SCHEDULING THE WORK

.1 Contractor shall schedule the Work to minimize disruption to normal building operations.

.2 Site mobilization shall not commence until all materials/products/systems necessary for the completion of Work within a given Zone are in the Contractor’s possession.

1.4 PROJECT DELIVERIES

.1 All deliveries are to be communicated in advance to The Owner’s Staff for coordination purposes. Contractor shall be responsible for receiving all deliveries within previously agreed location and times.

1.5 NOISY, PAINTING, GLUING, SUBSTANCES WITH VOC’S AND / OR STRONG ODOURS AND TARING (SEALANTS, ROOFING, ETC.)

.1 The Contractor shall minimize any reduction in comfort at the facility.

1.6 PARKING

.1 On site parking is not provided.

.2 Determine and make arrangement as required for loading and unloading of equipment and products at times that will not affect public traffic flow and that will be permitted by

the City of Toronto. Conform to City by-laws with regard to parking restrictions and other conditions.

1.7 SITE PROTECTION

.1 Dust barriers must be used at all times during dusty work. Poly sheet dust barriers are to be sealed tight to floor and ceiling and / or to the filter mediums on return air grills etc.

.2 Clean up after all work must be performed immediately and the area(s) are to be left in a clean and safe manner. Failure to clean properly may result in the Contractor being charged for cleaning services obtained by the Building Management and the Building Management may terminate the Contractor's access.

1.8 ADVANCE NOTIFICATION

.1 Fourteen (14) business days advance notification is required for any work affecting the building occupants such as the following:

- .1 Mold remediation (removal) work / asbestos abatement (removal) work.
- .2 Scanning and core drilling.
- .3 Notification of start time for painting.
- .4 Notification of any building system shutdown (i.e. power, water, etc.).
- .5 Notification of any loss of use area (i.e. resident room, washroom shutdown, lunchroom, etc.).
- .6 Allocation of a Zone (per item 1.2)

1.9 BREAKER PANELS

.1 Electrical panels must not be touched without first informing and obtaining written permission from Consultant and the Building Management.

.2 Whenever electrical power is shut off the Contractor must "Lock Out" and "Tag Out" any electrical panels or electrical breakers affected.

.3 Panel schedules to be updated each time a change to it is made.

1.10 DOORS

.1 For security purposes the building doors are to be close at all times.

- .1 Exit doors must not be propped open for any reason.
- .2 All fire doors must be kept closed at all times.

1.11 PROTOCOL FOR SCANNING, CORE DRILLING

.1 Prior to starting the scan work the contractor hired to carry out the work must provide a copy of their health and safety plan to The Owner.

.2 The plan must include a copy any of required license(s), a description of the process to be used and any information needed to design safety limits of the work zone. In addition, the plan must include a process to protect the work zone from inadvertent entry, a list of potential hazards that may be encountered by the workers, training and / or instruction that the workers have received to address the hazards and a contingency plan in case of an emergency.

.3 X-Raying is not allowed without prior authorization.

1.12 CORE DRILLING

.1 If dry core drilling will be performed appropriate dust control measure must be identified and used. If wet core drilling will be performed, water control measures must be identified and must be used.

.2 Before commencing the core drilling operation, the Contractor must ensure that it is safe to start drilling. The area must be secured, dust controls are in place, the equipment is set up as intended by the manufacturer, and all safety devices are present and functioning. The location selected to perform the core drilling must be appropriate and will not impact on the structural integrity of the building. The intended path of the coring unit must be free of all embedded power or communication wires, conduits, rebar, pipes and / or structures that could be damaged or disabled.

.3 All sources of asbestos are not to be disturbed. If this is not possible, the appropriate precautions must be taken to prevent the asbestos from becoming airborne which may include the use of either, a type 1, type 2 or type 3 process to comply with the asbestos designated substance regulations O. Reg 838 as am. O. Reg 510/92.

.4 All coring debris must be cleaned up and disposed of and the site returned to its original state after the coring is completed.

.5 If the coring debris contains asbestos, it must be cleaned up following the requirements of the designated substance specifications included in the Contract Documents.

1.13 DESIGNATED SUBSTANCES

.1 Handling and removal of any designated substances shall follow all applicable legislative requirements. Refer to project specific Designated Substances Report.

1.14 MAINTANING LIFE SAFETY SYSTEMS IN OCCUPIED FACILITIES

.1 Maintain operational life safety systems and public access to exits in occupied areas during all stages of the Work.

.2 Determine nature and exact locations of existing fire and smoke sensors prior to the commencement of the Work. Avoid direct or indirect jarring while working in adjacent areas and exercise caution to avoid triggering these devices.

.3 Be responsible for costs incurred by Owner on account of false fire alarms activated as a result of the execution of the Work, without adequate precautions.

1.15 PROJECT CONDITIONS, GENERAL

.1 Most of the project will be performed during regular business hours in an operational residence. Areas will be occupied during normal business hours. At end of each shift, broom clean and leave areas clean and in normal working condition.

.2 All items removed shall be replaced / returned / reinstalled during same shift.

.3 The Contractor shall not be responsible for moving furniture and equipment in areas of Work unless specifically specified in the Scope of Work. The Contractor shall be responsible for repairs or replacements of any damaged furniture.

.4 The Contractor shall cooperate / coordinate with moving contractors retained by Owner, and / or agencies.

1.16 CONTINUITY OF SERVICE

.1 Where equipment and systems are normally required to operate through the course of the Work, notify The Owner at least 2 weeks prior to the necessary interruption of mechanical or electrical service throughout course of Work

.2 Keep duration of interruptions to a minimum not to exceed 4 hours. Interruptions lasting longer than 4hrs will require approval from the Owner.

END OF SECTION

1.1 CASH ALLOWANCES

.1 Refer to the Construction Agreement Contract Paragraph GC 6.1 Cash Allowances

.2 Progress payments for Work and Products authorized under allowances will be made in accordance with the payment terms set out in Conditions of the Contract.

.3 Progress payments on accounts of Work authorized under cash allowances shall be included in the Consultant's monthly certificate for payment.

.4 Cash allowances, unless otherwise specified, cover the net cost to the Contractor of services, products, construction machinery and equipment, freight, handling, unloading, storage, installation where indicated, and other authorized expenses incurred in performing the Work. Cash allowances shall not be included by a Subcontractor in the amount for their Sub-contract work.

.5 Supply only allowances shall include:

- .1 Net cost of products.
- .2 Delivery to Site.
- .3 Applicable taxes and duties, excluding HST.

.6 Supply and install allowances shall include:

- .1 Net cost of products.
- .2 Delivery to Site.
- .3 Unloading, storing, handling or products on Site.
- .4 Installation, finishing and commissioning of products.
- .5 Applicable taxes and duties, excluding HST.
- .6 The amount of each cash allowance does not include Contractor’s overhead and profit, and other related costs, which shall be included in the Contract Price and not in the cash allowance.

.7 Inspection and testing allowances shall include:

- .1 Net cost of inspection and testing services.
- .2 Applicable taxes and duties, excluding HST.

.8 Other costs related to work covered by cash allowances are not covered by the allowance but shall be included in the Contract Price.

.9 Where costs under a cash allowance exceed the total cumulative amount of all allowances, the Contractor will be compensated for any excess incurred and substantiated plus an allowance for overhead and profit as set out in the Contract Documents.

.10 The Owner, through Consultant, may request Contractor to identify potential Suppliers or Subcontractors, as applicable, and to obtain at least three competitive prices for each cash allowance item.

.11 Submit, before application for final payment, copies of all invoices and statements from suppliers and Subcontractors for work which has been paid from cash allowances.

.12 The Owner, through the Consultant, will determine by whom and for what amount each cash allowance item will be performed. Obtain The Owner’s prior written approval in the form of a Cash Allowance Disbursement Authorization (CADA) before entering into a subcontract, amending an existing subcontract, or performing own forces work included in a cash allowance. Upon issuance of the CADA, the Contractor’s responsibilities for a cash allowance item shall be the same as for work of the Contract.

.13 Where the actual cost of the Work under any cash allowance exceeds the amount of the allowance, any unexpended amounts from other cash allowances shall be reallocated, at the Consultant's direction, to cover the shortfall, and, in that case, there shall be no additional amount added to the Contract Price for overhead and profit. Only where the actual cost of the Work under all cash allowances exceeds the total amount of all cash allowances shall the Contractor be compensated for the excess incurred and substantiated, plus an amount for overhead and profit on the excess only, as set out in the Contract Documents.

.14 The "Cash Allowances" expected and the amount of each allowance is listed on the Rate Bid Form included in the Bid package.

END OF SECTION

1 GENERAL

1.1 ALTERNATIVES AND SUBSTITUTIONS

.1 Refer to the Rate Bid Form included in the Bid package - Alternate Prices.

.2 Requests for substitutions will not be accepted prior to the Notification of Award. Where the Specifications include the “or approved alternate” of “equivalent” clauses, substitutions will be considered by The Owner and Consultant provided that:

.1 The materials and / or products specified are not available.

.2 Substitute products to those specified, which are brought to the attention of, and considered by Project Team after the Contract Award as "equivalent" to those specified will result in a credit to the Contract Price.

.3 Substitute products to those specified which are brought to the attention of, and considered by Project Team after the Contract Award as "superior" to those specified will result in a change to the Contract Price.

.4 The proposed substitutions have been investigated and complete data are submitted in accordance with the Specifications. Proposed substitutions to show the material and product names and complete data and specifications and state what difference, if any, will be made to the Contract Price for each substitution, should it be accepted.

.5 Data relating to changes in the Contract Schedule, if any, and relation to other Work have been submitted.

.6 Same warranty is given for the substitution as for the original product specified.

.7 All claims are waived for additional costs related to the substitution which may subsequently arise. Installation of the accepted substitution is coordinated into the Work and that full responsibility is assumed when substitutions affect other work. Make any necessary changes required to complete the Work. Revisions to the drawings for incorporation of the substitutions shall be made by the Consultant and all costs associated with the revisions shall be borne by the Contractor.

.8 Should the proposed substitution be accepted either in part or in whole, the Contractor will assume full responsibility when the substitution affects any other work or work of other Sections (Subcontractors). Drawing changes required as a

.9 result of the substitution will be executed by the Consultant at the Contractor's expense.

.10 Proposed substitutions must 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 must satisfy the space limitations,

.2 Static and dynamic weight limitations,

.3 Structural properties,

.4 Audible noise levels,

.5 Vibration generation,

.6 Interchangeability of parts and / or components,

.7 Accessibility for maintenance,

.8 Possible removal or replacement,

.9 Colours,

.10 Textures,

.11 Compatibility with other materials, products, assemblies and components.

.3 Substitutions to methods or process described in the Specifications or drawings, may be proposed for the consideration of the Consultant.

.4 Ensure that such substitutions are in accordance with the following requirements:

.1 Time spent by the Consultant in evaluating the substitution shall not be the basis for a claim by the Contractor for extensions;

.2 Clearly indicate how the proposed substitutions would be advantageous to the Owner or in the opinion of the Contractor would improve the operation of the installation;

.3 The cost of all changes in the work of Other Contractors, necessitated by the substituted methods or processes, if accepted, is borne by the Contractor;

.4 The substituted methods or processes fit into space allotted for the specified methods or processes. Revisions to the drawings for incorporation of the substitutions shall be made by the Consultant and all costs associated with the revisions shall be borne by the Contractor.

.5 Substitutions will not be considered if:

.1 They are indicated or implied on shop drawings or product data without formal request;

.2 Acceptance will require substantial revision of the Specifications and Drawings.

.3 Contractor fails to order a specified Product or order a Product by a specified manufacturer in adequate time to meet Contractor's construction schedule

.6 Do not substitute products or methods or processes into the Work unless such substitutions have been specifically approved for the Work by the Consultant.

.7 Approved substituted products shall be subject to Consultant's sole discretion. Approved substituted products shall only be installed after receipt of the Consultant's written approval.

.8 The cost of changes in the Work of a Contractor necessitated by the use of proposed material and / or product substitution is to be borne by the Contractor proposing the substitution.

.9 The Contract Price will be adjusted accordingly to any and all credits arising from the substitutions mentioned above.

1.2 SUBMISSION REQUIREMENTS FOR PROPOSED SUBSTITUTIONS

.1 Include with each proposed Substitution the following information:

.1 Identification of the Substitution, including product name and manufacturer's name, address, telephone numbers, and web site.

.2 Reason(s) for proposing the Substitution.

.3 A statement verifying that the Substitution will not affect the Contract Price and Contract Time or, if applicable, the amount and extent of a proposed increase or decrease in Contract Price and Contract Time on account of the Substitution.

.4 A statement verifying that the Substitution will not affect the performance (or warrant) of other parts of the Work.

.5 Manufacturer's Product literature for the Substitution, including material descriptions, compliance with applicable codes and reference standards, performance and test data, compatibility with contiguous materials and systems, and environmental considerations.

.6 Product samples as applicable.

.7 A summarized comparison of the physical properties and performance characteristics of the specified Product and the Substitution, with any significant variations clearly highlighted.

.8 Availability of maintenance services and sources of replacement materials and parts for the Substitution, as applicable, including associated costs and time frames.

.9 If applicable, estimated life cycle cost savings resulting from the Substitution.

.10 Details of other projects and applications where the Substitution has been used.

.11 Identification of any consequential changes in the Work to accommodate the Substitution and any consequential effects on the performance of the Work as a whole. A later claim for an increase to the Contract Price or Contract Time for other changes in the Work attributable to the Substitution will not be considered.

1.3 METHODS OR PROCESSES SUBSTITUTIONS

.1 The Contractor may suggest, for the consideration of the Project Team, substitutions to methods or processes described in the Specifications and / or shown on the Drawings. Any application for such substitutions must indicate how such substitutions are advantageous to the Owner or to the better fulfillment of the Contract. There shall be no obligation on the parties concerned to accept any such suggestions. Requests for alternatives must be made in duplicate and be accompanied by catalogue cuts, specifications and methods of installation.

.2 Time spent by the Consultant in evaluating the substitution shall not be the basis for a claim by the Contractor for extensions to the Contract Time.

.3 The Contractor will be responsible for substitutions to methods or processes concerning such work, and the warranty covering all parts of the Work shall not be affected.

.4 The cost of all changes in the work of other Sections (Subcontractors) necessitated by the use of substituted methods or processes, is to be borne by the Section (Subcontractor) proposing the substitution.

.5 Said methods or processes must fit into the space allotted for the specified methods or processes.

1.4 CREDITS ARISING FROM SUBSTITUTIONS

.1 Any and all credits arising from the substitutions mentioned will be credited to the Contract and the Contract Price will be adjusted accordingly.

1.5 RELATED CHANGES

.1 The Contractor will advise Subcontractors and suppliers and make all necessary changes to the related Work occasioned by Owner’s acceptance of alternatives.

END OF SECTION

1 GENERAL

1.1 MODIFICATIONS TO CONTRACT

.1 Supplemental Instruction: As issued by the Consultant, consistent with the intent of the Contract Documents, and will not involve an adjustment in Contract Price or Contract Time.

.2 Proposed Change: As issued by the Consultant, will notify the Contractor of an impending or proposed change to the Work, and will require submission of a quotation from the Contractor and all affected Subcontractors for each item noted. Submit quotation within the time period stipulated on the form, and indicate separate line item for labour and materials in each case. Work outlined in a Proposed Change must not proceed without the issuance of a Change Order signed by The Owner.

.3 Change Directive: Will be issued by the Consultant where an immediate response is required to an on-site condition. This form will authorize the Contractor to proceed with the change, with the stipulation that accurate accounts of costs be recorded, and may contain an upset cost, as agreed upon in advance by The Owner and the Contractor.

.4 Change Order: Will be issued by the Consultant upon review and approval of quotations for a Proposed Change, or a Change Directive, and authorizes the Contractor to proceed with the change(s) proposed. A Change Order will amend the Contract Price, and/or the Contract Time.

.5 Extras shall not be granted due to the Contractor’s unfamiliarity with the site or due to the Contractor’s lack of thorough investigation prior to bid submission.

.6 Any additions to the Work under this contract shall conform to all construction standards and conditions laid out herein, whether or not such conditions are expressly stated in The Owner's acceptance of the addition(s).

.7 The Contractor shall not proceed with Work in addition to the Contract Documents until the formal change process has been completed.

.8 Any request for additional time submitted with a Change Order shall be substantiated with supporting documentation and analysis, such as time impact analysis and critical path analysis. The Contractor shall establish how the critical path has shifted. The Contractor shall also submit a recovery plan demonstrating how the Contractor will recover the schedule.

1.2 CHANGE ORDER PROCEDURES

.1 Upon issuance by the Consultant to the Contractor of a proposed change in the Work, and unless otherwise requested in the proposed change or unless otherwise agreed:

.1 Submit to the Consultant a fixed price quotation for the proposed change in the Work within 5 days after receipt of the proposed change in the Work.

.2 If requested in the proposed change, provide a detailed breakdown of the price quotation including the following to the extent applicable, with appropriate supporting documentation:

.1 Estimated labour costs, including hours and applicable hourly rates based on the accepted schedule of labour rates.

.2 Estimated Product costs, including Supplier quotations, estimated quantities and unit prices.

.3 Estimated Construction Equipment costs.

.4 Enumeration of all other estimated costs included in the price quotation.

.5 Estimated credit amounts for labour and Products not required on account of the proposed change.

.6 Where applicable, Subcontractor quotations, also including a detailed

breakdown of all of the above.

.7 Include in the quotation the increase or decrease to the Contract Time, if any, for the proposed change, stated in number of days.

.8 Include in the quotation the number of days for which the quotation is valid.

.2 The quotation will be evaluated by the Consultant and The Owner and, if accepted by The Owner, be documented in the form of a signed Change Order.

1.3 FEES FOR OVERHEAD AND PROFIT – CHANGE ORDERS

.1 Refer to the Construction Agreement Contract Paragraph GC 7.2 Change Order.

1.4 CHANGE DIRECTIVE PROCEDURES

.1 Refer to the Construction Agreement Contract Paragraph GC 7.3 Change Directive.

1.5 FEES FOR OVERHEAD AND PROFIT – CHANGE DIRECTIVES

.1 Refer to the Construction Agreement Contract Paragraph GC 7.3 Change Directive.

END OF SECTION

1.1 SCHEDULE OF VALUES

.1 Prior to the first application for payment, submit for Consultant's review an initial schedule of values. Modify the initial schedule of values if and as requested by Consultant. Obtain Consultant's written acceptance of the initial schedule of values prior to the first application for payment.

.2 Together with the first and all subsequent applications for payment, submit updated versions of the schedule of values to indicate the values, to the date of application for payment, of work performed and Products delivered to Place of the Work.

.3 Provide the schedule of values in an electronic spreadsheet format acceptable to the Consultant.

.4 A work breakdown structure that is sufficiently detailed and comprehensive to facilitate Consultant's evaluation of applications for payment at an appropriate level of detail.

.5 Provisions for approved Change Orders [allowances,] [unit price work] [and] [assignable contracts] so that the breakdown amounts indicated in the schedule of values aggregate to the current total Contract Price. Also provide for indicating the estimated value of Change Directives within the schedule of values, separately from the current total Contract Price.

.6 For each item in the work breakdown structure, provide as a minimum the following information, under headings as indicated:

.1 Performed to Date: The value of Work performed and Products delivered to Place of the Work up to the date of the application for payment, stated as a percentage of the Contract Price and in dollars.

.2 Previously Performed: The value of Work performed and Products delivered to the Place of the Work for which payment has been previously certified, stated in dollars.

.3 Current Period: The value of Work performed and Products delivered to Place of the Work for which Contractor is currently applying for payment, stated in dollars.

.4 Balance to Complete: The value of Work not yet performed and Products not yet delivered to Place of the Work, stated in dollars.

1.2 CASH FLOW PROJECTION

.1 Prior to the first application for payment submit, for *Consultant*'s review, a forecast of approximate monthly progress payments for each month of the *Contract Time*.

.2 Submit revised cash flow forecasts when required due to significant changes in rate of progress of the *Work* or significant changes in the *Contract Price*.

1.3 WORKERS' COMPENSATION CLEARANCE

.1 Submit proof of workers' compensation clearance with each application for payment.

1.4 STATUTORY DECLARATIONS

.1 Submit a statutory declaration in the form of CCDC 9A – Statutory Declaration of Progress Payment Distribution by Contractor with each application for payment except the first.

END OF SECTION

1 GENERAL

1.1 COORDINATION

.1 Coordination of the work of all Sections of the specifications as required to complete the Project is the responsibility of the Contractor.

.2 Cooperation:

.1 Provide forms, templates, anchors, sleeves, inserts and accessories required to be fixed to or inserted into work and set in place or instruct separate Sections (Subcontractors) as to their locations.

.2 Supply items to be “Built-In” as and when required together with templates, measurements, shop drawings and other related information and assistance.

.3 Pay the cost of extra work and make up time lost as a result of failure to provide necessary information and items to be “Built-In” in adequate time.

.3 Coordination:

.1 Ensure that Subcontractors cooperate with each other including Other Contractors employed by The Owner, so that Work will be carried out expeditiously and will be satisfactory in all respects at completion.

.2 Ensure that Subcontractors examine Contract Documents with particular emphasis to work of other Sections which may affect the performance of their own work.

.3 Ensure Subcontractors cooperate 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 to fixed work.

.4 Ensure that Subcontractors requiring foundations or openings to be left for the installation of their Work furnish the necessary information to the Sections concerned in ample time so that proper provisions can be made.

.5 Pay particular attention to applied fireproofing requirements. Coordinate work to remove/reinstate services that may impede the application of continuous applied fireproofing to the required thickness for the scheduled fire resistance rating.

.6 Where supports or openings are to be left for the installation of various parts of the Work furnish the necessary information to those concerned in ample time so that proper provision can be made for such items. Have cutting, drilling and other remedial work, and the subsequent patching or other work required for failing to comply with this requirement, performed at a later date at no additional cost to the Owner.

.7 Ensure that items to be “Built-In” are supplied as and when required by Sections (Subcontractors) building in the items together with templates, measurements or shop drawings and other related information and assistance.

.8 Ensure coordination of products supplied in metric and imperial units into the overall layout.

.9 Placing, installation, application and connection of work by The Owner’s own forces or by Other Contractors on and to the Contractor's work shall not relieve the Contractor of their responsibility to provide and maintain the specified warranties.

.10 Ensure that setting drawings, templates, and all other information necessary for the location and installation of materials, fixtures, equipment, holes, sleeves, inserts, anchors, accessories, fastenings, connections, and access panels are provided by each Section whose work requires cooperative location and installation by other Sections, and that such information is communicated to the

applicable installer. Have cutting, fixing and making good to the work of Other Contractors, Sub-trades required for, and make up time lost as result of, failure to comply with this requirement, at no additional cost to the Owner.

.11 Coordinate with removals/installations specified in other Divisions and Other Contracts.

.12 Properly coordinate the work of the various Sections and trades 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 payment be allowed due to the failure by the Contractor to coordinate the Work. If required, in critical locations, prepare interference and/or installation drawings showing the work of the various Sections as well as the existing installation, and submit these drawings to the Consultant for review before the commencement of Work.

.13 In case of damage to active services or utilities, notify Consultant and respective authorities immediately and make all required repairs under direction of Consultant and respective authorities. Carry out repairs to such damaged services and utilities continuously to completion, including working beyond regular working hours.

.14 Under no circumstances will any extra payment be allowed due to the failure by the Contractor to coordinate the Work. If required, in critical locations, prepare interference and/or installation drawings showing the work of the various Sections as well as the existing installation, and submit these drawings to The Owner’s Project Team and Consultant for review before the commencement of Work.

.4 Other Contractors:

.1 The Contractor is responsible to correlate and coordinate all work with that of Other Contractors having separate contracts with The Owner in order to complete the Work as expeditiously as possible.

.2 Prior to commencement of work, ensure that all Sections (Subcontractors) are fully conversant with the extent of the work, the conditions and materials on the project, the schedule of completion, restrictions to safety, and access.

.3 Inform all Sections (Subcontractors) that each is responsible for checking all Sections of the specification for work pertaining to their Section (Subcontractor's work).

.5 Authorities and inspectors:

.1 City Inspector: Coordinate and cooperate with City Inspector as required to review specific site work to meet Building Permit requirements.

.6 Administrative Coordination:

.1 Coordinate work of this section to ensure information and material are promptly provided to ensure orderly and expeditious progress of the work, and to comply with schedule for completion.

END OF SECTION

1.1 SUMMARY

.1 This Section specifies Contractor's responsibilities for preparation and submission of schedules and other documentation related to tracking construction progress.

.2 The purpose of submitting progress schedules is to:

.1 Inform Owner and Consultant of actual progress versus planned progress, and

.2 Provide assurance that scheduling issues are being proactively identified and addressed in a timely manner, and that planned progress is being maintained as closely as possible.

1.2 CONSTRUCTION PROGRESS SCHEDULE

.1 Format and Content:

.1 Prepare schedule in the form of a Critical Path Method (CPM) Gantt chart using Microsoft Project or equivalent software as agreed.

.2 Provide a work breakdown structure identifying key activities, work packages, and major milestones, including long delivery Products, inspection and testing activities, preparation and review of mock-ups, Owner decisions for cash allowances, shutdown or closure activities, delivery of Owner supplied Products, Owner performed work, demonstration and training activities, and similar items, at a sufficient level of detail to effectively manage construction progress.

.3 Indicate milestone dates for Ready-for-Takeover and Substantial Performance of the Work.

.2 Submission:

.1 Submit initial schedule to *Owner* and *Consultant* within 15 *Working Days* after *Contract* award via email as .pdf file.

.2 Submit updated progress schedule monthly to Owner and Consultant, indicating actual and projected start and finish dates with report date line and progress, critical path, float, and baseline comparison to current progress.

1.3 SUBMITTALS SCHEDULE

.1 Format and Content:

.1 Prepare schedule identifying all required *Shop Drawing*, *Product* data, and sample submissions, including samples required for testing.

.2 Prepare schedule in electronic format.

.3 Provide a separate line for each required submittal, organized by

Specifications section names and numbers, and further broken down by individual *Products* and systems as required.

.4 For each required submittal, show planned earliest date for initial submittal, earliest date for return of reviewed submittal by *Consultant* and latest date for return of reviewed submittal without causing delay.

.5 Allow time in schedule for resubmission of submittals, should resubmission be necessary.

.2 Submission:

.1 Submit initial schedule to Consultant within 15 Working Days after Contract award via email.

.2 Submit updated submittals schedule monthly to Owner and Consultant.

1.4 SCHEDULE MANAGEMENT

.1 A schedule submitted as specified and accepted by Consultant shall become the baseline schedule and shall be used as the baseline for updates.

.2 At each regular progress meeting, review and discuss current construction progress and submittals schedules with Consultant and Owner, including activities that are behind schedule and planned measures to regain schedule slippage in key areas on or near the critical path.

.3 Activities considered behind schedule are those with start or completion dates later than the dates shown on the baseline schedule.

1.5 RECORDING ACTUAL SITE CONDITIONS ON AS-BUILT DRAWINGS

.1 Obtain from *Consultant* an electronic copy of the construction *Drawings* for the purpose of creating as-built drawings. Record information in electronic form, clearly identifying as-built deviations from the originally obtained construction *Drawings*.

.2 Clearly label each drawing as “AS-BUILT DRAWING”. Record information concurrently with construction progress. Do not conceal *Work* until required information is recorded.

.3 Record actual construction including:

.1 Measured depths of elements of foundation in relation to finish first floor datum.

.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

.3 Measured locations of pipes, ducts, conduits, outlets, fixtures, access panels, and appurtenances, referenced to visible and accessible features of construction.

.4 Field changes of dimension and detail.

.5 Changes made by Change Orders and Supplemental Instructions

.6 References to Shop Drawings, where Shop Drawings show more detail.

.4 Do not use as-built drawings for construction purposes.

1.6 PROGRESS PHOTOGRAPHS

.1 Arrange for periodic digital photography to document and provide a photographic record of the progress of the *Work*.

.2 Identify each photograph by project name and date taken.

.3 Submission: Submit .jpg format files in standard resolution via project web site monthly.

.4 Do not use progress or any other *Project* photographs for promotional purposes without *Owner*'s written consent.

END OF SECTION

1.1 ADMINISTRATIVE

.1 Submit specified submittals to Consultant for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in the Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time or for Product substitutions or other deviations from the Drawings and Specifications.

.2 Where required by authorities having jurisdiction, provide submittals to such authorities for review and approval.

.3 Do not proceed with Work affected by a submittal until review is complete.

.4 Present Shop Drawings, Product data, and samples in SI metric units. Where items or information is not produced in SI Metric, converted values are acceptable.

.5 Review submittals, provide verified field measurements where applicable, and affix Contractor's review stamp prior to submission to Consultant. Contractor's review stamp represents that necessary requirements have been determined and verified, and that the submittal has been checked and coordinated with requirements of the Work and Contract Documents.

.6 Verify field measurements and that affected adjacent work is coordinated.

.7 Submittals not meeting specified requirements will be returned with comments.

.8 Reproduction of construction Drawings to serve as background for Shop Drawings is not permitted.

.9 Do not propose Substitutions or deviations from Contract Documents via Shop Drawing, Product data and sample submittals. Proposed alternates must follow the procedures outlined in Section 01 25 00.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Indicate Products, methods of construction, and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of the Work.

.2 Where Products attach or connect to other Products, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and Installed. Indicate cross-references to Drawings, Specifications and other already reviewed Shop Drawings.

.3 Accompany submittals with a transmittal information including:

- .1 Date.
- .2 *Project* title and number.
- .3 *Contractor*'s name and address.
- .4 Identification of each submittal item and quantity.
- .5 Other pertinent data.

.4 *Shop Drawing* submittals shall include:

- .1 Date and revision dates.
- .2 *Project* title and number.
- .3 Name and address of:
  - .1 Subcontractor.
  - .2 Supplier.
  - .3 Manufacturer.
- .4 *Contractor*'s stamp, date, and signature of *Contractor*'s authorized representative

responsible for *Shop Drawing* review, indicating that each *Shop Drawing* has been reviewed for compliance with *Contract Documents* and, where applicable, that field measurements have been verified.

.5 Details of appropriate portions of the *Work* as applicable:

.1 Fabrication.

.2 Layout, showing dimensions, including identified field dimensions, and clearances.

.3 Setting or erection details.

.4 Capacities.

.5 Performance characteristics.

.6 Standards.

.7 Operating weight.

.8 Wiring diagrams.

.9 Single line and schematic diagrams.

.10 Relationships to other parts of the *Work*.

.6 *Product* data submittals shall include material safety data sheets (MSDS) for all controlled Products.

.7 Submit electronic copy of *Shop Drawings* where specified in the technical *Specifications*

.8 Submit electronic copy of Product data sheets or brochures where specified in the technical *Specifications*.

.9 Where a submittal includes information not applicable to the *Work,* clearly identify applicable information and strike out non-applicable information.

.10 Supplement standard information to include details applicable to *Project*.

.5 Allow 5 *Working Days* for *Consultant*'s review of each submittal and incorporate in submittals schedule specified in Section 01 32 00 – Construction Progress Documentation. Allow additional 3 *Working Days* where sub-*Consultant r*eview is required.

.6 If upon *Consultant*'s review no errors or omissions are discovered, or if only minor corrections are required as indicated, submittal will be returned and fabrication or installation of *Work* may proceed.

.7 If upon *Consultant*'s review significant errors or omissions are discovered, a so noted copy will be returned for correction and resubmission. Do not commence fabrication or installation.

.8 *Consultant*'s notations on submittals are intended to ensure compliance with *Contract Documents* and are not intended to constitute a change in the *Work* requiring change to the *Contract Price* or *Contract Time*. If *Contractor* considers any *Consultant*'s notation to be a change in the *Work*, promptly notify *Consultant* in writing before proceeding with the *Work*.

.9 Resubmit corrected submittals through same procedure indicated above, before any fabrication or installation of the *Work* proceeds. When resubmitting, notify *Consultant* in writing of any revisions other than those requested by *Consultant*.

1.3 SAMPLES

.1 Submit samples for *Consultant*'s review in triplicate where specified in the technical *Specifications*. Label samples as to origin, *Project* name, and intended use.

.2 Deliver samples prepaid to *Consultant*'s business address.

.3 Notify *Consultant* in writing of any deviations in samples from requirements of *Contract Documents*.

.4 Where a required colour, pattern or texture has not been specified, submit full range of available *Products* meeting other specified requirements.

.5 *Consultant* selection from samples is not intended to change the *Contract Price* or *Contract Time*. If a selection would affect the *Contract Price* or *Contract Time*, notify *Consultant* in writing prior to proceeding with the *Work*.

.6 Resubmit samples as required by *Consultant* to comply with *Contract Documents*.

.7 Reviewed and accepted samples will establish the standard against which installed *Work* will be reviewed.

END OF SECTION

1.1 REFERENCE STANDARDS

.1 "Reference standards" means consensus standards, trade association standards, guides, and other publications expressly referenced in Contract Documents.

.2 Where an edition or version date is not specified, referenced standards shall be deemed to be the latest edition or revision issued by the publisher at the time of bid closing. However if a particular edition or revision date of a specified standard is referenced in an applicable code or other regulatory requirement, the regulatory referenced edition or version shall apply.

.3 Reference standards establish minimum requirements. If Contract Documents call for requirements that differ from a referenced standard, the more stringent requirements shall govern.

.4 If compliance with two or more reference standards is specified and the standards establish different or conflicting requirements, comply with the most stringent requirement. Refer uncertainties to Consultant for clarification.

.5 Within the Specifications, reference may be made to the following standards writing, testing, or certification organizations by their acronyms or initialisms:

.1 AA - Aluminum Association

.2 ACI - American Concrete Institute

.3 AISC - American Institute of Steel Construction

.4 ANSI - American National Standards Institute

.5 ASME - American Society of Mechanical Engineers

.6 ASTM - American Society for Testing and Materials

.7 AWMAC - Architectural Woodwork Manufacturers Association of Canada

.8 AWPA - American Wire Producers Association

.9 CaGBC - Canadian Green Building Council

.10 CGSB - Canadian General Standards Board

.11 CISC - Canadian Institute of Steel Construction

.12 CPCI - Canadian Prestressed Concrete Institute

.13 CSA - Canadian Standards Association

.14 CSSBI - Canadian Sheet Steel Building Institute

.15 CWB – Canadian Welding Bureau

.16 ICEA - Insulated Cable Engineers Association

.17 IEEE - Institute of Electrical and Electronics Engineers

.18 IGMAC – Insulating Glass Manufacturers Association of Canada

.19 LEED - Leadership in Energy and Environmental Design

.20 MPP – Master Painters Institute

.21 MSS - Manufacturers Standardization Society of the Valve and Fittings Industry

.22 NAAMM - National Association of Architectural Metal Manufacturers

.23 NEMA - National Electrical Manufacturers Association

.24 NFPA - National Fire Protection Association

.25 NHLA - National Hardwood Lumber Association

.26 NLGA - National Lumber Grades Authority

.27 SSPC – The Society for Protective Coatings

.28 TTMAC - Terrazzo, Tile and Marble Association of Canada

.29 ULC - Underwriters' Laboratories of Canada

1.2 INDEPENDENT INSPECTION AND TESTING AGENCIES

.1 Except as otherwise specified, Owner will retain and pay for independent inspection and testing agencies to inspect, test, or perform other quality control reviews of parts of the Work.

.2 Retain and pay for inspection and testing that is for Contractor's own quality control or is required by regulatory requirements.

.3 Section 01 21 00 – Allowances specifies a cash allowance for independent inspection and testing services to be retained and paid for by Contractor. Cash allowance excludes any inspection and testing that is for Contractor's own quality control or is required by regulatory requirements.

.4 Employment of inspection and testing agencies by Contractor or Owner does not relieve Contractor from responsibility to perform the Work in accordance with Contract Documents.

.5 Allow and arrange for inspection and testing agencies to have access to the Work, including access to off site manufacturing and fabrication plants.

.6 For inspection and testing required by Contract Documents or by authorities having jurisdiction, provide Consultant and inspection and testing agencies with timely notification in advance of required inspection and testing.

.7 Submit test samples required for testing in accordance with submittals schedule specified in Section 01 32 00 – Construction Progress Documentation.

.8 Provide labour, Construction Equipment and temporary facilities to obtain and handle test samples on site.

1.3 INSPECTION AND TESTING AGENCY REPORTS

.1 For inspection and testing required by *Contract Documents* or by regulatory requirements, and performed by *Contractor* retained inspection and testing agencies, submit to *Consultant* copies of reports. Submit within 3 days after completion of inspection and testing.

.2 For inspection and testing performed by *Owner* retained inspection and testing agencies, copies of inspection and testing agency reports will be provided to *Contractor*.

1.4 MOCK-UPS

.1 Prepare mock-ups of *Work* as specified in the technical *Specifications*. If a mock-up location is not indicated in the *Drawings* or *Specifications*, locate where directed by *Consultant*.

.2 Modify mock-up as required until *Consultant* approval is obtained.

.3 Approved mock-ups establish an acceptable standard for the *Work*.

.4 Protect mock-ups from damage until the *Work* they represent is complete.

.5 Unless otherwise specified in the technical *Specifications*, approved mock-ups forming part of the *Work* may remain as part of the *Work*.

.6 Remove mock-ups only when the *Work* they represent is complete or when otherwise directed by *Consultant*.

END OF SECTION

1 GENERAL

1.1 TEMPORARY WORK

.1 Accept responsibility for all temporary structures and comply with applicable rules and regulations. Pay all taxes and all other charges.

.2 The expression "provide" shall be deemed to include the provision, installation and finishing, maintenance, servicing and removal of the work described. All Work damaged by temporary installations shall be repaired and made good at no expense to the Owner.

1.2 TEMPORARY UTILITIES - GENERAL

.1 Provide temporary utilities as specified and as otherwise necessary to perform the Work expeditiously.

.2 Remove temporary utilities after use.

1.3 TEMPORARY WATER SUPPLY

.1 Separate from water required for fire protection with adequate pressure at every floor, except hose extensions which shall be provided by Subcontractors requiring them.

.2 Water supply shall be potable, available from existing service. Be responsible for the careful and reasonable use of any Owner supplied water.

.3 If large quantity of water is required for the Work, a water meter shall be provided to monitor Contractor's water usage. Provide proof to Consultant of no drop in water pressure in water supply for affected tenant (s) (i.e. Contractors using hydrodemolition method to remove concrete in a project or similar instances).

1.4 TEMPORARY HEATING AND VENTILATION

.1 *Contractor* may connect to and use *Owner*'s existing supply of natural gas for temporary use during construction, subject to existing available volume and pressure. Usage at no cost to *Contractor*.

.2 Vent construction heaters in enclosed spaces to the outside or use flameless type of construction heaters.

.3 Provide temporary heat for the *Work* as required to:

.1 Facilitate progress of *Work*.

.2 Protect the *Work* against dampness and cold.

.3 Prevent moisture condensation on surfaces, freezing, or other damage to finishes or stored *Products*.

.4 Maintain specified minimum ambient temperatures and humidity levels for storage, installation and curing of *Products*.

.5 After building is enclosed, maintain interior temperature of minimum 20 degrees C.

.4 Provide temporary ventilation for the *Work* as required to:

.1 Prevent accumulations of fumes, exhaust, vapours, gases and other hazardous, noxious, or volatile substances in enclosed spaces, as required to maintain a safe work environment meeting applicable regulatory requirements.

.2 Ensure that hazardous, noxious, or volatile substances do not migrate to *Owner* occupied spaces.

.3 Ventilate temporary sanitary facilities.

.4 New permanent building heating and ventilation systems may be used during construction, at Contractor's option. If used during construction:

.1 *Owner* will pay utility costs resulting from the use of permanent systems.

.2 Operate systems in a non-wasteful and energy efficient manner. Be responsible for any system damage.

.3 Just prior to *Substantial Performance of the Work*, replace filters, and perform other required maintenance to ensure systems are in as near as new condition as possible. Refer also to Division 15 requirements.

.4 Ensure that systems manufacturers' warranties do not commence until the date of *Substantial Performance of the Work* or, if manufacturers' warranties do commence earlier when systems are put into use, arrange for necessary extension of manufacturers' warranties or provide equivalent coverage under *Contractor*'s warranty.

1.5 TEMPORARY COOLING

.1 If base building cooling is rendered inoperable during the cooling season (interior temperature exceeding 25 degrees C), provide temporary cooling to maintain normal building operations.

END OF SECTION

1.1 CONTRUCTION FACILITIES - GENERAL

.1 Provide temporary construction facilities as necessary for performance of the *Work* and in compliance with applicable regulatory requirements.

.2 Maintain temporary construction facilities in good condition for the duration of the *Work*.

.3 Remove temporary construction facilities from *Place of the Wor*k when no longer required.

1.2 CONSTRUCTION PARKING

.1 Parking at the *Place of the Work* is not provided. Contractor will be responsible for securing parking, according to their own requirements.

1.3 VEHICULAR ACCESS

.1 Provide and maintain adequate access to Place of the Work.

.2 Existing roads at Place of the Work may be used for access to Place of the Work, provided Contractor assumes responsibility for any damage caused by construction traffic, and prevents or promptly cleans up any mud tracking or material spillage.

1.4 SANITARY FACILITIES

.1 The Contractor will not be granted access to a dedicated sanitary facility within the existing building. It shall be the Contractor's responsibility to provide their own temporary sanitary facilities and remove said temporary facilities at the conclusion of the work.

1.5 FIRE PROTECTION

.1 Provide and maintain temporary fire protection systems and equipment during construction. Contractor shall provide firewatch as required; costs for firewatch shall be included in base bid price.

1.6 ELEVATORS

.1 Permanent elevators may be used by construction personnel and for transporting Products, at *Contractor*'s option. If used during construction:

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

.2 Just prior to *Substantial Performance of the Work*, perform required maintenance to ensure elevators are in as near as new condition as possible.

.3 Ensure that elevator manufacturer's warranty does not commence until the date of *Substantial Performance of the Work* or, if manufacturer's warranty does commence earlier when elevators are put into use, arrange for necessary extension of manufacturer's warranty or provide equivalent coverage under *Contractor*'s warranty.

END OF SECTION

1.1 BARRIERS AND ENCLOSURES - GENERAL

.1 Provide temporary barriers and enclosures necessary to protect the public and building occupants and to secure *Place of the Wor*k during performance of the *Work*.

.2 Comply with applicable regulatory requirements.

.3 Maintain temporary barriers and enclosures in good condition for the duration of the *Work*.

.4 Remove temporary barriers and enclosures from *Place of the Work* when no longer required.

1.2 FENCING

.1 Erect temporary security and safety site fencing, minimum 1.8m high, using self-supporting wire fence sections enclosing applicable portions of site as necessary to maintain safety and security. Maintain site fencing in good repair until removed.

1.3 WEATHER ENCLOSURES

.1 Provide weather tight enclosures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.

.2 Provide weather enclosures to protect floor areas where walls are not finished and to enclose work areas that require temporary heating.

.3 Design weather enclosures to withstand wind pressure and snow loading requirements.

1.4 DUST TIGHT PARTITIONS

.1 Provide dust tight wood stud and plywood and/or steel stud and gypsum board partitions to localize interior building areas from dust and noise generating activities.

.2 Erect, maintain, and relocate partitions as required to facilitate construction operations and *Owner*'s operational requirements.

1.5 EXIT ROUTES

.1 Maintain required access to exiting within the building.

.2 If exit routes are temporarily altered during the Work, Contractor shall have proposed modifications reviewed/approved by the Authority Having Jurisdiction.

.3 Provide temporary signage to the satisfaction of the Authority Having Jurisdiction for any modified exit routes.

1.6 FIRE ROUTES

.1 Maintain fire access routes, including overhead clearances, for use by emergency response vehicles.

1.7 PROTECTION OF BUILDING FINISHES

.1 Provide necessary temporary barriers and enclosures to protect [existing and] completed or partially completed finished surfaces from damage during performance of the *Work*.

END OF SECTION

1.1 TEMPORARY CONTROLS - GENERAL

.1 Provide temporary controls as necessary for performance of the *Work* and in compliance with applicable regulatory requirements.

.2 Maintain temporary controls in good condition for the duration of the *Work*.

.3 Remove temporary controls and *Construction Equipment* used to provide temporary controls from *Place of the Work* when no longer required.

1.2 DUST AND PARTICULATE CONTROL

.1 Implement and maintain dust and particulate control measures in accordance with applicable regulatory requirements.

.2 Execute *Work* by methods that minimize dust from construction operations and spreading of dust on site or to adjacent properties.

.3 Provide temporary enclosures to prevent extraneous materials resulting from sandblasting or similar operations from contaminating air beyond immediate work area.

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

.5 Use appropriate covers on trucks hauling fine, dusty, or loose materials.

1.3 DEWATERING

.1 Provide temporary drainage and pumping as necessary to dewater excavations, trenches, foundations, and other parts of the *Work*. Maintain such areas free of water arising from groundwater or surface run-off, as required to keep them stable, dry, and protected from damage due to flooding.

.2 Maintain standby equipment necessary to ensure continuous operation of dewatering system.

.3 Do not pump water containing suspended materials or other harmful substances into waterways, sewers or surface drainage systems. Treat or dispose of such water in accordance with applicable regulatory requirements

1.4 SITE DRAINAGE

.1 Maintain grades to ensure proper site drainage.

.2 Prevent surface water runoff from leaving the site.

.3 Prevent precipitation from infiltrating or from directly running off stockpiled materials. Cover stockpiled materials with an impermeable liner during periods of work stoppage including at end of each *Working Day*.

.4 Control surface drainage from cuts and fills, from borrow and waste disposal areas, from stockpiles, staging areas, and other work areas as required to prevent erosion and sedimentation.

.5 Control surface drainage by ensuring that gutters are kept open and water is not directed across or over pavements or sidewalks, except through pipes or properly constructed troughs. Ensure that runoff from unfinished areas is intercepted and diverted to suitable outlets.

1.5 EROSION AND SEDIMENT CONTROL

.1 Minimize amount of bare soil exposed at one time. Stabilize disturbed soils as quickly as practical to minimize erosion. Remove accumulated sediment resulting from construction activity from adjoining surfaces, drainage systems, and watercourses, and repair damage caused by soil erosion and sedimentation.

.2 Provide and maintain appropriate temporary measures such as silt fences, straw bales, ditches, geotextiles, drains, berms, terracing, riprap, temporary drainage piping,

sedimentation basins, vegetative cover, dikes, and other measures that may be required to prevent erosion and migration of silt, mud, sediment, and other debris.

.3 Do not disturb existing embankments or embankment protection.

.4 Periodically inspect erosion and sediment control measures to detect evidence of erosion and sedimentation. Promptly take corrective measures when necessary.

.5 If soil and debris from site accumulate in ditches or other low areas, remove accumulation and restore area to original condition.

1.6 POLLUTION CONTROL

.1 Take measures to prevent contamination of soil, water, and atmosphere through uncontrolled discharge of noxious or toxic substances and other pollutants, potentially causing environmental damage.

.2 Be prepared, by maintaining appropriate materials, equipment, and trained personnel on site, to intercept, clean up, and dispose of spills or releases that may occur. Promptly report spills and releases that may occur to:

.1 authority having jurisdiction,

.2 person causing or having control of pollution source, if known, and

.3 *Owner* and *Consultant*.

.4 Contact manufacturer of pollutant, if known and applicable, to obtain material safety data sheets (MSDS) and ascertain hazards involved and precautions and measures required in cleanup or mitigating actions.

.5 Take immediate action to contain and mitigate harmful effects of the spill or release.

END OF SECTION

1.1 GENERAL

.1 Provide *Products* that are not damaged or defective, and suitable for purpose intended, subject to specified requirements. If requested by *Consultant*, furnish evidence as to type, source and quality of *Products* provided.

.2 Unless otherwise specified, maintain uniformity of manufacture for like items throughout.

.3 Permanent manufacturer's markings, labels, trademarks, and nameplates on *Products* are not acceptable in prominent locations, except where required by regulatory requirements or for operating instructions, or when located in mechanical or electrical rooms.

1.2 PRODUCT AVAILABILITY AND DELIVERY TIMES

.1 Promptly upon Contract award and periodically during construction, review and confirm *Product* availability and delivery times. Order *Products* in sufficient time to meet the construction progress schedule and the *Contract Time*.

.2 If a specified *Product* is no longer available, promptly notify *Consultant*. *Consultant* will take action as required.

.3 If delivery delays are foreseeable, for any reason, promptly notify *Consultant*.

.1 If a delivery delay is beyond *Contractor*'s control, *Consultant* will provide direction.

.2 If a delivery delay is caused by something that was or is within *Contractor*'s control, *Contractor* shall propose actions to maintain the construction progress schedule for *Consultant*'s review and acceptance.

1.3 STORAGE, HANDLING, AND PROTECTION

.1 Store, handle, and protect *Products* during transportation to *Place of the Work* and before, during, and after installation in a manner to prevent damage, adulteration, deterioration and soiling.

.2 Comply with manufacturer's instructions for storage, handling and protection.

.3 Store packaged or bundled *Products* in original and undamaged condition with manufacturer's seals and labels intact. Do not remove from packaging or bundling until required in *Work*.

.4 Comply with the requirements of the workplace hazardous materials information system (WHMIS) regarding use, handling, storage, and disposal of hazardous materials, including requirements for labeling and the provision of material safety data sheets (MSDS).

.5 Store *Products* subject to damage from weather in weatherproof enclosures.

.6 Store sheet *Products* on flat, solid, supports and keep clear of ground. Slope to shed moisture.

.7 Remove and replace damaged *Products*.

END OF SECTION

1.1 SURVEYOR QUALIFICATIONS

.1 If required, engage a registered land surveyor, licensed to practice in *Place of the Work*.

1.2 SUBMITTALS

.1 Submit name and address of registered land surveyor performing survey work.

.2 Submit to *Owner* and *Consultant* the survey of the *Work* prepared and issued by a registered land surveyor on completion of the building footings and foundations and on completion of the *Work*.

1.3 SURVEY REFERENCE POINTS

.1 Locate and confirm permanent reference points prior to starting site work. Preserve and protect permanent reference points on site during construction.

.2 Do not change or relocate reference points without prior written notice to *Consultant*.

.3 Report to *Consultant* when a reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations. Require registered land surveyor to replace reference points in accordance with original survey.

1.4 SURVEY REQUIREMENTS

.1 Establish sufficient permanent benchmarks on site, referenced to established benchmarks by survey control points.

.2 Confirm that existing survey reference points are in accordance with *Owner*'s survey and property limits.

.3 Establish initial lines and levels for building layout.

.4 Maintain a complete, accurate log of control and survey work as it progresses. Record locations with horizontal and vertical data in project record documents.

1.5 EXISTING UTILITIES AND STRUCTURES

.1 Before commencing excavation, drilling or other earthwork, establish or confirm location and extent of all existing underground utilities and structures in work area.

.2 Promptly notify *Consultant* if underground utilities, structures, or their locations differ from those indicated in *Contract Documents* or in available project information. *Consultant* will provide appropriate direction.

.3 Record locations of maintained, re-routed and abandoned utility lines.

1.6 VERIFICATION OF EXISTING CONDITIONS

.1 Where work specified in any Section is dependent on the work of another Section or Sections having been properly completed, verify that work is complete and in a condition suitable to receive the subsequent work. Commencement of work of a Section that is dependent on the work of another Section or Sections having been properly completed, means acceptance of the existing conditions.

.2 Verify that ambient conditions are suitable before commencing the work of any Section and will remain suitable for as long as required for proper setting, curing, or drying of *Products* used.

.3 Ensure that substrate surfaces are clean, dimensionally stable, cured and free of contaminants.

.4 Notify *Consultant* in writing of unacceptable conditions.

END OF SECTION

1.1 SUMMARY

.1 Except where otherwise specified in technical *Specifications* or otherwise indicated on *Drawings*, comply with requirements of this Section.

1.2 MANUFACTURER'S INSTRUCTIONS

.1 Install, erect, or apply *Products* in strict accordance with manufacturer's instructions.

.2 Notify *Consultant*, in writing, of conflicts between *Contract Documents* and manufacturer's instructions where, in *Contractor*'s opinion, conformance with *Contract Documents* instead of the manufacturer's instructions may be detrimental to the *Work* or may jeopardize the manufacturer's warranty.

.3 Do not rely on labels or enclosures provided with *Products*. Obtain written instructions directly from manufacturers.

.4 Provide manufacturer's representatives with access to the *Work* at all times. Render assistance and facilities for such access so that manufacturer's representatives may properly perform their responsibilities.

1.3 CONCEALMENT

.1 Conceal pipes, ducts, and wiring in floors, walls and ceilings in finished areas:

.1 after review by *Consultant* and authority having jurisdiction, and

.2 where locations differ from those shown on *Drawings*, after recording actual locations on as-built drawings.

.2 Provide incidental furring or other enclosures as required.

.3 Notify *Consultant* in writing of interferences before installation.

1.4 FASTENINGS - GENERAL

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

.2 Prevent electrolytic action and corrosion between dissimilar metals and materials by using suitable non-metallic strips, washers, sleeves, or other permanent separators to avoid direct contact.

.3 Use non-corrosive fasteners and anchors for securing exterior work [and in spaces where high humidity levels are anticipated].

.4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage.

.5 Keep exposed fastenings to a minimum, space evenly and install neatly.

.6 Do not use fastenings or fastening methods that may cause spalling or cracking of material to which anchorage is made.

1.5 FASTENINGS - EQUIPMENT

.1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.

.2 Bolts shall not project more than one diameter beyond nuts.

1.6 FIRE RATED ASSEMBLIES

.1 When penetrating fire rated walls, ceiling, or floor assemblies, completely seal voids with fire-stopping materials, smoke seals, or both, in full thickness of the construction element as required to maintain the integrity of the fire rated assembly.

1.7 LOCATION OF FIXTURES, OUTLETS AND DEVICES

.1 Consider location of fixtures, outlets, and devices indicated on *Drawings* as approximate.

.2 Locate fixtures, outlets, and devices to provide minimum interference, maximum usable space, and as required to meet safety, access, maintenance, acoustic, and regulatory, including barrier free, requirements.

.3 Promptly notify *Consultant* in writing of conflicting installation requirements for fixtures, outlets, and devices. If requested, indicate proposed locations and obtain approval for actual locations.

1.8 PROTECTION OF COMPLETED WORK AND WORK IN PROGRESS

.1 Adequately protect parts of the *Work* completed and in progress from any kind of damage.

.2 Promptly remove, replace, clean, or repair, as directed by *Consultant,* work damaged as a result of inadequate protection.

.3 Do not load or permit to be loaded any part of the *Work* with a weight or force that will endanger the safety or integrity of the *Work*.

1.9 REMEDIAL WORK

.1 Notify *Consultant* of, and perform remedial work required to, repair or replace defective or unacceptable work. Ensure that properly qualified workers perform remedial work. Coordinate adjacent affected work as required.

END OF SECTION

1.1 REQUEST FOR CUTTING, PATCHING AND REMEDIAL WORK

.1 Submit written request in advance of cutting, coring, or alteration which affects or is likely to affect:

.1 Structural integrity of any element of the Work.

.2 Integrity of weather-exposed or moisture-resistant elements.

.3 Efficiency, maintenance, or safety of any operational element.

.4 Visual qualities of sight-exposed elements.

.5 Work of *Owner* or other contractors.

.6 Warranty of *Products* affected.

.2 Include in request:

.1 Identification of *Project*.

.2 Location and description of affected work, including drawings or sketches as required.

.3 Statement on necessity for cutting or alteration.

.4 Description of proposed work, and *Products* to be used.

.5 Alternatives to cutting and patching.

.6 Effect on work of *Owner* or other contractors.

.7 Written permission of affected other contractors.

.8 Date and time work will be executed.

1.2 PRODUCTS

.1 Unless otherwise specified, when replacing existing or previously installed Products in the course of cutting and patching work, use replacement Products of the same character and quality as those being replaced.

.2 If an existing or previously installed Product must be replaced with a different Product, submit request for substitution in accordance with Section 01 25 00 - Substitution Procedures.

1.3 PREPARATION

.1 Inspect existing conditions in accordance with Section 01 71 00 - Examination and Preparation.

.2 Provide supports to ensure structural integrity of surroundings; provide devices and methods to protect other portions of the *Work* from damage.

.3 Provide protection from elements for areas that may be exposed by uncovering work.

1.4 EXISTING UTILITIES

.1 When breaking into or connecting to existing services' utilities, execute the Work at times directed by local governing authorities, with a minimum of disturbance to the Work, pedestrian and vehicular traffic, and ongoing Owner operations.

.2 Maintain excavations free of water.

.3 Keep duration of interruptions to a minimum.

.4 Carry out interruptions after regular working hours of occupants, preferably on weekends, unless Owner's prior written approval is obtained.

.5 Protect and maintain existing active services. Record location of services, including depth, on as-built drawings.

.6 Construct or erect barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures as required to protect pedestrian and vehicular traffic.

1.5 CUTTING, PATCHING, AND REMEDIAL WORK

.1 Coordinate and perform the *Work* to ensure that cutting and patching work is kept to a minimum.

.2 Perform cutting, fitting, patching, and remedial work [including excavation and fill,] to make the affected parts of the *Work* come together properly and complete the *Work*.

.3 Provide openings in non-structural elements of the *Work* for penetrations of mechanical and electrical work.

.4 Perform cutting by methods to avoid damage to other work

.5 Provide proper surfaces to receive patching, remedial work, and finishing.

.6 Perform cutting, patching, and remedial work using competent and qualified specialists familiar with the *Products* affected, in a manner that neither damages nor endangers the *Work*.

.7 Do not use pneumatic or impact tools without *Consultant*'s prior approval.

.8 Ensure that cutting, patching, and remedial work does not jeopardize manufacturers' warranties.

.9 Refinish surfaces to match adjacent finishes. For continuous surfaces refinish to nearest intersection. For an assembly, refinish entire unit.

.10 Fit work to pipes, sleeves, ducts, conduit, and other penetrations through surfaces with suitable allowance for deflection, expansion, contraction, acoustic isolation, and firestopping.

.11 Maintain fire ratings of fire rated assemblies where cutting, patching, or remedial work is performed. Completely seal voids or penetrations of assembly with firestopping material to full depth or with suitably rated devices.

END OF SECTION

1.1 REGULATORY REQUIREMENTS

.1 Comply with applicable regulatory requirements when disposing of waste materials.

.2 Obtain permits from authorities having jurisdiction and pay disposal fees where required for disposal of waste materials and recyclables.

1.2 GENERAL CLEANING REQUIREMENTS

.1 Provide adequate ventilation during use of volatile or noxious substances. Do not rely on building ventilation systems for this purpose.

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

.3 Prevent cross-contamination during the cleaning process.

.4 Notify the *Consultant* of the need for cleaning caused by *Owner* or other contractors.

1.3 PROGRESSIVE CLEANING AND WASTE MANAGEMENT

.1 Maintain the *Work* in a tidy and safe condition, free from accumulation of waste materials and construction debris.

.2 Provide appropriate, clearly marked, containers for collection of waste materials and recyclables. Location of containers to be agreed with Owner.

.3 Remove waste materials and recyclables from work areas, separate, and deposit in designated containers at end of each *Working Day*. Collect packaging materials for recycling or reuse.

.4 Remove waste materials and recyclables from *Place of the Work* at regular intervals.

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

.6 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly finished surfaces nor contaminate building systems.

1.4 FINAL CLEANING

.1 Before final cleaning, arrange a meeting at *Place of the Work* to determine the acceptable standard of cleaning. Ensure that *Owner*, *Contractor* and cleaning company are in attendance.

.2 Remove from *Place of the Work* surplus *Products*, waste materials, recyclables, *Temporary Work*, and *Construction Equipment* not required to perform any remaining work.

.3 Remove dust from lighting reflectors, lenses, lamps, bulbs, and other lighting surfaces.

.4 Vacuum clean and dust exposed wall, floor, and ceiling surfaces, behind grilles, louvres and screens, above suspended ceiling tiles.

.5 Clean mechanical, electrical, and other equipment. Replace filters for mechanical

equipment if equipment is used during construction.

.6 Remove waste material and debris from crawlspaces and other accessible concealed spaces.

.7 Remove stains, spots, marks, and dirt from exterior facades.

.8 Clean exterior and interior window glass and frames.

.9 Clean and sweep roofs, clear roof drains and downspouts.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Dispose of waste materials and recyclables at appropriate municipal landfills and recycling facilities in accordance with applicable regulatory requirements.

.2 Do not burn or bury waste materials at Place of the Work.

.3 Do not dispose of volatile and other liquid waste such as mineral spirits, oil, paints and other coating materials, paint thinners, cleaners, and similar materials together with dry waste materials or on the ground, in waterways, or in storm or sanitary sewers. Collect such waste materials in appropriate covered containers, promptly remove from Place of the Work, and dispose of at recycling facilities or as otherwise permitted by applicable regulatory requirements.

.4 Cover or wet down dry waste materials to prevent blowing dust and debris.

END OF SECTION

1.1 READY-FOR-TAKEOVER

.1 The prerequisites to attaining Ready-for-Takeover of the Work are described in the General Conditions of the Contract.

1.2 INSPECTION AND REVIEW BEFORE READY-FOR-TAKEOVER

.1 Contractor's Inspection: Before applying for the Consultant's review to establish Ready-for-Takeover of the Work:

.1 Ensure that the specified prerequisites to Ready-for-Takeover of the Work are completed.

.2 Conduct an inspection of the Work to identify defective, deficient, or incomplete work.

.3 Prepare a comprehensive and detailed list of items to be completed or corrected.

.4 Provide an anticipated schedule and costs for items to be completed or corrected.

.2 Consultant's Review: Upon receipt of the Contractor's application for review, together with the Contractor's list of items to be completed or corrected, the Consultant will review the Work. The Consultant will advise the Contractor whether or not the Work is Ready-for-Takeover and will provide the Contractor with a list of items, if any, to be added to the Contractor's list of items to be completed or corrected. Provide the Consultant with a copy of the Contractor's revised list.

.3 Maintain the list of items to be completed or corrected and promptly correct or complete defective, deficient and incomplete work. The Contractor's inspection and Consultant's review procedures specified above shall be repeated until the Work is Ready-for-Takeover and no items remain on the Contractor's list of items to be completed or corrected.

.4 When the Consultant determines that the Work is Ready-for-Takeover, the Consultant will notify the Contractor and the Owner in writing to that effect.

1.3 PREREQUISITES TO FINAL PAYMENT

.1 After Ready-for-Takeover of the Work and before submitting an application for final payment in accordance with the General Conditions of Contract:

.1 Correct or complete all remaining defective, deficient, and incomplete work.

.2 Remove from the Place of the Work all remaining surplus Products, Construction Equipment, and Temporary Work.

.3 Perform final cleaning and waste removal necessitated by the Contractor's work performed after Ready-for-Takeover, as specified in Section 01 74 00 – Cleaning and Waste Management.

1.4 PARTIAL USER OCCUPANCY

.1 If partial Owner occupancy of a part of the Work is required before the date of

Ready-for-Takeover of the entire Work of the Contract, the provisions of this Section shall apply, to the extent applicable, to that part of the Work that the Owner intends to occupy.

1.5 SUBSTANTIAL PERFORMANCE OF THE WORK

.1 The prerequisites to, and the procedures for, attaining substantial performance of the Work, or similar such milestone as provided for in the lien legislation applicable to the Place of the Work, shall be:

.1 independent of those for attaining Ready-for-Takeover of the Work, and

.2 in accordance with the lien legislation applicable to the Place of the Work.

END OF SECTION

1.1 OPERATION AND MAINTENANCE MANUAL

.1 Prepare a comprehensive operation and maintenance manual, in the language of the Contract, using personnel qualified and experienced for this task.

.2 Submit an initial draft of the operation and maintenance manual for *Consultant*'s review. If required by *Consultant*'s review comments, revise manual contents and resubmit for *Consultant*'s review. If required, repeat this process until *Consultant* accepts the draft manual in writing.

.3 Submit final version to *Owner* in electronic format.

1.2 OPERATION AND MAINTENANCE MANUAL FORMAT

.1 Provide electronic copy of manual in PDF format.

.2 Provide electronic copy of Shop Drawings within manual in PDF format.

1.3 OPERATION AND MAINTENANCE MANUAL – GENERAL CONTENT

.1 Table of contents for each volume.

.2 Introductory information including:

.1 Date of manual submission.

.2 Complete contact information for *Consultant*, subconsultants, *Contractor and Sub Contractors*, with names of responsible parties.

.3 Schedule of *Products* and systems indexed to content of volume.

.3 For each *Product* or system, include complete contact information for *Subcontractors*, *Suppliers* and manufacturers, including local sources for supplies and replacement parts.

.4 *Product* Data: mark each sheet to clearly identify specific products, options, and component parts, and data applicable to installation. Delete or strike out inapplicable information. Supplement with additional information as required.

.5 Reviewed *Shop Drawings*.

.6 Permits, certificates, letters of assurance and other relevant documents issued by or required by authorities having jurisdiction.

.7 Warranties.

.8 Operating and maintenance procedures, incorporating manufacturer's operating and maintenance instructions, in a logical sequence.

.9 Training materials as specified in Section 01 79 00 - Demonstration and Training.

1.4 OPERATION AND MAINTENANCE MANUAL - EQUIPMENT AND SYSTEMS CONTENT

.1 Each Item of Equipment and Each System: include description of unit or system and component parts. Give function, normal operation characteristics, and

limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

.2 Panel Board Circuit Directories: provide electrical service characteristics, controls, and communications.

.3 Include installed colour coded wiring diagrams.

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

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

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

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

.8 Include sequence of operation by controls manufacturer.

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

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.

.12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

.13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.14 Include testing and balancing reports.

.15 Include additional content as specified in technical Specifications sections.

1.5 OPERATION AND MAINTENANCE MANUAL - PRODUCTS AND FINISHES CONTENT

.1 Include *Product* data, with catalogue number, options selected, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured *Products*.

.2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.3 Include an outline of requirements for routine and special inspections and for regular maintenance to ensure that on-going performance of the building envelope will meet the initial building envelope criteria.

.4 Include additional content as specified in technical *Specifications* sections.

1.6 OPERATION AND MAINTENANCE MANUAL - WARRANTIES CONTENT

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

.2 List each warrantor with complete contact information.

.3 Verify that documents are in proper form and contain full information. Ensure that warranties are for the correct duration and are in *Owner*'s name.

1.7 CONTRACTOR'S AS-BUILT DRAWINGS

.1 Contractor shall obtain a PDF copy of construction Drawings for the purpose of creating as-built drawings. Record information and maintain as-built drawings in orderly and legible condition.

1.8 PROJECT RECORD DRAWINGS

.1 Contractor shall transfer all information marked up on the as-built drawings during the progress of the *Work* to a master set of record drawing files provided by *Consultant*, in CAD format.

.2 Mark revised drawings as "RECORD DRAWINGS".

.3 Submit completed record drawings in electronic form to *Owner*.

1.9 SPARE PARTS, MAINTENANCE MATERIALS, AND SPECIAL TOOLS

.1 Supply spare parts, maintenance materials, and special tools in quantities specified in technical *Specifications* sections.

.2 Ensure spare parts and maintenance materials are new, not damaged nor defective, and of same quality, manufacturer, and batch or production run as installed *Products*.

.3 Provide tags for special tools identifying their function and associated *Product*.

.4 Deliver to and store items at location directed by *Owner* at *Place of the Work*. Store in original packaging with manufacturer's labels intact and in a manner to prevent damage or deterioration.

.5 Catalogue all items and submit to *Consultant* an inventory listing organized by *Specifications* section. Include *Consultant* reviewed inventory listing in operation and maintenance manual.

END OF SECTION

1.1 SUMMARY

.1 Demonstrate and provide training to *Owner*'s personnel on operation and maintenance of equipment and systems prior to scheduled date of *Ready-for-Takeover of the Work*.

.2 *Owner* will provide list of personnel to receive training and will coordinate their attendance at agreed upon times.

.3 Owner's representative will acknowledge the successful completion of each demonstration on a form provided by the Contractor. The form shall be agreed to by the Owner, Consultant and Contractor prior to demonstration and testing.

.4 Obtain and submit to Owner, letters from manufacturers of equipment and systems indicating that their technical representatives have inspected and tested equipment and systems installed and have approved methods of installation, connections and operation.

.5 Coordinate and schedule demonstration and training provided by *Subcontractors* and *Suppliers*.

1.2 SUBMITTALS

.1 Submit proposed dates, times, durations, and locations for demonstration and training of each item of equipment and each system for which demonstration and training is required. Allow sufficient time for training and demonstration for each item of equipment or system, or time as may be specified in technical *Specifications*.

.2 *Consultant* and *Owner* will review submittal and advise *Contractor* of any necessary revisions.

.3 Submit report(s) within 5 *Working Days* after completion of demonstration and training:

.1 identifying time and date of each demonstration and training session,

.2 summarizing the demonstration and training performed, and

.3 including a list of attendees.

.4 Submit video record of demonstration and training together with report.

1.3 PREREQUISITES TO DEMONSTRATION AND TRAINING

.1 Testing, adjusting, and balancing has been performed in accordance with *Contract Documents*.

.2 Equipment and systems are fully operational.

.3 Copy of completed operation and maintenance manual is available for use in demonstration and training.

.4 Conditions for demonstration and training comply with requirements specified in technical *Specifications*.

1.4 DEMONSTRATION AND TRAINING

.1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment and system.

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

.3 Prepare and insert additional information in operation and maintenance manual if required.

END OF SECTION

1.1 GENERAL

.1 The Contractor must provide all labour, materials, products, equipment and services for commissioning of all building systems to ensure building is operating according to requirements of Contract Documents.

1.2 CONTRACTOR RESPONSIBILITIES

.1 Prepare each system ready for commissioning. Verify systems installation is complete and in operation.

.2 Coordinate commissioning with and assist commissioning agency.

.3 Perform and document verification, performance testing, adjusting, and balancing operations.

.4 Cooperate with commissioning agency and provide access to equipment and systems.

.5 Provide personnel and operate systems at designated times, and under conditions required for proper commissioning.

.6 Make instruments available to commissioning agency to facilitate spot checks during commissioning.

.7 Participate in commissioning meetings.

.8 Complete commissioning forms as requested by commissioning agency.

.9 Correct deficiencies identified in commissioning process.

.10 Incorporate commissioning data into operation and maintenance manual.

.11 Ensure that commissioning agency participates in demonstration and training as specified in Section 01 79 00 – Demonstration and Training.

END OF SECTION

1 General

1.1 SUMMARY

.1 Review drawings, site conditions, and other specification sections to ascertain the extent and nature of work of this section.

.2 The Work of this Section includes, but is not limited to the following:

.1 Demolish and removal of the following where indicated on the Drawings:

.1 Interior mechanical equipment and ductwork;

.2 Masonry

.3 Acoustic ceiling tile and grid;

.4 Drywall/steel stud partitions/assemblies and interior finishes;

.5 Doors, frames and associated hardware;

.6 Exterior mechanical equipment and cap weather tight.

.2 Disconnect/cap existing service in areas of demolition.

.3 Trace, demolish and remove decommissioned mechanical and electrical services found during demolition. Remove decommissioned services to the area of demolition to the source, leaving no buried services in walls and floors, unless otherwise approved by written notice from the Owner.

.4 Dispose of demolished materials except where required to be salvaged or reused.

.5 Refer to demolition notes indicated on all disciplines Drawings.

.3 Drawings contain details that suggest directions for solving some of the major demolition and removal requirements for this project; Contractor is required to develop these details further by submitting a demolition plan prepared by a professional engineer employed by the Contractor.

1.2 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI):

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

.2 Canadian Standards Association (CSA):

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

.3 National Fire Protection Association (NFPA):

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

.4 Provincial Legislation:

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

1.3 DEFINITIONS

.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.

.2 Remove and Salvage: Detach items from existing construction and deliver them to Owner ready for reuse.

.3 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

.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.

1.4 EXAMINATION

.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.

.2 Where appropriate prepare a photographic or video record of existing conditions, particularly of existing work scheduled to remain.

.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.

1.5 SUBMITTALS

.1 Provide required information in accordance with Division 01.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Prepare schedule in conjunction with overall project schedule, and outline proposed methods in writing. Obtain approval before commencing demolition work, and indicate the following:

.1 Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity

.2 Interruption of utility services

.3 Coordination for shutoff, capping, and continuation of utility services

1.6 QUALITY ASSURANCE

.1 Conform to requirements of all authorities having jurisdiction.

.2 Comply with applicable requirements of CSA S350-M "Code of Practice for Safety in Demolition of Structures".

.3 Work of this Contract shall be executed by an approved company having a minimum of five (5) years continuous experience and able to deploy adequate equipment and skilled personnel to complete work expediently in an efficient and orderly manner.

.4 Perform cutting and coring, where applicable, by a firm specializing in this type of work, able to produce evidence of successful completion of similar work over a period of at least five (5) years immediately prior to date of contract.

.5 Apply for, secure, arrange and pay for all permits, notices and inspections necessary for proper execution and completion of work in this Section.

.6 Professional Engineer Qualifications: Procure the services of a professional engineer who is experienced in providing relevant engineering services to perform the following:

.1 Review portions of the Work requiring structural performance, prepare plan of action, engineer temporary shoring and bracing, and Provide site administration and inspection for work of this Section.

1.7 PROTECTION

.1 Prevent movement or settlement of adjacent work. Provide and place bracing or shoring and be responsible for safety and support of such work. Be liable for any such movement or settlement, and any damage or injury caused.

.2 Cease operations and notify Consultant if safety of any adjacent work or structure appears to be endangered. Take all precautions to support the structure. Do not resume operations until reviewed with the Consultant.

.3 Prevailing weather conditions and weather forecasts shall be considered. Demolition work shall not proceed when weather conditions constitute a hazard to the workers and site.

.4 Prevent damage of surrounding vegetation by construction. Install tree protection barriers to trees that are scheduled to remain.

.5 Prevent debris from blocking surface drainage inlets and mechanical and electrical systems which remain in operation.

.6 Temporarily suspended work that is without continuous supervision shall be closed to prevent entrance of unauthorized persons.

1.8 REMAINING AND ADJACENT STRUCTURES

.1 Do not interfere with, encumber, endanger or create nuisance, from any cause due to demolition work, to public property or any adjacent attached and/or detached structures in possession of Owner or others, which are to remain, whether occupied or unoccupied during this work.

.2 Make good damage to such structures resulting from work under this Section at no cost to Owner. Make good adjacent building surfaces damaged by work of this Section.

1.9 PROTECTION OF SERVICES AND STRUCTURES

.1 Take necessary precautions to guard against movement, settlement or collapse of existing adjacent utility services, public property and/or structures, whether to remain or not. If these or other unforeseen conditions develop, take immediate emergency measures, report to Consultant, confirm in writing, and await instructions before proceeding with any further related demolition work.

.2 Prior to saw cutting or core drilling of existing concrete slabs, use ground penetrating radar (GPR) to detect utilities and structural reinforcing. Concrete X-Rays can be used when access to both sides of concrete slab is accessible for placement of required x-ray film.

1.10 EXISTING SERVICES

.1 Prior to start of demolition disconnect all electrical service lines in the areas to be demolished. Post warning signs on all electrical lines and equipment which must remain energized to serve other areas during period of demolition. Disconnect electrical service lines in demolition areas to the requirements of local authority having jurisdiction.

.2 In each case, notify the affected utility company in advance and obtain approval where required before commencing with the work on main services.

.3 Arrange with utility companies for locating of such services and for disconnection of existing services owned by utility companies and which will be disconnected by said utility companies, provided such services do not interfere with adjacent tenancy operators.

.4 Remove sewer and water lines where required within existing building as deemed necessary, and cap to prevent leakage, in accordance with authorities having jurisdiction.

.5 Existing services are to be maintained where required for normal tenant operation during regular hours of operation and/or as deemed necessary by Owner.

1.11 DECOMMISSIONED SERVICES

.1 Remove fully decommissioned electrical and mechanical service lines, plumbing, ducting, fixtures and all fasteners and supports for decommissioned items.

.1 Remove sewer and water lines where required within existing building as deemed necessary, and cap to prevent leakage, in accordance with authorities having jurisdiction.

.2 Patch and repair surfaces affected by this selective demolition to match existing adjacent surfaces, as approved by the Consultant.

1.12 EXISTING WARRANTIES

.1 Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

2 Products

2.1 DEBRIS, SALVAGED MATERIAL AND EQUIPMENT DISPOSAL

.1 All materials and or equipment salvaged from demolition work becomes property of demolition Contractor unless designated otherwise.

.2 At no cost to Owner repair or replace material and/or equipment scheduled to remain which is damaged by demolition work. Do not sell any salvaged material or equipment directly from project site.

.3 Remove waste debris continually and entirely from project site during demolition work. Do not load vehicles transporting such debris beyond their safe capacity or in a manner which might cause spillage on public or private property. If spillage does occur, clean up immediately to prevent traffic hazards or nuisance.

2.2 PROTECTION

.1 Temporary Protection:

.1 Erect temporary hoarding protection, to enclose openings in exterior walls, and/or provide security to partially occupied interior spaces, as indicated in Division 01.

.2 Erect temporary dust screens to prevent dust and debris to enter areas of the building which are not scheduled for demolition. Remove temporary dust screens when no longer required.

2.3 REPAIR MATERIALS

.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 Floor Patching and Levelling Compounds: Cement based, trowelable, self-levelling compounds compatible with specified floor finishes;

.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.

.4 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 29 00.

.5 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.

2.4 EXISTING MATERIALS

.1 Items to be retained for re-use in new construction include, but are not limited to the following:

.1 Confirm with Consultant any materials that appear to be in re-usable condition prior to disposal.

.2 Confirm with Consultant any materials scheduled for re-use that are not in re-usable condition prior to installation.

3 Execution

3.1 GENERAL

.1 Exercise caution in dismantling, disconnecting of work adjacent to existing work designated to remain.

.2 Carry out demolition in a manner to cause as little inconvenience to the adjacent properties as possible.

.3 Carry out demolition in an orderly and careful manner.

.4 Demolition by explosives is not permitted.

.5 Selling or burning of materials on site is not permitted.

.6 Sprinkle exterior debris with water to prevent dust. Do not cause flooding, contaminated run-off or icing. Do not allow waste material, rubbish, and windblown debris to reach and contaminate adjacent properties.

.7 Lower waste materials in a controlled manner; do not drop or throw materials from heights.

.8 At end of each day's work, leave in safe condition so that no part is in danger of toppling or falling.

3.2 PREPARATION

.1 Although possible (with additional precautions), openings through existing concrete columns and beams are generally not permitted; the structural engineer must be contacted for such proposed openings for specific additional requirements.

.2 For all openings to be located through existing structural components, the following requirements for coring or sawcutting openings through existing reinforced concrete floor slabs, roof slab and shear walls for mechanical and electrical services must be followed:

.1 Prior to installation of openings, a testing agency is to be engaged to accurately scan the areas of the proposed openings to locate existing reinforcing steel, electrical conduit and cast-in mechanical services (i.e. pipes). Electromagnetic scanning or ground-penetrating radar are acceptable methods of scanning for these purposes. Note that x-ray technology will not be permitted as this will be an occupied building during construction.

.2 During/after conducting the scanning procedures, the testing agency is to clearly and accurately mark the surfaces of the concrete elements identifying individual existing reinforcing bars and electrical/mechanical services.

3.3 SAFETY AND SECURITY

.1 Maintain security of the building at all times during demolition work.

.2 Provide and maintain fire prevention equipment and alarms accessible during demolition.

3.4 ACCESS ROUTES

.1 Restrict operations to designated access routes.

.2 Do not obstruct roads, parking lots, sidewalks, hydrants and the like.

3.5 SELECTIVE DEMOLITION

.1 Provide necessary shoring and supports to assure safety of structure prior to cutting and coring.

.2 Where practical, sawcut and remove material as required.

.3 Where sawcutting is not appropriate, use suitable hand tools.

.4 Demolish, cut-out and remove from site all other work noted on drawings or required to permit new construction.

.5 Do not allow water to accumulate or flow beyond work area. Provide receptacles and mop-up as work proceeds.

.6 Fill all openings in concrete block walls with concrete masonry units, coursing to match existing, prepare ready to receive new finishes to match existing.

.1 Provide bond beams in new openings cut into existing concrete masonry unit walls.

.2 Provide finished end masonry units to patch and repair for new jamb sections in existing concrete masonry unit walls.

.7 Fill all openings in gypsum board walls with gypsum board and steel framing to match existing, skim coat to make wall smooth and even.

.8 Demolish existing flooring and wall finishes, and adhesive remnants as follows:

.1 Floor and wall substrate shall be smooth, free from ridges and depressions, and adhesive remnants that could telegraph through new flooring and wall finishes.

.9 Demolish completely all ceiling panels and grid as indicated.

.10 Patch and repair all walls, floor and ceilings damaged during demolition with material matching adjacent walls, prepare ready for new finishes.

.1 Prepare existing surfaces schedule to receive new finish by grinding, filling, over-coating, stripping, washing, etching, shot blasting or other chemical or mechanical means, as required to ensure satisfactory installation of new finish.

3.6 PATCHING AND REPAIRING

.1 Floors and Walls:

.1 Where walls or partitions that are demolished extend from one finished area into another, patch and repair floor and wall surfaces in the new space.

.2 Provide a level and smooth surface having uniform finish colour, texture, and appearance.

.3 Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform colour and appearance.

.4 Patch with durable seams that are as invisible as possible.

.5 Provide materials and comply with installation requirements specified in other Sections of these Specifications.

.6 Patch any existing areas adjoining / adjacent to new construction in good workmanship, filling and finishing gaps between finishes to allow new work to blend seamlessly with existing work.

.7 Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.

.8 Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

.2 Exterior Walls:

.1 Where existing doors and/or windows are schedule to be removed during demolition, patch and repair exterior walls using similar wall construction techniques as adjacent wall construction. Ensure compatibility between insulation, air barrier and vapour retarder, providing continuous air and vapour control and wall R-Value between existing and new construction. Provide exterior and interior finish materials, matching existing adjacent materials, to provide an even-plane surface of uniform appearance.

.3 Parging:

.1 Patch and repair existing parging damaged or spalling, in areas identified on the Drawings, using single-component, sand/cement blend designed for coating or parging vertical surfaces.

3.7 EQUIPMENT

.1 The Testing Agency shall provide and operate all necessary equipment for conducting accurate scans of existing reinforced concrete components for which openings are required.

.2 Equipment and methodology to be capable of scanning concrete elements to a maximum of 400 mm thickness.

3.8 EXCESSIVE DEMOLITION

.1 Where excessive demolition occurs, be responsible for cost of replacing such work.

.2 Consultant shall determine extent of such 'over-demolition' and method of rectification.

3.9 COMPLETION

.1 Leave project site as directed, reasonably clean and presentable, free from above grade debris, any salvaged material and/or equipment except those designated to remain.

.2 Maintain access to exits clean and free of obstruction during removal of debris.

END OF SECTION

HAZARDOUS BUILDING MATERIALS REMOVAL SPECIFICATIONS

Project:

HVAC Upgrades Project
126 Pape Avenue, Toronto, Ontario

Sections:

Section 02 82 13.2 – Type 2 Asbestos Abatement
Section 02 82 13.3 – Type 3 Asbestos Abatement
Section 02 83 13 – Lead Disturbance Precautions
Section 02 84 16 – Handling of Mercury Containing Equipment
Section 02 87 13 – Silica Disturbance Precautions

Prepared by:

Safetech Environmental Limited
14-3045 Southcreek Road
Mississauga, Ontario
L4X 2X7

Prepared for:

Inder Bhamra
Environmental Coordinator – Project Management Office

Corporate Real Estate Management – City of Toronto
Metro Hall
55 John Street, 2nd Floor
Toronto, Ontario
M5V 3C6

September 2025

Part 1 General

1.1 GENERAL REQUIREMENTS

1. Conform to Sections of Division 1 as applicable.

1.2 RELATED SECTIONS

1. Section 02 82 13.3 – Type 3 Asbestos Abatement
2. Section 02 83 13 – Lead Disturbance Precautions
3. Section 02 84 16 – Handling of Mercury Containing Equipment
4. Section 02 87 13 – Silica Disturbance Precautions

1.3 SITE CONDITIONS

1. Types of asbestos present: Chrysotile present within, within but not limited to textured ceiling finish, 12x12 red vinyl floor tiles, and 12x12 yellow with white streak vinyl floor tiles. Vinyl floor tiles are not expected to be are not expected to be disturbed during the HVAC Upgrade Project.
2. Materials identified to contain Asbestos can be found within the Safetech Environmental Limited report titled “Designated Substances and Hazardous Materials Assessment Report, HVAC Upgrades Project, 126 Pape Avenue, Toronto, Ontario” issued on August 15, 2025.
3. Removal or disturbance of asbestos-containing materials must be conducted in accordance with Ontario Regulation 278/05 (O. Reg. 278/05), “Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations” as made under the Occupational Health and Safety Act.

1.4 DESCRIPTION OF WORK

1. The following are classified as **Type 2 operations** under O. Reg. 278/05:
    1. Removing all or part of a false ceiling to obtain access to a work area, if asbestos-containing material is likely to be lying on the surface of the false ceiling.
    2. The removal or disturbance of one square metre or less of friable asbestos-containing material during the repair, alteration, maintenance or demolition of all or part of machinery or equipment or a building, aircraft, locomotive, railway car, vehicle or ship.
    3. Enclosing friable asbestos-containing material.
    4. Applying tape or a sealant or other covering to pipe or boiler insulation that is asbestos-containing material.
    5. Installing or removing ceiling tiles that are asbestos-containing material, if the tiles cover an area of 7.5 square metres or more and are installed or removed without being broken, cut, drilled, abraded, ground, sanded or vibrated.
    6. Breaking, cutting, drilling, abrading, grinding, sanding or vibrating non-friable asbestos-containing material if,

1. the material is not wetted to control the spread of dust or fibres, and
2. the work is done only by means of non-powered hand-held tools.

7. Removing one square metre or more of drywall in which joint filling compounds that are asbestos-containing material have been used.
8. Breaking, cutting, drilling, abrading, grinding, sanding or vibrating non-friable asbestos-containing material if the work is done by means of power tools that are attached to dust-collecting devices equipped with HEPA filters.
9. Removing insulation that is asbestos-containing material from a pipe, duct or similar structure using a glove bag.
10. Cleaning or removing filters used in air handling equipment in a building that has sprayed fireproofing that is asbestos-containing material.
11. An operation that,
    1. is not mentioned in 1.41.1 through 1.41.10,
    2. may expose a worker to asbestos, and
    3. is not classified as a Type 1 or Type 3 operation.

2. If removing 1.0m^2 or less of asbestos-containing texture coat finish, perform all work in accordance with Section 02 82 13.2 (Type 2 Asbestos Abatement).
3. Maintain electrical and mechanical services passing through asbestos work area.
4. Seal all surfaces from which asbestos has been cleaned or removed with slow drying sealer.
5. Dispose of temporary enclosures, disposable equipment and any asbestos-containing or contaminated materials removed, as asbestos waste.
6. All work will be subject to inspection and air monitoring both inside and outside asbestos work area by Owner's Consultant. Any contamination of surrounding areas (indicated by visual inspection or air monitoring) shall necessitate complete enclosure and clean-up of affected areas.

1.5 DEFINITIONS

1. **Asbestos Work Area(s)**: Area(s) where work takes place which will, or may disturb asbestos-containing material, including overspray and fallen material, or settled dust that may contain asbestos.
2. **Airlock**: 2 curtained doorways spaced minimum of 2 m (6') apart.
3. **Authorized Visitor(s)**: Construction Manager or person(s) representing regulatory agencies, and person(s) authorized by them.
4. **Curtained Doorway**: Device to allow ingress or egress from enclosure while permitting minimal air movement, typically constructed by placing 2 overlapping flaps of polyethylene sheeting (2 sheets of polyethylene per flap) attached to head and 1 jamb of existing or temporarily constructed door frame. Secure vertical edge of 1 flap along 1 vertical side of door frame, and vertical edge of other flap along opposite vertical side of door frame. Reinforce free edges of polyethylene with duct tape.
5. **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.

6. **HEPA Filter**: High Efficiency Particulate Aerosol filter at least 99.97 percent efficient in collecting 0.3 micrometer aerosol.

7. **Negative Pressure**: Reduced pressure within asbestos work area(s) established by extracting air directly from work area, and discharging directly to exterior of building. Discharged air first passes through HEPA filter. Extract sufficient air to ensure constant reduced pressure at perimeter of work area with respect to surrounding areas.

8. **Polyethylene Sheeting**: Polyethylene sheeting 0.15 mm (6 mil) minimum thickness; with tape seals along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide continuous polyethylene membrane protection.

1.6 QUALITY ASSURANCE

1. Ensure work proceeds to Schedule and meets all requirements of this Section. Perform work so airborne asbestos, asbestos waste or water run off does not contaminate areas outside asbestos work enclosure.

2. Pay cost to Owner of inspection and air monitoring performed as result of failure to perform work satisfactorily.

3. Use only skilled and qualified workers for all trades required for this work.

1.7 REGULATIONS

1. Comply with Ontario Regulation 278/05, "Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations" made under Occupational Health and Safety Act (as amended) and local requirements pertaining to asbestos. In case of conflict with these specifications, the most stringent requirements shall apply.

2. Handle and dispose of contaminated waste as required by R.R.O. 1990, "General – Waste Management" made under The Environmental Protection Act (as amended).

1.8 SUBMITTALS

1. Before Commencing Work:

    1. Obtain and submit all necessary permits for transporting and disposal of asbestos waste.
    2. Submit names of supervisory personnel who will be responsible for asbestos work area(s). One of supervisors must remain on Site at all times while asbestos removal or clean-up is occurring. Submit proof that supervisory personnel have attended training course on asbestos control (two-day minimum duration) and have performed supervisory function on at least two other asbestos control projects.
    3. Submit proposed schedule showing phasing and proposed workforce related to each work area enclosure or repair operation.
    4. Submit list of existing damage for acceptance.

1.9 WORKER AND VISITOR PROTECTION

1. Instructions: Before entering asbestos work area(s), instruct workers and visitors in use of respirators, entry and exit procedures, and all aspects of work procedures and protective measures. Instruction shall be provided by competent person as defined by Occupational Health and Safety Act.

2. **Respiratory Protection**

    1. Provide appropriate respiratory equipment for all persons within asbestos work area including authorized visitors. Type of respirator (full-face or half-face APR) depends on the classification of Type 2 operation.

        1. **Half-Face Air-Purifying Respirator** (APR)

            1. Half-face APR is required for asbestos operations not specified in specified in 1.92.1.2 below.

        2. **Full Face Air-Purifying Respirator** (APR)

            1. Full-face APR is required for the following Type 2 operations

                1. Removing all or part of a false ceiling to obtain access to a work area, if asbestos-containing material is likely to be lying on the surface of the false ceiling.

                2. Breaking, cutting, drilling, abrading, grinding, sanding or vibrating non-friable asbestos-containing material if the work is done by means of power tools that are attached to dust-collecting devices equipped with HEPA filters **and** the material is not wetted.

        3. **Filters**: acceptable filters include N-, R-, or P-100 filters.

            1. Replace filters daily or test according to manufacturer's specifications and replace as indicated.

    2. Respirators shall be acceptable to Occupational Health Branch of Ministry of Labour, Immigration, Training and Skills Development.

    3. Provide proper instruction to workers and visitors on use of respirators, including qualitative fit testing.

    4. No supervisor, worker or authorized visitor shall wear facial hair which affects seal between respirator and face.

    5. Maintain respiratory protection equipment in proper functioning and clean condition, or remove from site

3. **Protective Clothing**: Provide workers and visitors in asbestos work area with full body coveralls with integral hoods. Once coveralls are worn in asbestos work area, treat and dispose of as asbestos contaminated waste. Workers and visitors shall also wear other protective apparel required by Ministry of Labour, Immigration, Training and Skills Development construction regulations.

4. Before entering asbestos work area, put on respirator with new or tested filters, clean coveralls and head covers. Wear coveralls with hoods up at all times.

5. Workers may leave asbestos work area, only after all disturbance of asbestos-containing materials is complete and work area has been cleaned-up. When leaving asbestos work area, workers and visitors must use HEPA vacuum to clean exterior of respirator to remove visible contamination, and remove gross contamination from coveralls and other protective equipment. Immediately upon leaving asbestos work area, workers and visitors shall remove coveralls, wash face and hands thoroughly with soap and water, and wet clean inside of respirator. Remove filters and dispose of or test filters according to manufacturer's specifications. Place coveralls and used filters in receptacles for disposal with other asbestos contaminated materials. Coveralls can be reused, to maximum of 8 hours wear, if coveralls remain inside work area.

6. Do not eat, drink, smoke or chew gum or tobacco in asbestos work area.
7. Workers and visitors shall be fully protected as specified herein whenever possibility of disturbance of asbestos exists.

Part 2 Products

2.1 MATERIALS

1. Polyethylene Sheeting: 0.15 mm (6 mil) minimum thickness unless otherwise specified; in sheet size to minimize joints.
2. Rip-Proof Polyethylene: 0.20 mm (8 mil) fabric made up from 0.13 mm (5 mil) weave and 2 layers 0.04 mm (1.5 mil) poly laminate, in sheet size to minimize joints.
3. Tape: Tape suitable for sealing polyethylene to surface encountered under both wet conditions using amended water, and dry conditions.
4. Wetting Agent: Non-sudsing surface active agent; mixed with water in concentration to provide thorough wetting of asbestos fibre: Asbestos-Wet, distributed by Asbetec Distributors, Richmond Hill, Ontario.
5. Amended Water: Water with wetting agent added.
6. Asbestos Waste Receptors: 2 separate containers of which 1 shall consist of 0.15 mm (6 mil) minimum thickness polyethylene bag. Other container may be 0.15 mm (6 mil) minimum thickness polyethylene bag or rigid sealable container such as metal or cardboard, fibre drum or wood box. Other container shall be adequate to prevent perforating rips, or tears in first container during filling, transport or disposal. Containers must be acceptable to disposal Site selected and Ministry of the Environment, Conservation and Parks.
7. Sealer: Sealer for purpose of trapping residual fibre debris. Product must have flame spread and smoke development ratings both less than 25. Product shall leave no stain when dry: TC-55 (clear), A/D Fire Protection Systems Inc., Scarborough, Ontario. For mechanical equipment, pipes, boilers, etc. use high temperature sealer only: Chil-Abate CP210, Childers Products Company, Mississauga, Ontario.
8. Sprayer: Garden-type portable manual sprayer, low velocity, capable of producing mist or fine spray.
9. HEPA Vacuum: Vacuum with all necessary fittings, tools and attachments. Air must pass HEPA filter before discharge.

Part 3 Execution

3.1 ASBESTOS WORK AREA(S) – FULL ENCLOSURE

1. Full enclosures must be constructed for Type 2 operations mentioned in 1.41.2 and 1.3 in Section 02 82 13.2 (Type 2 Asbestos Abatement).
2. Move equipment, tools, and stored materials which can be moved without disturbing asbestos-containing materials.
3. Remove elements which can be removed without disturbing asbestos-containing materials.

4. If working from within building, request building personnel to shut off air handling and ventilation systems supplying or exhausting from asbestos work area enclosure(s). Ensure air-handling systems remain shut off for duration of work.
5. Erect wood or metal framing between asbestos work area and remaining building area, as necessary to support polyethylene sheeting enclosures. Free standing enclosure shall have completely sealed polyethylene top.
6. Use sufficient layers to provide adequate protection. Protect floors with at least one layer of polyethylene sheeting. Where walls are protected with sheeting, cover floors first so that wall polyethylene overlaps floor layer by at least 300 mm (12").
7. Where applicable clean previously contaminated surfaces with HEPA vacuum before covering with sheeting.
8. If enclosure is used for more than 1 shift, construct airlock for entry to and exit from enclosure. Clean enclosure prior to exiting at completion of each shift.
9. Establish negative pressure in asbestos work area. Operate negative pressure units or HEPA vacuums continuously from this time until completion of contaminated work.
10. Provide soap, water and towels for washing of worker's face and hands when exiting enclosure.
11. Maintain emergency and fire exits from asbestos work area, or establish alternative exits satisfactory to authorities having jurisdiction.
12. Ensure existing power supply to asbestos work area is isolated and disconnected where necessary. Do not disrupt power supply to remainder of building.

3.2 ASBESTOS WORK AREA(S) [NO ENCLOSURE]

1. Establish asbestos work area with appropriate hoarding (partial enclosure, caution tape, fencing, etc.) to prevent unauthorized access to the asbestos work area.
2. Move equipment, tools, and stored materials which can be moved without disturbing asbestos-containing materials.
3. Remove elements which can be removed without disturbing asbestos material.
4. Request building personnel to shut off air handling and ventilation systems supplying or exhausting from asbestos work area(s). Ensure air-handling systems remain shut off for duration of work.
5. Use sufficient layers to provide adequate protection. Protect floors with at least one (1) layer of polyethylene sheeting.
6. Where applicable, clean previously contaminated surfaces with HEPA vacuum before covering with sheeting.
7. Provide soap, water and towels for washing of worker's face and hands when exiting enclosure.
8. Ensure existing power supply to asbestos work area is isolated and disconnected where necessary.

3.3 MAINTENANCE OF ASBESTOS WORK AREA(S)

1. Maintain asbestos work area in tidy condition.

2. Ensure barriers and polyethylene linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately upon discovery.

3. Visually inspect asbestos work area(s) at beginning of each working period.

3.4 COMMENCE ASBESTOS REMOVAL OR CLEANUP WORK WHEN

1. Arrangements have been made for disposal of waste.

2. Asbestos work area(s) and parts of building required to remain in use are effectively segregated.

3. Tools, equipment and materials waste receptors are inside asbestos work area(s).

4. Signs are displayed in all areas where access to sealed asbestos work areas possible. Signs shall read:

CAUTION
Asbestos Hazard Area
No Unauthorized Entry
Wear assigned protective equipment
Breathing asbestos dust may cause serious bodily harm.

5. Owner's Consultant has been notified of intention to proceed and has reviewed asbestos work area(s) and equipment.

3.5 REMOVAL OF FRIABLE MATERIALS (≤1.0M²)

1. Before commencing work, prepare asbestos work area as described in 3.1 (full enclosure), 3.3, and 3.4.

2. Seal opening to enclosure with tape after entry of worker. Worker shall remain inside enclosure until disturbed asbestos-containing materials are removed and enclosure has been effectively cleaned.

3. Perform work required inside enclosure.

4. When cleaning or removing asbestos-containing material within enclosure, spray asbestos-containing material with amended water. Saturate asbestos to prevent release of airborne fibres during removal. Place fully saturated asbestos directly into waste containers.

5. Treat materials removed including used polyethylene sheeting as asbestos contaminated waste and dispose of as such.

6. Carefully place asbestos waste in inner bag of asbestos waste receptor. Clean inner bag surface of gross contamination and place in clean 6 mil outer bag. If waste is likely to tear inner bag, then instead of outer bag, use fibre or metal drum, cardboard or wood box, or other suitably sturdy container

7. Following completion of work, clean surfaces from which asbestos has been disturbed with HEPA vacuum, or wet-sponge if appropriate to remove all visible material.

8. After wet-sponging or vacuuming to remove visible asbestos, wet clean entire enclosure. Apply coat of sealer to all surfaces from which asbestos has been disturbed. Apply thinned coat (sufficient to coat all surfaces) to interior of polyethylene enclosure prior to tear down.

3.6 TEAR DOWN OF PROTECTION

1. When dismantling enclosure, carefully roll polyethylene toward centre of enclosure. As polyethylene is rolled away, immediately remove any visible debris with HEPA vacuum.
2. Place polyethylene sheeting seals, tape, cleaning material, coveralls, and other contaminated waste in asbestos waste receptors for transport. Remove any debris fallen behind plastic with HEPA vacuum.
3. Clean up asbestos waste receptors and equipment used in work, and remove from asbestos work area(s) via drum and equipment decontamination enclosure systems, at appropriate time in sequence. Double bag waste immediately prior to transport from site to disposal bin.
4. Final review may be carried out by Owner's Consultant to ensure no dust or debris remains.

3.7 RE-ESTABLISHMENT OF OBJECTS AND SYSTEMS

1. When clean-up is complete reinstall items removed to facilitate asbestos related operation, in their proper positions. Reconstruction and reinstallation shall be by tradesmen qualified in work being reinstalled or reconstructed.
2. At completion of work make good all damage not identified in pre-removal survey referred to in para. 1.81.4.

3.8 INSPECTION

1. From commencement of work until completion of clean-up operations, Clients Consultant may be present.
2. If visual inspection indicates that areas outside current asbestos work area enclosures are contaminated these areas are to be cleaned in same manner as that applicable to asbestos work areas, at no cost to Client.
3. Pay cost to provide re-inspection of work found not to be in accordance with these specifications and requirements of authorities having jurisdiction.

3.9 WASTE TRANSPORT AND DISPOSAL

1. Conform to requirements of Regulation 347 (as amended) made under Environmental Protection Act for Waste Management, transporting and disposal of hazardous waste.
2. Obtain Certificate of Approval from Ministry of the Environment, Conservation and Parks for waste management disposal system for asbestos.
3. Check with dump operator to determine type of waste containers acceptable.
4. Ensure shipment of containers to dump is taken by waste hauler licensed to transport asbestos waste.
5. Each load requires completion of bill of lading showing type and weight of hazardous waste being transported.
6. Co-operate with Ministry of the Environment, Conservation and Parks inspectors and immediately carry out instructions for remedial work at dump to maintain environment, at no additional cost to Owner.
7. Ensure dump operator is fully aware of hazardous material being dumped.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

1. Conform to Sections of Division 1 as applicable.

1.2 RELATED SECTIONS

1. Section 02 82 13.2 – Type 2 Asbestos Abatement
2. Section 02 83 13 – Lead Disturbance Precautions
3. Section 02 84 16 – Handling of Mercury Containing Equipment
4. Section 02 87 13 – Silica Disturbance Precautions

1.3 SITE CONDITIONS

1. Types of asbestos present: Chrysotile present within, but not limited to textured ceiling finish, 12x12 red vinyl floor tiles, and 12x12 yellow with white streak vinyl floor tiles. Vinyl floor tiles are not expected to be are not expected to be disturbed during the HVAC Upgrade Project.
2. Materials identified to contain Asbestos can be found in the following Safetech Environmental Limited report, "Designated Substances and Hazardous Materials Assessment Report, HVAC Upgrades Project, 126 Pape Avenue, Toronto, Ontario" issued on August 15, 2025.

1.4 DESCRIPTION OF WORK

1. The following are classified as **Type 3 operations** under O. Reg. 278/05:
    1. The removal or disturbance of more than one square metre of friable asbestos-containing material during the repair, alteration, maintenance or demolition of all or part of a building, aircraft, ship, locomotive, railway car or vehicle or any machinery or equipment.
    2. The spray application of a sealant to friable asbestos-containing material.
    3. Cleaning or removing air handling equipment, including rigid ducting but not including filters, in a building that has sprayed fireproofing that is asbestos-containing material.
    4. Repairing, altering or demolishing all or part of a kiln, metallurgical furnace or similar structure that is made in part of refractory materials that are asbestos-containing materials.
    5. Breaking, cutting, drilling, abrading, grinding, sanding or vibrating non-friable asbestos-containing material, if the work is done by means of power tools that are not attached to dust-collecting devices equipped with HEPA filters.
    6. Repairing, altering or demolishing all or part of any building in which asbestos is or was used in the manufacture of products, unless the asbestos was cleaned up and removed before March 16, 1986.
2. If removing more than 1.0m^2 of asbestos-containing texture coat finish perform all work in accordance with Section 02 82 13.3 (Type 3 Asbestos Abatement).

3. Dispose of temporary enclosures, disposable equipment and any asbestos-containing or contaminated materials removed, as asbestos waste.
4. HEPA-filtered construction air handling units must be DOP-tested on-site.
5. Abatement contractor must provide a bill of lading for the disposal of asbestos waste.
6. Seal surfaces from which asbestos has been removed and surfaces potentially contaminated with asbestos, with sealer.
7. Maintain only emergency electrical and mechanical services passing through asbestos work area. All other services must be deactivated during abatement work.
8. All work will be subject to inspection and air monitoring inside and outside asbestos work area by the Owner's Consultant. Any contamination of surrounding areas, indicated by visual inspection or air monitoring, shall necessitate complete cleanup of affected areas at no additional cost to the Owner.
9. Protect surfaces remaining within asbestos work area.

1.5 REFERENCES

1. Canadian Standards Association (CSA): CSA Z180.1-19 Compressed breathing air and systems.
2. Canadian Standards Association (CSA): CSA-Z94.4-18 Selection, use, and care of respirators.

1.6 DEFINITIONS

1. **Authorized Visitor(s):** Owner's Consultant, person(s) representing regulatory agencies, or other authorized persons.
2. **Competent Person or Supervisor:** A person who is qualified because of knowledge, training and experience, to organize the work and its performance; is familiar with the Occupational Health and Safety Act and the regulations that apply to the work; and has knowledge of any potential or actual danger to health or safety in the workplace.
3. **Contractor:** Asbestos abatement contractor providing demolition, removal and cleaning services as defined in these specifications.
4. **Critical Barrier or Enclosure:** Minimum of two separate layers rip-proof polyethylene sheeting taped securely and separately over windows, doorways, diffusers, grilles and any other openings between Work Area and areas outside of the Work Area, including outside of the building.
5. **Curtained Doorway:** Device to allow ingress or egress from one room to another while permitting minimal air movement between rooms, typically constructed by placing two (2) overlapping sheets of polyethylene sheeting (two sheets of polyethylene sheeting per flap) attached to head and one jamb of existing or temporarily constructed door frame. Secure vertical edge of one flap along one vertical side of doorframe and vertical edge of other flap along opposite vertical side of doorframe. Reinforce free edges of polyethylene sheeting with duct tape.
6. **DOP Test**: A testing method employing dioctyl phthalate aerosol for purpose of leak testing negative air units.

7. **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.

8. **HEPA Filter**: High Efficiency Particulate Aerosol filter at least 99.97 percent efficient in collecting 0.3-micrometer aerosol.

9. **HVAC**: Heating, ventilating and air-conditioning system(s) which serve occupied areas. Includes, but is not limited to, air handling units, ductwork, terminal boxes and grilles.

10. **Polyethylene Sheeting:** Polyethylene sheeting of 0.15 mm (6 mil) minimum thickness with tape seals along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide continuous membrane protection

11. **Negative Pressure**: Reduced pressure within asbestos work area(s) established by extracting air directly from work area, and discharging it directly to exterior of building or to an adjacent area within the building outside of the Work Area. Discharged air first passes through HEPA filter. Extract sufficient air to ensure constant reduced pressure at perimeter of work area with respect to surrounding areas.

12. **Occupied Area:** Areas of the building or work site that are outside of the Work Area.

13. **Owner:** Toronto Community Housing and its representatives.

14. **Owner's Consultant:** Safetech Environmental Limited, the environmental consultant overseeing asbestos abatement.

15. **PPE:** Personal protective equipment.

16. **Work Area:** Specific area or location where actual asbestos abatement work is being performed or such other area of the building which it has been determine may be hazardous to public health as a result of asbestos abatement.

1.7 REGULATIONS

1. Comply with applicable Federal, Provincial, and Local laws and regulations in effect at time work is performed. In case of conflict among these requirements or with these specifications the more stringent requirement applies. Contractor shall observe all such laws and regulations and shall obtain and/or pay all permits, notices, fees, taxes, duties as may be required. If no regulations exist, follow guidelines most widely accepted by recognized professional organizations such as occupational hygienists, health professionals and environmental consultants as listed in paragraph 1.5 References.

2. Contractor shall ensure that the measures and procedures prescribed under the Occupational Health & Safety Act (the Act) are carried out and that every employee and worker on the project complies with applicable regulations (as amended) made under the Act, including (but not limited to):

    1. Ontario Regulation 213/91 – Construction Projects
    2. Ontario Regulation 278/05 – Designated Substance - Asbestos on Construction Projects and in Buildings and Repair Operations
    3. Ontario Regulation 297/13 – Occupational Health and Safety Awareness and Training
    4. Ontario Regulation 490/09 – Designated Substances
    5. Ontario Regulation 632/05 – Confined Spaces

6. R.R.O. 1990, Regulation 860 – Workplace Hazardous Materials Information System (WHMIS)

3. Asbestos-containing waste or contaminated waste to be handled and disposed of in accordance with R.R.O. 1990, Regulation 347/90, "General – Waste Management" made under The Environmental Protection Act.

1.8 QUALITY ASSURANCE

1. Ensure work proceeds to schedule, and meets all requirements of this Section. Perform work so that airborne asbestos, asbestos waste, or water runoff do not contaminate areas outside asbestos work enclosure.

2. Pay cost to the Owner of inspection and air monitoring performed as result of failure to perform work satisfactorily regarding quality, safety, or schedule.

3. Use only skilled and qualified workers for all trades required for this work.

4. Contractor shall ensure that:

    1. Measures and procedures prescribed under the Occupational Health & Safety Act and regulations are carried out.
    2. Every employee and every worker on project complies with applicable act and regulations.
    3. Health & safety of workers and public is protected.
    4. All material handling, and associated equipment conform to and are operated in accordance with "Workplace Hazardous Materials Information System" (WHMIS).
    5. Advise the Owner whenever work is expected to be hazardous to employees and/or public.

5. Contractor may be requested to provide information on their health & safety record.

1.9 SUBMITTALS

1. Submit proof that all workers conducting abatement activities have successfully completed the **Asbestos Abatement Worker** Training Program approved by the Ministry of Labour, Immigration, Training and Skills Development and supervisors conducting abatement activities have successfully completed the **Asbestos Abatement Supervisor** Training Program approved by the Ministry of Labour, Immigration, Training and Skills Development as outlined in Section 20 of Ontario Regulation 278/05.

2. Submit names of supervisory personnel who will be responsible for asbestos work area(s). One of supervisors must remain on Site at all times while asbestos removal or clean-up is occurring. Submit proof that supervisory personnel have attended training course on asbestos control (2-day minimum duration) and have performed supervisory function on at least two other asbestos control projects.

3. Submit proof satisfactory to Owner's Consultant that workers have had instruction and training related to care and use of respirators in accordance with and have been fit-tested for the type(s) of respirator(s) to be used.

4. Submit Notice of Project [Form 0175] to the Ministry of Labour, Immigration, Training and Skills Development. Print and sign a copy of the Notice of Project and post or make it available at the project site.

1. Not later than ten days before commencing asbestos work on this project, notify in writing Ontario Ministry of Labour, Immigration, Training and Skills Development, Construction Health and Safety Branch located nearest to the area the abatement is being conducted. The information provided to the Ontario Ministry of Labour, Immigration, Training and Skills Development must comply with the requirements outlined in Section 11, subsection 3 of O. Reg. Orally notify them before commencing work.

5. Submit Material Safety Data Sheets (MSDSs) for all products to be used during asbestos abatement.

6. Obtain and submit all necessary permits for transporting and disposal of asbestos waste.

    1. Notify sanitary landfill site in accordance with requirements of Reg. 347.

7. Submit proposed schedule showing phasing and proposed workforce related to each work area enclosure or repair operation.

8. Submit list of existing damage for acceptance.

9. Submit proof that abatement contractor is a member of and in good standing with the Environmental Abatement Council of Ontario (EACO).

10. Submit proof of Contractors Liability Insurance for dealing with hazardous materials, specifically stating that asbestos is not excluded from the policy.

11. Submit confirmation of good standing with Workplace Safety and Insurance Board (WSIB).

1.10 WORKER AND VISITOR PROTECTION

1. **Instructions:** Before entering asbestos work area, instruct workers and visitors in use of respirators, dress, showers, entry and exit from asbestos work areas, and all aspects of work procedures and protective measures. Instruction shall be provided by Competent Person as defined by Occupational Health and Safety Act.

2. **Full-Face Air-Purifying Respirator:** During wet removal and cleanup in enclosed asbestos work area workers, supervisors, and authorized visitors shall be supplied with and use air-purifying full-face respirator (APR) with N-, R- or P-100 filters. Replace filters daily or test according to manufacturer's specifications and replace as indicated. Respirators shall be acceptable to Occupational Health Branch of Ministry of Labour, Immigration, Training and Skills Development. Provide proper instruction to workers and visitors in use of respirators, including qualitative fit testing. Maintain respiratory protection equipment in proper functioning and clean condition.

3. **Atmosphere Supplying Respirators:** Removal of more than 1.0 m^2 of sprayed applied asbestos-containing materials that contain a type of asbestos other than chrysotile or the dry removal of asbestos-containing materials indicated in paragraph 1.41 require the use of atmosphere supplying respirators as stipulated in O. Reg. 278/05.

    1. Prior to use, testing of the compressed air system used with supplied air respirators shall be completed to ensure it meets the standards set out in Table 1 of CSA Standard Z180.1-19, Compressed Breathing Air and Systems.

1. If an oil-lubricated compressor is used to supply breathing air, a continuous carbon monoxide monitor equipped with an alarm shall be provided.
2. If an ambient breathing air system is used, the air intake shall be located in accordance with Appendix B of CSA Standard Z180.1-19.

4. **Protective Clothing**: Provide workers and visitors in Work Area with full body coveralls with integral hoods. Once coveralls are worn in the Work Area, dispose of as contaminated waste. Workers and visitors shall wear other protective apparel required by Ministry of Labour, Immigration, Training and Skills Development regulations.

5. Before entering Work Area, remove street clothes in clean change room and put on respirator with new or tested filters, clean coveralls and head covers before entering equipment and access areas or Work Area. Store street clothes, uncontaminated footwear, towels etc. in clean change room.

6. Persons leaving Work Area shall remove gross contamination from clothing before entering dirty room of decontamination facility. Proceed to equipment and access area and remove all clothing except respirator. Place contaminated work suit in receptacles for disposal with other asbestos contaminated materials. Footwear, clothing, hardhats, protective eyewear, etc., shall be left in equipment and access area to dry for later use. Still wearing respirator proceed naked to showers. Clean respirator to ensure that visible contamination is removed. After having thoroughly washed hair and body with shampoo and soap, remove respirator. Remove filters and dispose of in container provided for this purpose or test filters according to manufacturer's recommendation. Dispose of filters as necessary. Wet clean inside of respirator. Upon completion of asbestos abatement, dispose of footwear as contaminated waste or clean before removing from equipment and access area, or carry in sealed plastic bag to next site.

7. Following showering, proceed to clean change room, dry off and dress in street clothes. Store respirators in fashion to allow them to be put on prior to entering asbestos work area at start of next shift without contaminating clean area. If re-entry to Work Area is to take place after having left for eating or drinking, follow procedures in para. 1.105.

8. Removal of waste and equipment from holding room of waste decontamination enclosure system shall be performed by workers entering from outside. These workers shall wear clean coveralls and half-face air-purifying respirator with P100 filters. No worker shall use this system as means to leave or enter Work Area.

9. Do not eat, drink smoke or chew gum or tobacco at work site. Tobacco products are not allowed on property.

10. Workers and visitors shall be fully protected as specified herein when possibility of disturbance of asbestos exists.

Part 2 Products

2.1 MATERIALS

1. **Polyethylene**: 0.15 mm (6 mil) minimum thickness unless otherwise specified.

2. **Rip-Proof Polyethylene**: 0.20 mm (8 mil) fabric made up from 0.13 mm (5 mil weave and 2 layers 0.04 mm (1.5 mil).

3. **Tape**: Tape suitable for sealing polyethylene to surface encountered, under both wet conditions using amended water, and dry conditions.

4. **Wetting Agent**: Non-foaming surface active agent; mixed with water in concentration to provide thorough wetting of asbestos fibre: Standard of Acceptance, Asbesto-Wet, distributed by Asbetec Distributors, or equivalent.

5. **Amended Water**: Water with wetting agent added.

6. **Asbestos Waste Receptors**: Two separate containers of which 1 shall consist of 0.15 mm **(true 6 mil)** minimum thickness sealable polyethylene bag. Other container may be 0.15 mm **(true 6 mil)** minimum thickness polyethylene bag. Outer container shall be adequate to prevent perforating rips, or tears during filling, transport or disposal. Containers must be acceptable to disposal site selected, and the Ministry of the Environment, Conservation and Parks, and shall be clearly marked to indicate that contents contain asbestos.

7. **Sealer**: Sealer for purpose of trapping residual fibre debris. Product must have flame spread and smoke development ratings both less than 25. Product shall leave no stain when dry: Standard of acceptance - TC-55 (clear), A/D Fire Protection Systems Inc., Scarborough, Ontario, or equivalent. For mechanical equipment, piping and boilers, etc. use high temperature sealer only: Standard of acceptance - Chil-Abate CP210, Childers Products Company, or equivalent.

8. **Ground Fault Panel**: Portable electrical panel equipped with ground fault circuit interrupters (5 mA protection) of sufficient capacity to power all electrical equipment and lights in asbestos work enclosure. Panel complete with ground fault interrupter lights, test switch to ensure unit is working, and reset switch

9. **HEPA Vacuum:** Vacuum with all necessary fittings, tools and attachments. Air must pass HEPA filter before discharge.

10. **Protective Coveralls**: Disposable full body coveralls complete with elasticized hoods made of spun polyolefin material Tyvek by Dupont or nonwoven material Kleenguard by Kimberley Clark (or equivalent).

11. **Flexible ducting**: Metal reinforced flexible ductwork, 12" diameter minimum.

12. **Negative Air Unit**: Portable air handling system, which extracts air directly from asbestos work area and discharges air outside building. Unit shall be fitted with prefilter and HEPA final filter. Air shall pass HEPA filter before discharge. Unit shall have pressure differential gauge to monitor filter loading. Unit shall have auto shut-off and warning system for HEPA filter failure. HEPA filter shall have separate hold down clamps to retain filter in place.

13. **Power Sprayer**: Standard of acceptance - Graco Maxi-wetter, or equivalent.

14. **Encapsulant**: Standard of acceptance - Ocean No. 666, Ocean Fire Retardants Inc., or equivalent, coloured bright red.

Part 3 Execution

3.1 PREPARATION

1. Occupants who will be impacted by the work will need to be temporarily relocated during the work.

2. Cover wall and floor surfaces with polyethylene sheeting sealed with tape. Provide two separately sealed layers of reinforced polyethylene sheeting. Separately seal floor drains or openings. Use sufficient layers (2) and necessary sheathing for walking surface to protect floors which may be damaged. Cover floors first so that polyethylene extends at least 300 mm (12") up walls then cover walls to overlap floor sheeting. Provide additional protection for floors likely to be damaged by amended water, by covering floor with rip-proof polyethylene sheeting sealed with tape.

3. Seal off openings such as doorways, windows, vents, service holes in walls and grilles to non-operating ducts with polyethylene sheeting with tape or with polyurethane foam as appropriate.

4. If applicable, cover with polyethylene sheeting, motors, heating units, fire apparatus, door closers, benches, shelving, storage racks, valves, taps, controllers, lights, and other fixtures and furnishings which are not being removed from asbestos work area and which could be damaged and/or which cannot be readily cleaned at completion of this work. Pre-clean surfaces potentially contaminated with asbestos, with HEPA vacuum or damp cloth prior to installing protection.

5. Install plywood enclosures, covered with rip-proof polyethylene sheeting to protect equipment or fixtures in asbestos work area(s) that may be damaged.

6. Establish negative pressure in asbestos work area as described in Para. 1.611. Negative pressure units shall have total rated capacity with filters in place sufficient to provide minimum one (1) air change every twenty (20) minutes in wet removal sites. Volume of air shall be sufficient to ensure airflow is maintained from clean areas into asbestos work area. Vent units to outside of building by removing, and later replacing, windows, and/or providing flexible ducting. Locate vents to discharge air away from building access points or sidewalks. Do not discharge air into building interior without obtaining approval from The Owner’s Consultant. Leak test negative air units prior to commencement of abatement at operating position, using DOP method. Provide reports for unit efficiency test results within 48 hours of testing, including calibration certificates for testing equipment. Venting of exhaust air through occupied area shall be in rigid airtight ductwork. Operate negative pressure units continuously from this time until completion of final air monitoring. Replace pre-filters as necessary to maintain airflow. Maintain negative air pressure of 5 Pascal (0.02 inches water column) pressure reduction within asbestos enclosure with respect to surrounding areas.

7. Maintain emergency and fire exits from asbestos work area, or establish alternative exits satisfactory to authorities having jurisdiction.

8. Ensure existing power supply to asbestos work area is isolated and disconnected where necessary. Do not disrupt power supply to remaining areas of building. Provide ground fault electrical system where application of amended water is required for wetting asbestos containing materials. Supply all electrical apparatus from this ground fault system. Ensure safe installation of electrical lines and equipment.

9. Provide temporary lighting in asbestos work area to levels that will permit work to be done safely and well.

10. Provide fire extinguisher at each emergency exit, and in decontamination facilities. Protect extinguishers with polyethylene sheeting in manner that will not hamper emergency use.

3.2 WORKERS' DECONTAMINATION ENCLOSURE SYSTEM

1. Construct workers' decontamination enclosure at entrance to Work Area. Worker decontamination enclosure system shall comprise three interconnecting rooms as follows:

2. Provide a set of curtain doorways between each room, and at both dirty and clean entrances to enclosure systems.

3. **Equipment and Access Room**: Build room between shower room and Work Area. Install waste receptor, and storage facilities for worker's shoes and any protective clothing to be reworn in asbestos work areas. Equipment and access room shall be large enough to accommodate specified facilities, and other equipment needed, and at least one worker allowing sufficient space to undress comfortably. Minimum size 3 square metres (30 sq. ft.).

4. **Shower Room**: Build room between clean room and equipment and access room. Provide constant separate supplies of hot and cold water. Provide valves controllable at shower(s) to regulate water temperature. Provide rigid piping with watertight connections and connect to water sources and drains. Provide soap, clean towels and appropriate containers for disposal of used respirator filters. Direct wastewater to sanitary sewer drains via water filtering system consisting of a minimum 2-stage filtering system (25-micron and 5-micron filters).

5. **Clean Room**: Build room between shower room and clean areas outside of enclosures. At doorway to clean room, provide vented wood door, with locking passage set. Provide hangers for workers' street clothes and personal belongings. Provide storage for clean protective clothing and respiratory equipment. Install water heater, if required.

3.3 WASTE AND EQUIPMENT DECONTAMINATION ENCLOSURE SYSTEM

1. Construct system comprised of three linked rooms: Purpose of this system is to provide means to decontaminate drums, scaffolding, material containers, vacuum and spray equipment; and other tools and equipment for which worker decontamination system is not suitable. Provide curtain doorways between rooms, and at both dirty and clean entrances to Enclosure System.

2. **Staging Area:** Build staging area in asbestos work area for gross removal of dust and debris from waste containers and equipment, labeling and sealing of waste containers, and temporary storage pending removal to container cleaning room.

3. **Container Cleaning Room**: Build container cleaning room between staging area and holding room. Room shall be of sufficient size to allow proper washing of equipment and drums or double bagging of asbestos waste. Treat wash water as asbestos contaminated waste.

4. **Holding Room**: Build holding room between container cleaning room and uncontaminated area. Holding room shall be of sufficient size to accommodate largest item of equipment used and ten waste containers.

3.4 CONSTRUCTION OF DECONTAMINATION ENCLOSURES

1. **Floor**: Prior to erecting wall framing, lay 1 sheet of rip-proof polyethylene sheeting over floor area to be covered by enclosures. Turn 600 mm (24") of rip-proof polyethylene sheeting up outside of enclosure, overlapping with polyethylene sheeting covering perimeter walls. Provide second layer of rip-proof polyethylene sheeting to all floors, extending 600 mm up inside of enclosure walls.

2. **Walls**: Build load-bearing walls of 39 mm x 89 mm (2" x 4") wood framing, 400 mm (16") o.c. with continuous top and sill plates. Cover both sides walls with polyethylene sheeting. Walls exposed to asbestos work area shall be covered with min. 9 mm (3/8") plywood sheeting or hardboard. Caulk seal and tape plywood joints. Walls exposed to occupied area shall be covered with good one side 9 mm plywood.

3. **Roof:** Size of joists shall be determined by span, loads, use and Code. Use as a minimum 39 mm x 138 mm (2" x 6") joists. Cover joists with 19 mm (3/4") plywood sheeting. Seal and tape joints, and cover with two layers of rip-proof polyethylene sheeting. At underside of joists install one layer of polyethylene sheeting.

4. **Doorways**: Build curtain doorways designed so that when workers or drums and equipment move through doorway, one of two barriers comprising doorway always remains closed.

3.5 MAINTENANCE OF ENCLOSURES

1. Maintain enclosures in tidy condition.

2. Ensure barriers and polyethylene sheeting linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately upon discovery.

3. Visually inspect enclosures at beginning and end of each working period.

3.6 DO NOT COMMENCE ASBESTOS REMOVAL WORK UNTIL

1. Arrangements have been made for disposal of waste.

2. Asbestos work areas and decontamination enclosures are effectively segregated.

3. Negative pressure equipment is operating continuously.

4. Tools, equipment and waste materials receptors are on hand.

5. Signs are displayed in areas where access to sealed asbestos work area is possible. Signs shall read:

CAUTION
Asbestos Hazard Area
No Unauthorized Entry
Wear assigned protective equipment
Breathing asbestos dust may cause serious bodily harm.

6. Proof of notification to Ministry of Labour, Immigration, Training and Skills Development has been submitted.

7. The Owner’s Consultant has been notified of intention to proceed and has reviewed enclosures, equipment and procedures.

3.7 CONTAMINATED PREPARATION

1. After work has been completed as described in 3.1 to 3.6, request inspection from Owner’s Consultant before proceeding with Contaminated Preparation as described in 3.7.

2. Request building personnel to deactivate air handling and ventilation systems supplying or exhausting from asbestos work area(s).

3. Remove false ceiling (if required) and install upper seals (polyethylene seal from the top surface of the false ceiling to the structural deck) as necessary to allow polyethylene sheeting

to be fastened to structure. Each of two sheets forming wall of enclosure shall be fastened separately to deck using tape, spray adhesive, rapid setting foam or other suitable method. Provide suitable framing to support polyethylene sheeting. Seal holes in existing perimeter walls, columns, deck etc., to ensure an airtight asbestos work area.

4. Promptly seal holes or penetrations in structure above ceiling, ducts, etc. to provide airtight enclosure around asbestos work area(s).

5. Protect electrical, communication, life safety and control systems to remain in place in asbestos work area with polyethylene sheeting.

6. Seal joints and holes in uninsulated HVAC ductwork to remain operational through an asbestos work area, using tape and rip-proof polyethylene sheeting.

3.8 REMOVAL

1. Spray asbestos with amended water using airless spray equipment. Saturate asbestos to prevent release of airborne fibres during removal. Fully saturated asbestos may be scraped directly into waste containers or may be allowed to fall to floor.

2. Place asbestos waste into asbestos waste receptors. Double polyethylene bags are to be used, inner bag shall be cleaned of gross contamination and placed in a clean **6 mil** outer polyethylene bag in container cleaning room immediately prior to transfer from Site.

3. Treat all materials removed to expose asbestos, as asbestos-contaminated waste unless such materials are specified to be re-used.

3.9 CLEAN-UP

1. Clean surfaces from which asbestos has been removed with brushes and vacuum or wet-sponge to remove visible dust and debris.

2. Remove sealed and labeled asbestos waste receptors and dispose of in authorized disposal area in accordance with requirements of disposal authority.

3. After brushing and wet-sponging to remove visible asbestos, wet clean entire Work Area including equipment and access area, polyethylene sheeting and equipment used in process. Floor and wall surfaces, ducts, and similar items not covered with polyethylene sheeting must be wet cleaned.

4. Request visual inspection and acceptance. Following inspection and acceptance, apply heavy coat of slow drying sealer to all surfaces from which asbestos has been removed. Apply thinned coat (sufficient to coat all surfaces) to other surfaces in Work Area including all polyethylene sheeting and surfaces scheduled for demolition. Allow minimum of 12 hours flushing time with no disturbance of asbestos work area. Operate negative air units during this period.

3.10 DISMANTLING OF PROTECTION

1. If air sampling by The Owner’s Consultant shows that levels in asbestos work area do not exceed 0.01 fibres/cc. as determined by NIOSH 7400 Method, A counting rules, proceed with final dismantling of Work Area.

2. Remove polyethylene sheeting exposed during contaminated work including upper surfaces plus any underlying sheeting contaminated by water leaks, rips, tears, or exposed by failure of upper layer. Wear half-face air-purifying respirator with P100 filters and disposable

coveralls during removal of sheeting. Carefully roll sheeting away from walls to center of Work Area. As sheeting is rolled away from walls and corners, HEPA vacuum visible debris.

3. While removing top layer of sheeting from surfaces protected by two layers of sheeting, cut lower sheeting so as to expose horizontal surfaces that may be contaminated with asbestos debris. HEPA vacuum any visible debris.

4. Place polyethylene sheeting, seals, tape, cleaning material, clothing, and other contaminated waste in asbestos waste receptors for transport. Remove with HEPA vacuum any debris which may have fallen behind sheeting.

5. Clean Work Area, equipment and access area, washing/showering room, and other enclosures that may have been contaminated during work.

6. Clean asbestos waste receptors and equipment used in work and remove from Work Area via drum and equipment decontamination enclosure system, at an appropriate time in sequence.

7. Remove hoardings, temporary lighting, equipment and facilities provided for work. A final review may be carried out by the Owner's Consultant to ensure that no dust or debris remains. Contractor responsible for inspecting and cleaning all adjacent spaces to the Work Area. Adjacent work areas to be left free of construction related dust and debris.

3.11 RE-ESTABLISHMENT OF OBJECTS AND SYSTEMS

1. When cleanup is complete re-establish mechanical and electrical systems to remain operative in proper working order. Arrange for, and pay costs of electrical or mechanical repairs needed due to work of this Section.

2. Make good all damage at completion of work not identified in pre-removal survey (para. 1.98).

3.12 AIR MONITORING

1. The Owner's Consultant will arrange for air samples to be taken from commencement of work until completion of cleaning operations, both inside and outside of Work Area in accordance with NIOSH methods.

2. If air monitoring (or visual inspection) shows that areas outside current asbestos work area(s) enclosure or decontamination facilities are contaminated above 0.05 fibre/cc., clean these areas in same manner as that applicable to asbestos work areas, at no cost to the Owner.

3. Air clearance sampling will be done in accordance with O. Reg. 278/05. The air clearance sampling will be conducted following aggressive air sampling methods as outlined in US Environmental Protection Agency "Guidance for Controlling Asbestos-Containing Materials in Buildings – Published June 1985 – Appendix M – Section M.1.5". A minimum of 2,400 L of air will be collected for each sample. An abatement area is deemed clear only if every air sample collected within the Work Area has a concentration of fibres that does not exceed 0.01 fibres/cc. The number of air clearance samples to be collected are based on Ontario Regulation. 278/05, Table 3.

4. If air monitoring in the Work Area shows airborne fibre levels exceed normal levels for wet removal, workers shall use positive pressure supplied air respirators with full-face piece.

5. If final air sampling by the Owner's Consultant shows that levels in completed Work Area do not exceed 0.01 fibres/cc. as determined by NIOSH 7400 Method - "A" counting rules, proceed with dismantling of Work Area.

6. Clearance level is < 0.01 f/cc.

3.13 INSPECTION

1. From commencement of work until completion of clean-up operations, the Owner's Consultant will be present on a full-time basis; both inside and outside Work Area. The following inspections will be conducted at a minimum:
    1. Pre-contamination inspection
    2. Inspection of upper seals and HVAC isolation measures
    3. Post-abatement inspection
    4. Clearance air sampling
2. If Work Area or adjacent areas are found unacceptable in accordance with standards specified or required by authorities having jurisdiction, correct such deficiencies at no cost to the Owner.
3. Pay cost to provide re-inspection of work found not to be in accordance with these specifications and requirements of authorities having jurisdiction.

3.14 WASTE TRANSPORT AND DISPOSAL

1. Conform to requirements of Regulation 347/90 (as amended) - General Waste Management under Environmental Protection Act for Waste Management, transporting and disposal of hazardous waste.
2. Check with dump operator to determine type of waste containers acceptable.
3. Ensure shipment of containers to dump is taken by waste hauler licensed to transport asbestos waste. Waste hauler in possession of valid Ministry of the Environment, Conservation and Parks Certificate of Approval to transport asbestos waste.
4. Each load requires completion of bill of lading showing type and weight of hazardous waste being transported. Provide copies of bill of lading indicating acceptance of waste at landfill.
5. Co-operate with Ministry of the Environment, Conservation and Parks inspectors and immediately carry out instructions for remedial work at dump to maintain environment, at no additional cost to the Owner.
6. Ensure dump operator is fully aware of hazardous material being dumped.
7. Ensure that containers used for dumping are locked and covered at all times.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

1. Conform to Sections of Division 1 as applicable.

1.2 RELATED WORK

1. Section 02 82 13.1 – Type 1 Asbestos Abatement
2. Section 02 82 13.2 – Type 2 Asbestos Abatement
3. Section 02 82 13.3 – Type 3 Asbestos Abatement
4. Section 02 84 16 – Handling of Mercury Containing Equipment
5. Section 02 87 13 – Silica Disturbance Precautions

1.3 SITE CONDITIONS

1. Paints and surface coatings have been confirmed to be lead-containing. Paints and surface coatings not sampled are assumed to be lead-containing.
2. Materials identified to contain lead can be found within the Safetech Environmental Limited report titled “Designated Substances and Hazardous Materials Assessment Report, HVAC Upgrades Project, 126 Pape Avenue, Toronto, Ontario” issued on August 15, 2025.

1.4 DESCRIPTION OF WORK

1. Disturbance of lead-containing materials must be conducted in accordance with measures and procedures outlined in the Ministry of Labour, Immigration, Training and Skills Development “Lead on Construction Projects” guideline.
2. The following work is classified as a **Type 1 operation** under the Ministry of Labour, Immigration, Training and Skills Development “Lead on Construction Projects” guideline (September 2011).
    1. Application of lead-containing coatings with a brush or roller.
    2. Removal of lead-containing coatings with a chemical gel or paste and fibrous laminated cloth wrap.
    3. Removal of lead-containing coatings or materials using a power tool that has an effective dust collection system equipped with a HEPA filter (Effective implies that the dust collection system should be capable of controlling airborne lead concentration levels to below 0.05 mg/m3. Employers should follow manufacturer's recommendations and maintenance specifications for optimal function)
    4. Installation or removal of lead-containing sheet metal.
    5. Installation or removal of lead-containing packing, babbit or similar material.
    6. Removal of lead-containing coatings or materials using non-powered hand tools, other than manual scraping or sanding.
    7. Soldering.

3. Work area surfaces may be HEPA vacuumed with vacuum cleaner contents collected and disposed of as hazardous waste.
4. Dispose of all waste as lead contaminated including insulation, polyethylene drop sheets, coveralls, respirator filters, and all porous materials that cannot be properly cleaned and decontaminated.
5. Lead-containing wastes should be recycled if practicable or handled and disposed of according to Reg. 347.

1.5 REFERENCES/REGULATIONS

1. Comply with Federal, Provincial and local authority requirements. The more stringent requirements shall apply in the event of a conflict with any particular authority or jurisdiction. Regulations and Guidelines include:
2. Regulations made under the Occupational Health and Safety Act, Revised Statutes of Ontario, 1990, Chapter O.1 as amended.
3. The Occupational Health and Safety Act, Regulation for Construction Projects, O. Reg. 213/91 (as amended).
4. The Occupational Health and Safety Act, Regulation Respecting Lead, O. Reg. 490/09.
5. Ministry of Labour, Immigration, Training and Skills Development Guideline regarding Lead on Construction Projects, April 2011.
6. Ministry of the Environment, Conservation and Parks, Regulation 347/90 (as amended) for disposal of hazardous waste.

1.6 DEFINITIONS

1. **Authorized Visitor(s):** Owner's Consultant or persons representing regulatory agencies, and person(s) authorized by either of them
2. **Work Area(s):** Area(s) where work takes place which will, or may disturb lead paint and lead dust.
3. **HEPA Filter:** High Efficiency Particulate Aerosol filter at least 99.97 percent efficient in collecting 0.3-micrometer aerosol.
4. **HEPA Vacuum:** High Efficiency Particulate Aerosol filtered vacuum equipment acceptable to local provincial Ministry of Labour, Immigration, Training and Skills Development, and Health Canada. Ensure vacuums are equipped with hoses, fittings, and nozzle attachments. Maintain vacuum equipment and system properly.
5. **Polyethylene Sheeting**: Polyethylene sheeting of 0.15 mm (6 mil) minimum thickness with tape seals along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide continuous polyethylene membrane protection.

1.7 SUBMITTALS

1. Submit list of existing damage for acceptance.
2. Laws of province of Ontario shall govern this work. Contractor shall observe all such laws and shall obtain and/or pay all permits, notices, fees, taxes, and duties as may be required. Likewise, it is the responsibility of contractor to comply with Workplace Safety and Insurance Board (WSIB).

3. Before commencing any work, Contractor shall submit, in writing, confirmation of good standing with Workplace Safety and Insurance Board (WSIB).
4. Submit proposed schedule showing phasing and scheduling.
5. Submit proof satisfactory to Owner's Consultant that suitable arrangements have been made to dispose of lead containing waste in accordance with requirements of authority having jurisdiction.
6. Instruction and Training
    1. Before commencing work provide satisfactory proof that every worker has had instruction and training in hazards of lead exposure, in personal hygiene and work practices, and in use, cleaning, and disposal of respirators and protective clothing.
    2. Instruction and training on respirators includes:
        1. Limitations of equipment,
        2. Inspection and maintenance of equipment,
        3. Fitting of equipment, and disinfecting of equipment.
    3. Submit names of supervisory personnel who will be responsible for Lead abatement work area(s). One of these supervisors must remain on site at all times while lead paint disturbance, removal or cleanup is occurring.
    4. If respirators are worn, certificates indicating each worker has had proper respirator fit test for the respirator appropriate for work being performed.
7. The Abatement Contractor to post on the job bulletin board instructions, procedures and information pertaining to abatement work.

1.8 WORKER AND VISITOR PROTECTION

1. **Instructions:** Before entering lead removal work area(s), instruct workers and Authorized Visitor(s) in use of respirators (respirators are not mandatory for Type 1 operations, but may be worn by workers/visitors if requested), and all aspects of Work procedures and protective measures. Provide instruction by competent person as defined by The Occupational Health and Safety Act.
2. Provide disposable full body coveralls and approved respiratory protection to authorized visitors.
3. **Respirators:**
    1. Respirator should not be necessary for Type 1 operations provided that the contractor follows all Type 1 measures and procedures outlined in the MOL guideline.
    2. If the worker requests a respirator, provide worker with personally issued and marked half-face air-purifying respirators with N-, R-, or P-series filters with 95, 99 or 100% efficiency filters.

1. Provide sufficient filters and cartridges so workers can install new filters and cartridges following disposal of used filters and cartridges before re-entering contaminated areas.
2. Respirators shall be acceptable to Occupational Health Branch of Ministry of Labour.

3. Provide instruction in use of respirators, including qualitative fit testing. No worker or Authorized Visitor(s) may have facial hair which prevents proper contact between respirator face-piece and skin.
4. Maintain respirators in proper functioning and clean condition, or remove from Site.

4. **Protective Clothing:** Workers and Authorized Visitor(s) shall wear disposable full body personal protective apparel including attached head covering. In addition, workers are expected to wear nitrile gloves and protective eye goggles as is required by Ministry of Labour construction regulations. Once worn, protective coveralls shall be discarded and disposed of as lead contaminated waste
5. Do not eat, drink, smoke or chew gum or tobacco in work area.
6. Workers and Authorized Visitors shall wash hands and face when leaving lead removal work area. Contractor to provide workers with a designated washroom facility.

Part 2 Products

2.1 MATERIALS

1. **Polyethylene:** 0.15 mm (6 mil) minimum thickness unless otherwise specified; in sheet size to minimize joints.
2. **Rip-Proof Polyethylene:** 0.20 mm (8 mil) fabric made up from 0.13 mm (5 mil weave and 2 layers 0.04 mm (1.5 mil) poly laminate, in sheet size to minimize joints.
3. **Tape:** Tape suitable for sealing polyethylene to surface encountered, under both wet conditions using amended water, and dry conditions.
4. **Waste Receptors:** Two separate containers of which 1 shall consist of 0.15 mm (6 mil) minimum thickness sealable polyethylene bag. Other container may be 0.15 mm (6 mil) minimum thickness polyethylene bag. Other container shall be adequate to prevent perforating rips, or tears during filling, transport or disposal. Containers must be acceptable to disposal site selected, and Ministry of the Environment, Conservation and Parks.
5. **Sprayer:** Garden type, portable manual sprayer, low velocity, capable of producing fine spray.
6. **Ground Fault Panel:** Portable electrical panel equipped with ground fault circuit interrupters (5 mA protection) of sufficient capacity to power all electrical equipment and lights in Lead work enclosure. Panel complete with ground fault interrupter lights, test switch to ensure unit is working, and reset switch. Installed by licensed electrician.
7. **HEPA Vacuum:** Vacuum with all necessary fittings, tools and attachments. Air must pass HEPA filter before discharge.

8. **Protective Coveralls:** Disposable full body coveralls complete with elasticized hoods made of spun polyolefin material Tyvek by Dupont or nonwoven material Kleenguard by Kimberley Clark.
9. **Power Sprayer:** Graco Maxi-wetter or equivalent, from Hazmasters Environmental, Pickering, Ontario.

Part 3 Execution

3.1 PREPARATION

1. Establish hoarding around work area (caution tape, ropes, etc.) to prevent unauthorized personnel from entering the Work Area.
2. Provide washing facility (wash basin, water, soap, and towels) at entrance to Work Area.
3. Place polyethylene drop sheets beneath the area of work.
4. Provide fire extinguisher at each emergency exit, and in decontamination facilities. Protect extinguishers with polyethylene sheeting in manner that will not hamper emergency use.

3.2 REMOVAL

1. Remove/disturb lead containing material as required. Ensure that classification of work is in accordance with work operation listed in 1.41.
2. Use laminate cloth and paint removers (e.g. Dumond Peel Away 1 Paint Remover, or equivalent) in accordance with the manufacturer's specifications.
3. Hand tools may also be used to perform required cutting of lead sheeting and/or pipe.
4. Removal or disturbance (e.g. drilling) of lead-containing paints, surface coatings or mortar with power tools is not permitted. Only power tools (drill, grinder) attached to an effective dust collection device equipped with a HEPA filter are permitted.
5. Any removed lead-containing materials must be placed in appropriate waste receptors.
6. Dust and debris generated by work activities must be cleaned up with a HEPA vacuum or by wet methods (wet shovelling, damp wiping, damp mopping).
7. If HEPA vacuuming, place full vacuum bags into waste receptors. Double polyethylene bags are to be used, inner bag shall be cleaned of gross contamination and placed in a clean 6 mil outer polyethylene bag in container cleaning room immediately prior to transfer from Site.
8. Workers to properly decontaminate him/herself before each break and before going home at completion of work shift. Wash area to have plenty of soap and hot water, and towels. Instruction to be provided for proper hygiene practices.
9. Perform work in manner to reduce dust creation to lowest levels practicable. Work is subject to visual inspection and air monitoring. Any contamination of surrounding areas indicated by visual inspection or air monitoring shall require complete enclosure and clean-up of affected areas.
10. If significant concentrations of dust are being generated the work should be re-evaulated by a qualified person and additional procedures should be implemented such as: a full enclosure should be erected using polyethylene sheeting (or in the event that the sheeting needs support, wood framing may also be used) in order to separate lead work area(s) from remaining

building areas. The Ontario Ministry of Labour, Immigration, Training and Skills Development Guideline – Lead on Construction Projects dated September 2011. The Environmental Abatement Council of Ontario (EACO) *"Lead Guideline"* (October 2014) and/or the Ministry of Labour, Immigration, Training and Skills Development *"Lead on Construction Projects"* guideline should be consulted for all additional recommended requirements.

3.3 CLEAN-UP

1. Clean surfaces from which lead has been removed with brushes and HEPA vacuum or wet-sponge to remove visible dust and debris. HEPA vacuum all surfaces to ensure free of dust and debris.
2. Remove sealed and labeled lead waste receptors and dispose of at authorized disposal area in accordance with requirements of disposal authority.
3. After brushing and wet sponging to remove visible lead dust, damp clean entire work area including equipment and access area, polyethylene sheeting and equipment used in process.
4. Request visual inspection and acceptance. There should be no dust on ducts, scaffold or platform, sills, building surfaces or enclosure, where applicable. Following inspection and acceptance, allow minimum of 2 hours flushing time with no disturbance of work area.

3.4 TEAR DOWN OF PROTECTION

1. Remove polyethylene sheeting exposed during contaminated work plus any underlying sheeting contaminated by water leaks, rips, tears, or exposed by failure of upper layer. Wear appropriate personal protective equipment during this work.
2. Carefully roll sheeting away from walls to center of lead work area. As sheeting is rolled away from walls and corners, HEPA vacuum visible debris.
3. Place polyethylene sheeting, seals, tape, cleaning material, clothing, and other contaminated waste in Lead waste receptors for transport.
4. Clean up lead work area(s) to ensure all visible dust and debris associated with the work has been cleaned up or other surfaces that may have been contaminated during work.
5. Clean up lead waste receptors and equipment used in work and remove from work area(s) via drum and equipment decontamination enclosure system, at an appropriate time in sequence.
6. A final review may be carried out by Owner's Consultant to ensure that no dust or debris remains.

3.5 FIELD QUALITY CONTROL

1. Inspection
    1. From commencement of work until completion of clean-up operations, Owner's Consultant may be present periodically; both inside and outside lead removal work area(s) to ensure compliance with Section 02 83 13.1 (Type 1 Lead Abatement).
    2. If lead work area(s) or adjacent areas, are found unacceptable in accordance with standards specified or required by authorities having jurisdiction, correct such deficiencies at no cost to Owner.

3. Pay cost to provide re-inspection of work found not in accordance with these specifications and requirements of authorities having jurisdiction.
4. Cooperate with and assist inspection and testing company's personnel during inspection and testing.

2. Air Monitoring

1. Owner's Consultant may arrange for air samples to be taken from commencement of work until completion of cleaning operations in accordance with NIOSH methods. Air samples may be collected both inside the building during abatement activity and/or inside the Work Area.
2. Cooperate with Owner's Consultant in collection of air samples, including requiring workers to wear sampling pumps for up to half shift periods. Workers shall exercise care not to damage sampling equipment.
3. During the course of work, additional air samples for lead may be taken periodically inside the building or adjacent to ongoing work. If airborne concentrations exceed 50% of the Time-Weighted Average Limit (TWA) of 0.05 mg/m^3, then the contractor performing the lead abatement shall cease all work in the area until the source of infiltration is mitigated.

3.6 DISPOSAL

1. Conform to requirements of Regulation 347 (as amended) under Environmental Protection Act for Waste Management, transporting and disposal of hazardous waste.
2. Dispose of lead waste in accordance with requirements of Provincial and federal authority having jurisdiction.
3. Cooperate with Ministry of the Environment, Conservation and Parks inspectors and immediately carry out instructions for remedial work at dump to maintain environment, at no additional cost to Owner.
4. Provided Owner's Consultant with original copy of waste shipping manifest for disposed lead containing waste issued by dump operator. Contractor is responsible for completing all required manifest documentation for each load leaving the site.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

1. Comply with requirements of Division 1.

1.2 RELATED SECTIONS

1. Section 02 82 13.1 – Type 1 Asbestos Abatement
2. Section 02 82 13.2 – Type 2 Asbestos Abatement
3. Section 02 82 13.3 – Type 3 Asbestos Abatement
4. Section 02 83 13 – Lead Disturbance Precautions
5. Section 02 87 13 – Silica Disturbance Precautions

1.3 SITE CONDITIONS

1. Mercury is present in the form of the following:
    1. Vapour in fluorescent lamps
    2. Liquid in vials
2. Materials identified to contain mercury can be found within the Safetech Environmental Limited report titled “Designated Substances and Hazardous Materials Assessment Report, HVAC Upgrades Project, 126 Pape Avenue, Toronto, Ontario” issued on August 15, 2025.
3. Please note that Section 02 84 16 has been provided in case fluorescent lamps need to be removed to facilitate work for this project.

1.4 DESCRIPTION OF WORK

1. Remove, package and recycle/dispose of, if applicable, all mercury vapour containing fluorescent light tubes.
2. All work may be subject to inspection by Client’s Consultant.

1.5 REGULATIONS

1. Comply with Federal, Provincial and local requirements, provided that in any case of conflict among those requirements or with these Specifications more stringent requirements shall apply. Work shall be performed under regulations in effect at time work is performed. Regulations include but are not limited to the following:
    1. Environmental Protection Act, Revised Statutes of Ontario 1990, Chapter E. 19.
    2. Canadian Environmental Protection Act, Revised Statutes of Canada 1985, c.16.
    3. Ministry of the Environment, Conservation and Parks Regulations for the disposal of mercury waste, including R.R.O. 1990, Regulation 347/90 (as amended).
    4. Ontario Regulation 490/09, Designated Substances (as amended).

1.6 INSTRUCTION AND TRAINING

1. Ensure that all workers likely to handle mercury-containing items are trained in use of Mercury Spill Kit and are trained in handling of mercury.

Part 2 Products

2.1 MATERIALS

1. **Cardboard Containers**: New or used cardboard boxes. Suitable for packaging of fluorescent light tubes to prevent breakage of tubes.

2.2 EQUIPMENT

1. Mercury Spill Response Kit consisting of following:
    1. HEPA vacuum dedicated for use with mercury spills
    2. Air-purifying cartridge respirators with mercury absorbing cartridges and an end-of-life service indicator
    3. Surgical gloves to prevent skin exposure when handling droplets of mercury
    4. Neutralizing compound such as 20% calcium polysulfide or 20% sodium thiosulfide to clean spilled surfaces

Part 3 Execution

3.1 PACKAGING OF FLUORESCENT LIGHT TUBES

1. Carefully remove fluorescent light tubes from fixtures wipe with a damp cloth or clean with a HEPA filtered vacuum and place in cardboard containers.
2. Place tubes in container as they are removed from fixtures. Ensure that tubes are packaged in a manner to prevent breakage.
3. Avoid rough handling of tubes to avoid breakage.
4. Store full containers in a central location on site.

3.2 DISPOSAL

1. Do not dispose of fluorescent light tubes containing mercury with other construction waste or in a landfill.
2. Dispose of mercury containing equipment at a recycling facility approved by Consultant. Recycling company must have the following minimum requirements:
3. Offer complete recycling of all parts (i.e., lamps, caps, clips etc.)
4. Must be able to supply contractor with packaging material, if necessary

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

1. Comply with requirements of Division 1.

1.2 RELATED SECTIONS

1. Section 02 82 13.1 – Type 1 Asbestos Abatement
2. Section 02 82 13.2 – Type 2 Asbestos Abatement
3. Section 02 82 13.3 – Type 3 Asbestos Abatement
4. Section 02 83 13 – Lead Disturbance Precautions
5. Section 02 84 13 – Handling of Mercury Containing Equipment

1.3 SITE CONDITIONS

1. Silica is present in, but not limited to, the following building materials:
    1. Brick
    2. Refractory brick
    3. Concrete
    4. Concrete block
    5. Mortar
    6. Asphalt
    7. Drywall
    8. Sprayed Fireproofing
2. Materials identified to contain silica can be found within the Safetech Environmental Limited report titled “Designated Substances and Hazardous Materials Assessment Report, HVAC Upgrades Project, 126 Pape Avenue, Toronto, Ontario” issued on August 15, 2025.

1.4 DESCRIPTION OF WORK

1. Removing/demolishing of building materials suspected to contain silica must follow Type 1, Type 2, and/or Type 3 operations and procedures as outlined in the Ontario
2. All work may be subject to inspection and/or air sampling (clearance and/or exposure monitoring) inside and outside work areas by Client’s Consultant. Any contamination of surrounding areas, indicated by visual inspection or air monitoring, shall necessitate complete clean-up of affected areas.

1.5 DEFINITIONS

1. **Silica**: means crystalline silica in a respirable form. Silica is the primary component of many construction materials. The best-known and most abundant type of crystalline silica is quartz. Other forms of crystalline silica include cristobalite, tridymite and tripoli. Some commonly used construction materials containing silica include: abrasives used for blasting, brick, refractory brick, plaster, concrete, concrete block, cement, mortar, granite, sandstone,

quartzite, slate, gunite, mineral deposits, rock and stone, sand, fill dirt, top soil and asphalt containing rock or stone.

2. **Silica Work Area**: Area where work takes place, which will, or may, disturb silica-containing material.

3. **Authorized Visitors**: Client's Consultant and/or person(s) representing regulatory agencies, and person(s) authorized by them.

4. **HEPA Filter**: High Efficiency Particulate Aerosol filter, at least 99.97% efficient in collecting a 0.3 micron aerosol. Each filter should be individually tested and certified to have an efficiency of not less than 99.97 percent when challenged with 0.3 micron dioctylphtalate (DOP) particles. DOP test must be conducted immediately prior to commencement of work and certificate presented to owner and/or consultant.

5. **Effective**: implies that the dust collection system should be capable of controlling airborne silica concentration levels to below 0.05 milligrams per cubic metre (mg/m^3).

6. **Competent Person:** A worker who is qualified because of knowledge, training, and experience to perform work, is familiar with relevant acts and regulations that apply to the work, and has knowledge of all potential or actual dangers to health or safety in work.

1.6 REGULATIONS, GUIDELINES, & INDUSTRY STANDARDS

1. Contractor shall:

    1. Comply with Federal, Provincial, and local requirements pertaining to silica, provided that in any case of conflict among these requirements or with these specifications, most stringent requirements shall apply.
    2. Carry out measures and procedures prescribed under the Ontario Regulation 490/09, Designated Substance – Silica.
    3. Protect health and safety of workers by ensuring compliance with the specific occupational exposure limits (OELs) for silica. The OEL for cristobalite silica is 0.05 mg/m^3 of air as an 8-hour daily or 40 hour weekly time-weighted average. The OEL for quartz and tripoli silica is 0.10 mg/m^3. Measures and procedures that ensure construction workers receive the same standard of protection as workers covered by O. Reg. 490 should be implemented on construction projects where exposure to silica is a hazard. Such measures and procedures are deemed to be in compliance with section 25(2) (h) of the OHSA, as taking "every precaution reasonable in the circumstances for the protection of a worker.
    4. Carry out measures and procedures prescribed under the Ontario Regulation 213/91 (as amended) – Regulation for Construction Projects; Ontario Regulation 860/90 – Workplace Hazardous Materials Information System (WHMIS); and Ontario Ministry of Labour, Immigration, Training and Skills Development Guideline – Silica on Construction Projects dated April 2011.
    5. Comply with Ontario Environmental Protection Act Regulation 347/90 (as amended) - General-Waste Management.
    6. Ensure every employee and every worker on project complies with applicable acts and regulations.
    7. Provide instruction and training by a competent person to every worker in the following subjects: WHMIS training, hazards of silica exposure, recognition of

typical operations containing silica, personal hygiene, the use, cleaning and disposal of respirators and personal protective equipment.

8. Protect health and safety of workers and public.

2. Contractor may:

1. Be requested to provide information on their health and safety record.
2. Be required to provide a copy of their respiratory protection program.
3. Be requested to provide periodic medical examinations for all workers who may be exposed to respirable crystalline silica.

1.7 INTERNAL POLICIES & PROCEDURES

1. Ensure that internal policies and procedures of the clients are complied with including, but not limited to the following:

1. All contractors/consultants will not enter designated areas unless trained and appropriately garmented, including appropriate medical clearance which may include medical monitoring and immunization.
2. Have a competent supervisor onsite at all times to supervise work of their employees/subcontractors for large projects.
3. Provide sufficient number of workers trained in first aid on large projects.
4. Do not modify, shut down, open, tap into or alter facilities systems without permission.

1.8 QUALITY ASSURANCE

1. Ensure work proceeds on schedule and meets all requirements of this Section.
2. Pay cost to Client for inspection performed as a result of failure to perform work satisfactorily regarding quality, safety, or schedule.
3. Use only skilled and qualified workers for all the trades required for this work.

1.9 SUBMITTALS

1. Before commencing work:

1. Laws of the province of Ontario shall govern this work. Contractor shall observe all such laws and shall obtain and/or pay all permits, notices, fees, taxes, duties as may be required.
2. Submit names of supervisor personnel who will be responsible for silica work area(s).
3. Contractor shall submit, in writing, confirmation of good standing with Workplace Safety and Insurance Board and transcription of insurance.
4. Submit documentation including test results for fire and flammable data and Material Safety Data Sheets for materials and chemicals to be used.

1.10 WORKER AND VISITOR PROTECTION

1. **Instruction and Training:** Before commencing work, provide to owner and/or consultant satisfactory proof that every worker has had instruction and training in WHMIS; hazards of silica exposure, including health effects and symptom recognition; personal hygiene;

respirator requirements; work measures and procedures; and use, cleaning and disposal of respirators and protective equipment by a competent person as defined by Occupational Health and Safety Act.

2. **Respirators:** NIOSH-approved respirators may be worn during silica removal activities as per Ontario Regulation 490/09. Silica dust on personal respirators should be removed by damp wiping or HEPA vacuuming. Respirators should be selected in accordance with the NIOSH assigned protection factors. A summary of respirator requirements based on anticipated concentration of airborne silica can be found in Table 1. Maintenance and care for respirators should be conducted as per Canadian Standards Association Z94.4-02 Selection, Use, and Care of Respirators Guideline. If Contractor can demonstrate that the silica exposure levels are below the OEL, respirators may not be required.

Table 1: Respirator Requirements

Silica Removal Operations	**Required Respirator**
Type 1 Silica Removal Operations (> 0.05 to 0.50 mg/m3 of silica in the form of cristobalite and tridymite) (> 0.10 to 1.0 mg/m3 of silica in the form of quartz and tripoli) • The drilling of holes in concrete or rock that is not part of a tunneling operation or road construction. • Milling of asphalt from concrete highway pavement. • Charging mixers and hoppers with silica sand (sand consisting of at least 95% silica) or silica flour (finely ground sand consisting of at least 95% silica) • Any other operation at a project that requires the handling of silica-containing material in a way that may result in a worker being exposed to airborne silica. • Entry into a dry mortar removal or abrasive blasting area while airborne dust is visible for less than 15 minutes for inspection and/or sampling. • Working within 25 metres of an area where compressed air is being used to remove silica-containing dust outdoors.	**NIOSH APF = 10** • Half-mask particulate respirator with N-, R-, or P-series filter and 95, 99, or 100 percent efficiency.
Type 2 Silica Removal Operations (> 0.50 to 2.5 mg/m3 of silica in the form of cristobalite and tridymite) (> 1.0 to 5.0 mg/m3 of silica in the form of quartz and tripoli) • Removal of silica containing refractory materials with a jackhammer. • The drilling of holes in concrete or rock that is part of a tunneling operation or road construction. • The use of a power tool to cut, grind, or polish concrete, masonry, terrazzo or refractory materials. • The use of a power tool to remove silica-containing materials. • The use of a power tool indoors to chip or break and remove concrete, masonry, stone, terrazzo or refractory materials. • Tunneling (operation of the tunnel boring machine, tunnel drilling, or tunnel mesh installation). • Tuckpointing and surface grinding. • Dry method dust clean-up from abrasive blasting operations. • Dry mortar removal with an electric or pneumatic cutting device. • The use of compressed air outdoors for removing silica dust. • Entry into area where abrasive blasting is being carried out for more than 15 minutes.	**NIOSH APF = 50** • Full-facepiece air-purifying respirator with any 100-series particulate filter. • Tight-fitting powered air-purifying respirator with any 100-series particulate filter. • Full-facepiece supplied-air respirator operated in demand mode. • Half-mask or full-facepiece supplied air respirator operated in continuous-flow mode.

Silica Removal Operations	Required Respirator
Type 3 Silica Removal Operations (> 2.5 mg/m3 of silica in the form of cristobalite and tridymite) (> 5.0 mg/m3 of silica in the form of quartz and tripoli) • Abrasive blasting with an abrasive that contains ≥ 1% silica. • Abrasive blasting of a material that contains ≥ 1% silica.	**NIOSH APF ≥ 1000** • Type CE abrasive-blast supplied air respirator operated in a positive pressure mode with a tight-fitting half-mask facepiece. • Type CE abrasive-blast supplied air respirator operated in a pressure demand or positive pressure mode with a tight-fitting facepiece.

3. **Protective Clothing:** Provide workers and visitors in silica work area(s) with disposable and/or washable work clothes, including shoe covers. Work clothes that are contaminated with silica dust should not be worn outside the work area(s). Silica dust on washable work clothes should be removed by damp wiping or HEPA vacuuming and washed in facilities suitable for handling silica contaminated laundry before reusing. Provide or have access to appropriate washing facility equipped with clean water, soap, and individual towels for washing hands and face of workers. The washing facility shall be used by every worker when leaving silica work area(s) and if feasible, the washing facility should include a shower.
4. Workers who may be exposed to silica on a regular basis should undergo a pre-placement medical assessment and periodic medical examinations.
5. A worker shall not eat, drink, chew gum, or use tobacco products in work area(s).

Part 2 Products

2.1 MATERIALS

1. **HEPA Vacuum:** High Efficiency Particulate Air filtered vacuum equipment with a filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.
2. **Polyethylene sheeting sealed with tape**: Polyethylene sheeting of type and thickness specified sealed with tape along all edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide a continuous polyethylene membrane to protect underlying surfaces from water damage or damage by sealants, and to prevent escape of silica dust through sheeting into a clean area.
3. **Tape**: Tape suitable for sealing polyethylene to surfaces under both dry and wet conditions using amended water.

Part 3 Execution

3.1 PREPARATION

1. Equipment, tools, furnishings, and stored materials which can be moved, without disturbing silica-containing materials have been moved by Contractor.
2. Seal all opening or voids in work area(s), such as vents, service holes in walls and air handling ducts as appropriate with plugs and/or tape and/or caulking and/or polyethylene sheeting sealed with tape.

3. Building personnel have shut off air handling and ventilation systems (if applicable) supplying or exhausting from silica work area(s)/enclosure(s). Ensure air handling systems remain shut off during duration of work.

4. Before disturbing silica-containing material, install polyethylene drop sheets as appropriate to control spread of dust.

5. Establish ropes, barriers and/or partial enclosures in order to prevent unauthorized personnel from entering work area(s).

6. If significant concentrations of dust are being generated the work should be re-evaulated by a qualified person and additional procedures should be implemented such as: a full enclosure should be erected using polyethylene sheeting (or in the event that the sheeting needs support, wood framing may also be used) in order to separate silica work area(s) from remaining building areas. The Ontario Ministry of Labour, Immigration, Training and Skills Development Guideline – Silica on Construction Projects dated September 2011 should be consulted for all additional recommended requirements.

7. Emergency and fire exits are established from silica work area(s), or alternative exits have been established satisfactory to authorities having jurisdiction.

8. Temporary lighting in silica work area(s) has been provided (if necessary) to level that will permit work to be done safely and well where necessary.

9. Signs are displayed in all areas where access to silica work area(s) is possible. Signs should be at least 500 mm x 350 mm and state the date and place of the silica removal project. Such signs shall read in large, clearly visible letters:

   CAUTION

   Silica Dust Hazard

   No Unauthorized Entry

   Wear Assigned Personal Protective Equipment

10. Arrangements have been made with Client for work area security.

11. Client's Consultant has been notified of intention to proceed and has reviewed equipment and procedures.

3.2 REMOVAL

1. Seal opening to polyethylene enclosure with tape or ensure appropriate barriers are in place after entry of worker(s).

2. Perform work required within silica enclosure(s)/work area(s) using appropriate dust control measures, including a mechanical ventilation system and/or wetting, and/or the use of a dust collection system if practical. Compressed air or dry sweeping should be avoided.

3. The work area(s) should be thoroughly wetted prior to and/or during all silica removal operations.

4. Continuous cleaning during removal work operations should be conducted to control the spread of silica dust.

3.3 CLEAN-UP

1. Clean all surfaces by washing down with water and vacuuming with a HEPA vacuum until no visible residue remains to prevent dust-containing silica from spreading.
2. Workers exposed to silica should be provided with or have access to washing facilities equipped with clean water, soap, and individual towels.
3. Silica dust on personal protective clothing and equipment should be removed by damp wiping or HEPA vacuuming.
4. When exiting the enclosure(s)/area(s), dispose of contaminated disposable work clothes as construction waste.
5. All workers and visitors in the silica work area(s) must properly decontaminate themselves prior to leaving the work area.

3.4 RE-ESTABLISHMENT OF OBJECTS AND SYSTEMS

1. Reconstruct items demolished (if required) which are to remain and reinstall objects and items in their proper positions which were removed to facilitate silica removal operations. Reconstruction and reinstallation shall be done by tradesmen qualified in work being reinstalled or reconstructed.
2. Re-establish mechanical and electrical systems (if required) to remain operative in proper working order. Arrange for, and pay costs of, electrical or mechanical repairs needed due to this work.

3.5 DISPOSAL OF WASTE

1. Conform to requirements of Ontario Environmental Protection Act Regulation 374/90 (as amended) – General Waste Management.

END OF SECTION

1 General

1.1 SUMMARY

.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.

1.2 REFERENCE STANDARDS

.1 CSA O80 Series, Wood Preservation.

.2 CAN/CSA O141, Softwood Lumber.

.3 CSA O121, Douglas Fir Plywood.

.4 CSA O151, Canadian Softwood Plywood.

.5 CSA O153, Poplar Plywood.

.6 CAN/CSA 0325.0 (R1998), Construction Sheathing.

.7 CAN 0437 Series-93, Standard on OSB and Waferboard.

.8 CSA B111, Wire Nails, Spikes and Staples.

.9 National Lumber Grades Authority (NLGA) Standard Grading Rules for Canadian Lumber, Latest Edition.

1.3 INSTALLER QUALIFICATIONS

.1 Maintain a qualified crew of carpenters for the work of this Section. Only qualified journeymen shall be engaged in framing and each journeyman shall have an Ontario Certificate of Proficiency.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Protect materials from moisture upon delivery.

.2 Store materials on raised supports. Cover materials with waterproof covering. Provide adequate air circulation and ventilation.

.3 Do not store seasoned materials in wet or damp areas.

.4 Store all materials in a dry environment. Do not cover materials having a moisture content of over 15%.

.5 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.

2 Products

2.1 LUMBER MATERIALS

.1 Lumber: Except as otherwise specified, lumber shall be softwood, S-P-F, S4S, kiln-dried, moisture content 15% or less, not finger jointed, and in accordance with the following standards:

.1 CAN/CSA O141.

.2 Graded and stamped in accordance with the National Lumber Grades Authority (NLGA) Standard Grading Rules for Canadian Lumber and by an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Furring, Blocking, Strapping, Nailing Strips, Grounds, Rough Bucks: S-DRY, douglas fir species.

.1 Board Sizes: “Standard” grade to NLGA, Paragraph 114c.

.2 Dimension Sizes: “Standard” grade to NLGA, Paragraph 122c.

.3 Roofing Curbs, Nailers, Blocking, Cants: as specified in 2.1.2 above.

.4 Wood Trim: kiln-dried spruce, comb faced fascia material.

2.2 PLYWOOD SHEATHING

.1 Shall be 19mm (3/4") thick and/or thickness as indicated on drawings, exterior grade at exterior locations; Douglas Fir plywood, veneer core.

.2 Select Sheathing; Tight Face, un-sanded, "B" faces and conforming to CSA 0121-08.

2.3 PRESSURE PRESERVATIVE TREATED WOOD

.1 Pressure Preservative Treated lumber:

.1 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 O80.20M.

.2 Species: Pine or Spruce-Pine

.3 Grade: No.2 or better structural posts and lumber, pieces may be grade stamped or shipment certified by letter of compliance.

.4 Grading authority: NLGA, paragraph 131CC

.5 Material having twisted grain or structural defects affecting integrity of lumber will not be acceptable for this project.

.6 Use only material with radius edges, minimum 6 mm.

.7 Kiln dry lumber materials to 8% moisture content or less.

.2 Pressure Preservative Treated Plywood: Treated in accordance with CAN/CSA O80.9M 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.

.3 Water-borne preservative treated wood shall have maximum moisture content of 19% after treatment.

.1 SCAQMD Rule #1113 - Architectural Coatings.

.2 Maximum allowable VOC limit 350g/L.

.4 Provide coatings that do not contain chemical listed in GS-II.

2.4 FASTENERS

.1 Roof Nailers: CSP material, “Sheathing” grade.

.2 Nail, Spikes and Staples: to CSA B111 and as follows:

.1 Use common spiral nails and spiral spikes, except where specified otherwise, for interior work.

.2 Fasteners in contact with borate treated lumber: hot-dipped galvanized finished steel.

.3 Fasteners in contact with ACQ treated lumber: stainless steel.

.3 Underlayment Fasteners:

.1 Nails: galvanized, annular ringed, length to provide minimum 85% penetration into subfloor, but not enough to anchor underlayment to joists.

.4 Bolt, Nut, Washer, Screw and Pin Type Fasteners: hot-dipped galvanized finished steel for all fasteners in contact with borate treated lumber or stainless steel for all fasteners in contact with ACQ treated lumber, unless specified otherwise.

.5 Joist Hangers: hot-dipped galvanized finished steel for all hangers, plates, straps, etc. in contact with borate treated lumber or stainless steel for all such connectors in contact with ACQ treated lumber.

.6 Do not combine stainless steel fasteners with galvanized hardware or vice-versa.

2.5 PRESERVATIVE TREATMENT

.1 Treat following items in accordance with applicable CAN/CSA O80 commodity standard using alkaline copper quat type C (ACQ-C) or copper azole type B (CAB) preservative to obtain minimum net retention of 4.0 kg/m3 of wood. Materials shall be kiln-dried after treatment.

.1 All dimension lumber and panel materials directly exposed to moisture (i.e. deck boards, trellis and similar such framing, exposed stairs).

.2 Treat following items in accordance with applicable CAN/CSA 080 commodity standard using “Advance Guard” borate-pressure treatment to obtain minimum net retention of 2.7 kg/m3 of wood. Materials shall be kiln-dried after treatment. Lumber shall carry the Canadian Wood Preserver’s Bureau Quality Mark (“Advance Guard” quality mark).

.1 New lumber and panel materials inside, outside and crossing the wall moisture barrier.

.2 Items in contact with concrete or masonry.

.3 Furring, blocking, strapping, etc. for rainscreen cavity provisions.

.4 Roofing curbs, nailers, blocking, and cants.

.3 Inspection of products treated with preservative by vacuum-pressure impregnation will be carried out by an accredited inspection agency of the Canadian Wood Preservers Bureau (CWPB).

.4 All treated lumber and plywood shall bear an identifying stamp in accordance with the CWPB, CSA 080 or AWPA requirements.

.5 Following water-borne preservative treatment, dry material to maximum moisture content of 15%.

3 Execution

3.1 FIELD TREATMENT OF PRESERVATIVE TREATED AND EXISTING PRODUCTS

.1 Field treat surfaces exposed by cutting, trimming or boring of preservative-treated items with liberal application of preservative and in accordance with AWPA M4.

.2 Apply preservative in accordance with manufacturer’s instructions. Apply by dipping, by brush or by spray to completely saturate and maintain wet film on surface for minimum three minute soak on lumber and one minute soak on plywood. Allow to dry 24 hours prior to covering.

3.2 ERECTION OF FRAMING MEMBERS

.1 Install members true to line, levels and elevations, square and plumb. Space uniformly.

.2 Construct continuous members from pieces of longest practicable length.

.3 Install spanning members with "crown-edge" up.

.4 Install blocking to facilitate installation of finishing materials, fixtures, specialty items and trim.

.5 Select exposed framing for appearance. Install lumber and panel materials so that grade-marks and other defacing marks are concealed or are removed by sanding where materials are left exposed.

.6 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

.7 Countersink bolts where necessary to provide clearance for other work.

.8 Install foam sill gaskets between wood and concrete.

3.3 WOOD FURRING AND BLOCKING

.1 Provide wood furring and blocking at locations indicated on Drawings and as specified.

3.4 NAILING STRIPS, GROUNDS AND ROUGH BUCKS

.1 Install rough bucks, nailer and linings to rough openings as required to provide backing for frames and other work.

.2 Erect all wood framing members level and plumb. Construct to framing member's full height without splices.

3.5 WOOD TRIM AND FASCIAS

.1 Install wood trim and fascia boards using finishing nails set slightly below the surface.

.2 Mitre joints to disguise shrinkage.

END OF SECTION

1 General

1.1 DOCUMENTS

.1 This Section of the Specifications forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SUMMARY

.1 Section Includes: Furnishing of all labour, materials, services and equipment necessary for the supply and installation of firestopping as indicated on drawings and as specified.

1.3 REFERENCES

.1 CAN4-S115-M85, "Standard Method of Fire Tests of Firestop Systems".

1.4 SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00 – Submittals Procedures.

.2 Product Data: Submit three copies of manufacturer's specification and installation instructions for each type of material required. Include data substantiating that materials comply with specified requirements.

.3 Shop Drawings: Submit shop drawings to show proposed material, reinforcement, anchorage, fastenings and method of installation. Construction details should accurately reflect actual job conditions.

.4 Samples: Submit duplicate 300 mm x 300 mm (12" x 12") samples showing actual firestop material proposed for project.

1.5 DELIVERY, STORAGE, & HANDLING

.1 Comply with manufacturer's recommendations for handling, storage and protection during installation.

.2 Do not allow materials to become wet or soiled, or covered with ice or snow.

1.6 JOB CONDITIONS

.1 Examine substrate and the conditions under which the insulation work is to be performed. Do not proceed with firestopping work until unsatisfactory conditions have been corrected.

1.7 FIRE-RESISTANCE RATINGS

.1 Ratings of firestop systems shall be not less than the fire-resistance ratings noted on drawings and required by authorities having jurisdiction for firestopping of the floor, wall, ceiling and roof assemblies involved.

.2 Ratings of firestop assemblies for service penetrations shall be not less than the fire resistance rating of the floor, wall, ceiling or roof assembly being penetrated.

.3 Use only ULC tested firestopping assemblies as approved by the Consultant prior to firestop installations.

2 Products

2.1 MATERIALS

.1 Firestopping Systems: In accordance with CAN4-S115-M85. All firestopping systems installed shall be from single manufacturer. Trade Contractors shall coordinate with General Contractor.

.1 Accepted Products:

.1 "Fire & Smoke Containment Systems" by Tremco Ltd., Construction Division.

.2 "Fire barrier Firestop Systems" by A/D Fire Protection Systems Inc.

.3 "Fire Protection Products" by Electrical Products Division/3M.

.4 "Firestop Systems" by Hilti (Canada) Limited.

.5 Equivalent products per Specification 01 25 00.

.2 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of CAN4-S115-M85 and not to exceed opening sizes for which they are intended.

.3 Firestop System Rating: Equal to fire separation rating as noted on drawings.

.2 Service Penetration Assemblies: Certified by ULC in accordance with CAN4-S115-M85 and listed in ULC Guide No. 40 U19.

.3 Service Penetration Firestop Components: Certified by ULC in accordance with CAN4-S115-M85 and listed in ULC Guide No. 40 U19.13 and ULC Guide No. 40 U19.15 under the Label Service of ULC.

.4 Fire-resistance rating of installed fire stopping assembly not less than the fire-resistance rating of surrounding floor and wall assembly.

.5 Firestopping at openings intended for ease of re-entry such as cables: Elastomeric or resilient seal; do not use cementitious or rigid seal at such locations.

.6 Firestopping at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: Elastomeric or resilient seal; do not use a cementitious or rigid seal at such locations.

.7 Primers: To manufacturer's recommendation for specific material, substrate, and end use.

.8 Water (if applicable): Potable, clean and free from injurious amounts of deleterious substances.

.9 Damming and backup materials, supports and anchoring devices: To manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

.10 Sealants for vertical joints: Non-sagging.

3 Execution

3.1 PREPARATION

.1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials. Ensure that substrates and surfaces are clean, dry and frost free.

.2 Prepare surfaces in contact with firestopping materials to manufacturer's instructions.

.3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.

.4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.2 INSTALLATION

.1 Install firestopping material and components in accordance with ULC certification and manufacturer's instructions.

.2 Seal holes or voids made by through penetrations, poke-through termination devices, and un-penetrated openings or joints to ensure continuity and integrity of fire separation are maintained.

.3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.

.4 Tool or trowel exposed surfaces to a neat finish.

.5 Remove excess compound promptly as work progresses and upon completion.

3.3 INSPECTION

.1 Notify Consultant when ready for inspection and prior to concealing or enclosing firestopping materials and service penetration assemblies.

3.4 SCHEDULE

.1 Firestop at:

.1 Edges of floor slabs and rated roof slabs at slab edge covers, aluminum windows/curtain wall.

.2 Deflection space at top of fire-resistance rated masonry and gypsum board walls.

.3 Intersections of fire-resistance rated masonry walls to concrete and to gypsum board walls and of fire-resistance rated gypsum board walls to concrete and to masonry.

.4 Penetrations through fire-resistance rated masonry, concrete and gypsum board walls.

.5 Penetrations through fire-resistance rated floors, ceilings and roofs.

.6 Openings and sleeves installed for future use through fire separations.

.7 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.

.8 Firestopping around mechanical and piping assemblies penetrating fire separations by Division 20 - Mechanical. Firestopping systems and products to be coordinated with this specification section.

.9 Firestopping around electrical assemblies penetrating fire separations by Division 26 - Electrical. Firestopping systems and products to be coordinated with this specification section.

3.5 CLEAN-UP

.1 Remove excess materials and debris and clean adjacent surfaces immediately after application.

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

END OF SECTION.

1 General

1.1 SUMMARY

.1 Read other Sections of the Specification for extent of sealant specified in those Sections. Do all other sealing indicated, specified or required.

.2 Provide all items, articles, materials, operations or methods listed, mentioned or scheduled on drawings and/or herein, including all labour, materials, equipment and incidentals necessary and required for the completion of the sealant.

1.2 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM):

.1 ASTM C509-06(2011), Standard Specifications for Elastomeric Cellular Performed Gasket and Sealing Material

.2 ASTM C920-11, Standard Specification for Elastomeric Joint Sealants

.3 ASTM C-1382-11, Standard Test Method for Determining Tensile Adhesion Properties of Sealants when Used in Exterior Insulation and Finish Systems (EIFS) Joints

.4 ASTM D2240-05(2010), Standard Test Method for Rubber Property - Durometer Hardness

.2 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-19.13-M87, Sealing Compound, One-Component, Elastomeric, Chemical Curing

1.3 SUBMITTALS

.1 Provide submittals in accordance with Division 01.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Manufacturer's Data: Submit manufacturer's literature describing each material to be used in the work of this Section. Literature shall contain a statement that the material complies with the specified standard.

.2 Samples: Submit for approval and colour selection sample of each type of compound, recommended primers and joint filler or fillers proposed to be used.

.3 Mock-Up:

.1 If requested by the Consultant, construct mock-ups where directed to show location, size, shape, colour and depth of joints complete with back-up material, primer and sealant. Mock-up may be part of finished work.

.2 Allow 24-hours for inspection of work before proceeding with work.

.4 Safety Data Sheets: 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.

1.4 QUALITY ASSURANCE

.1 Adhere to Manufacturer's recommendations for mixing or preparation of materials listed in this Section.

.2 Pot life or installation times shall not be exceeded.

.3 Integral materials which compose a joint detail shall be compatible.

.4 Component parts, where possible, shall have the same manufacturer.

.5 A representative of sealant material manufacturer shall visit the site during application to ensure that all Work is carried out according to the manufacturer's printed instructions.

1.5 SITE CONDITIONS

.1 Apply sealants only to completely dry surfaces, and at air, substrate and material temperatures above minimum established by manufacturer's written specifications.

1.6 DELIVERY, STORAGE HANDLING AND PROTECTION

.1 Deliver all materials to the jobsite in their original, unopened containers, with all labels intact.

.2 Receive and store materials as recommended by materials manufacturer.

.3 Maintain containers and labels in undamaged condition.

1.7 WARRANTY

.1 Provide a written warranty endorsed and issued in the name of the Owner stating that all sealant work of this Section is warranted against leakage, cracking, crumbling, melting, running, deterioration, shrinkage, loss of cohesion, loss of adhesion, staining of adjoining or adjacent work or surfaces, or failure to provide intended seal for a period of five (5) years from the Date of Substantial Performance of the Work, and that any defects will be made good including, related materials and installation at no additional cost to the Owner.

2 Products

2.1 MATERIALS

.1 Joint Cleaner:

.1 Non-corrosive solvents as recommended by sealant manufacturer for applicable substrate material(s).

.2 Primer:

.1 Non-staining type as recommended by sealant manufacturer, for use on substrate conditions outlined, and compatible with specified sealant being applied.

.3 Joint Back-Up – Backer Rod:

.1 Round, closed cell, reticulated foam, 50% compression, compatible with sealant and primer, non-adhering to sealant.

.4 Bond Breaker:

.1 Pressure sensitive plastic tape, not bondable to sealant as recommended by sealant manufacturer.

.5 Sealant Type "A" – Joints around Interior Door Frames, Windows and Under Exterior Thresholds:

.1 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

.4 Or approved equivalent.

OR

.2 One component, low modulus, moisture curing, polyurethane joint sealant, conforming to ASTM C920-11, Type S, Grade NS, Class 25.

.1 Dymonic FC by Tremco Ltd., division of RPM Company.

.2 Sikaflex 1A by Sika Canada Inc.

.3 Sonolastic NP1 by BASF.

.4 Pourthane NS by W.R MEADOWS

.5 Or approved equivalent.

.6 Sealant Type "B" – Exterior Wall Joints; Control Joints; Expansion Joints:

.1 One-part, ultra low modulus, non-staining neutral curing 100% silicone joint sealant, conforming to ASTM C920-11, Type S, Grade NS, Class 50.

.1 DC 790 by Dow Corning.

.2 Spectrem 1 by Tremco

.3 SCS2700 SilPruf LM by GE

.4 SikaSil WS-290 by Sika

.5 Or approved equivalent.

.7 Sealant Type "C" – Floor Control Joints:

.1 Multi-component, chemical curing, self-levelling, polyurethane joint sealant, conforming to ASTM C920-11, Type M, Grade P, Class 25.

.1 THC-900 by Tremco (Canada) Ltd., division of RPM Company.

.2 Sonolastic SL2 by Sonneborn Building Products, division of BASF Building Systems.

.3 Sikaflex 2c SL by Sika Canada Inc.

.4 Or approved equivalent.

.8 Sealant Type "E" – Mould and Mildew Resistant:

.1 Mould and mildew resistant, Shore A Hardness 15-25, conforming to ASTM C920-11, Type S, Grade NS, Class25, use NT, G, and A:

.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

.6 Or approved equivalent.

.9 Sealant Type "F" – Glazing Joints:

.1 Silicone Sealant: Butt glazing, one part, moisture curing, shore A hardness 15-25, conforming to CAN/CGSB-19.13-M, Classification C-1-40-B-N and C-1-25-B-N and ASTM C920-11, Type S, Grade NS, Class 25, use NT, G, A, O; Colour: clear (translucent):

.1 DC 795 by Dow Corning

.2 SCS2000 by GE.

.3 Multiseal by Chemtron.

.4 Spectrum 2 by Tremco

.5 SikaSil WS-295 by Sika

.6 Or approved equivalent.

.10 Sealant Type "H" – Saw Cut Sealant:

.1 Multi-component, self-levelling, conforming to ASTM D2240-05(2010):

.1 Tremco Control Joint Sealant

.2 BASF Masterfill 300

.3 Sika Loadflex

.4 Rezi-Weld Flex by W.R MEADOWS

.5 Or approved equivalent.

.11 Sealant Type “I” – HVAC Sealant:

.1 One-part, RTV, acetoxy-cure silicone sealant for heating, ventilation, air conditioning and refrigeration applications:

.1 Dow Corning HVAC Silicone Sealant

.2 Or approved equivalent.

.12 Sealant Type “J” – Electrical Sealant:

.1 One-part, white, non-flowing moisture cure adhesive for electrical applications:

.1 Dow Corning 738 Electrical Sealant

.2 Or approved equivalent.

.13 Sealant Type “K” - Interior Acoustical Sealant:

.1 Non-skinning, non-hardening, single component synthetic rubber sealant, conforming to CAN/CGSB-19.21-M:

.1 Tremco Acoustic Sealant

.2 Chemtron Metaseal

.3 Or approved equivalent.

.14 Preformed Compression Seal:

.1 Compartmental open cell neoprene extrusion type conforming to ASTM C509-06(2011), complete with liquid lubricant adhesive recommended by manufacturer.

3 Execution

3.1 INSPECTION

.1 Verify at site that joints and surfaces conditions provided will not adversely affect execution, performance or quality of completed work.

.2 Ensure masonry and concrete have cured 28 days minimum.

.3 Ascertain that sealers and coatings applied to substrates are compatible with sealant used and that full bond of the sealant and substrate is attained. Request samples of the sealed or coated substrate from their fabricators for testing of compatibility and adhesion, if necessary.

.4 Verify that specified recommended environmental conditions are present before commending work.

.5 Defective work resulting from application to unsatisfactory joint conditions will be considered the responsibility of those performing the work of this section.

.6 Do not start work of this Section until conditions are satisfactory.

3.2 PREPARATION

.1 Clean joint surfaces using joint cleaner as necessary, to remove dust, paint, loose mortar, and other foreign matter and dry joint surfaces.

.2 Remove dust, silt, scale and coatings from ferrous metals by wire brush, grinding or sandblasting.

.3 Remove oil, grease and other coatings from non-ferrous metals with approved cleaning solvent.

.4 Ensure surfaces are free of frost, rust, lacquers, laitance, release agents, moisture or other matter which might adversely affect adhesion of sealant.

.5 Examine joint sizes and correct as required to allow for anticipated movement and to achieve proper width/depth ratio per manufacturer's written recommendations for specified sealant.

.6 Support joint filler on horizontal traffic surfaces against vertical movement which might result from traffic loads or foot traffic.

.7 Prepare surfaces as recommended by sealant manufacturer.

.8 Fully remove existing sealant scheduled to be removed and replaced with new sealant, in areas indicated on the Drawings.

.1 Follow manufacturers procedures for removal of existing sealant and test areas for adhesion of new sealant. Provide the Consultant with field report identifying results of adhesion testing.

.9 Install joint backing material or apply bond breaker tape to achieve correct joint depth and prevent three-sided adhesion.

.10 To protect adjacent surfaces, mask adjacent surfaces with tape prior to priming and/or sealing.

.11 Prime sides of joints using two cloth method in accordance with manufacturer's directions immediately prior to sealing.

.12 Before any sealing is commended, a test of the material shall be made for indications of staining, poor adhesion or other undesirable effects.

.13 Seal joints in surfaces to be painted before painting. Where surfaces to be sealed are prime painted in shop before sealing, check to make sure prime paint is compatible with primer and sealant. If incompatible inform Consultant, consult the manufacturer, and change primer and sealant to approved compatible types.

.14 Check form release agent used on concrete for compatibility with primer and sealant. If incompatible inform Consultant and change primer and sealant to approved compatible types or clean concrete to Consultant's approval.

3.3 APPLICATION

.1 Apply sealant in accordance with manufacturer's directions, using a gun with proper nozzle size, ensuring to fill voids and joints completely, to leave a weathertight, airtight installation. Superficial pointing with skin bead is not acceptable.

.2 Neatly tool surface to a slight concave profile. Surface of sealant shall be smooth, free from ridges, wrinkles, sags, air pockets and embedded impurities.

.3 Clean adjacent surfaces immediately and leave Work neat and clean. Remove excess sealant and droppings, using recommended cleaners as Work progresses. Remove masking tape after tooling of joints.

3.4 CLEANING AND PROTECTION

.1 Remove all waste materials from site. Sealant shall be cleaned of all foreign material as recommended by the sealant manufacturer. Leave work in a condition satisfactory to the Consultant.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes the following:

.1 Steel stud framing systems for interior partitions.

.2 Suspension systems for interior ceilings

.3 Grid suspension systems for gypsum board ceilings.

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA):

.1 CSA S136-07, North American Specification for the Design of Cold-Formed Steel Structural Members.

.2 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-7.1-98, Lightweight Steel Wall Framing Components

.3 American Society for Testing and Materials International (ASTM):

.1 ASTM A641/A641M-09a, Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

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

.3 ASTM A792/A792M-10, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

.4 ASTM A875/A875M-10, Specification for Steel Sheet, Zinc-5% Aluminum Alloy-coated by the Hot Dip Process.

.5 ASTM A1003/A1003M-12, Specification for Steel Sheet, Carbon, Metallic and Non-Metallic Coated for Cold Formed Framing Members.

.6 ASTM C11-10a, Standard Terminology Relating to Gypsum and Related Building Materials.

.7 ASTM C473-12, Standard Test Methods for Physical Testing of Gypsum Panel Products.

.8 ASTM C645-11a, Standard Specification for Nonstructural Steel Framing Members.

.9 ASTM C665-12, Standard Specification for Mineral-Fibre Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

.10 ASTM C754-11, Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

.11 ASTM C834-10, Standard Specification for Latex Sealants.

.12 ASTM C841-03(2008)e1, Standard Specification for Installation of Interior Lathing and Furring.

.13 ASTM C954-11, Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033" to 0.112" in Thickness.

.14 ASTM C955-11c, Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases

.15 ASTM C1002-07, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

.4 Canadian Sheet Steel Building Institute (CSSBI):

.1 CSSBI S6-2011, Guide Specification for Lightweight Steel Framing

1.3 SUBMITTALS

.1 Provide submittals in accordance with Division 01.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit manufacturer's product data for each materials specified including recommended application rates and methods of installation.

.3 Informational Submittals: Provide the following submittals during the course of the work:

.1 Product Certificates: For each type of code-compliance certification for studs and tracks.

.2 Shop Drawings: Submit shop drawings showing the design, construction and relevant details of furring, enclosures and partitions which require a fire rating.

.3 Retain a Professional Engineer registered in the province of Ontario to design the Lightweight Steel Framing System where indicated in drawings; to prepare, seal and sign all shop drawings; and to perform field review. Shop drawings shall show both design and installation requirements.

1.4 QUALITY ASSURANCE

.1 Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Steel Stud Manufacturers Association (SSMA).

.2 Contractor executing work of this Section shall have a minimum of five (5) years continuous experience in successful installation of work of type and quality shown and specified. Submit proof of experience upon Consultant's request.

1.5 DELIVERY, STORAGE, HANDLING AND PROTECTION

.1 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.

.2 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect materials with suitable non-staining waterproof coverings.

.3 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 PERFORMANCE REQUIREMENTS

.1 Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.

.2 STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

1.7 FRAMING SYSTEMS

.1 Framing Members, General: Comply with ASTM C754 for conditions indicated.

.1 Steel Sheet Components: Comply with ASTM C645 requirements for steel unless otherwise indicated.

.2 Steel sheet components shall comply with ASTM C645 requirements for metal, unless otherwise indicated.

.3 Steel for non-loadbearing members shall have metallic coats that conform to ASTM A653M or ASTM A792M with minimum metallic coating weighs (mass) of Z120 and AZM150 respectively.

.4 Framing members shall comply with the CAN/CSA S136 - North American Specification for the Design of Cold Formed Steel Structural Members, for conditions indicated.

.5 Isolate where necessary to prevent electrolysis due to dissimilar metal-to-metal contact or metal-to-masonry and concrete contact. Use bituminous paint, butyl tape or other approved divorcing material.

.2 Studs and Tracks: ASTM C645.

.1 Steel Studs and Tracks:

.1 Minimum 0.0179" (25 gauge), screwable with crimped web and returned flange. Provide knockout openings in web at 150mm (6") O.C. to accommodate (if required) horizontal mechanical and electrical service lines, and bracing. Widths as indicated on drawings. Provide structural studs where indicated.

.2 Framing behind all fire resistant gypsum board shall be minimum 0.0329" (20 gauge).

.3 Where metal stud framing forms walls are to be thermally insulated as indicated on drawings, provide metal studs with integrated fastening system for glass fibre/mineral fibre insulation.

.4 Provide special shapes indicated on drawings as part of steel stud/drywall assemblies.

.3 Slip-Type Head Joints:

.1 Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to tracks while allowing 2” (51-mm) minimum vertical movement.

.2 Double-Track System: ASTM C645 top outer tracks, inside track with 2” (51 mm) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.

.3 Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1.8 SUSPENSION SYSTEMS

.1 Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062” (1.59 mm) diameter wire, or double strand of 0.048” (1.21 mm) diameter wire.

.2 Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16” (4.12 mm) in diameter.

.3 Flat Hangers: Steel sheet, in size indicated on Drawings.

.4 Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-steel thickness of 0.0538" (1.367 mm) and minimum ½" (13 mm) wide flanges.

.1 Depth: As indicated on Drawings.

.5 Furring Channels (Furring Members):

.1 Cold-Rolled Channels: 0.0538" (1.367 mm) uncoated-steel thickness, with minimum ½" (13 mm) wide flanges, ¾" (19 mm) deep.

.2 Steel Studs and Tracks: ASTM C645.

.1 Depth: As indicated on Drawings.

.3 Hat-Shaped, Rigid Furring Channels: ASTM C645, 7/8 inch (22 mm) deep.

.4 Resilient Furring Channels: 1/2'" (13 mm) deep members designed to reduce sound transmission.

.1 Configuration: Hat shaped.

.6 Grid Suspension System for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.

2 Execution

2.1 EXAMINATION

.1 Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

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

2.2 PREPARATION

.1 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.

.1 Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

2.3 INSTALLATION, GENERAL

.1 Installation Standard: ASTM C754.

.1 Gypsum Plaster Assemblies: Also comply with requirements in ASTM C841 that apply to framing installation.

.2 Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

.2 Install framing and accessories plumb, square, and true to line, with connections securely fastened.

.3 Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

.4 Install bracing at terminations in assemblies.

.5 Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

2.4 INSTALLING FRAMED ASSEMBLIES

.1 Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

.2 Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

.3 Install studs so flanges within framing system point in same direction.

.4 Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

.1 Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.

.2 Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.

.1 Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

.3 Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

.4 Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

.5 Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

.6 Curved Partitions:

.1 Bend track to uniform curve and locate straight lengths so they are tangent to arcs.

.2 Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6” (150 mm) o.c.

.5 Direct Furring:

.1 Screw to wood framing.

.2 Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

.6 Z-Shaped Furring Members:

.1 Erect insulation, vertically and hold in place with Z-shaped furring members spaced 24” (610 mm).

.2 Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24” (610 mm) o.c.

.3 At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12” (305 mm) from corner and cut insulation to fit.

.7 Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8” (3 mm) from the plane formed by faces of adjacent framing.

END OF SECTION

PART 1 - GENERAL

1.1 References

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C1396 Standard Specification for Gypsum Board

.2 ASTM C 475-94, Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

.3 ASTM C 514-94, Specification for Nails for the Application of Gypsum Board.

.4 ASTM C 557-93a, Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.

.5 ASTM C 840-95, Specification for Application and Finishing of Gypsum Board.

.6 ASTM C 954-93, Specification for Steel Drill Screws for the Application of Gypsum Board.

.7 ASTM C 1047-94, Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

.8 ASTM C1177-08, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing

.9 ASTM C1178M -08, Standard Specification for Coated Glass Mat Water Resistant Gypsum Backing Panel

.10 ASTM C1658-06, Standard Specification for Glass Mat Gypsum Panels

.11 ASTM C1629M-06, Standard Classification for Abuse Resistant Non Decorated Interior Gypsum Panel Products and Fiber Reinforced Cement Panels

.12 ASTM D3273-00, Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.2 CAN/CGSB-71.25-M88, Adhesive, for Bonding Drywall to Wood Framing and Metal Studs.

.3 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102-1988, Building Materials and Assemblies, Standard Method of Test for Surface Burning Characteristics of.

1.2 Site Environmental Requirements

.1 Maintain temperature minimum 10C, maximum 21C for 48 hours prior to and during application of gypsum boards and joint treatment, and for at least 48 hours after completion of joint treatment.

.2 Apply board and joint treatment to dry, frost free surfaces.

PART 2 - PRODUCTS

2.1 Materials

.1 Standard Gypsum Board: to ASTM C1396, 12.7mm (1/2”) or 15.9mm (5/8” thick), 1200mm (4’-0”) wide x maximum practical length.

.1 Provide 15.9mm (5/8”) thick Type X, Fire Rated panels where scheduled/detailed (Classification as to CAN/ULC-S114 for fire resistance, surface-burning characteristics and non-combustibility).

.2 Tilebacker: Acrylic coated glass mat facers with water resistant gypsum core to ASTM C1178, 12.7mm (1/2") thick, 1200mm (4'0") wide x maximum practical length. Score of 10 (no mould growth) as per ASTM D3273, or Cement Board to ASTM C1325. Use at all locations scheduled to receive tile and at ceilings to washroom/shower areas.

.1 Provide 15.9mm (5/8") thick Type X, Fire Rated panels where scheduled/detailed (Classification as to CAN/ULC-S114 for fire resistance, surface-burning characteristics and non-combustibility).

.3 Abuse Resistant Gypsum Board; Heavy duty glass mat facers with dense water resistant treated gypsum core to ASTM C1658 and ASTM C1629, 12.7mm (1/2") thick, 1200mm (4'0") wide x maximum practical length. Score of 10 (no mould growth) as per ASTM D3273.

.1 Provide 15.9mm (5/8") thick Type X, Fire Rated panels where scheduled/detailed (Classification as to CAN/ULC-S114 for fire resistance, surface-burning characteristics and non-combustibility).

.4 Shaftliner: Glass Mat faced with water resistant treated gypsum core to ASTM C1658, Type X, 25mm (1') thick, 610mm (2'0") wide x maximum practical length. Score of 10 (no mould growth) as per ASTM D3273

.4 Steel drill screws: to ASTM C 1002.

.5 Stud adhesive: to CAN/CGSB-71.25 ASTM C 557.

.6 Laminating compound: as recommended by manufacturer, asbestos-free.

.7 Shadow gap: Bailey D300 Metal trim, CGC Dur-a-bead or Nicolson Rollforming No 114, fillable edge trim, 0.55mm (0.022") base thickness commercial grade sheet steel with zinc wiped coating to ASTM A 525-93; perforated flanges; one piece length per location. To be used at the junction of all dissimilar materials and/or as detailed.

.8 Corner bead: Bailey D100-90, 90-degree corner trim fillable edge trim, 0.55mm (0.022") base thickness commercial grade sheet steel with zinc wiped coating to ASTM A 525-93; perforated flanges; one piece length per location.

.9 Control joints: No 093 Zinc Control Joints by CGC Inc or Nicholson Rollforming. To be installed where indicated on drawings.

.10 Sealants: in accordance with Section 07 90 00 - Joint Sealers.

.11 Acoustic sealant: concealed purpose made, non-skinning, non hardening type to CAN/CGSB-19.21-M87, as manufactured by Tremco or Monsey-Bakor, USE Hickson

.12 Sound attenuation insulation (acoustic batt insulation type 'C')

.1 Mineral or fiberglass sound attenuation batt or boards to ULC S702 and as required by fire rated tests.

.2 Thickness: full stud thickness or as otherwise stated on the Drawings and Schedule.

.13 Joint compound: to ASTM C 475, asbestos-free. Latex resin base, possessing good adhesion, mixed with fresh, unadulterated water having no detrimental effects on compounds. Type recommended by manufacturer for application indicated.

.14 Joint reinforcing tape; for gypsum board; 50mm (2") x 0.3mm (0.01")thick perforated paper with chamfered edges. Use fiberglass joint reinforcing tape at all areas where gypsum board may come in contact with moisture.

.15 1 hour rated walls to be filled with absorptive material processed from rock or slag with a mass of at least 2.8 kg/m^2 for 89mm thickness and completely filling the wall cavity.

PART 3 - EXECUTION

3.1 Erection

1 Do application and finishing of gypsum board in accordance with ASTM C 840 except where specified otherwise.

.2 Do application of gypsum sheathing in accordance with ASTM C 1280.

.3 Erect hangers and runner channels for suspended gypsum board ceilings in accordance with ASTM C 840 except where specified otherwise.

.4 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.

.5 Install work level to tolerance of 1:1200.

.6 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles.

.7 Install 19 x 64 mm furring channels parallel to, and at exact locations of steel stud partition header track.

.8 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.

.9 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.

.10 Install wall furring for gypsum board wall finishes in accordance with ASTM C 840, except where specified otherwise.

.11 Furr openings and around built-in equipment, cabinets, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.

.12 Furr duct shafts, beams, columns, pipes and exposed services where indicated

3.2 Application

.1 Do not apply gypsum board until bucks, anchors, blocking, electrical and mechanical work are approved.

.2 Apply 12 mm (1/2”) diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts,in partitions where perimeter sealed with acoustic sealant.

3.3 Installation

.1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 150mm oc using contact adhesive for full length.

.2 Install casing beads around perimeter of suspended ceilings.

.3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.

.4 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.

.5 Install shadow mould at gypsum board/ceiling juncture as indicated. Minimize joints; use corner pieces and splicers.

.6 Construct control joints of preformed units two back-to-back casing beads set in gypsum board facing and supported independently on both sides of joint.

.7 Provide continuous polyethylene dust barrier behind and across control joints.

.8 Locate control joints where indicated at changes in substrate construction at approximate 10m spacing on long corridor runs at approximate 15m spacing on ceilings.

.9 Install control joints straight and true.

.10 Construct expansion joints as detailed, at building expansion and construction joints. Provide continuous dust barrier.

.11 Install expansion joint straight and true.

.12 Splice corners and intersections together and secure to each member with 3 screws.

.13 Install access doors to electrical and mechanical fixtures specified in respective Sections.

.1 Rigidly secure frames to furring or framing systems.

.14 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.

.15 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.

.16 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.

.17 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.18 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

.19 Mix joint compound slightly thinner than for joint taping.

.20 Apply thin coat to entire surface using trowel or drywall broadknife to fill surface texture differences, variations or tool marks.

.21 Allow skim coat to dry completely for walls receiving high gloss paint and where indicated.

.22 Remove ridges by light sanding or wiping with damp cloth.

.23 Fasten board to metal support members by metal gypsum board screws at, 9.5mm (0.374”) minimum to , and 12.7mm (1/2”) maximum from, center of joints. Space screw:

.1 At ceilings of fire rated board at 200mm (8”) o.c. at edges and in field unless indicated otherwise.

.2 At walls of fire rated board at 200mm (8”) o.c. at edges and 305mm (12”) o.c. in field Locate screws opposite one another in adjacent panels unless indicated otherwise.

.3 At typical board walls at 400mm (16”) o.c. at edges and field unless noted otherwise.

.4 At typical board ceilings at 305mm (12”) o.c. at edges and field unless noted otherwise.

.24 When installing fiberglass mat faced mould and moisture resistant gypsum board do so as per manufacturers recommendations. Tape joints with self adhesive fiberglass tape and embed the tape in setting type compound. Finish joint with two layers of all purpose joint compound. High build primer should be applied to surface before painting. As with regular paper faced gypsum board, in areas where gloss paint is to be applied or in areas of critical light a skim coat should be applied to the surface before priming and painting.

3.4 Schedules

.1 Construct fire rated assemblies where indicated on drawings

END OF SECTION

1 General

1.1 SUMMARY

.1 The Work of this Section includes Glass Fibre Reinforced Gypsum:

.1 Ceiling Access Panels

1.2 REFERENCES

.1 ASTM International (ASTM):

.1 ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

.2 ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

1.3 SUBMITTALS

.1 Submit under provisions of Division 1.

.2 Product Data:

.1 Manufacturer's data sheets on each product to be used.

.2 Preparation instructions and recommendations.

.3 Storage and handling requirements and recommendations.

.4 Typical installation methods.

.3 Verification Samples: Two representative units of each type, size, pattern, and color.

.4 Shop Drawings: Include details of materials, construction, and finish. Include relationship with adjacent construction.

1.4 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum of five years documented experience.

.2 Installer Qualifications: Company specializing in performing Work of this section with minimum two years documented experience with projects of similar scope and complexity.

.3 Source Limitations: Provide each type of product from a single manufacturing source to ensure uniformity.

1.5 MOCK-UPS

.1 Provide mock-ups in accordance with Section 01 43 39.

.2 Construct mock-ups for each form of construction and finish required to verify selections made under sample submittals and to demonstrate aesthetic effects and qualities of materials and execution before installing materials indicated in this Section.

.3 Build mock-ups using exposed and concealed materials indicated for the completed Work.

1.6 ADMINISTRATIVE REQUIREMENTS

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

.2 Pre-Construction Conference: Arrange a site meeting, to coincide with regular bi-weekly site meetings, attended by the Contractor, 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.

.1 Review methods and procedures related to installation, including manufacturer's written instructions;

.2 Examine substrate conditions for compliance with manufacturers installation requirements;

.3 Review temporary protection measures required during and after installation.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Store and handle in strict compliance with manufacturer's written instructions and recommendations.

.2 Protect from damage due to weather, excessive temperature, and construction operations.

1.8 PROJECT CONDITIONS

.1 Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.9 WARRANTY

.1 Provide 2-year warranty on materials.

2 PRODUCTS

2.1 MANUFACTURERS

.1 Glass Fiber Reinforced Gypsum (GRG) products shall consist of glass-fiber reinforcing and high strength alpha hemihydrate gypsum cement (FRG), Potable Water and PORAVER Expanded Glass Granules – Fibrous Glass CAS 65997-17-3

.2 Units will be suitably reinforced with additional materials as required and supplied primer ready for field painting.

.3 Basis of Design Manufacturer: Castle Access Panels & Forms Inc, or equivalent as per Specification 01 25 00.

2.2 MATERIALS

.1 Seamless Access Panels, consisting of framed surround and lockable hinged door.

.1 Radius corner, concealed hinge access panels with flange suitable for tape-in installation to 16mm (5/8”) thick adjacent drywall finish.

.2 Lock: flush, tamper proof camlock.

.2 Access Panel Schedule

.1 AP-01: HG-RC-580024

.2 Quantities as per drawings.

3 EXECUTION

3.1 EXAMINATION

.1 Do not begin installation until the substrates have been properly constructed and prepared.

.2 Notify Consultant in writing of unsatisfactory preparation before proceeding.

3.2 PREPARATION

.1 Clean surfaces thoroughly prior to installation.

.2 Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

.1 Install in accordance with manufacturer's instructions, reviewed submittals, and in proper relationship with adjacent construction.

3.4 FIELD QUALITY CONTROL

.1 Field Inspection: Coordinate field inspection in accordance with appropriate sections in Division 01.

3.5 CLEANING AND PROTECTION

.1 Clean products in accordance with the manufacturers recommendations.

.2 Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 Acoustical ceiling panels

.2 Exposed grid suspension system

.3 Wire hangers, fasteners, main runners, cross tees, and wall angle moldings

.4 Perimeter Trim

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM):

.1 ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

.2 ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

.3 ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

.4 ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

.5 ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

.6 ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.

.7 STM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.

.8 ASTM E 1414 Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum.

.9 ASTM E 1111 Standard Test Method for Measuring the Interzone Attenuation of Ceilings Systems.

.10 ASTM E 1264 Classification for Acoustical Ceiling Products.

.11 ASTM E 1477 Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers.

.12 ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

.13 ASTM E 119 Standard Test Methods for Fire Tests of Building Construction and Material.

.2 ASHRAE Standard 62.1-2004, "Ventilation for Acceptable Indoor Air Quality"

1.3 EQUIVALENT PRODUCTS

.1 As per Section 01250 – Alternatives & Substitutions.

.2 Submittals which do not provide adequate data for the product evaluation will not be considered. The proposed substitution must meet all requirements of this section, including but not necessarily limited to, the following: Single source materials suppliers (if specified); Underwriters' Laboratories Classified Acoustical performance; Panel design, size, composition, color, and finish; Suspension system component profiles and sizes; Compliance with the referenced standards.

1.4 SUBMITTALS

.1 Product Data: Submit manufacturer's technical data for each type of acoustical ceiling unit and suspension system required.

.2 Samples: Minimum 6 inch x 6 inch samples of specified acoustical panel; 8 inch long samples of exposed wall molding and suspension system, including main runner and 4 foot cross tees.

.3 Shop Drawings: Layout and details of acoustical ceilings. Show locations of items which are to be coordinated with, or supported by the ceilings.

.4 Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards. For acoustical performance, each carton of material must carry an approved independent laboratory classification of NRC, CAC, and AC.

.5 If the material supplied by the acoustical subcontractor does not have an Underwriter's Laboratory classification of acoustical performance on every carton, subcontractor shall be required to send material from every production run appearing on the job to an independent or NVLAP approved laboratory for testing, at the architect's or owner's discretion. All products not conforming to manufacturer's current published values must be removed, disposed of and replaced with complying product at the expense of the Contractor performing the work.

1.5 QUALITY ASSURANCE

.1 Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.

.2 Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.

.1 Surface Burning Characteristics: As follows, tested per ASTM E 84 and complying with ASTM E 1264 for Class A products.

a. Flame Spread: 25 or less

b. Smoke Developed: 50 or less

.2 Fire Resistance Ratings: As indicated by reference to design designations in UL Fire Resistance Directory, for types of assemblies in which acoustical ceilings function as a fire protective membrane and tested per ASTM E 119.

a. Protect lighting fixtures and air ducts to comply with requirements indicated for rated assembly.

.3 Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

.2 Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.

.3 Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.7 PROJECT CONDITIONS

.1 All ceiling products and suspension systems must be installed and maintained in accordance with manufacturer written installation instructions for that product in effect at the time of installation and best industry practice. Prior to installation, the ceiling product must be kept clean and dry, in an environment that is between 32°F (0°C) and 120°F (49°C) and not subject to Abnormal Conditions.

Abnormal conditions include exposure to chemical fumes, vibrations, moisture from conditions such as building leaks or condensation, excessive humidity, or excessive dirt or dust buildup.

1.8 WARRANTY

.1 Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace acoustical panels that fail within the warranty period. Failures include, but are not limited to:

.1 Acoustical Panels: Sagging and warping as a result of defects in materials or factory workmanship.

.2 Grid System: Rusting and manufacturer's defects

.3 Acoustical Panels designated as inherently resistive to the growth of micro-organisms installed with corresponding suspension systems: Visible sag and will resist the growth of mold/mildew and gram positive and gram negative odor and stain causing bacteria.

.2 Warranty Period Humiguard:

.1 Acoustical panels: Ten (10) years from date of substantial completion.

.2 Grid: Ten (10) years from date of substantial completion.

.3 Acoustical panels and grid systems with HumiGuard Plus or HumiGuard Max performance supplied by one source manufacturer is thirty (30) years from date of substantial completion.

.3 The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.9 MAINTENANCE

.1 Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.

.1 Acoustical Ceiling Units: Furnish quality of full-size units equal to 5.0 percent of amount installed, for each ceiling type/pattern.

.2 Exposed Suspension System Components: Furnish quantity of each exposed suspension component equal to 2.0 percent of amount installed, for each ceiling type/pattern.

PART 2-PRODUCTS

2.1 MANUFACTURERS

.1 Armstrong World Industries, Inc.

.2 Ceiling Panels: Model numbers for acoustic ceiling tiles and grid as manufactured by Armstrong World Industries, are listed to establish a standard of quality for design, function, materials, performance, workmanship, and appearance. The following manufacturers may be submitted for evaluation by the architect by following the conditions of the Product Substitutions Section 01250. The architect shall be the sole judge as to the acceptability of all products submitted for substitution.

.1 CertainTeed.

.2 Canadian Gypsum Company (CGC).

2.2. ACOUSTICAL CEILING UNITS

.1 Surface Texture: Smooth Texture/Fine

.2 Composition: Wet formed mineral fibre

.3 Color: White

.4 Size: 24in X 48in X 5/8in

.5 Edge Profile: Square

.6 Noise Reduction Coefficient (NRC): 0.55.

.7 CAC: .35

.8 Fire Performance: ASTM E84 and CAN/ULC S102 surface burning characteristics. Flame Spread Index 25 or less. Smoke Developed Index 50 or less (UL labeled.)

.9 Flame Spread: ASTM E 1264; Type XII, Form 2, Pattern E Fire Class A

.10 Light Reflectance (LR): ASTM E 1477; White Panel: Light Reflectance: 0.85.

.11 Antimicrobial Protection: Inherent - Resists the growth of mold/mildew and bacterial growth.

.12 Acceptable Product: School Zone Fine Fissured 465 as manufactured by Armstrong World Industries, or equivalent.

2.3 SUSPENSION SYSTEMS

.1 Components: All main beams and cross tees shall be commercial quality hot-dipped galvanized (galvanized steel, aluminum, or stainless steel) as per ASTM A 653. Main beams and cross tees are double-web steel construction with 15/16 IN type exposed flange design. Exposed surfaces chemically cleansed, capping pre-finished galvanized steel (aluminum or stainless steel) in baked polyester paint. Main beams and cross tees shall have rotary stitching (exception: extruded aluminum or stainless steel).

.1 Structural Classification: ASTM C 635 LD.

.2 Color: White Aluminum and match the actual color of the selected ceiling tile, unless noted otherwise.

.3 Acceptable Product: Prelude XL 15/16" Exposed Tee as manufactured by Armstrong World Industries, Inc.

.2 Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.

.3 Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper, pre-stretched, with a yield stress load of at least time three design load, but not less than 12 gauge.

.4 Edge Moldings and Trim: Metal or extruded aluminum of types and profiles indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations, including light fixtures, that fit type of edge detail and suspension system indicated. Provide moldings with exposed flange of the same width as exposed runner.

.5 Accessories

.1 Shadow molding with ½” (13mm) reveal, exposed flange same width as exposed runners, to be used at interface with walls/bulkheads.

.2 2” Floating Edge Trim Channel to be provided at all locations where ACT ceiling terminates away from walls/bulkheads. See also details.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations. (Exception: HumiGuard Max Ceilings)

3.2 PREPARATION

.1 Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders, and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.

.2 Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.

.1 Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.

3.3 INSTALLATION

.1 Install suspension system and panels in accordance with the manufacturer's instructions, and in compliance with ASTM C 636 and with the authorities having jurisdiction.

.2 Suspend main beam from overhead construction with hanger wires spaced 4-0 on center along the length of the main runner. Install hanger wires plumb and straight.

.3 Install wall moldings at intersection of suspended ceiling and vertical surfaces. Miter corners where wall moldings intersect or install corner caps.

.4 For reveal edge panels: Cut and reveal or rabbet edges of ceiling panels at border areas and vertical surfaces.

.5 Install acoustical panels in coordination with suspended system, with edges resting on flanges of main runner and cross tees. Cut and fit panels neatly against abutting surfaces. Support edges by wall moldings.

3.4 INTERFACE WITH OTHER WORK

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

3.5 ADJUSTING AND CLEANING

.1 Replace damaged and broken panels.

.2 Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage.

.1 Ceiling Touch-Up Paint, (Item #5760, 8oz. bottles) (Item #5761, quart size cans), "global white" latex paint should be used to hide minor scratches and nicks in the surface and to cover field tegularized edges that are exposed to view.

.3 Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

PART 1 - GENERAL

1.1 Related Sections.

.1 Section 01 10 10 – General Requirements; Submittal Procedures.

.2 Section 01 10 10 - General Requirements; Basic Product Requirements.

.3 Section 01 10 10 - General Requirements; Closeout Submittals.

1.2 References

.1 Architectural Painting Specifications Manual, Master Painters Institute (MPI).

.2 Systems and Specifications Manual, SSPC Painting Manual, Volume Two, Society for Protective Coatings (SSPC).

.3 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings) of the Environmental Protection Agency (EPA).

.4 National Fire Code of Canada.

1.3 Quality Assurance

.1 Contractor shall have past experience in the manufacture or fabrication of the products specified herein and shall have successfully completed projects of similar scope and type.

.2 Qualified journeymen who have a "Tradesman Qualification Certificate of Proficiency" shall be engaged in painting work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.

.3 Conform to latest MPI requirements for interior painting work including preparation and priming.

.4 Materials primers, paints, fillers, thinners, solvents, etc. shall be in accordance with MPI Painting Specification Manual "Approved Product" listing and shall be from a single manufacturer for each system used.

.5 Other paint materials such as linseed oil, shellac, turpentine, etc. shall be the highest quality product of an approved manufacturer listed in MPI Painting Specification Manual and shall be compatible with other coating materials as required.

.6 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Consultant.

.7 Standard of Acceptance:

.1 Walls: No defects visible from a distance of 1000 mm at 90 degrees to surface.

.2 Ceilings: No defects visible from floor at 45degrees to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

1.4 Environmental Performance Requirements

.1 Provide paint products meeting MPI "Environmentally Friendly" ratings based on VOC (EPA Method 24) content levels.

1.5 Scheduling of Work

1 Submit work schedule for various stages of painting to Consultant for approval. Submit schedule minimum of 48 hours in advance of proposed operations.

.2 Obtain written authorization from Consultant for any changes in work schedule.

.3 Schedule painting operations to prevent disruption of occupants in and about the building.

1.7 Quality Control

.1 When requested by Consultant prepare and paint designated surface, area, room or item in each colour scheme to requirements specified herein, with specified paint or coating showing selected colours, gloss/sheen, textures and workmanship to MPI Painting Specification Manual standards for review and approval. When approved, surface, area, room and/or items shall become acceptable standard of finish quality and workmanship for similar on-site work.

1.8 Delivery, Handling and Storage

.1 Deliver, store and handle materials in accordance with Section 01 10 10 - Basic Product Requirements.

.2 Labels shall clearly indicate:

.1 Manufacturer's name and address.

.2 Type of paint or coating.

.3 Compliance with applicable standard.

.4 Colour number in accordance with established colour schedule.

.3 Remove damaged, opened and rejected materials from site.

.4 Provide and maintain dry, temperature controlled, secure storage.

.5 Observe manufacturer's recommendations for storage and handling.

.6 Store materials and supplies away from heat generating devices.

.7 Store materials and equipment in a well ventilated area with temperature range 7C to 30C.

.8 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.9 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Consultant. After completion of operations, return areas to clean condition to approval of Consultant.

.10 Remove paint materials from storage only in quantities required for same day use.

.11 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.

.12 Fire Safety Requirements:

.1 Provide one 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.

.2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.3 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.9 Site Requirements

.1 Heating, Ventilation and Lighting:

.1 Ventilate enclosed spaces

.2 Perform no painting work unless adequate and continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above 10 C for 24 hours before, during and after paint application until paint has cured sufficiently.

.3 Where required, provide continuous ventilation for seven days after completion of application of paint.

.4 Coordinate use of existing ventilation system with Contractor and ensure its operation during and after application of paint as required.

.5 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.

.6 Perform no painting work unless a minimum lighting level of 323 Lux is provided on surfaces to be painted. Adequate lighting facilities shall be provided by General Contractor.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Unless specifically pre-approved by the specifying body, Paint Inspection Agency and the applied product manufacturer, perform no painting work when:

.1 Ambient air and substrate temperatures are below 10 C.

.2 Substrate temperature is over 32 C unless paint is specifically formulated for application at high temperatures.

.3 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's prescribed limits.

.4 The relative humidity is above 85% or when the dew point is less than 3 C variance between the air/surface temperature.

.5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.

.2 Perform no painting work when the maximum moisture content of the substrate exceeds:

.1 12% for concrete and masonry (clay and concrete brick/block).

.2 15% for wood.

.3 12% for plaster and gypsum board.

.3 Conduct moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple "cover patch test".

.4 Test concrete, masonry and plaster surfaces for alkalinity as required.

.3 Surface and Environmental Conditions:

.1 Apply paint finish only in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint only to adequately prepared surfaces and to surfaces within moisture limits noted herein.

.3 Apply paint only when previous coat of paint is dry or adequately cured.

.4 Additional Interior Application Requirements:

.1 Apply paint finishes only when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.

.2 Apply paint in occupied facilities during silent hours only. Schedule operations to approval of Owner such that painted surfaces will have dried and cured sufficiently before occupants are affected

1.10 Extra Materials

1 Submit maintenance materials in accordance with Section 01 10 10 – General Requirements, Closeout Submittals.

.2 Submit – (one) four litre can of each type and colour of primer, stain, and finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

.3 Deliver to Contractor and store where directed.

PART 2 - PRODUCTS

2.1 Materials

.1 Paint and fillers shall be manufacture's premium quality, of type and brand herein specified and listed under "Paint Product Recommendations" premium grade as covered in the association manual, latest edition, for specific uses and only as supplied by **Pratt & Lambert Co., Benjamin Moore & Co., Para Paints Canada Inc., ICI Paints (Canada) Inc, (Glidden), Sherwin Williams Canada Inc., Pittsbugh Paints**. Paint material such as linseed oil, shellac, turpentine and the like, and any of the materials not specifically mentioned herein but required for first class work with finish specified shall be highest quality product of approved manufacturer. Where specific products are indicated in painting schedule, use product manufacturer as specified.

.2 Paint materials for paint systems shall be products of a single manufacturer.

.3 Only qualified products with "Environmentally Friendly" rating are acceptable for use on this project.

.4 Water-borne surface coatings must be manufactured and transported in a manner that steps of process, including disposal of waste products arising therefrom, will meet requirements of applicable governmental acts, by-laws and regulations including, for facilities located in Canada, Fisheries Act and Canadian Environmental Protection Act (CEPA).

.5 Water-borne surface coatings must not be formulated or manufactured with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavelant chromium or their compounds.

.6 Water-borne surface coatings and recycled water-borne surface coatings must have a flash point of 61.0 C or greater.

.7 Both water-borne surface coatings and recycled water-borne surface coatings must be made by a process that does not release:

.1 Matter in undiluted production plant effluent generating a 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.

.2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.

.8 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes must meet a minimum "Environmentally Friendly" rating.

.9 Recycled water-borne surface coatings must contain 50 % post-consumer material by volume.

.10 Recycled water-borne surface coatings must not contain:

.1 Lead in excess of 600.0 ppm weight/weight total solids.

.2 Mercury in excess of 50.0 ppm weight/weight total product.

.3 Cadmium in excess of 1.0 ppm weight/weight total product.

.4 Hexavelant chromium in excess of 3.0 ppm weight/weight total product.

.5 Organochlorines or polychlorinated biphenyls (PCBS) in excess of 1.0 ppm weight/weight total product.

.11 The following must be performed on each batch of consolidated post-consumer material before surface coating is reformulated and canned. These tests must be performed at a laboratory or facility which has been accredited by the Standards Council of Canada.

.1 Lead, cadmium and chromium are to be determined using ICP-AES (Inductively Coupled Plasma - Atomic Emission Spectroscopy) technique no. 6010 as defined in EPA SW-846.

.2 Mercury is to be determined by Cold Vapour Atomic Absorption Spectroscopy using Technique no. 7471 as defined in EPA SW-846.

.3 Organochlorines and PCBs are to be determined by Gas Chromatography using Technique no. 8081 as defined in EPA SW-846.

2.2 Finishes and Colours

.1 Generally and unless otherwise specified herein or noted on Finish Schedules the quantity of colors and finishes shall be based on the following criteria. Colours to match existing.

.2 Interior Colours will be based upon the selection of three (3) base colours and three (3) accent colours. No more than six colours will be selected for the entire project and no more than three colours will be selected in each area. Include for 25% dark tones.

.3 Exterior colors will be based on two (2) base colors and two (2) accent colors with a maximum of two (2) deep or bright colors. No more than four (4) colors will be selected for the entire project. Note that this does not include pre-finished items by others, e.g. flashings, aluminum or vinyl windows, aluminum doors, etc

.4 Selection of colours will be from manufacturers full range of colours.

.5 Where specific products are available in a restricted range of colours, selection will be based on the limited range.

.6 Second coat in a three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 Mixing and Tinting

1 Perform colour tinting operations prior to delivery of paint to site. On-site tinting of painting materials is allowed only with Consultant's written permission.

.2 Paste, powder or catalyzed paint mixes shall be mixed in strict accordance with manufacturer's written instructions.

.3 Where thinner is used, addition shall not exceed paint manufacturer's recommendations. Do not use kerosene or any such organic solvents to thin water-based paints.

.4 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 Gloss/Sheen Ratings

.1 Paint gloss shall be defined as the sheen rating of applied paint, in accordance with the following values:

Gloss Level	Description	Units @ 60 degrees	Units @ 85 degrees
G1	Matte of Flat finish	0 to 5	10 max
G2	Velvet Finish	0 to10	10 to 35
G3	Eggshell Finish	10 to 25	10 to 35

G4	Satin Finish	20 to 35	35 min
G5	Semi-Gloss Finish	35 to 70	
G6	Gloss Finish	70 to 85	
G7	High Gloss Finish	➢ 85	

.2 Gloss level ratings of painted surfaces shall be as specified herein and as noted on Finish Schedule

2.5 Interior Painting Systems

.1 Plaster and Drywall: Int 9.2A Latex (G3) finish over latex sealer

.2 Plaster and Gypsum Board Ceilings: Int 9.2A Latex (G1) finish over latex sealer

.3 Dressed lumber/Wood trim: Int 6.3T Latex (G5) finish over latex primer.

.4 Spray Textured Ceiling: Int 9.1A Latex, flat finish

.5 Concrete Ceilings: Int 3.1B Latex (G1) finish over textured latex primer.

.6 Structural steel & metal fabrications: Int 5.1R (G5) finish.

.7 Galvanized metal/zinc coated steel: Int 5.3A (G5) finish

.8 Use fire retardant paint on fire rated plywood sheets behind electrical panels.

All Finishing System Codes are from the Ontario Painting Contractors Association.

2.6 Exterior Painting Systems

.1 Traffic markings on Asphalt surfaces: Ext 2.1A.

.2 Galvanized metal: Ext 5.3A Latex (G5) finish.

All Finishing System Codes are from the Ontario Painting Contractors Association.

PART 3 - EXECUTION

3.1 General

.1 Perform preparation and operations for interior painting in accordance with MPI Painting Specifications Manual except where specified otherwise.

.2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.2 Existing Conditions

1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Consultant damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

.2 Conduct moisture testing of surfaces to be painted using a properly calibrated electronic moisture meter, except test concrete floors for moisture using a simple "cover patch test" and report findings to Consultant. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

.3 Maximum moisture content as follows:

.1 Stucco, Plaster and Gypsum Board: 12%.

.2 Concrete: 12%.

.3 Clay and Concrete Block/Brick: 12%.

.4 Wood: 15%.

3.3 Protection

.1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore such surfaces as directed by Consultant.

.2 Protect items that are permanently attached such as Fire Labels on doors and frames.

.3 Protect factory finished products and equipment.

.4 Protect passing pedestrians, building occupants and general public in and about the building.

.5 Removal of electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings shall be done prior to undertaking any painting operations by General Contractor. Items shall be securely stored and re-installed after painting is completed by General Contractor.

.6 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.

.7 As painting operations progress, place "WET PAINT" signs in occupied areas to approval of Consultant

3.4 Cleaning and Preparation

.1 Clean and prepare surfaces in accordance with MPI Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:

.1 Remove dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths or compressed air.

.2 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.

.3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.

.4 Allow surfaces to drain completely and allow to dry thoroughly.

.5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.

.6 Use trigger operated spray nozzles for water hoses.

.7 Many water-based paints cannot be removed with water once dried. However, minimize the use of kerosene or any such organic solvents to clean up water-based paints.

.2 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

.3 Where possible, prime surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.

.1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.

.2 Apply wood filler to nail holes and cracks.

.3 Tint filler to match stains for stained woodwork.

.4 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

.5 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes, blowing with clean dry compressed air, or vacuum cleaning.

.6 Touch up of shop primers with primer as specified in applicable section. Major touch-up including cleaning and painting of field connections, welds, rivets, nuts, washers, bolts, and damaged or defective paint and rusted areas, shall be by supplier of fabricated material.

.7 Do not apply paint until prepared surfaces have been accepted by Consultant.

3.5 Application

1 Method of application to be as approved by Consultant. Apply paint by brush or roller. Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and Roller Application:

.1 Apply paint in a uniform layer using brush and/or roller of types suitable for application.

.2 Work paint into cracks, crevices and corners.

.3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.

.4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces shall be free of roller tracking and heavy stipple unless approved by Consultant

.5 Remove runs, sags and brush marks from finished work and repaint.

.3 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access and only when specifically authorized by Consultant.

.4 Apply coats of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.5 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.6 Sand and dust between coats to remove visible defects.

.7 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges and behind wall mounted items.

3.6 Mechanical/Electrical Equipment

.1 Unless otherwise specified, paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as noted otherwise.

.2 Boiler room, mechanical and electrical rooms: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.

.3 Other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.

.4 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.5 Do not paint over nameplates.

.6 Keep sprinkler heads free of paint.

.7 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.

.8 Paint fire protection piping red, if required.

.9 Paint disconnect switches for fire alarm system and exit light systems in red enamel.

.10 Paint natural gas piping yellow.

.11 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

.12 Do not paint interior transformers and substation equipment.

3.7 Field Quality Control

.1 Advise Consultant when surfaces and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.

3.8 Restoration

.1 Clean and re-install all hardware items removed before undertaking painting operations.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

.4 Protect freshly completed surfaces from paint droppings and dust to approval of Consultant. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Consultant.

END OF SECTION

MECHANICAL SPECIFICATIONS

21 Park
Toronto, Ontario
M4W 2N1



DeCARIA ENGINEERING

DeCaria Engineering Limited
1661 Denison Street, Unit D12
Markham, Ontario
L3R 6E4
Tel: 647 498-4397

Project: 4880-100

Section	Title	Pages
23 01 05	Operation And Maintenance Of HVAC Systems During Construction	1
23 01 05.05	Maintenance of HVAC Systems	4
23 05 00	Common Work Results For HVAC	4
23 05 13	Common Motor Requirements For HVAC Equipment	3
23 05 15	Common Installation Requirements For HVAC Pipework	5
23 05 16	Expansion Fittings And Loops For HVAC Piping	4
23 05 17	Pipe Welding	4
23 05 19.13	Thermometers And Pressure Gauges	3
23 05 29	Hangers And Supports For HVAC Piping And Equipment	7
23 05 31	PHP Duct Supports	6
23 05 53	Identification For HVAC, Piping And Equipment	6
23 05 93	Testing, Adjusting And Balancing For HVAC	5
23 05 94	Pressure Testing of Ducted Systems	4
23 07 13	Duct Insulation	5
23 07 16	HVAC Equipment Insulation	6
23 07 20	Refrigerant Piping Insulation	6
23 23 00	Refrigerant Piping	5
23 31 13.01	Metal Ducts - Low Pressure To 500 PA	6
23 33 00	Air Duct Accessories	4
23 33 14	Dampers – Balancing	3
23 33 15	Dampers – Operating	3
23 33 53	Duct Liners	4
23 72 00	Energy Recovery Ventilator	9
23 81 40	Air Source Heat Pumps	4

END OF TABLE OF CONTENTS

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Maintenance recommendations.

Part 2 Fan Coils and Heat Pumps

2.1 General

.1 Conduct inspections of the fan coils and heat pumps on a regular basis:
.1 Weekly Inspections .2 Monthly Inspections
.3 Six month inspections .4 Yearly inspections
.5 Four Year inspections

2.2 Weekly Inspection Checklist

.2 Observe and review the unit for any changes in operating conditions

.3 Check for any unusual noises

.3 Check temperature setting to ensure as per design/operational needs

2.3 Monthly Inspection Checklist

.4 Change or Clean Filters – Visually inspect and if clogged or dirty clean or replace If they are the permanent/washable type filter can be cleaned If not then replace

.5 Inspect and Clean Condensate Drain Pan – Visually inspect and if dirty or debris have accumulated, clean fully.

.6 Inspect and Clean Wet coils – Visually inspect and if dirty or debris accumulated clean

.4 Inspect and Clean Strainer if present – Remove strainer mesh; inspect and clean.

2.4 Six Months Inspection Checklist

.1 Inspect Fan – Manually rotate the fan to check for any obstructions. The access panel to the FCU will need to be removed to allow full access and visibility to the fan housing.

.2 Inspect Motor – check the bracket for the motor and that the torque is still correct

.3 Inspect/Clean Wet coils – complete a more detailed visual inspection and if dirty or debris is accumulated, clean thoroughly.

.4 Test Control valves – ensure that the FCU control valve is operating as per design, not damaged and the actuator is still fixed properly.

.5 Fresh Air Ducting– Visually inspect to ensure free and clear and the connection to the FCU plenum is in good condition

.6 Insulation at Fresh Air Ducting – Visually inspect insulation to ensure that there is no damage, duct is not torn, and that the vapor barrier is unaffected.

.7 Recirculating and Supply Air Ducting – Visually inspect to ensure free and clear and the connection to the FCU plenum and grille is in good condition.

.8 Test that the condensate pan and pipework still operates as design by pouring 2 liters of water into it and ensuring it flows out to discharge.

.9 Electrical - Check the operation of emergency stop.

2.5 Yearly Inspection Checklist

.1 General – Check all screws and bolts on the unit are tight and secure

.2 Fan – clean the fan, blades, and impeller, remove any rust from the shaft and recoat where necessary.

.3 Fan – Adjust the fan if rubbing

.4 Electrical – check the tightness of connections

.5 Fresh Air, return air, and supply air – Measure airflow rates to ensure in line with design requirements.

.6 Volume Control Dampers – Inspect all volume control dampers to ensure that they are in good condition.

.7 Fire Dampers – Inspect any fire dampers to ensure that they are in position as per design. It will be required to be tested every 4 years after that.

.8 System – check over the system for any evidence of corrosion and repair if any found.

2.6 Heat Pump Maintenance

.7 The heat pumps are to be serviced by professional maintenance technicians at least once a year.

.8 Inspect ducts, filters, blower, and indoor coil for dirt and other obstructions.

.9 Diagnose and seal duct leakage.

.10 Verify adequate airflow by measurement.

.11 Verify correct refrigerant charge by measurement.

.12 Check for refrigerant leaks.

.13 Inspect electric terminals, clean and tighten connections if necessary, and apply nonconductive coating.

.14 Lubricate motors and inspect belts for tightness and wear.

.15 Verify correct electric control, ensuring that heating is locked out when the thermostat calls for cooling and vice versa.

.10 Verify correct thermostat operation.

Part 3 Energy Recovery Ventilator

3.1 General

.1 Specified ERV is built to operate with minimal maintenance. After unit commissioning, the primary areas of attention are the air filters, periodic lubrication of the fan motors and annual vacuuming of the enthalpic core.

3.2 Maintenance 24 Hours After Start-Up

.1 24 hours after unit start-up: Readjust the tension on the motor drive belts.

.2 Check the air filters for dust, dirt and debris at the time of start-up.

3.3 Maintenance 30 Days After Start-Up

.1 After 30 days of operation:
- .1 Tighten all electrical connections, paying special attention to VFD wiring.
- .2 Readjust the tension on motor drive belts.
- .3 Check the air filters as part of the normal monthly maintenance.

3.4 Filters

.1 Inspection and replacement of air filters is the most frequent maintenance issue. For units that do not have filter air pressure differential sensors, filters must be visually inspected monthly, as a minimum. If a filter looks discolored or dirty, REPLACE IT! When installing new filters, DO NOT USE filter sprays. Residue from the filter spray could migrate to the enthalpic core media and damage the cores.

.2 For units that have filter air pressure differential sensors, a dirty filter alarm will occur on the connected alarm or control device.

.3 Filter cleanliness and replacement is the most important and frequent maintenance issue. Dirty filters will cause an immediate reduction in operating efficiency of the ERV. Normally, filters should be inspected and changed when they are dirty. Paper filters are not to be cleaned, they are to be replaced. In general, if a filter looks dirty, replace it. The best indication of dirty filters is to check the pressure drop across the filter banks with an optional filter monitor.

.4 As a minimum, change the filters every two months.

3.5 Fan Motors

.1 The most important issues in motor maintenance are:
- .1 Belt condition and belt tension
- .2 Sheave condition
- .3 Motor cleanliness
- .4 Motor lubrication

.2 Belt Tension: Premature or frequent belt failures can be caused by improper belt tension (either too loose or too tight) or misaligned sheaves. Abnormally high belt tension or drive misalignment will cause excessive bearing loads and may result in failure of the fan and/or motor bearings. Conversely, loose belts will cause squealing on start-up, excessive belt flutter, slippage and overheated sheaves. Both loose and tight belts can cause fan vibration.

.3 Do not pry belts on or off the sheave. Loosen belt tension until the belts can be removed by simply lifting the belts off the sheaves. After replacing belts, ensure that slack in each belt is on the same side of the drive. Belt dressing should never be used.

.4 The proper belt setting is the lowest tension at which the belts will not slip under peak load operation. For initial tensioning, set the belt deflection at 1/64" for each inch of belt span (measured half-way between sheave centers). Example: If the belt span is 16", the belt deflection should be 1/64", or 1/4" (using moderate thumb pressure at mid-point of the drive).

.5 Check belt tension two times during the first 24 hours of operation and periodically thereafter.

.6 Sheave Condition: Do not install new belts on worn sheaves. If the sheaves have grooves worn in them, they must be replaced before new belts are installed.

.7 Motor Cleanliness: Removing dust and grease buildup on the motor housing assists proper cooling. Never wash down the motor with high pressure spray.

.8 Motor Lubrication: High efficiency motors have unique maintenance requirements that vary from motor to motor. Many smaller horsepower motors have sealed bearings that do not require periodic greasing. Larger horsepower motors come equipped with grease fittings. Before greasing any motor, consult the motor manufacturer's web site to determine the correct maintenance and greasing schedule.

3.6 Enthalpic Cores

.1 Enthalpic Core Maintenance: The enthalpic core media is a fibrous material that must be kept clean at all times. As a minimum, cores should be cleaned once per year.

.2 Do not wash or allow the enthalpic cores to get wet.

.3 Do not expose the enthalpic cores to high heat or flames.

.4 Do not direct compressed air at the core media.

.5 Do not remove the enthalpic cores from the erv unless necessary.

.6 Use caution when working around the enthalpic cores. Do not drop tools or other objects on the cores, do not bump or twist the cores.

.2 To access enthalpic cores for cleaning, remove the air filters. To clean enthalpic cores, all exposed surfaces must be vacuumed with an attachment having long, soft bristles. The greatest buildup of dirt and dust will normally be on the leading 1–2 inches of the inlet side (closest to the air filters).

.3 Enthalpic Core Removal: Before removing enthalpic cores, switch the main disconnect to OFF. Open the door to the Energy Recovery Module and simply pull each core straight out of its guides.

.4 Enthalpic Core Replacement: Cores have foam gasketing on one end of each core. The core should be reinstalled so that the foam gasketing is toward the back of the ERV and the core label is facing toward the front.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Use of mechanical systems during construction.

.2 Related Requirements

.1 Section 20 00 10.

1.2 USE OF SYSTEMS

.1 Use of new HVAC systems for supplying temporary ventilation and heat is [permitted only under following conditions:

.1 Entire system is complete, pressure tested, cleaned, flushed out.

.2 Building has been closed in, areas to be heated/ventilated are clean and will not thereafter be subjected to dust-producing processes.

.3 There is no possibility of damage.

.4 Supply ventilation systems are protected by filters, inspected daily, changed every week or more frequently as required.

.5 Return systems have approved filters over openings, inlets, outlets.

.6 Systems will be:

.1 Operated as per manufacturer's recommendations and instructions.

.2 Operated by Contractor.

.3 Monitored continuously by Contractor.

.7 Warranties and guarantees are not relaxed.

.8 Regular preventive and other manufacturers recommended maintenance routines are performed by Contractor at own expense and under supervision of General Contractor.

.9 Refurbish entire system before static completion; clean internally and externally, restore to "as- new" condition, replace filters in air systems.

.2 Filters specified in this Section are over and above those specified in other Sections of this project.

.3 Exhaust systems are not included in approvals for temporary heating ventilation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 00 10

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section [01 33 00- Submittal Procedures] .

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for all HVAC equipment.

.3 Shop Drawings:

.1 Indicate on drawings:

.1 Mounting arrangements.

.2 Operating and maintenance clearances.

.3 Motor sizes and voltage.

.4 Equipment capacities.

.2 Shop drawings and product data accompanied by:

.1 Detailed drawings of bases, supports, and anchor bolts.

.2 Acoustical sound power data, where applicable.

.3 Points of operation on performance curves.

.4 Manufacturer to certify current model production.

.5 Certification of compliance to applicable codes.

.3 In addition to transmittal letter, use mechanical engineer’s equipment tags.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with requirements of this Section.

.2 Operation and Maintenance Data: submit operation and maintenance data for all mechanical HVAC equipment.

.1 Operation and maintenance manual approved by, and final copies deposited with, project engineer before final inspection.

.2 Operation data to include:

.1 Control schematics for systems including environmental controls.

.2 Description of systems and their controls.

.3 Description of operation of systems at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for systems and component.

.5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.8 Valve Tag Chart

.3 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.4 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.4 Testing, adjusting and balancing reports as specified in the relevant section.

.5 Approvals:

.1 Submit 2 copies of draft Operation and Maintenance Manual to Engineer.

.2 Make changes as required and re-submit as directed by Engineer .

.6 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.7 Site records:

.1 Engineer will provide 1 set of mechanical drawings in Aurocad. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring .

.2 Transfer information to Autocad drawings to show work as actually installed.

.3 Make available for reference purposes and inspection.

.8 As-built drawings:

.1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of Autocad as-built drawings.

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" Signature of Contractor, Date.

.3 Submit to Engineer for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for HVAC using as-built drawings.

.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.9 Submit copies of as-built drawings for inclusion in final TAB report.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit in accordance with requirements of this section.

.2 Furnish spare parts as follows:

.1 One set of packing for each pump.

.2 One casing joint gasket for each size pump.

.3 One head gasket set for each heat exchanger.

.4 One glass for each gauge glass.

.5 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

.3 Provide one set of special tools required to service equipment as recommended by manufacturers.

.4 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 HVAC and R Equipment: All systems to use R410A refrigerant.

Part 3 Execution

3.1 EXAMINATION

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

.1 Visually inspect substrate in.

.2 Inform General Contractor and Engineer of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 PAINTING REPAIRS AND RESTORATION

.1 Do painting as required.
.2 Prime and touch up marred finished paintwork to match original.
.3 Restore to new condition, finishes which have been damaged.

3.3 SYSTEM CLEANING

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

3.4 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit.

.2 Provide manufacturer's start up report for all boilers and air handling units.

3.5 DEMONSTRATION

.1 General Contractor, Owner and Engineer will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Trial usage to apply to following equipment and systems:

.1 Boiler and boiler plants
.2 Rooftop and Indoor air handling units
.3 Exhaust and transfer fans
.4 Energy Recovery Ventilators
.5 Heat Pumps
.6 Split Units

.3 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.4 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

.5 Instruction duration time requirements as specified in appropriate sections.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with General Contractor’s instructions. Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

3.7 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Electrical motors, drives and guards for mechanical equipment and systems.

.2 Supplier and installer responsibility indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.

.3 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 22 and 23. Refer to Division 26 for quality of materials and workmanship.

1.2 REFERENCE STANDARDS

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

.1 ASHRAE 90.1-[01] , Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA cosponsored; ANSI approved; Continuous Maintenance Standard).

.2 Electrical Equipment Manufacturers' Association Council (EEMAC)

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals: in accordance with Section 23 05 00.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheets. Include product characteristics, performance criteria, and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS).

.2 Shop Drawings: submit electronic drawings is Acrobat PDF format.

.3 Quality Control:

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.4 Closeout Submittals

.1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 23 05 00.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements: work to be performed in compliance with applicable Provincial and municipal regulations.

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with applicable Health and Safety Requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

Part 2 Products

2.1 GENERAL

.1 Motors: TEFC high efficiency, in accordance with local Hydro company standards and to ASHRAE 90.1.

2.2 MOTORS

.1 Provide motors for mechanical equipment as specified.

.2 Motors under 1/2 HP : speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.

.3 Motors 1/2 HP and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40 degrees C, 3 phase, voltage as specified.

2.3 TEMPORARY MOTORS

.1 If delivery of specified motor will delay completion or commissioning work, install motor approved by Engineer for temporary use. Work will only be accepted when specified motor is installed.

2.4 BELT DRIVES

.1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.

.2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise indicated.

.3 For motors under 10 HP: standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.

.4 For motors [7.5 kW] [10 HP] and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.

.5 Correct size of sheave determined during commissioning.

.6 Minimum drive rating: [1.5] times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

.7 Motor slide rail adjustment plates to allow for centre line adjustment.

.8 Supply one set of spare belts for each set installed.

2.5 DRIVE GUARDS

.1 Provide guards for unprotected drives.

.2 Guards for belt drives;
- .1 Expanded metal screen welded to steel frame.
- .2 Minimum 1.2 mm thick sheet metal tops and bottoms.
- .3 38 mm dia holes on both shaft centres for insertion of tachometer.
- .4 Removable for servicing.

.3 Provide means to permit lubrication and use of test instruments with guards in place.

.4 Install belt guards to allow movement of motors for adjusting belt tension.

.5 Guard for flexible coupling:
- .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
- .2 Securely fasten in place.
- .3 Removable for servicing.

.6 Unprotected fan inlets or outlets:
- .1 Wire or expanded metal screen, galvanized, 19 mm mesh.
- .2 Net free area of guard: not less than 80% of fan openings.
- .3 Securely fasten in place.
- .4 Removable for servicing.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Fasten securely in place.

.2 Make removable for servicing, easily returned into, and positively in position.

3.3 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests:

- .1 Ensure that motors are wired to rotate in the correct direction.

3.4 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 22 05 00 and 23 05 00.

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM A53/A53M-07 , Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A105/A105M-05, Standard Specification for Carbon Steel Forgings, for Piping Applications.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for fixtures, and include product characteristics, performance criteria, physical size, finish and limitations.

.1 Manufacturer, model number, line contents, pressure and temperature rating.

.2 Movement handled, axial, lateral, angular and the amounts of each.

.3 Nominal size and dimensions including details of construction and assembly.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance and operation data for maintenance manuals.

.1 Data to include:

.1 Servicing requirements, including special requirements, stuffing box packing, lubrication and recommended procedures.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance General Contractor’s instructions.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse or disposal as directed by General Contractor.

Part 2 Products

2.1 SLIP TYPE EXPANSION JOINTS

.1 Application: for axial pipe movement, as indicated.

.2 Repacking: under full line pressure.

.3 Body and packing housings: Class 150, 1MPa carbon steel pipe to ASTM A53/A53M, Grade B. Wall thickness to match pipe with ends for welding, slip-on flanges to match pipe.

.4 Slip or traverse sleeves: carbon steel pipe to ASTM A53/A53M, Grade B.

.5 Anchor base: construction steel, welded to body.

.6 Guides (internal and external): embody into packing housing with concentric alignment of slip or traverse sleeve with packing housing.

.7 Extension limit stop: stainless steel, to prevent over-extension with accessible and removable pins.

.8 Packing rings: 6 mm impregnated non-asbestos.

.9 Thermal plastic packing: non-asbestos slug supplied loose.

.10 Lubricating fittings: pet cocks with grease nipple.

.11 Plunger body and plunger:

.1 Plunger body: heavy wall carbon steel welded to body.

.2 Plunger: carbon steel with hex head for use with socket wrench.

.12 Lubricant: to manufacturer's recommendations.

.13 Lubricant gun: complete with hose assembly.

.14 Drip connection: 20 MPa forged steel to ASTM A105/A105M. Include half coupling with drain plug.

2.2 BELLOWS TYPE EXPANSION JOINTS

.1 For axial, lateral or angular movements, as indicated.

.2 Type A: controlled or free flexing, factory tested to 1 ½ times maximum working pressure. Provide test certificates.

.3 Type B: externally pressurized, constant volume, pressure balanced, designed to eliminate pressure thrust, factory tested to 1 ½ times maximum working pressure. Provide test certificates.

.4 Bellows:

.1 Multiple bellows, hydraulically formed, for specified fluid, pressure and temperature, water treatment and pipeline cleaning procedures.

.5 Reinforcing or control rings:

.1 2 piece nickel iron.

.6 Ends: For butt welding, raised face flanges to match pipe] .

.7 Liner: Austenitic stainless steel in direction of flow.

.8 Shroud: Carbon steel, painted.

2.3 GROOVED END EXPANSION JOINTS

.1 Packless, Gasketted, Slip, Expansion Joints:

.1 2413 kPa maximum working pressure.

.2 Steel pipe fitting consisting of telescoping body and slip-pipe sections.

.3 PTFE modified polyphenylene sulfide coated slide section.

.4 Suitable for axial end movement to 75 mm.

.2 Expansion joint consisting of series of grooved end pipe nipples joined in tandem with flexible couplings. Total joint movement dependent on number of couplings and nipples used.

2.4 FLEXIBLE CONNECTION

.1 Application: to suit motion.

.2 Minimum length in accordance with manufacturer's recommendations to suit offset.

.3 Inner hose: stainless steel.

.4 Braided wire mesh or stainless steel outer jacket.

.5 Diameter and type of end connection: as required.

.6 Operating conditions:

.1 To match system requirements.

.7 Three flexible grooved couplings placed in close proximity to vibration source for vibration attenuation and stress relief.

2.5 ANCHORS AND GUIDES

.1 Anchors:

.1 Provide as indicated.

.2 Alignment guides:

.1 Provide as required.

.2 To accommodate specified thickness of insulation.

.3 Vapour barriers, jackets to remain uninterrupted.

Part 3 Execution

3.1 APPLICATION

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

3.2 INSTALLATION

.1 Install expansion joints with cold setting. Make record of cold settings.

.2 Install expansion joints and flexible connections in accordance with manufacturer's instructions.

.3 Install pipe anchors and guides as indicated. Anchors to withstand 150 % of axial thrust.

.4 Do welding Welding] .

3.3 PIPE CLEANING AND START-UP

.1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

3.4 PERFORMANCE VERIFICATION

.1 In accordance with Section 23 08 01- Performance Verification: Mechanical Piping Systems.

3.5 CLEANING

.1 Clean in accordance with General Contractor’s and Engineer’s instructions.

.2 Waste Management: separate waste materials for recycling or disposal in accordance with General Contractor’s requirements.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Sections 22 05 00 and 23 05 00.

1.2 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B40.100-2005, Pressure Gauges and Gauge Attachments.

.2 ASME B40.200-2008, Thermometers, Direct Reading and Remote Reading.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-14.4-M88, Thermometers, Liquid-in-Glass, Self Indicating, Commercial/Industrial Type.

.2 CAN/CGSB-14.5-M88, Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.

.3 Efficiency Valuation Organization (EVO)

.1 International Performance Measurement and Verification Protocol (IPMVP)

.1 IPMVP [2007] Version.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Sections 22 05 00 and 23 05 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for thermometers and pressure gauges and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings in Acrobat PDF format.

.4 Certificates:

.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Test and Evaluation Reports:

.1 Submit certified test reports for thermometers and pressure gauges from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store thermometers and pressure gauges in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect thermometers and pressure gauges from [nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 GENERAL

.1 Design point to be at mid-point of scale or range.

.2 Ranges: as indicated.

2.2 DIRECT READING THERMOMETERS

.1 Industrial, variable angle type, mercury-free, 125 mm scale length: to ASME B40.200 and CAN/CGSB-14.4.

.1 Resistance to shock and vibration.

2.3 REMOTE READING THERMOMETERS

.1 100 mm diameter mercury-free activated dial type: to CAN/CGSB-14.5 and ASME B40.200, accuracy within one scale division, brass movement, stainless steel capillary, spiral armour, stainless steel bulb and polished brass case for wall mounting.

2.4 THERMOMETER WELLS

.1 Copper pipe: copper or bronze.

.2 Steel pipe: brass.

2.5 PRESSURE GAUGES

.1 112 mm, dial type: to ASME B40.100 , Grade 2A, stainless steel bourdon tube having 0.5% accuracy full scale unless otherwise specified.

.2 Provide:

.1 Snubber for pulsating operation.

.2 Diaphragm assembly for corrosive service.

.3 Gasketted pressure relief back with solid front.

.4 Bronze stop cock.

.5 Oil filled for high vibration applications.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions are acceptable for installation in accordance with manufacturer's written instructions.

3.2 GENERAL

.1 Install thermometers and gauges so they can be easily read from floor or platform.
  .1 If this cannot be accomplished, install remote reading units.

.2 Install between equipment and first fitting or valve.

3.3 THERMOMETERS

.1 Install in wells on piping. Include heat conductive material inside well.

.2 Install in locations as indicated and on inlet and outlet of:
  .1 Where indicated.

.3 Install wells as indicated for balancing purposes.

.4 Use extensions where thermometers are installed through insulation.

3.4 PRESSURE GAUGES

.1 Install in locations as follows:

  .1 Air Filters.

  .2 Where indicated.

.2 Install gauge cocks for balancing purposes, elsewhere as indicated.

.3 Use extensions where pressure gauges are installed through insulation.

3.5 NAMEPLATES

.1 Install engraved lamicoid nameplates in accordance with Section 23 05 53 - Identification For HVAC Piping and Equipment] , identifying medium.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with General Contractor’s instructions.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with General Contractor’s directives.

3.7 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by thermometer and gauge installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Sections 22 05 00 and 23 05 00.

1.2 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B31.1-07, Power Piping.

.2 ASTM International (ASTM)

.1 ASTM A125-1996(2007), Standard Specification for Steel Springs, Helical, Heat-Treated.

.2 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A563-07a , Standard Specification for Carbon and Alloy Steel Nuts.

.3 Factory Mutual (FM)

.4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP58-2002, Pipe Hangers and Supports - Materials, Design and Manufacture.

.2 MSS SP69-2003, Pipe Hangers and Supports - Selection and Application.

.3 MSS SP89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.

.5 National Research Council Canada (NRC)

.1 National Plumbing Code of Canada 2015 (NPC).

.6 Underwriter's Laboratories of Canada (ULC)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Sections 22 05 00 and 23 05 00.

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit shop drawings for:

.1 Bases, hangers and supports.

.2 Connections to equipment and structure.

.3 Structural assemblies.

.4 Certificates:

.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Manufacturers' Instructions:

.1 Provide manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into maintenance manual.

1.5 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse or recycling in accordance with General Contractor's instructions.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
.2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP58.
.3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
.4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.

.2 Performance Requirements:

.1 Design supports, platforms, catwalks, hangers to withstand seismic events if specified.

2.2 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with MSS SP58. ANSI B31.1 and

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.3 PIPE HANGERS

.1 Finishes:

.1 Pipe hangers and supports: galvanized after manufacture.

.2 Use electro-plating galvanizing process or hot dipped galvanizing process.

.3 Ensure steel hangers in contact with copper piping are epoxy coated or copper plated.

.2 Upper attachment structural: suspension from lower flange of I-Beam:

.1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut [carbon steel retaining clip] .

.1 Rod: 13 mm FM approved.

.2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed MSS-SP69; FM approved to MSS-SP58.

.3 Upper attachment structural: suspension from upper flange of I-Beam:

.1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, FM approved to MSS SP69; UL listed.

.2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut; FM approved; UL listed.

.4 Upper attachment to concrete:

.1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye is 6 mm minimum greater than rod diameter.

.2 Concrete inserts: wedge shaped body with knockout protector plate UL listed; FM approved to MSS SP69.

.5 Shop and field-fabricated assemblies:

.1 Trapeze hanger assemblies:
.2 Steel brackets:
.3 Sway braces for seismic restraint systems: if specified.

.6 Hanger rods: threaded rod material to MSS SP58:

.1 Ensure that hanger rods are subject to tensile loading only.
.2 Provide linkages where lateral or axial movement of pipework is anticipated.
.3 Do not use 22 mm or 28 mm rod.

.7 Pipe attachments: material to MSS SP58:

.1 Attachments for steel piping: carbon steel [black] [galvanized] .
.2 Attachments for copper piping: copper plated black steel.
.3 Use insulation shields for hot pipework.
.4 Oversize pipe hangers and supports.

.8 Adjustable clevis: material to MSS SP69 UL listed; FM approved, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.

.1 Ensure "U" has hole in bottom for rivetting to insulation shields.

.9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP69.

.10 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563.

.1 Finishes for steel pipework: galvanized or black.

.2 Finishes for copper, glass, brass or aluminum pipework: black; epoxy coated or galvanized, with formed portion plastic coated.

.11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69.

2.4 RISER CLAMPS

.1 Steel or cast iron pipe: galvanized or black carbon steel to MSS SP58, type 42, UL listed; FM approved.

.2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.

.3 Bolts: to ASTM A307.

.4 Nuts: to ASTM A563.

2.5 INSULATION PROTECTION SHIELDS

.1 Insulated cold piping:

.1 64 kg/m^{3}density insulation plus insulation protection shield to: MSS SP69, galvanized sheet carbon steel. Length designed for maximum 3 m span.

.2 Insulated hot piping:

.1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP69.

2.6 CONSTANT SUPPORT SPRING HANGERS

.1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR).

.2 Load adjustability: [10] % minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.

.3 Provide upper and lower factory set travel stops.

.4 Provide load adjustment scale for field adjustments.

.5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.

.6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.7 VARIABLE SUPPORT SPRING HANGERS

.1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.

.2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.

.3 Variable spring hanger complete with factory calibrated travel stops. Provide certificate of calibration for each hanger.

.4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

2.8 EQUIPMENT SUPPORTS

.1 Fabricate equipment supports not provided by equipment manufacturer or other trades from structural grade steel meeting requirements of structural engineer. Submit calculations with shop drawings.

2.9 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

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

2.10 PLATFORMS AND CATWALKS

.1 To relevant section.

2.11 HOUSE-KEEPING PADS

.1 Provide 100 mm high concrete housekeeping pads for base-mounted equipment; size pads 50 mm larger than equipment; chamfer pad edges.

.2 Concrete: to section for Cast-in-Place Concrete.

2.12 OTHER EQUIPMENT SUPPORTS

.1 Fabricate equipment supports from structural grade steel meeting requirements of Section 05 12 23- Structural Steel for Buildings.

.2 Submit structural calculations with shop drawings.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install in accordance with Manufacturer's instructions and recommendations.

.2 Vibration Control Devices:

.1 Install on piping systems at pumps, boilers, chillers, cooling towers, and as indicated.

.3 Clamps on riser piping:

.1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.

.2 Bolt-tightening torques to industry standards.

.3 Steel pipes: install below coupling or shear lugs welded to pipe.

.4 Cast iron pipes: install below joint.

.4 Clevis plates:

.1 Attach to concrete with minimum of 4 concrete inserts, one at each corner.

.5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

.6 Use approved constant support type hangers where:

.1 Vertical movement of pipework is 13 mm or more,
.2 Transfer of load to adjacent hangers or connected equipment is not permitted.

.7 Use variable support spring hangers where:

.1 Transfer of load to adjacent piping or to connected equipment is not critical.
.2 Variation in supporting effect does not exceed 25 % of total load.

3.3 HANGER SPACING

.1 Plumbing piping: to Provincial Plumbing Code and authority having jurisdiction.
.2 Fire protection: to applicable fire code.
.3 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.
.4 Copper piping: up to NPS 1/2: every 1.5 m.

.5 Flexible joint roll groove pipe: in accordance with table below for steel, but not less than one hanger at joints. Table listings for straight runs without concentrated loads and where full linear movement is not required.

.6 Within 300 mm of each elbow.

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

.7 Pipework greater than NPS 12: to MSS SP69.

3.4 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

3.5 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.
.2 Equalize loads.

.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanger performance.
.2 Tighten upper nut after adjustment.

.3 C-clamps:

.1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:

.1 Hammer jaw firmly against underside of beam.

3.7 CLEANING

.1 Clean in accordance with Section [01 74 00- Cleaning] .

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for recycling or reuse in accordance with General Contractor's instructions.

END OF SECTION

.1 PART 1 GENERAL

1.1 SECTION INCLUDES

A. Portable, non-penetrating, rooftop support system for:
1. Outdoor Ductwork.
2. HVAC equipment.
3. Platform Systems.

1.2 REFERENCES

A. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized)
.1 Coatings on Iron and Steel Products.

B. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

C. ASTM A 525 - Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process

D. ASTM D 1929 - Standard Test Method for Determining Ignition Temperature of Plastics.

E. MSS SP-58 - Pipe Hangers and Supports -- Materials, Design and Manufacture;
.1 Manufacturers Standardization Society of the Valve and Fittings Industry.

F. MSS SP-69 - Pipe Hangers and Supports -- Selection and Application; Manufacturers Standardization Society of the Valve and Fittings Industry.

1.3 SYSTEM DESCRIPTION

A. Support piping on roof with an engineered prefabricated PHP System designed for installation without roof penetrations, flashing or damage to the roofing material. The system shall consist of bases, made of high density polypropylene plastics with UV Protection, a HDG structural steel frame and suitable pipe hangers for the application. Nuts, threaded rods and washers shall be HDG, spring nuts and bolts for spring nuts will be electro-plated. System shall be custom designed to fit piping and conduit to be installed and the actual conditions of service.

B. Support ductwork on roof with an engineered prefabricated PHP-Duct System designed for installation without roof penetrations, flashing or damage to the roofing material. The system shall consist of bases, made of high density polypropylene plastics with UV Protection, and a HDG structural steel frame. Nuts, threaded rods and washers shall be HDG, spring nuts and bolts for spring nuts will be electro-plated. System shall be custom designed to fit the load requirements that will be required.

C. Support elevated walkway systems routed across the roof with an engineered prefabricated PHP-Walkway System designed for installation without roof penetrations, flashing or damage to the roofing material. The system shall consist of bases, made of high density polypropylene plastics with UV Protection, a galvanized structural steel frame, walkway planking, and handrail if required. Nuts, threaded rods and washers shall be HDG, spring nuts and bolts for spring nuts will be electro-plated. System shall be custom designed to fit the load requirements that will be required.

D. Support PHP Telecommunication Platform System on the roof with an engineered prefabricated PHP Platform System designed for installation without roof penetration, flashing or damage to the roofing material. The system shall be designed to support all weight as required and shall consist of bases, made of high density polypropylene plastics with UV protection, galvanized substructures, bar grating and handrails if required. Nuts, threaded rods and washers shall be HDG, spring nuts and bolts for spring nuts will be electro-plated.

E. Seismic and High Wind applications are available for all categories listed above.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings: Show installation layout, sizes of units, and details of installation.

D. Verification Samples: Actual samples of bases, each type of support, hanger, and fasteners, and not less than 12 inches (300 mm) of framing members.

E. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

F. Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic checking and adjustment of components.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing pipe support systems, with a minimum of eight years of documented experience.

B. Installer Qualifications: Company approved by manufacturer and with not less than five years of experience in installation of piping support systems.

C. References: Submit list of references comprising not less than 10 installations that have been in use for a minimum of five years. Include contact name and phone numbers for each reference.

D. Pre-Installation Meeting: After approval of submittals, but before beginning installation, conduct a meeting at project site attended by Architect, Contractor, installers of roofing, and mechanical and electrical piping to be installed on pipe support systems.
1. Purpose of meeting is to describe in detail the installation process and to establish agreement, coordination, and responsibilities.
2. Prepare detailed meeting report and distribute copies to the Architect and all attendees.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver all materials to project site in manufacturer's original packaging, marked with manufacturer's name, product model names and catalog numbers, identification numbers, and other related information.

B. Store materials under cover until needed for installation.

1.7 WARRANTY

A. See general conditions for warranty requirements.

B. Warranty: PHP Systems/Design 5 year limited warranty to repair or replace, at our option, any products we find to be structurally defective in material or workmanship. Warranty is not valid if System was modified, installed incorrectly, or not designed by Portable Pipe Hangers. PHP Systems/Design.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: PHP Systems/Design, which is located at: 5534 Harvey Wilson Dr. ; Houston, TX 77020; Toll Free Tel: 800-797-6585; Tel: 713-672-5088; Email: request info (info@phpsd.com); Web: www.phpsd.com

B. Requests for substitutions will be considered.

C Substitutions must be submitted and approved seven days prior to date of pre-bid conference.

2.2 APPLICATION

A. Support pipes and ducts minimum of 24 inches (610 mm) above roof surface.
1. Support Spacing: 6 feet.
2. For Multiple Lines: Portable Pipe Hanger Model number PSE custom.
3. For Ductwork: Portable Pipe Hanger Model number PPH-D - Goal Post style.
4. For Ductwork: Portable Pipe Hanger Model number PPH-D - Enclosed style.
5. Accessories for PSE Custom and Other Applications when required
   a. On Sloped Roof Surfaces, Where Slope Exceeds 1/4 inch per foot (13 mm per 305 mm): Provide base with swivel for slope adjustment. Note: PHP Approved bracing required when using base with swivel.
   b. Un-insulated Piping: Roller support or clevis hanger.
   c. Insulated Piping: Band hanger supported from horizontal strut or clevis hanger with Insulation Protection Shield.
   d. Conduit: Band hanger supported from horizontal strut.
   e. Bracing required when using base with swivel, when pipe exceeds 24 inches (610 mm) above roof, or when thermal expansion of pipe is great.

2.3 MATERIALS

A. Portable Support System: Engineered, portable system specifically designed for installation without the need for roof penetrations or flashings, and without causing damage to the roofing membrane.
1. Design system using high density / high impact polypropylene bases with carbon black, anti-oxidants for UV protection, and steel framing for support is 1-5/8 inch (41 mm) B22TH or 1-7/8 inch (48 mm) BTS22TH.
2. Custom design system to fit piping, conduits, equipment, or walkways to be installed and actual conditions of service and loading.
3. Piping Supports: Provide suitable hangers and supports.
4. Duct and Equipment Supports: Factory fabricated to support exact duct sizes and equipment to be installed.

B. Bases: Injection molded high density / high impact polypropylene with UV-inhibitors and anti-oxidants, conforming to the following:
   1. Moisture Content: Negligible.
   2. Shrinkage/Swelling Due to Moisture: Negligible.
   3. Density: 55.8 lb/cu ft (894 kg/cu m).
   4. Insect Resistance: No known insect damage potential.
   5. Chemical Resistance (oil, brake fluid, gasoline, diesel, antifreeze, battery acid, and sulfuric acid: No visual or physical change apparent.
   6. Flammability: No ignition after 10 minutes, 25 kW/m, when tested in accordance with ASTM D 1929.
   7. Sized as required by loading conditions and as indicated on the drawings.
   8. Shop fabricated with inserts for square tubing or threaded rods as required.
   9. Color: Integral black color as molded.
   10. Bases for Mechanical Attachment: Sealant chamber around penetration point, with injection port for sealing after fastening; beveled lip for sealant bead around entire diameter.
   11. Do not use bases containing carbonated plastics, press molded recycled rubber and plastics, steel, stainless steel, or any injection molded threaded receivers.

C. Steel Framing:
   1. Channel Types: 1-5/8 inch (41.3 mm) B22TH or 1-7/8 inch (47.6 mm) BTS22H, as required for loading conditions.
   2. Thickness: 12 gage (2.7 mm).
   3. Form: Roll-formed 3-sided or tubular shape, perforated with 9/16 inch (14.3 mm) holes at 1-7/8 inch (47.6 mm) centers on three sides.
   4. Finish: Hot dip galvanize in accordance with ASTM A 123 after fabrication, free of roughness, whiskers, unsightly spangles, icicles, runs, barbs, sags, droplets, and other surface blemishes.
   5. Do not use tubing or tube steel.

D. Stainless Steel Framing:
   1. Channel Types: 1-5/8 inch (41.3 mm) or 1-7/8 inch (47.6 mm), as required for loading conditions.
   2. Thickness: 12 gage (2.7 mm).
   3. Form: Roll-formed 3-sided or tubular shape.
   4. Finish: Mill finish.
   5. Do not use tubing or tube steel.

E. Pipe Supports and Hangers: Conform to MSS SP-58 and MSS SP-69 and as follows:
   1. Fabricate of carbon steel where framing is carbon steel; fabricate of stainless steel where framing is stainless steel; finished same as framing.
   2. Sizes 2-1/2 inch (63 mm) and smaller: Single roller supports for piping subject to expansion and contraction; 3-sided channels and pipe clamps.
   3. Sizes 3 inch (76 mm) and larger: Rollers, clevis hangers, or band hangers, to allow for expansion and contraction without movement of the bases or framing.

F. Accessories: Clamps, bolts, nuts, washers, and other devices as required for a complete system.
   1. Carbon Steel: Hot-dip galvanized in accordance with ASTM A 153/A 153M.
   2. Stainless Steel: Mill finish.
   3. For Mechanical Fastening to Deck: On wood and steel decks, use bolts with toggle wings; on concrete decks use threaded rods and adhesive anchors, with rod embedded at least 1-3/4 inches (44 mm) into concrete.

3.3 INSTALLATION

A. Pipe, Duct, Cable, and Conduit Support Systems:
   1. Locate bases and support framing as indicated on drawings and as specified herein. Provide complete and adequate support of all piping, ducts, and conduit, whether or not all required devices are shown.
   2. The use of wood for supporting piping is not permitted.
   3. Provide supports spaced so deflection of piping does not exceed 1/240 of span.
   4. Install framing at spacing indicated, but in no case at greater than 10 feet (3 m) on center.
   5. Accurately locate and align bases.
      a. Consult manufacturer of existing or new roofing system as to the type of isolation pads required between the roof and base.
      b. Set isolation pads in adhesive if required by manufacturer's instructions.
      c. Place bases on isolation pads.
      d. Adhere or mechanically attach if required by code.
      e. Where applicable, replace gravel around bases.
   6. Set framing posts into bases and assemble framing structure as indicated.
   7. Use galvanized fasteners for galvanized framing and stainless steel fasteners for stainless steel framing.

B. Duct Support Systems
   1. Locate bases and support framing as indicated on drawings and as specified herein. Provide complete and adequate support of all piping, ducts, and conduit, whether or not all required devices are shown.
   2. Accurately locate and align bases.
      a. Consult manufacturer of existing or new roofing system as to the type of isolation pads required between the roof and base.
      b. Set isolation pads in adhesive if required by manufacturer's instructions.
      c. Place bases on isolation pads.
      d. Adhere or mechanically attach if required by code.
      e. Where applicable, replace gravel around bases.
   3. Place pre-assembled support on bases and attach framing post to base bracket with 1/2 inch bolts provided and adjust as needed. Support shall be adjustable to maintain existing elevation and slope.
   4. Use galvanized fasteners for galvanized framing and stainless steel fasteners for stainless steel framing.

3.4 FIELD QUALITY CONTROL

A. Provide a factory-trained representative of the manufacturer to visit the site while the work is in progress to assure that the installation conforms to the design requirements and the manufacturer's installation requirements.

3.5 CLEANING AND PROTECTION

A. Remove all packaging, unused fasteners, adhesive, and other installation materials from the project site.

B. Remove adhesive from exposed surfaces of supports and bases, and leave the work in clean condition.

C. Provide protection as required to leave the work in undamaged condition at the time of substantial completion.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.

.2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 QUALIFICATIONS OF TAB PERSONNEL

.1 Submit names of personnel to perform TAB to Engineer within 30 days of award of contract.

.2 Provide documentation confirming qualifications, successful experience.

.3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:

.1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2002.

.2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-1998.

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.

.4 Recommendations and suggested practices contained in the TAB Standard: mandatory.

.5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.

.6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.

.7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.

.8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.

.1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.

.2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.3 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads

.2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.4 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.5 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.6 PRE-TAB REVIEW

.1 Review Contract Documents before project construction is started, and confirm in writing to Engineer adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to Engineer in writing proposed procedures which vary from standard.

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

1.7 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in Division 23.

1.8 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required for verification of TAB reports.

1.9 START OF TAB

.1 Notify Engineer and General Contractor days prior to start of TAB.
.2 Start TAB when building is essentially completed, including:
.3 Installation of ceilings, doors, windows, other construction affecting TAB.
.4 Application of weatherstripping, sealing, and caulking.
.5 Pressure, leakage, other tests specified elsewhere Division 23.
.6 Provisions for TAB installed and operational.

.7 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.

.2 Air systems:

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

1.10 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:

.1 HVAC systems: plus 5%, minus 5%.

1.11 ACCURACY TOLERANCES

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

1.12 INSTRUMENTS

.1 As part of TAB report, provide list of instruments used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate within 3 months of TAB.

1.13 PRELIMINARY TAB REPORT

.1 Submit for checking and approval of Engineer, prior to submission of formal TAB report, sample of rough TAB sheets. Include:

.1 Details of instruments used.
.2 Details of TAB procedures employed.
.3 Calculations procedures.
.4 Summaries.

1.14 TAB REPORT

.1 Format in accordance with [referenced standard] .

.2 TAB report to show results in SI units and to include:

.1 Project record drawings.
.2 System schematics.

.3 Submit Acrobat PDF copy of TAB Report to Engineer for review.

1.15 VERIFICATION

.1 Reported results subject to verification by Engineer.

.2 Provide personnel and instrumentation to verify up to 30% of reported results.

.3 Number and location of verified results as directed by Engineer.

.4 Pay costs to repeat TAB as required to satisfaction of Engineer.

1.16 SETTINGS

.1 After TAB is completed to satisfaction of Engineer, reinstall drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.

.2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

1.17 COMPLETION OF TAB

.1 TAB considered complete when final TAB Report received and approved by Engineer.

1.18 AIR SYSTEMS

.1 Standard: TAB to most stringent of this section TAB standards of SMACNA, AABC, ASHRAE.

.2 Do TAB of following systems, equipment, components, and controls:

.1 All air systems.

.3 Qualifications: personnel performing TAB qualified to standards of AABC; current member in good standing of AABC.

.4 Quality assurance: perform TAB under direction of supervisor qualified by AABC.

.5 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

.6 Locations of equipment measurements: to include as appropriate:

.1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.

.2 At controllers, controlled device.

.7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.19 OTHER TAB REQUIREMENTS

.1 General requirements applicable to work specified this paragraph:

.1 Qualifications of TAB personnel: as for air systems specified this section.

.2 Quality assurance: as for air systems specified this section.

.2 Building pressure conditions:

.1 Adjust HVAC systems, equipment, controls to ensure specified pressure conditions where specified.

.2 TAB procedures:

Part 2 Products

2.1 HVAC Components

.1 Belts, sheaves and pulleys.

Part 3 Execution

3.1 HVAC Components

.1 Replace belts, sheaves and pulleys as required to meet air flow requirements for belt driven fan systems.

.2 Assist HVAC contractor in changing motor speeds if required for multi-speed motors.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Sections 22 05 00 and 23 05 00.

1.2 REFERENCE STANDARDS

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

.1 ANSI/ASHRAE/IESNA 90.1-04, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 ASTM International (ASTM)

.1 ASTM B209M-07, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

.2 ASTM C335-05ae1, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.

.3 ASTM C411-05, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.4 ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.5 ASTM C547-07e1, Standard Specification for Mineral Fiber Pipe Insulation.

.6 ASTM C553-02e1, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.7 ASTM C612-04e1, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

.8 ASTM C795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.9 ASTM C921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.3 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.4 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (2005).

.5 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102-03, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

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

1.3 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - means "not concealed" as previouslydefined.

.3 Insulation systems - insulation material, fasteners, jackets, and other accessories.

.2 TIAC Codes:

.1 CRD: Code Round Ductwork,

.2 CRF: Code Rectangular Finish.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Sections 22 05 00 and 23 05 00.

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for duct insulation, and include product characteristics, performance criteria, physical size, finish and limitations.

.1 Description of equipment giving manufacturer's name, type, model, year and capacity.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list.

.3 Samples:

.1 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed if requested.

.2 Mount sample on 12 mm plywood board.

.3 Affix typewritten label beneath sample indicating service.

.4 Manufacturers' Instructions:

.1 Provide manufacture's written duct insulation jointing recommendations. and special handling criteria, installation sequence, cleaning procedures.

1.5 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project

1.6 DELIVERY, STORAGE AND HANDLING

1.7 Deliver, store and handle in accordance with manufacturer's written instructions.

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address and ULC markings.

.2 Packaging Waste Management: remove for reuse or recycling in accordance with General Contractor's instructions.

Part 2 Products

2.1 FIRE AND SMOKE RATING

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

2.2 INSULATION

.1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.

.3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with factory applied vapour retarder jacket to CGSB 51-GP-52Ma.

.4 TIAC Code C-2: Mineral fibre blanket to ASTM C553 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).

- .1 Mineral fibre: to ASTM C553.
- .2 Jacket: to CGSB 51-GP-52Ma.
- .3 Maximum "k" factor: to ASTM C553.

2.3 JACKETS

.1 Canvas:

- .1 220 gm/m^2cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.2 Lagging adhesive: compatible with insulation.

- .1 Maximum VOC limit as per Authorities Having Jurisdiction.

.3 Aluminum:
- .1 To ASTM B209 with moisture barrier.
- .2 Thickness: 0.50 mm sheet.
- .3 Finish: Smooth.
- .4 Jacket banding and mechanical seals: 12 mm wide, 0.5 mm thick stainless steel.

.4 PVC:
- .1 PVC Jacket provided by manufacturer.

2.4 ACCESSORIES

.1 Vapour retarder lap adhesive:

- .1 Water based, fire retardant type, compatible with insulation.
  - .1 Maximum VOC limit as permitted by AHJ.

.2 Indoor Vapour Retarder Finish:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449.

.4 ULC Listed Canvas Jacket:

.1 220 gm/m^2cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.5 Contact adhesive: quick-setting

.1 Maximum VOC limit as permitted by AHJ.

.6 Canvas adhesive: washable.

.1 Maximum VOC limit as permitted by AHJ.

.7 Tie wire: 1.5 mm stainless steel.

.8 Banding: 12 or 19 mm wide, 0.5 mm thick stainless steel.

.9 Facing: 25 mm galvanized steel hexagonal wire mesh stitched on one face of insulation with expanded metal lath on both faces of insulation.

.10 Fasteners: 4 mm diameter pins with 35 mm square diameter clips, length to suit thickness of insulation.

Part 3 Execution

3.1 APPLICATION

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

3.2 PRE-INSTALLATION REQUIREMENTS

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

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards.
.2 Apply materials in accordance with manufacturers instructions and as indicated.
.3 Use 2 layers with staggered joints when required nominal thickness exceeds 75 mm.
.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
.1 Ensure hangers, and supports are outside vapour retarder jacket.

.5 Hangers and supports in accordance with [Section 23 05 29- Hangers and Supports for HVAC Piping and Equipment] .

.1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.

.6 Fasteners: install at 300 mm on centre in horizontal and vertical directions, minimum [2] rows each side.

3.4 DUCTWORK INSULATION SCHEDULE

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

TIAC Code	Code	Vapour Retarder	Thickness (mm)
Rectangular cold and dual temperature supply air ducts	C-1	Yes	25
Round cold and dual temperatire supply air ducts	C-2	Yes	25
Rectangular warm air ducts	C-1	No	25
Round warm air ducts	C-1	No	25
Supply, return and exhaust ducts exposed in space being served	None		
Outside air ducts to mixing plenum	C-1	Yes	25
Mixing plenums	C-1	Yes	25
Exhaust duct between dampers and louvres	C-1	Yes	25
Rectangular ducts outside	C-1	See drawings	50
Round ducts outside	C-1	See drawings	50
Acoustically lined ducts	none	See drawings	

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

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

.1 Finishes: conform to following table:

TIAC Code		
Rectangular	Round	
Indoor, concealed	None	none
Indoor, exposed within mechanical room	CRF/1	CRD/2
Indoor, exposed elsewhere	CRF/2	CRD/3
Outdoor, exposed to precipitation	CRF/3	CRD/4
Outdoor, elsewhere	CRF/4	CRD/5

3.5 CLEANING

.1 Clean in accordance with Section [01 74 00- Cleaning] .

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for reuse or recycling in accordance with General Contractor’s instructions.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Sections 22 05 00 and 23 05 00.

1.2 REFERENCE STANDARDS

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

.1 ANSI/ASHRAE 90.1-04 -SI Edition, Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 ASTM International (ASTM)

.1 ASTM C335-05ae1, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.2 ASTM C449/C449M-07, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.3 ASTM C533-07, Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.

.4 ASTM C547-07, Standard Specification for Mineral Fiber Pipe Insulation.

.5 ASTM C553-02, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.6 ASTM C612-04e1, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

.7 ASTM C795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.8 ASTM C921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.3 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52MA-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.2 CAN/CGSB 51.53-95, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.5 Thermal Insulation Association of Canada (TIAC)

.1 National Insulation Standards 2005.

.6 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102-07, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Sections 22 05 00 and 23 05 00.

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for insulation and adhesives, include product characteristics, performance criteria, physical size, finish and limitations.

.2 Provide WHMIS MSDS - Material Safety Data Sheets in accordance with Health and Safety Requirements.

.3 Samples:

.1 Provide for review and approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed if requested.

.1 Mount sample on 12 mm plywood board.

.2 Affix typewritten label beneath sample indicating service.

.4 Manufacturer's Instructions:

.1 Include procedures to be used and installation standards to be achieved.

.5 Qualifications:

.1 Installer to be specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with manufacturer’s instructions.

.2 Deliver materials to site in original factory packaging with original labels.

.3 Store at temperatures and conditions recommended by manufacturer.

.4 Packaging Waste Management: remove for reuse or recycling in accordance with General Contractor’s instructions .

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 Fire and smoke ratings to CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre: includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.

.3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.

.1 Mineral fibre: ASTM C547.

.2 Maximum "k" factor: ASTM C547.

.4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.
- .1 Mineral fibre: ASTM C547.
- .2 Jacket: to CGSB 51-GP-52MA.
- .3 Maximum "k" factor: ASTM C547.

.5 TIAC Code C-1: rigid mineral fibre board, unfaced.
- .1 Mineral fibre: ASTM C612.
- .2 Maximum "k" factor: ASTM C612.

.6 TIAC Code C-4: rigid mineral fibre board faced with factory applied vapour retarder jacket.
- .1 Mineral fibre: ASTM C612.
- .2 Jacket: to CGSB 51-GP-52MA.
- .3 Maximum "k" factor: ASTM C612.

.7 TIAC Code C-2: mineral fibre blanket unfaced or faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).
- .1 Mineral fibre: ASTM C553.
- .2 Jacket: to CGSB 51-GP-52MA.
- .3 Maximum "k" factor: ASTM C553.

.8 TIAC Code A.6: flexible unicellular tubular elastomer.
- .1 Insulation: with vapour retarder jacket.
- .2 Jacket: to CGSB 51-GP-52MA.
- .3 Maximum "k" factor.
- .4 Certified by manufacturer free of potential stress corrosion cracking corrodents.

.9 TIAC Code A-2: rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.
- .1 Insulation: ASTM C533.
- .2 Maximum "k" factor: ASTM C533.
- .3 Design to permit periodic removal and re-installation.

2.3 CEMENT

.1 Thermal insulating and finish
- .1 To: ASTM C449/C449M.
- .2 Hydraulic setting or Air drying on mineral wool, to ASTM C449.

2.4 JACKETS

.1 Polyvinyl Chloride (PVC):
- .1 One-piece moulded type to CAN/CGSB 51.53 with pre-formed shapes as required.
- .2 Colours: White.
- .3 Minimum service temperatures: -20 degrees C.
- .4 Maximum service temperature: 65 degrees C.
- .5 Moisture vapour transmission: 0.02 perm.
- .6 Thickness:

.7 Fastenings:

.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.

.2 Tacks.

.3 Pressure sensitive vinyl tape of matching colour.

.8 Special requirements:

.1 Outdoor: UV rated material at least 0.5 mm thick.

.9 Covering adhesive: compatible with insulation.

.1 Maximum VOC limit as per AHJ.

.2 Canvas:

.1 [120] [220] gm/m^2cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.2 Lagging adhesive: compatible with insulation.

.1 Maximum VOC limit [250] [80] [30] g/L [GSES GS-36] [to SCAQMD Rule 1168] and in accordance with Section [01 35 21- LEED Requirements] .

.3 Aluminum:

.1 To ASTM B209.
.2 Thickness: 0.50 mm sheet.
.3 Finish: smooth.
.4 Joining: longitudinal and circumferential slip joints with 50 mm laps.
.5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
.6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

2.5 INSULATION SECUREMENTS

.1 Tape: self-adhesive, aluminum, [reinforced] [plain] , [50] mm wide minimum.

.2 Contact adhesive: quick setting.

.1 Maximum VOC limit [250] [80] [30] g/L [GSES GS-36] [to SCAQMD Rule 1168] and in accordance with Section [01 35 21- LEED Requirements] .

.3 Canvas adhesive: washable.

.1 Maximum VOC limit [250] [30] [80] g/L [to SCAQMD Rule 1168] [GSES GS-36] and in accordance with Section [01 35 21- LEED Requirements] .

.4 Tie wire: [1.5] mm diameter stainless steel.

.5 Bands: Stainless steel, [19] mm wide, [0.5] mm thick.

.6 Facing: 25 mm [galvanized] steel hexagonal wire mesh on [on one face of insulation with expanded metal lath on other face] [[one face] [both faces] of insulation] .

.7 Fasteners: [2] [4] mm diameter pins with [35] mm [diameter] [square] clips. Length of pin to suit thickness of insulation.

2.6 VAPOUR RETARDER LAP ADHESIVE

.1 Water based, fire retardant type, compatible with insulation.
.1 Maximum VOC limit as required by AHJ.

2.7 INDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

2.8 OUTDOOR VAPOUR RETARDER MASTIC

.1 Vinyl emulsion type acrylic, compatible with insulation.
.2 Reinforcing fabric: Fibrous glass, untreated 305 g/m^2.

Part 3 Execution

3.1 APPLICATION

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

3.2 PRE- INSTALLATION REQUIREMENTS

.1 Pressure testing of equipment and adjacent piping systems complete, witnessed and certified.

.2 Surfaces clean, dry, free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards

.1 Hot equipment: To TIAC code 1503-H.
.2 Cold equipment: to TIAC code 1503-C.

.2 Elastomeric Insulation:to remain dry. Overlaps to manufacturer's instructions. Joints tight and sealed properly.

.3 Provide vapour retarder as recommended by manufacturer.

.4 Apply materials in accordance with insulation and equipment manufacturer's instructions and this specification.

.5 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.

.6 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
.1 Hangers, supports outside vapour retarder jacket.

.7 Supports, Hangers:
.1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

.1 Application: At expansion joints , valves, primary flow measuring elements, flanges and unions at equipment.

.2 Installation to permit periodic removal and replacement; to permit movement of expansion joints without damage to adjacent insulation.

3.5 EQUIPMENT INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.

.2 Hot Equipment:

- .1 TIAC code C-1 with mechanical fastenings and 13 mm cement reinforced with one layer of reinforcing mesh.
- .2 TIAC code C-2 unfaced with bands and 13 mm cement precede by one layer of reinforcing mesh.
- .3 Thicknesses:
  - .1 Domestic hot water storage tanks - 25 mm
  - .2 Heat exchangers – 25 mm

.3 Breechings, engine exhausts and mufflers:

- .1 TIAC code A-2 with 25 mm air gap, mechanical fastenings and 13 mm cement reinforced with one layer of reinforcing mesh.

.4 Cold equipment:

- .1 TIAC C-4 with mechanical fastenings and 13 mm cement reinforced with one layer of reinforcing mesh.
- .2 TIAC C-2 faced with vapour retardant jacket and with bands and 13 mm cement preceded by one layer of reinforcing mesh.
- .3 TIAC C-4 with mechanical fastenings.
- .4 Thicknesses: chillers (except factory insulated) 50 mm.

.5 Finishes:

- .1 Engine exhaust piping and muffler: To TIAC code CRF-4.
- .2 Equipment in mechanical rooms: TIAC code CEF/1
- .3 Equipment elsewhere: TIAC code CEF/2 with 13 mm cement jacket.

3.6 CLEANING

.1 Clean in accordance with General Contractor’s instructions.Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for recycling or reuse in accordance with General Contractor’s instructions.

END OF SECTION

PART 1 - GENERAL

1.1 Scope Of Work

.1 This specification covers the materials, methods, and installation of thermal insulation for refrigeration piping and equipment, including but not limited to, refrigeration suction, sub-cooled liquid piping, and evaporator coil condensate piping, for the purpose of condensation control, freeze prevention, and energy savings.

1.2 References

1. ASTM (American Society for Testing and Materials)
2. ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers)
3. NSF (National Sanitation Foundation)
4. OSHA (Occupational Safety & Health Administration)

1.3 Definitions

1. Thermal Conductivity (K-value): The time rate of steady state heat flow through a unit area of a homogeneous material induced by a unit temperature gradient in a direction perpendicular to that unit area. Typically expressed in units of Btu-inch / hour per square foot per degree F. The lower the K-value, the higher the insulating value.

.2 Water Vapor Transmission Rate: The steady water vapor flow in unit time through unit area of a body, normal to specific parallel surfaces, under specific conditions of temperature and humidity at each surface. Any additional special terms or definitions should be inserted in this section.

1.4 Quality Assurance

.1 All insulation recommendations/design criteria are based on products manufactured by K-Flex USA.

.2 Material shall be delivered in non-broken, factory-furnished packaging and stored in a clean, dry indoor space that provides protection against the weather.

.3 Insulation shall be applied by qualified personnel skilled in this trade.

1.5 Submittals For Information

.1 Product data: To include product description, manufacturer’s installation instructions, types of insulation and recommended thicknesses for each application, and location of materials.

.2 Samples of systems shall be provided upon engineer’s request.

1.6 Codes, Regulations & Standards

.1 Insulation systems, repairs, additions and alterations shall be furnished and installed in accordance with industry standards (ASHRAE) and such statutory provisions (national, state and local codes) as apply to the work under contract. All systems shall be installed according to the manufacturer's recommended practices.

.2 All material shall conform to specified ASTM Standards where applicable, principally ASTM E84 and ASTM C534.

.3 When applicable all materials shall conform to NSF or other requirements that are mandated for the application or equipment.

.4 Contractors shall conform to all OSHA and other published practices for the installation of insulation.

PART 2 – PRODUCTS

2.1 Insulation Materials

.1 Physical Properties:
- .1 Insulation shall have a maximum thermal k value of 0.25 BTU - in./hr. - ft2 - °F (0.036 W/mK) when tested according to ASTM C177 or C518 at 75°F (24°C) mean temperature.
- .2 Insulation shall have a water vapor transmission rate of 0.01 perm - inch or less when tested according to ASTM E96 (dry cup method).
- .3 Insulation shall have a flame spread of 25 or less and a smoke development rating of 50 or less when tested according to ASTM E84 at the installed thickness for applications inside the building envelope.
- 4. Insulation materials shall be manufactured without the use of CFCs, HFCs, or HCFCs and also be free of formaldehyde, fibers and dust.
- 5. Insulation materials shall be UL GREENGUARD® Gold Certified for VOC content.
- 6. Insulation shall be UL Validated as Mold Resistant per UL 2824 / ASTM D6329.
- 7. Insulation materials installed indoors that are exposed to food prep or wash down areas shall be NSF-certified to Standard 169, "Special Purpose Food Equipment and Devices".
- 8. Insulation materials shall be manufactured under the supervision of an independent third party testing program verifying the properties of K-value (thermal conductivity), wvt (water vapor transmission) and fire performance.

.2 Flexible Elastomeric: Closed Cell Flexible Elastomeric Foam Insulation that complies with ASTM C 534, Type I for tubular material and Type II for sheet material.
- .1 Products: Subject to compliance with requirements, available products that may be incorporated include, but are not limited to, the following:
  - a. K-Flex USA; Insul-Tube, Insul-Lock DS, Insul-TubeWhite, Insul-Lock DS White, K-Fit Fittings

.2 Product Recommendations: Recommendations for different applications are as follows:
   a. Pipe and Equipment Insulation: Insul-Tube, Insul-Lock DS, Insul-Tube White, InsulLock DS White tubular insulation supplied up to 2" wall thickness.
   b. Factory Fabricated Fittings (Elbows, Tees, P-Traps): K-Fit

2.2 Adhesives

.1 Flexible Elastomeric Adhesives: For adhering all seams, butts and ends, and adhering sheet insulation to substrates.
   .1 Products: Subject to compliance with requirements, available products that may be incorporated include, but are not limited to, the following:
      a. K-Flex USA; K-Flex Contact Adhesive (373, 320, 420, 620, 720 LVOC, or 1120)
   2. Product Recommendations: Recommendations for different applications are as follows:
      a. Fast Dry Adhesives: K-Flex 320 (Amber Color) or 620 (Black Color)
      b. Comply with MIL-A-24179: K-Flex 373 (Blue Color)
      c. LEED Projects: K-Flex 720 LVOC and K-Flex 1120. These adhesives meet the VOC requirements of South Coast Air Quality Management District (SCAQMD) Regulation 1168.
      d. Water Based: K-Flex 1120
      e. Comply with ASTM C916 Type 1: K-Flex 1120

2.3 Factory Or Field Applied Jackets And Finishes

.1 Jacketing shall be a PVC Composite Jacket (PCJ) in lieu of metal or PVC jacketing:

.2 PCJ shall have a maximum permeance of 0.001 perms when tested according to ASTM E 96 (dry cup method), shall be puncture and dent resistant, shall have a minimum thickness of 0.012", shall have a flame/smoke rating of 25/50 or less when tested according to ASTM E 84 for indoor applications, and shall be NSF-certified for use in food prep or wash down areas.
   1. Products: Subject to compliance with requirements, available products that may be incorporated include, but are not limited to, the following:
      a. K-Flex USA; K-Flex Clad WT, K-Flex Clad AL.

   2. Products Recommendations: Recommendations for different applications are as follows:
      a. Indoor NSF certified applications: K-Flex Clad WT or WT NS
      b. Outdoor Jacket: K-Flex Clad AL or AL NS
      c. Outdoor Finish (UV Protection Only): K-Flex 374 Protective Coating

2.4 Insulated Pipe Supports

.1 Insulated pipe supports shall be used at pipe hanger locations to prevent the insulation from compressing, shall be comprised of a load-bearing rigid foam insert (high-density urethane or equivalent) with elastomeric foam collars, and shall have a minimum compressive strength of 72 psi.

1. Products: Subject to compliance with requirements, available products that may be incorporated include, but are not limited to, the following:
   a. K-Flex USA; K-Flex 360 Insulated Pipe Support

PART 3 – EXECUTION

3.1 Examination And Preparation

.1 All insulation work shall be performed by trained personnel regularly engaged in the insulation trade.

.2 Progressive testing of systems to be insulated shall have been completed, inspected and approved by owner's representative before insulation is applied. Guide Specification: Refrigeration Systems

.3 Insulation shall not be applied until all surfaces are clean, dry and free of dirt, grease, moisture or other imperfections. Insulation should not be applied to surfaces that are wet or frosted. Insulation should not be applied to a system that is in operation.

.4 All refrigerant copper lines must be free of extraneous chemicals, such as corrosive cleaners or building material's dust, prior to installation.

.5 Suitable application temperatures and conditions shall be provided by the Owner and in compliance with the installers design criteria.

.6 All materials, including accessories (i.e. adhesive, coatings, etc.) shall be shipped to the job site in marked, unopened containers as received from the manufacturer. All boxes shall be identified with a manufacturing lot number allowing traceability back to the manufacturing date.

.7 All insulation materials shall comply with specification requirements (material type, thickness and ID).

.8 Insulation shall be protected from moisture and weather during storage and installation. Insulation must be clean and dry prior to installation.

3.2 Installation Of Flexible Elastomeric Insulation

.1 Install refrigeration piping insulation in accordance with ASTM C1710 and manufacturer's recommendations.

.2 Install insulation using the following general guidelines:

1. Install pipe insulation by sliding non-slit sections over the open ends of pipe.
2. Refrigerant pipe shall be sealed while slipping on insulation to prevent foreign matter from entering the tube. Insulation shall be pushed onto the pipe, never pulled. Stretching of insulation may result in open seams and joints.
3. Do not slit tubes for straight pipe sections unless unavoidable.
4. Longitudinal seams shall be installed facing down in order to reduce weight and pressure on the seam.
5. All seams, butts and ends shall be completely sealed to retard moisture vapor from entering the system using K-Flex contact adhesive. Do not tape insulation joints.
6. All fittings (elbows, tees, P-traps) shall be insulated with the same insulation thickness as the adjacent piping. All seams and mitered joints shall be adhered with K-Flex contact adhesive.
7. Insulation shall be adhered directly to the pipe using a two-inch strip of K-Flex contact adhesive on the ID of the insulation and on the pipe at the following locations: high end Guide Specification: Refrigeration Systems of the pipe run, every termination point (supports, valves, flanges, end of pipe run), and every 18 feet of the pipe run.
8. K-Flex 360 Insulated Pipe Supports, comprised of high-density rigid foam inserts with elastomeric foam collars, shall be installed at all pipe hanger locations to prevent the insulation from compressing. The pipe support shall have with the same insulation thickness as the pipe insulation. All joints shall be sealed with K-Flex contact adhesive. Saddles shall be installed under all insulated lines at locations where the hanger may move due to movement in the piping from expansion and contraction.
9. All outdoor piping exposed to sunlight and weather shall be covered with a PCJ field or factory applied, or shall be painted with two coats of K-Flex 374 Protective Coating. Prior to applying 374 Protective Coating, the insulation shall be wiped clean with denatured alcohol. All outdoor exposed piping seams shall face downward.

.3 Piping Insulation Thickness Schedule:

1. All liquid and suction lines shall be insulated continuously from a point 6” inside the display case to the suction service valve at the compressor.
2. Pipes to be insulated include, but may not be limited to, domestic water, roof drain, condensate drain, evaporator condensate, liquid / suction refrigerant, ammonia, glycol secondary loop, and CO2 secondary loop.
3. Miscellaneous piping subject to sweating under normal operating conditions shall be insulated.
4. Piping design must allow for adequate spacing of insulation thickness and cross ventilation around the insulation. Do not crowd the insulation.

Refrigeration Piping System	≤1½”	1½” to 4”	>4” to 6”
Above 25°F	¾”	1”	1”
11°F to 25°F	¾”	1”	1”
-9°F to 10°F	1”	1”	1¼”
-30°F to -10°F	1¼”	1¼”	1½”
<-30°F (-34°C)	Contact K-Flex USA for recommendation		

- End of Section -

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASME

.1 ASME B16.22-12, Wrought Copper and Copper Alloy Solder - Joint Pressure Fittings.

.2 ASME B16.24-11, Cast Copper Pipe Flanges and Flanged Fittings: Class 150, 300, 600, 900, 1500 and 2500.

.3 ASME B16.26-11, Cast Copper Alloy Fittings for Flared Copper Tubes.

.4 ASME B31.5-10, Refrigeration Piping and Heat Transfer Components.

.2 ASTM International (ASTM)

.1 ASTM A307-12, Standard Specification for Carbon Steel Bolts and Studs, and Threaded Rod 60,000 PSI Tensile Strength.

.2 ASTM B280-08, Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

.3 CSA Group (CSA)

.1 CSA B52-05(R2009), B52 Package, Mechanical Refrigeration Code.

.4 Environment Canada (EC)

.1 EPS 1/RA/1-96, Environmental Code of Practice for the Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Pre-installation Meetings:

.1 Convene pre-installation meeting prior to beginning work of this Section with General Contractor and other trades to:

.1 Verify project requirements.

.2 Review installation and site conditions.

.3 Co-ordination with other building construction subtrades.

.4 Review manufacturer's written installation instructions and warranty requirements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit shop drawings in Acrobat PDF in accordance with Sections 22 05 00 and 23 05 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for refrigerant piping, fittings and equipment and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS MSDS sheets. Indicate VOC's for adhesive and solvents during application and curing.

.3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties if requested.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties if requested.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Sections 22 05 00 and 23 05 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for refrigerant piping for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect refrigerant piping, fittings and equipment from [nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 TUBING

.1 Processed for refrigeration installations, deoxidized, dehydrated and sealed.

.1 Hard copper: to ASTM B280, type B ACR.

.2 Annealed copper: to ASTM B280, with minimum wall thickness as per CSA B52 and ASME B31.5.

2.2 FITTINGS

.1 Service: design pressure 2070 kPa and temperature 121 degrees C or as specified.

.2 Brazed:
.1 Fittings: wrought copper to ASME B16.22.
.2 Joints: silver solder, copper-phosphorous, 95% Cu-5%P and non-corrosive flux.

.3 Flanged:
.1 Bronze or brass, to ASME B16.24, Class 150 and Class 300.
.2 Gaskets: suitable for service.
.3 Bolts, nuts and washers: to ASTM A307, heavy series.

.4 Flared:
.1 Bronze or brass, for refrigeration, to ASME B16.26.

2.3 PIPE SLEEVES

.1 Hard copper or steel, sized to provide 6 mm clearance around between sleeve and uninsulated pipe or between sleeve and insulation.

2.4 VALVES

.1 22 mm and under: Class 500, 3.5 Mpa, globe or angle non-directional type, diaphragm, packless type, with forged brass body and bonnet, moisture proof seal for below freezing applications, brazed connections.

.2 Over 22 mm: Class 375, 2.5 Mpa, globe or angle type, diaphragm, packless type, back-seating, cap seal, with cast bronze body and bonnet, moisture proof seal for below freezing applications, brazed connections.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that site conditions are acceptable for refrigerant piping installation in accordance with manufacturer's written instructions.

.1 Visually inspect site conditions before proceeding with work.

.2 Inform Engineer and General Contractor of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 MANUFACTURER'S INSTRUCTIONS

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

3.3 GENERAL

.1 Install in accordance with CSA B52, EPS1/RA/1 and ASME B31.5 Section 23 05 05-Installation of Pipework.

3.4 BRAZING PROCEDURES

.1 Bleed inert gas into pipe during brazing.
.2 Remove valve internal parts, solenoid valve coils, sight glass.
.3 Do not apply heat near expansion valve and bulb.

3.5 PIPING INSTALLATION

.1 General:

.1 Hard drawn copper tubing: do not bend. Minimize use of fittings

.2 Soft annealed copper tubing: bend without crimping or constriction.

.2 Hot gas lines:
- .1 Pitch at least 1:240 down in direction of flow to prevent oil return to compressor during operation.
- .2 Provide trap at base of risers greater than 2400 mm high and at each 7600 mm thereafter.
- .3 Provide inverted deep trap at top of risers.
- .4 Provide double risers for compressors having capacity modulation.
  - .1 Large riser: install traps as specified.
  - .2 Small riser: size for 5.1 m^3/s at minimum load. Connect upstream of traps on large riser.

3.6 PRESSURE AND LEAK TESTING

.1 Close valves on factory charged equipment and other equipment not designed for test pressures.

.2 Leak test to CSA B52 before evacuation to 2 MPa and 1 MPa on high and low sides respectively.

.3 Test procedure: build pressure up to 35 kPa with refrigerant gas on high and low sides. Supplement with nitrogen to required test pressure. Test for leaks with electronic or halide detector. Repair leaks and repeat tests.

3.7 FIELD QUALITY CONTROL

.1 Site Tests/Inspection: Close service valves on factory charged equipment.

.2 Ambient temperatures to be at least 13 degrees C for at least 12 hours before and during dehydration.

.3 Use copper lines of largest practical size to reduce evacuation time.

.4 Use two-stage vacuum pump with gas ballast on 2nd stage capable of pulling 5 Pa absolute and filled with dehydrated oil.

.5 Measure system pressure with vacuum gauge. Take readings with valve between vacuum pump and system closed.

.6 Triple evacuate system components containing gases other than correct refrigerant or having lost holding charge as follows:
- .1 Twice to 14 Pa absolute and hold for 4 hours.
- .2 Break vacuum with refrigerant to 14 kPa.
- .3 Final to 5 Pa absolute and hold for at least 12 hours.
- .4 Isolate pump from system, record vacuum and time readings until stabilization of vacuum.
- .5 Submit test results to Engineer.

.7 Charging:
- .1 Charge system through filter-drier and charging valve on high side. Low side charging not permitted.

.2 With compressors off, charge only amount necessary for proper operation of system. If system pressures equalize before system is fully charged, close charging valve and start up. With unit operating, add remainder of charge to system.

.3 Re-purge charging line if refrigerant container is changed during charging process.

.8 Checks:

.1 Make checks and measurements as per manufacturer's operation and maintenance instructions.

.2 Record and report measurements to [Departmental Representative] [DCC Representative] [Consultant] .

.9 Manufacturer's Field Services:

.1 If requested, have manufacturer of products, supplied under this Section, review Work involved in the handling, installation/application, protection and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of Work with Contract.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.8 CLEANING

.1 Progress Cleaning: clean in accordance with General Contractor’s instructions.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Waste Management: separate waste materials for recycling or reuse in accordance with General Contractor’s instructions.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

.2 ASTM International (ASTM)

.1 ASTM A480/A480M-12 , Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.2 ASTM A635/A635M-09b, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for.

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

.3 National Fire Protection Association (NFPA)

.1 NFPA 90A-12, Standard for the Installation of Air-Conditioning and Ventilating Systems.

.2 NFPA 90B-12, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

.3 NFPA 96-11, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

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

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2005.

.2 SMACNA HVAC Air Duct Leakage Test Manual, 2012.

.3 IAQ Guideline for Occupied Buildings Under Construction 2007.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 23 05 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for metal ducts and include product characteristics, performance criteria, physical size, finish and limitations if requested.

.3 Shop Drawings:

.1 Submit shop drawings if requested for specialized fittings.

.4 Test and Evaluation Reports:

.1 Certification of Ratings:

.1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with General Contractor's instructions.

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

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect metal ducts from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse or recycling as directed by General Contractor.

Part 2 Products

2.1 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
500	C
250	C
125	C

.2 Seal classification:

.1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.

.2 Class B: longitudinal seams, transverse joints and connections made airtight with tape and sealant.

.3 Class C: transverse joints and connections made air tight with gaskets, tape and sealant. Longitudinal seams unsealed.

.4 Unsealed seams and joints.

2.2 SEALANT

.1 Sustainability Characteristics:

.1 Adhesives and sealants: as required.

.2 Adhesives and sealants: VOC limits as per Authorities Having Jurisdiction.

.2 Sealant: oil resistant, water borne, polymer type flame resistant duct sealant. Temperature range of minus 30 degrees C to plus 93 degrees C.

2.3 TAPE

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.4 DUCT LEAKAGE

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

2.5 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radiused elbows:
- .1 Rectangular: standard radius 2 times width of duct.
- .2 Round: smooth radius 2 times diameter.

.3 Mitred elbows, rectangular:
- .1 To 400 mm: with double thickness turning vanes.
- .2 Over 400 mm: with double thickness turning vanes.

.4 Branches:
- .1 Rectangular main and branch: with 45 degrees entry on branch.
- .2 Round main and branch: enter main duct at 45 degrees with conical connection.
- .3 Provide volume control damper in branch duct near connection to main duct.
- .4 Main duct branches: with splitter damper.

.5 Transitions:
- .1 Diverging: 20 degrees maximum included angle.
- .2 Converging: 30 degrees maximum included angle.

.6 Offsets:
- .1 As indicated.

.7 Obstruction deflectors: maintain full cross-sectional area.
- .1 Maximum included angles: as for transitions.

2.6 FIRE STOPPING

.1 Retaining angles around duct, on both sides of fire separation in accordance with AHJ.
.2 Fire stopping material and installation must not distort duct.

2.7 GALVANIZED STEEL

.1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating.
.2 Thickness, fabrication and reinforcement: to ASHRAE and SMACNA.
.3 Joints: to ASHRAE and SMACNA.

2.8 ALUMINUM

.1 To ASHRAE and SMACNA. Aluminum type: as required.
.2 Thickness, fabrication and reinforcement: to SMACNA and ASHRAE.
.3 Joints: to SMACNA and ASHRAE.

2.9 KITCHEN EXHAUST SYSTEMS

.1 Construct in accordance with NFPA 96.
.2 Material: welded steel.
.3 Drainage: as required.
.4 Grease filters: at Commercial Kitchen Hood as specified on drawings.

2.10 HANGERS AND SUPPORTS

.1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

.1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.

.1 Maximum size duct supported by strap hanger: 500.

.2 Hanger configuration: to ASHRAE and SMACNA.

.3 Hangers: galvanized or black steel angle with steel rods to ASHRAE and following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

.4 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.2 For steel joist: manufactured joist clamp.

.3 For steel beams: manufactured beam clamps:

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions are acceptable for metal duct installation in accordance with manufacturer's written instructions.

.1 Visually inspect site conditions.

.2 Inform Engineer and General Contractor of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 GENERAL

.1 Do work in accordance with ASHRAE, NFPA 96 AND SMACNA standards as applicable.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.

.1 Ensure diffusers fully seated. Insulate strap hangers 100 mm beyond insulated duct.

.3 Support risers in accordance with ASHRAE and SMACNA standards.

.4 Install breakaway joints in ductwork on sides of fire separation.

.5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

.6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining where specified.

3.3 HANGERS

.1 Strap hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: as follows:

Duct Size	Spacing
(mm)	(mm)
to 1500	3000
1501 and over	2500

3.4 WATERTIGHT DUCT

.1 Provide watertight duct for:
- .1 Dishwasher exhaust.
- .2 Shower exhaust.
- .3 Fresh air intake.
- .4 Minimum 3000 mm from duct mounted humidifier in all directions.
- .5 As indicated.

.2 Form bottom of horizontal duct without longitudinal seams.
- .1 Seal joints of bottom and side sheets.
- .2 Seal other joints with duct sealer.

.3 Slope horizontal branch ductwork down towards [fume] hoods served.
- .1 Slope header ducts down toward risers.

.4 Fit base of riser with 150 mm deep drain sump and 32 mm drain connected, with deep seal trap discharging to open funnel drain or as indicated.

3.5 KITCHEN EXHAUST SYSTEMS

.1 Install to NFPA 96 and as indicated.

3.6 SEALING AND TAPING

.1 Apply sealant in accordance with manufacturer's recommendations and SMACNA.

.2 Bed tape in sealant and recoat with minimum of 1 coat of sealant to manufacturers recommendations.

3.7 LEAKAGE TESTS

.1 Refer to Section 23 05 94 - Pressure Testing of Ducted Air Systems.
.2 In accordance with SMACNA HVAC Duct Leakage Test Manual.
.3 Do leakage tests in sections.

.4 Make trial leakage tests as instructed to demonstrate workmanship.
.5 Do not install additional ductwork until trial test has been passed.
.6 Test section minimum of 30 m long with not less than three branch takeoffs and two 90 degrees elbows or as designated on site.
.7 Complete test before performance insulation or concealment Work.

3.8 CLEANING

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Waste Management: separate waste materials for reuse or recycling as directed by General Contractor.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 General Requirements

1.2 REFERENCE STANDARDS

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

.1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, [2005] .

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with relevant Section.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for air duct accessories and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Indicate:

.1 Flexible connections.

.2 Duct access doors.

.3 Turning vanes.

.4 Instrument test ports.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect air duct accessories from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 GENERAL

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

2.2 FLEXIBLE CONNECTIONS

.1 Frame: galvanized sheet metal frame.

.2 Material:

.1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, density of 1.3 kg/m^2.

2.3 ACCESS DOORS IN DUCTS

.1 Non-Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.

.2 Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.

.3 Gaskets: neoprene or foam rubber.

.4 Hardware:

.1 Up to 300 x 300 mm: two sash locks complete with safety chain .

.2 301 to 450 mm: four sash locks complete with safety chain .

.3 451 to 1000 mm: piano hinge and minimum two sash locks.

.4 Doors over 1000 mm: piano hinge and two handles operable from both sides.

.5 Hold open devices.

2.4 TURNING VANES

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

2.5 INSTRUMENT TEST

.1 1.6 mm thick steel zinc plated after manufacture.

.2 Cam lock handles with neoprene expansion plug and handle chain.

.3 28 mm minimum inside diameter. Length to suit insulation thickness.

.4 Neoprene mounting gasket.

2.6 SPIN-IN COLLARS

.1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.

.2 Sheet metal thickness to co-responding round duct standards.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for air duct accessories installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

.1 Flexible Connections:

.1 Install in following locations:

.1 Inlets and outlets to supply air units and fans.

.2 Inlets and outlets of exhaust and return air fans.

.3 As indicated.

.2 Length of connection: [100] mm.

.3 Minimum distance between metal parts when system in operation: [75] mm.

.4 Install in accordance with recommendations of SMACNA.

.5 When fan is running:

.1 Ducting on sides of flexible connection to be in alignment.

.2 Ensure slack material in flexible connection.

.2 Access Doors:

.1 For all concealed valves and balancing dampers above drywall ceilings.

.2 As provided by manufacturer of air handling units.

.3 Fire and smoke dampers.

.4 Control dampers.

.5 Devices requiring maintenance.

.6 Required by code.

.7 Reheat coils.

.8 Elsewhere as indicated.

.3 Instrument Test Ports:

.1 General:

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

.2 Locate to permit easy manipulation of instruments.

.3 Install insulation port extensions as required.

.4 Locations:

.1 For traverse readings:

.1 Ducted inlets to roof and wall exhausters.

.2 Inlets and outlets of other fan systems.

.3 Main and sub-main ducts.

.4 And as indicated.

.2 For temperature readings:

.1 At outside air intakes.

.2 In mixed air applications in locations as approved by [DCC Representative] [Departmental Representative] [Consultant] .

.3 At inlet and outlet of coils.

.4 Downstream of junctions of two converging air streams of different temperatures.

.5 And as indicated.

.4 Turning Vanes:

.1 Install in accordance with recommendations of SMACNA and as indicated.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section [01 74 00- Cleaning] .

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

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 General Requirements.

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM)

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

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section [01 33 00- Submittal Procedures] .

.2 Product Data:

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

.2 Construction IAQ Management Plan:

.1 During construction meet or exceed the requirements of SMACNA IAQ Guideline for Occupied Buildings Under Construction.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with relevant section.

.2 Operation and Maintenance Data: submit operation and maintenance data for dampers for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials in dry location indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect dampers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MULTI-LEAF DAMPERS

.1 Opposed or parallel blade type as indicated.

.2 Extruded aluminum or Structurally formed steel, interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, structurally formed and welded galvanized steel or extruded aluminum] frame.

.3 Pressure fit self-lubricated bronze bearings.

.4 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.

.5 Operator: provided by BAS contractor

.6 Performance:

.1 Leakage: in closed position less than 2% of rated air flow.

.7 Insulated aluminum dampers:

.1 Frames: insulated with extruded polystyrene foam with RSI 0.88.

.2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, RSI 0.88.

2.2 DISC TYPE DAMPERS

.1 Frame: insulated brake formed, welded, 1.6 mm thick, galvanized steel to ASTM A653/A653M.

.2 Disc: insulated spin formed, 1.6 mm thick, galvanized steel to ASTM A653/A653M.

.3 Gasket: extruded neoprene, field replaceable, with 10 year warranty.

.4 Bearings: roller self lubricated and sealed.

.5 Operator: compatible with damper, linear stroke operator, [spring loaded] actuator, zinc-aluminum foundry alloy casting cam follower.

.6 Performance:

.1 Leakage: in closed position less than 2% of rated air flow.

2.3 BACK DRAFT DAMPERS

.1 Automatic gravity operated, single leaf, aluminum construction with nylon bearings counterweighted.

2.4 RELIEF DAMPERS

.1 Automatic multi-leaf aluminum dampers with ball bearing centre pivoted and counter-weights set to open as indicated.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for damper installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.

.3 Seal multiple damper modules with silicon sealant.

.4 Install access door adjacent to each damper.

.5 Ensure dampers are observable and accessible.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with General Contractor’s instructions.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM C423-09a, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

.2 ASTM C916-85(2007), Standard Specification for Adhesives for Duct Thermal Insulation.

.3 ASTM C1071-12, Standard specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).

.4 ASTM C1338-08, Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.

.5 ASTM G21-09, Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

.2 National Fire Protection Association (NFPA)

.1 NFPA 90A-12, Standard for the Installation of Air Conditioning and Ventilating Systems.

.2 NFPA 90B-12, Standard for the Installation of Warm Air Heating and Air Conditioning Systems.

.3 North American Insulation Manufacturers Association (NAIMA)

.1 NAIMA AH116-2002, Fibrous Glass Duct Construction Standards.

.4 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)

.1 SMACNA, HVAC Duct Construction Standards, Metal and Flexible-2005.

.2 SMACNA IAQ Guideline for Occupied Buildings Under Construction-2007.

.5 Underwriter's Laboratories of Canada (ULC)

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

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Sections 22 05 00 and 23 05 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for duct liners and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Sections 22 05 00 and 23 05 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for duct liners for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:
- .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect duct liners from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse or recycling as directed by Gneeral Contractor.

Part 2 Products

2.1 DUCT LINER

.1 General:
- .1 Mineral Fibre duct liner: air surface coated [mat facing] .
- .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50 when tested in accordance with [CAN/ULC-S102] [NFPA 90B] [NFPA 90A] .
- .3 Recycled Content: [EcoLogo certified] [with minimum [by weight] [35] recycled content] .
- .4 Fungi resistance: to [ASTM G21] [ASTM C1338] .

.2 Rigid:
- .1 [Use on flat surfaces and where indicated.
- .2 25 mm thick, to[ASTM C1071, fibrous glass rigid board duct liner.
- .3 Density: 48 kg/m^3minimum.
- .4 Maximum velocity on faced air side: 20.3 m/s.
- .5 Minimum NRC of 0.70 at 25 mm thickness based on Type A mounting to ASTM C423.

.3 Flexible:
- .1 Use on round or oval surfaces as indicated.
- .2 25 mm thick, to ASTM C1071 Type 1, fibrous glass blanket duct liner.
- .3 Density: 24 kg/m^3minimum.
- .4 Thermal resistance to be minimum [1.11 (m^2.degrees C)/W for 38 mm thickness] [1.41 (m^2.degrees C)/W to 50 mm thickness] [0.74 (m^2.degrees C)/W for 25 mm thickness] [0.37 (m^2.degrees C)/W for 12 mm thickness] when tested in accordance with [ASTM C177] , at 24 degrees C mean temperature.
- .5 Maximum velocity on coated air side: [[25.4] [30.5] m/s] .
- .6 Minimum NRC of [0.65 at 25 mm] thickness based on Type A mounting to ASTM C423.

2.2 ADHESIVE

.1 Adhesive: to NFPA 90A, NFPA 90B and ASTM C916.

.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 29 degrees C to plus 93 degrees C.

.3 Water-based [fire retardant] type.

2.3 FASTENERS

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

2.4 JOINT TAPE

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

2.5 SEALER

.1 Meet requirements of NFPA 90B and NFPA 90A.

.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 68 degrees C to plus 93 degrees C.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for duct liner installation in accordance with manufacturer's written instructions.
- .1 Visually inspect site conditions before installation.
- .2 Inform Engineer and General Contractor of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 GENERAL

.1 Do work in accordance with SMACNA HVAC Duct Construction Standard and as indicated.

.2 Line inside of ducts where indicated.

.3 Duct dimensions, as indicated, are clear inside duct lining.

3.3 DUCT LINER

.1 Install in accordance with manufacturer's recommendations, and as follows:

- .1 Fasten to interior sheet metal surface with [100] [90] % coverage of adhesive [to ASTM C916] .
  - .1 Exposed leading edges and transverse joints to be factory coated or coated with adhesive during fabrication.

.2 In addition to adhesive, [install weld pins not less than 2 rows per surface and not more than 425 mm on centres] [impact driven mechanical fasteners] to compress duct liner sufficiently to hold it firmly in place.

.1 [Spacing of mechanical fasteners in accordance with [NAIMA AH116] [SMAC HVAC Duct Construction Standard]] .

.2 In systems, where air velocities exceeds [20.3] m/s, install galvanized sheet metal noising to leading edges of duct liner.

3.4 JOINTS

.1 Seal butt joints, exposed edges, weld pin and clip penetrations and damaged areas of liner with joint tape and sealer. Install joint tape in accordance with manufacturer's written recommendations, and as follows:

.1 Bed tape in sealer.

.2 Apply [2] coats of sealer over tape.

.2 Replace damaged areas of liner at discretion of Engineer.

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

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with General Contractor’s instructions.

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

.3 Waste Management: separate waste materials for recycling or reuse in accordance with General Contractor’s instructions.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- This section includes Air-to-Air Energy Recovery Ventilators for rooftop installation.
- Within this document, these units may be referred to as Energy Recovery Ventilator (ERV) for brevity.

1.2 RELATED

Drawing and general provisions of the contract, including General Requirements Division 01, Division 23, Division 23 Specifications Sections, and common work requirements for HVAC apply to work specified in this section.

- Section 23 09 00: Controls and Instrumentation

1.3 SUBMITTALS

- Product data: For each type or model of Energy Recovery Ventilator, include the following:
    - Unit performance data for both Supply Air and Exhaust Air, with system operating conditions indicated.
    - Enthalpy plate performance data for both summer and winter operation.
    - Motor ratings and unit electrical characteristics.
    - Dimensioned drawings for each type of installation, showing isometric and plan views, to include location of attached ductwork and service clearance requirements.
    - Estimated gross weight of each installed unit.
    - Filter types, quantities, and sizes
    - Installation, Operating and Maintenance manual (IOM) for each model.
- Shop Drawings: For air-to-air energy recovery ventilators, include plans, elevations, sections, details, and attachments to other work.
    - Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
    - Wiring Diagrams: For power, signal, and control wiring.
- Operation and maintenance data for air-to-air energy recovery ventilator

1.4 QUALITY ASSURANCE

- Source Limitations: Obtain Air-to-Air Energy Recovery Ventilator with all appurtenant components or accessories from a single manufacturer.

- For the actual fabrication, installation, and testing of work under this section, use only thoroughly trained and experienced workers completely familiar with the items required and with the manufacturer's current recommended methods of installation.
- The ERV core shall be warranted to be free of manufacturing defects and to retain its functional characteristics, under circumstances of normal use, for a period of ten (10) years from the date of purchase. The balance-of-unit shall be warranted to be free of manufacturing defects and to retain its functional characteristics, under circumstances of normal use, for a period of two (2) years from the date of installation.
- Manufacturer shall be able to provide evidence of independent testing of the core by Underwriters Laboratory (UL), verifying a maximum flame spread index (FSI) of 25 and a maximum smoke developed index (SDI) of 50 thereby meeting NFPA90A and NFPA 90B requirements for materials in a compartment handling air intended for circulation through a duct system. The method of test shall be UL Standard 723.
- Certifications:
    - The energy recovery cores used in these products shall be third party Certified by AHRI under its Standard 1060 for Energy Recovery Ventilators. AHRI published certifications shall confirm manufacturer’s published performance for airflow, static pressure, temperature and total effectiveness, purge air (OACF) and exhaust air leakage (EATR). Products that are not currently AHRI certified will not be accepted. OACF shall be no more than 1.02 and EATR shall be zero when application design criteria reduce static pressure differential to zero or less.
    - Units intended for outdoor use shall be rain tested in accordance with UL 1812 Section 67.
- Every unit to be factory tested prior to shipping: Motor Dielectric Voltage-Withstand Bench Test, Unit Dielectric Voltage-Withstand Test, Continuity of Internal Control Circuits Test, Unit Amperage Test

1.5 COORDINATION

- Coordinate size and location of all building penetrations required for installation of each Energy Recovery Ventilator and associated electrical systems.
- Coordinate sequencing of construction for associated plumbing, HVAC, electrical supply.
- Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- Available Manufacturers: Subject to compliance with specifications contained within this document, manufacturers offering products that may be incorporated into the work include, but are not limited to: RenewAire
- Manufacturer should be in business for minimum 10 years manufacturing energy recovery ventilators.

2.2 MANUFACTURED UNITS

- Air-to-Air Energy Recovery Ventilators shall be fully assembled at the factory and consist of a fixed-plate cross-flow heat exchanger with no moving parts, an insulated single or double wall G90 galvanized painted 20-gauge steel cabinet, outdoor air hood with bird screen, motorized outside air intake damper, filter assemblies for both intake and exhaust air, enthalpy core, supply air blower assembly, motorized exhaust air damper, exhaust air hood, exhaust air blower assembly and electrical control box with all specified components and internal accessories factory installed and tested and prepared for single-point high voltage connection. Entire unit with the exception of field-installed components shall be assembled and test operated at the factory.

2.3 CABINET

- Materials: Formed single or double wall insulated metal cabinet, fabricated to permit access to internal components for maintenance.
- Outside casing: 20 gauge, galvanized (G90) steel meeting ASTM A653 for components that do not receive a painted finish. Painted components as supplied by the factory shall have polyester urethane paint on 20 gauge G90 galvanized steel.
- Access doors shall be hinged with airtight closed cell foam gaskets. Door pressure taps, with captive plugs, shall be provided for cross-core pressure measurement allowing for accurate airflow measurement.
- Unit shall have factory-installed duct flanges on all duct openings.
- Cabinet Insulation: Unit walls and doors shall be insulated with 1 inch, 4 pound density, foil/scrim faced, high density fiberglass board insulation, providing a cleanable surface and eliminating the possibility of exposing the fresh air to glass fibers, and with a minimum R-value of 4.3 (hr-ft^2-°F/BTU).
- Enthalpy core: Energy recovery core shall be of the total enthalpy type, capable of transferring both sensible and latent energy between airstreams. Latent energy transfer shall be accomplished by direct water vapor transfer from one airstream to the other, without exposing transfer media in succeeding cycles directly to the exhaust air and then to the fresh air. No condensate drains shall be allowed. The energy recovery core shall be designed and constructed to permit cleaning and

removal for servicing. The energy recovery core shall have a ten year warranty. Performance criteria are to be as specified in AHRI Standard 1060.

- Control center / connections: Energy Recovery Ventilator shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit single-point high voltage power supply connections to the [non-fused][fused] disconnect.
- Passive Frost Control: The ERV core shall perform without condensing or frosting under normal operating conditions (defined as outside temperatures above -10ºF and inside relative humidity below 40%). Occasional more extreme conditions shall not affect the usual function, performance or durability of the core. No condensate drains will be allowed.
- Motorized Isolation Damper(s): [None included.][Exhaust Air][and][Outside Air][motorized damper(s)][of an AMCA Class I leakage type shall be factory installed.]

2.4 BLOWER SECTION

- Blower section construction, Supply Air and Exhaust Air: Blower assemblies consist of a 208-3 Phase 60 HZ, TEFC motor, and a belt driven forward-curved blower.
- Blower assemblies: Shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower.

2.5 MOTORS

- Blower motors shall be Premium Efficiency, EISA compliant for energy efficiency. The blower motors shall be totally enclosed (TEFC) and be shall be supplied with factory installed motor starters.
- Belt drive motors shall be provided with adjustable pulleys and motor mounts allowing for blower speed adjustment, proper motor shaft orientation and proper belt tensioning.

2.6 UNIT CONTROLS

- Fan control: Motor starter and contactor, Onboard VFDs for both air streams.
- Sensors: Dirty filter monitor for both airstreams.
- Timeclock: Digital Time Clock wall mounted indoors, with up to 8 on/off cycles per day or 50 per week, 24VAC power, witrh battery backup protection of program settings against power failure to energize unit
- Factory-installed microprocessor controller and sensors, with Premium ERV controls that:
    - Comply with requirements in Division 23 Section "Sequence of Operations for HVAC Controls"
    - Has factory-installed hardware and software to enable the building automation interface via BACnet to monitor, control, and display status and alarms
    - The microprocessor controller shall be capable of operating at temperatures between -20F to 160F

- The microprocessor controller shall be a DIN rail mounting type
- Factory-installed microprocessor controller shall come with backlit display that allows menu-driven display for navigation and control of unit
- The microprocessor controller shall have the ability to communicate with the BMS via Modbus RTU/TCP and BACnet MSTP/IP
- The microprocessor controller shall have integrated ethernet interface and a web server for displaying unit parameters
- The microprocessor shall have near field communication (NFC) capability for android devices
- The microprocessor controller shall have an internal programmable time clock that will allow the user to add up to different occupancy schedules and add holidays
- The microprocessor control shall be capable of integral diagnostics
- The microprocessor control shall be capable of IP or SI unit display
- The microprocessor controller shall have a battery powered clock
- The microprocessor controller shall at a minimum offer the ability for three modes of determining occupancy: a dry contact, the internal time clock or the BMS
- A remote user terminal to allow for remote monitoring and adjustment of parameters, allowing ease of control access without going outdoors or into the mechanical room if desired by the user
- The microprocessor controller shall have at a minimum (10) universal inputs/outputs (AI, DI, AO) and have (6) six relay outputs (DO)
- The microprocessor controller shall have an integrated fieldbus port
- The microprocessor controller shall have the capability for I/O expansion
- The microprocessor controller shall have a micro USB port to load the application program, the unit parameters, saving logs, etc.
- The sensors that will be required for control are:
    - (2) Temperature sensor for fresh air and exhaust air
    - (2) Temperature and humidity sensor for outside air, return air
    - (2) Differential pressure sensors for filter alarms
    - [(2) Differential pressure sensors for measuring pressure drop across energy recovery core and for determining airflow in both airstreams]
    - (2) Adjustable current switches
    - [Field-installed duct or room IAQ sensor]
    - [Field-installed duct or room CO2 sensor]
    - [Field-installed duct static sensor]
    - [Field-installed room pressurization sensor]
- The microprocessor controller shall have the capability to monitor the unit conditions for alarm conditions. Upon detecting an alarm, the microprocessor controller shall have the capability to record the alarm description, time, date, available temperatures, and unit status for user review. A digital output shall be reserved for remote alarm indication.

Alarms to be also communicated via BMS as applicable. Provide the following alarm functions:

- Outside air temperature sensor alarm
- Outside air humidity sensor alarm
- Return air temperature sensor alarm
- Return air humidity sensor alarm
- Fresh air sensor alarm
- Exhaust air sensor alarm
- Dirty filter alarm
- Supply and exhaust air proving alarm

- Display the following on the face of microprocessor controller:
  - Unit on
  - Outdoor air temperature
  - Outdoor air humidity
  - Return air temperature
  - Return air humidity
  - Supply air temperature
  - [Airflows in both airstreams]
  - Unit on/off
  - Fan on/off
  - Damper status
  - Alarm digital display
- The microprocessor controller shall have factory pre-programmed multiple operating sequences for control of the ERV. Factory default settings shall be fully adjustable in the field. Available factory pre-programmed sequences on operations are:

SEQUENCE OF OPERATIONS

DDC CONTROLLER:

- Controller with integral LCD readout for changing set points and monitoring unit operation.
- Provided with required sensors and programming.
- Factory programmed, mounted, and tested.
- Integral USB and Ethernet ports for updating programs and retrieving log files.

BMS INTERFACE:

- [BACnet MS/TP]
- [BACnet IP]
- [Modbus RTU]
- [Modbus TCP]

GENERAL OPERATION

POWER UP:

- When the unit main disconnect is closed a delay of 10 seconds (adjustable) occurs for the controller to come online.

ERV UNIT START COMMAND:

- An input signal is required to enable the unit operation. The unit will be commanded on by:
  - The digital timeclock.
- All types of input that are enabled must be true before the unit will start.
  - The exhaust fan starts after a 3 second delay (adjustable). The exhaust fan will not start until the damper actuator end switch closes.
  - The supply fan starts after a 6 second delay (adjustable). The supply fan will not start until the damper actuator end switch closes.

ERV UNIT STOP COMMAND (OR DE-ENERGIZED):

- The unit can then be commanded off by:
  - The digital time clock
  - Disable via controller display
- Supply fan and exhaust fan are de-energized.
- All dampers are unpowered and spring return to their default position after a 10 second delay (adjustable).

SUPPLY FAN OPERATION:

- The supply fan will operate at a constant speed.
- The unit will attempt to start the supply fan when the supply fan delay timer expires. When the supply fan starts the supply fan adjustable current switch should close and remain closed until the fan is turned off.

SUPPLY FAN STATUS:

Once the supply fan current switch closes [heating] operation is allowed. After a delay of 90 seconds (adjustable) from supply fan start signal, if the supply fan current switch is still open the supply fan alarm should be set to true and [heating] operation shall be prohibited. The supply fan status shall be set to true only when the supply fan output is on and supply fan current switch is closed. The supply fan status shall be false in all other circumstances.

FIXED FAN SPEED OPTION:

The analog voltage command to the supply fan VFD can be set from the unit controller display [or by the BMS]. The adjustable range of 0% to 100% correspond to the minimum and maximum fan operating speed. This supply fan operation mode can be used to field balance the supply air flow rate.

SUPPLY AIR FLOW CONTROL OPTION:

The controller will adjust the supply fan VFD command to maintain the supply air flow rate at a set point. The supply air flow rate set point is entered and adjusted from the unit controller display. The minimum and maximum values for supply air flow rate set point are unit dependent. An adjustable PI (proportional & integral) loop will compare the measured supply air flow to the air flow rate set point and adjust the fan speed. If the measured supply air flow rate varies from the desired air flow rate by more than 10% (adjustable) for more than 60 seconds (adjustable) a supply air flow rate alarm will be set to true. This supply fan operation mode can be used to provide a constant supply air flow rate as the unit filters become loaded.

EXHAUST FAN OPERATION:

- The exhaust fan will operate at a constant speed.
- The unit will attempt to start the exhaust fan when the exhaust fan delay timer expires. When the exhaust fan starts the exhaust fan adjustable current switch should close and remain closed until the fan is turned off.

EXHAUST FAN STATUS:

After a delay of 90 seconds (adjustable) from exhaust fan start signal, if exhaust fan current switch is still open the exhaust fan alarm should be set to true. The exhaust fan status shall be set to true only when the exhaust fan output is on and exhaust fan current switch is closed. The exhaust fan status shall be false in all other circumstances.

FIXED FAN SPEED OPTION:

The analog voltage command to the exhaust fan VFD can be set from the unit controller display. The adjustable range of 0% to 100% correspond to the minimum and maximum fan operating speed (0 VDC minimum to 10 VDC maximum, adjustable). This exhaust fan operation mode can be used to field balance the exhaust air flow rate.

2.7 FILTER SECTION

- ERV shall have 2" thick MERV 13 disposable pleated filters located in the outdoor air and exhaust airstreams. All filters shall be accessible from the exterior of the unit.

PART 3 – EXECUTION

3.1 EXAMINATION

- Prior to start of installation, examine area and conditions to verify correct location for compliance with installation tolerances and other conditions affecting unit performance. See unit IOM.
- Examine roughing-in of plumbing, electrical and HVAC services to verify actual location and compliance with unit requirements. See unit IOM.
- Proceed with installation only after all unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- Installation shall be accomplished in accordance with these written specifications, project drawings, manufacturer's installation instructions as documented in manufacturer's IOM, Best Practices and all applicable building codes.
- Install unit with clearances for service and maintenance.

3.3 CONNECTIONS

ERV's are to be installed per manufacturers' guidelines and industry Best Practices shall be incorporated, and duct connections are to conform to use material, weight, thickness, gauge, construction, and installation methods as outlined in the SMACNA publications below, and Division 23 of this document, and are to be made subject to the installation requirements shown above.

- HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition, 2005
- HVAC Air Duct Leakage Test Manual, 2nd Edition, 2012
- HVAC Systems - Duct Design, 4th Edition, 2006
- Rectangular Industrial Duct Construction Standard, 2nd Edition, 2004
- Round Industrial Duct Construction Standards, 2nd Edition, 1999
- Thermoplastic Duct (PVC) Construction Manual, 2nd Edition, 1995

- Electrical installation requirements are specified in Division 26 of this document.

3.4 FIELD QUALITY CONTROL

- Contractor to inspect field assembled components and equipment installation, to include electrical and piping connections. Report results to Architect/Engineer in writing. Inspection must include a complete startup checklist to include (as a minimum) the following: Completed Start-Up Checklists as found in manufacturer's IOM. Insert any other requirements here.

3.5 START-UP SERVICE

- Contractor to perform startup service. Clean entire unit, comb coil fins as necessary, and install clean filters. Measure and record electrical values for voltage and amperage. Refer to Division 23 "Testing, Adjusting and Balancing" and comply with provisions therein.
- Contractor to provide start up and commissioning report.

3.6 DEMONSTRATION AND TRAINING

- Contractor to train owner's maintenance personnel to adjust, operate and maintain the entire Make-Up Air unit. Refer to relevant section.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section for General Requirements.

1.2 REFERENCE STANDARDS

.1 American National Standards Institute/Air-Conditioning and Refrigeration Institute (ANSI/ARI)

.1 ANSI/ARI 210/240, Unitary Air Conditioning and Air-Source Heat Pump Equipment.

.2 American National Standards Institute/American Society of Heating, Refrigeration and Air-Conditioning Engineers (ANSI/ASHRAE)

.1 ANSI/ASHRAE Standard 15, Safety Standard for Refrigeration Systems.

.3 CSA Group (CSA)

.1 CAN/CSA-C656-[05(R2010)] , Performance Standard for Split-System and Single Package Central Air Conditioners and Heat Pumps.

.2 CAN/CSA-C13256-[2001(R2011)] , Water-Source Heat Pumps-Testing and Rating for Performance, Part 1 Water-to-Air and Brine-to-Air Heat Pumps.

.4 Environment Canada, (EC) / Environmental Protection Services (EPS)

.1 EPS 1/RA/2, Code of Practice for Elimination of Fluorocarbons Emissions from Refrigeration and Air Conditioning Systems.

.2 Environment Canada, Ozone-Depleting Substances Alternatives and Suppliers List.

.5 National Fire Protection Association (NFPA)

.1 NFPA 90A-[2009] , Standard for Installation of Air Conditioning and Ventilating Systems.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section for Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for heat pumps and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate on drawings:

.1 Dimensions, weight, performance

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with relevant Section on Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for heat pumps for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials in dry location indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect heat pumps from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.6 WARRANTY

.1 Provide parts and labour warranties.

Part 2 Products

2.1 DESCRIPTION

.1 Heat pumps: to EPS 1/RA/2, CSA [and Ontario Hydro Inspection] approved and with ARI or CSA certification seal.

2.2 REFRIGERANTS

.1 Type of Refrigerant: R410A as per specified model.

2.3 DRAIN PANS

.1 Design and construct condensate drain pans under indoor coils so that no water can accumulate and install to allow for easy cleaning.

2.4 PACKAGED AIR SOURCE HEAT PUMP

.1 General:

.1 To consist of air-to-air outdoor unit and DX fan coil indoor unit, for use with R410A refrigerant.

.2 Performance data: as indicated on project schedule drawings.

.3 Outdoor unit:

.1 Semi-hermetic compressor with crankcase heater, oil pump, internal and external current sensitive overload and over-temperature protection.

.2 Outdoor air fan: propeller type with vertical or horizontal discharge, direct-driven from permanently lubricated motor.

.3 Coil: aluminum plate fins mechanically bonded to copper tubing with joints brazed.

.4 Mounted legs and snow stand to elevate unit.

.5 Finish: primer and corrosion restraint coatings.

.4 Indoor air handling unit:

.1 Refer to project schedules on drawings.

.5 Refrigeration piping:

.1 Between compressor, outdoor coil and indoor coil, complete with refrigerant metering devices and valves.

.6 Controls and protective devices to include:

.1 High pressure stat, loss-of-charge pressure stat.
.2 Crankcase heater.
.3 Suction line accumulator.
.4 Pressure relief device.
.5 Short-cycle protection of compressor.
.6 [Demand defrost] [Defrost control to defrost every 90 minutes based on liquid temperature] .
.7 Defrost interlock relay to ensure only one heat pump can defrost.

.7 Accessories:

.1 Indoor heating/cooling thermostat.
.2 Outdoor thermostat.
.3 Refrigerant head pressure controls.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for heat pumps installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of General Contractor.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

.1 Install where indicated and in accordance with manufacturer's instructions.

.2 Install outdoor units at ground level on RC housekeeping pad.

.3 Install outdoor units on roof with vibration isolation providing 95% isolation efficiency.

.1 Co-ordinate installation with Architect for flashing, weatherproofing and roofing.

.4 Secure with hold-down bolts in accordance with manufacturer's recommendations.

.5 Make duct connections through flexible connections.

.6 Level unit with fans running. Align duct work. flexible connections. Misalignment with fan stopped not to strain or damage flexible connection.

.7 Make piping connections.

.8 Nothing to obstruct ready access to components or to prevent removal of components for servicing.

3.3 DRAIN PANS

.1 Install so that no water can accumulate. Arrange easy access for cleaning.

.2 Include internal or external trap for proper draining.

3.4 START-UP AND COMMISSIONING

.1 Have manufacturer certify installation.

.2 Have manufacturer present [tests and start up units] [during start-up] and certify performance.

.3 Submit written start-up and commissioning reports to [DCC Representative] [Departmental Representative] [Consultant] .

3.5 CLOSEOUT ACTIVITIES

.1 Manufacturer to deliver verbal, [video] , and written instructions to operating personnel.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with General Contractor’s instructions.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with relevant Section.

3.7 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by heat pumps installation.

END OF SECTION

MECHANICAL SPECIFICATIONS

126 Pape
Toronto, Ontario
M4M-2V8



DeCARIA ENGINEERING

Project: 4880-150

DeCaria Engineering Limited
1661 Denison Street, Unit D12
Markham, Ontario
L3R 6E4
Tel: 647 498-4397

Section	Title	Pages
23 01 05	Operation And Maintenance Of HVAC Systems During Construction	1
23 01 05.05	Maintenance of HVAC Systems	3
23 05 00	Common Work Results For HVAC	4
23 05 13	Common Motor Requirements For HVAC Equipment	3
23 05 15	Common Installation Requirements For HVAC Pipework	5
23 05 16	Expansion Fittings And Loops For HVAC Piping	4
23 05 17	Pipe Welding	4
23 05 19.13	Thermometers And Pressure Gauges	3
23 05 29	Hangers And Supports For HVAC Piping And Equipment	7
23 05 53	Identification For HVAC, Piping And Equipment	6
23 05 93	Testing, Adjusting And Balancing For HVAC	5
23 05 94	Pressure Testing of Ducted Systems	4
23 07 13	Duct Insulation	5
23 07 16	HVAC Equipment Insulation	6
23 07 20	Refrigerant Piping Insulation	6
23 23 00	Refrigerant Piping	5
23 31 13.01	Metal Ducts - Low Pressure To 500 PA	6
23 33 00	Air Duct Accessories	4
23 33 14	Dampers – Balancing	3
23 33 15	Dampers – Operating	3
23 33 53	Duct Liners	4
23 81 40	Air Source Heat Pumps	4
23 82 19	Fan Coil Units	2

END OF TABLE OF CONTENTS

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Maintenance recommendations.

Part 2 Fan Coils and Heat Pumps

2.1 General

.1 Conduct inspections of the fan coils and heat pumps on a regular basis:
.1 Weekly Inspections .2 Monthly Inspections
.3 Six month inspections .4 Yearly inspections
.5 Four Year inspections

2.2 Weekly Inspection Checklist

.2 Observe and review the unit for any changes in operating conditions

.3 Check for any unusual noises

.3 Check temperature setting to ensure as per design/operational needs

2.3 Monthly Inspection Checklist

.4 Change or Clean Filters – Visually inspect and if clogged or dirty clean or replace If they are the permanent/washable type filter can be cleaned If not then replace

.5 Inspect and Clean Condensate Drain Pan – Visually inspect and if dirty or debris have accumulated, clean fully.

.6 Inspect and Clean Wet coils – Visually inspect and if dirty or debris accumulated clean

.4 Inspect and Clean Strainer if present – Remove strainer mesh; inspect and clean.

2.4 Six Months Inspection Checklist

.1 Inspect Fan – Manually rotate the fan to check for any obstructions. The access panel to the FCU will need to be removed to allow full access and visibility to the fan housing.

.2 Inspect Motor – check the bracket for the motor and that the torque is still correct

.3 Inspect/Clean Wet coils – complete a more detailed visual inspection and if dirty or debris is accumulated, clean thoroughly.

.4 Test Control valves – ensure that the FCU control valve is operating as per design, not damaged and the actuator is still fixed properly.

.5 Fresh Air Ducting– Visually inspect to ensure free and clear and the connection to the FCU plenum is in good condition

.6 Insulation at Fresh Air Ducting – Visually inspect insulation to ensure that there is no damage, duct is not torn, and that the vapor barrier is unaffected.

.7 Recirculating and Supply Air Ducting – Visually inspect to ensure free and clear and the connection to the FCU plenum and grille is in good condition.

.8 Test that the condensate pan and pipework still operates as design by pouring 2 liters of water into it and ensuring it flows out to discharge.

.9 Electrical - Check the operation of emergency stop.

2.5 Yearly Inspection Checklist

.1 General – Check all screws and bolts on the unit are tight and secure

.2 Fan – clean the fan, blades, and impeller, remove any rust from the shaft and recoat where necessary.

.3 Fan – Adjust the fan if rubbing

.4 Electrical – check the tightness of connections

.5 Fresh Air, return air, and supply air – Measure airflow rates to ensure in line with design requirements.

.6 Volume Control Dampers – Inspect all volume control dampers to ensure that they are in good condition.

.7 Fire Dampers – Inspect any fire dampers to ensure that they are in position as per design. It will be required to be tested every 4 years after that.

.8 System – check over the system for any evidence of corrosion and repair if any found.

2.6 Heat Pump Maintenance

.7 The heat pumps are to be serviced by professional maintenance technicians at least once a year.

.8 Inspect ducts, filters, blower, and indoor coil for dirt and other obstructions.

.9 Diagnose and seal duct leakage.

.10 Verify adequate airflow by measurement.

.11 Verify correct refrigerant charge by measurement.

.12 Check for refrigerant leaks.

.13 Inspect electric terminals, clean and tighten connections if necessary, and apply nonconductive coating.

.14 Lubricate motors and inspect belts for tightness and wear.

.15 Verify correct electric control, ensuring that heating is locked out when the thermostat calls for cooling and vice versa.

.10 Verify correct thermostat operation.

Part 3 Ultraviolet Lighting

3.1 General

.1 The intensity of the ultraviolet energy emitted from the UV lamps is dependent on the cleanliness and lamp age. The surface of the lamp should be kept as clean as possible for optimum intensity. Depending on the filtration level of the HVAC system and the general hygiene of the building, periodic cleaning may be necessary. Before attempting any maintenance procedures, always follow all warnings and cautions as detailed in this maintenance section.

3.2 Cleaning Lamps

Note: If lamps are found to be broken, see the proper warning and cautions below regarding broken lamps and hazardous vapors.

.1 Disconnect all electrical power to the unit and the UV lamps.

.2 Wearing soft cloth gloves and safety glasses, grasp the lamp with your fingers and twist the lamp until it can be removed from the tombstone.

.3 Wipe down each lamp with a clean cloth and isopropyl alcohol. Avoid touching the lamp glass you're your bare hands as skin oils can accelerate lamp degradation. (If lamps are coated with Teflon they can be touched with bare hands).

.4 Apply dielectric grease to the 4 pins. Place the lamp back in the tombstone and twist the lamp until it clicks into place.

3.3 Replacing The Lamps Annually

.1 Ultraviolet lamps should be replaced annually if operated continuously or after 9,000 hours of use if operated intermittently. Replacement lamps must be the specific size and wattage as originally supplied by the factory. Note: Although the lamps may continue to generate a characteristic blue glow beyond 9,000 operating hours, the ultraviolet energy emitted by the bulbs degrades over time and will no longer provide the intended benefit.

1.4 Lamp Disposal

.1 UV lamps should be treated the same as other mercury-containing devices, such as fluorescent bulbs, according to local regulations. Most lamps must be treated as hazardous waste and cannot be discarded with regular waste. Low-mercury bulbs often can be discarded as regular waste; however, some states and local jurisdictions classify these lamps as hazardous waste. The U.S. EPA's universal waste regulations allow users to treat mercury lamps as regular waste for the purpose of transporting to a recycling facility. The National Electrical Manufacturers Association (NEMA) maintains a list of companies claiming to recycle or handle used mercury lamps at www.lamprecycle.org.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Use of mechanical systems during construction.

.2 Related Requirements

.1 Section 20 00 10.

1.2 USE OF SYSTEMS

.1 Use of new HVAC systems for supplying temporary ventilation and heat is [permitted only under following conditions:

.1 Entire system is complete, pressure tested, cleaned, flushed out.

.2 Building has been closed in, areas to be heated/ventilated are clean and will not thereafter be subjected to dust-producing processes.

.3 There is no possibility of damage.

.4 Supply ventilation systems are protected by filters, inspected daily, changed every week or more frequently as required.

.5 Return systems have approved filters over openings, inlets, outlets.

.6 Systems will be:

.1 Operated as per manufacturer's recommendations and instructions.

.2 Operated by Contractor.

.3 Monitored continuously by Contractor.

.7 Warranties and guarantees are not relaxed.

.8 Regular preventive and other manufacturers recommended maintenance routines are performed by Contractor at own expense and under supervision of General Contractor.

.9 Refurbish entire system before static completion; clean internally and externally, restore to "as- new" condition, replace filters in air systems.

.2 Filters specified in this Section are over and above those specified in other Sections of this project.

.3 Exhaust systems are not included in approvals for temporary heating ventilation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 00 10

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section [01 33 00- Submittal Procedures] .

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for all HVAC equipment.

.3 Shop Drawings:

.1 Indicate on drawings:

.1 Mounting arrangements.

.2 Operating and maintenance clearances.

.3 Motor sizes and voltage.

.4 Equipment capacities.

.2 Shop drawings and product data accompanied by:

.1 Detailed drawings of bases, supports, and anchor bolts.

.2 Acoustical sound power data, where applicable.

.3 Points of operation on performance curves.

.4 Manufacturer to certify current model production.

.5 Certification of compliance to applicable codes.

.3 In addition to transmittal letter, use mechanical engineer’s equipment tags.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with requirements of this Section.

.2 Operation and Maintenance Data: submit operation and maintenance data for all mechanical HVAC equipment.

.1 Operation and maintenance manual approved by, and final copies deposited with, project engineer before final inspection.

.2 Operation data to include:

.1 Control schematics for systems including environmental controls.

.2 Description of systems and their controls.

.3 Description of operation of systems at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for systems and component.

.5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.8 Valve Tag Chart

.3 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.4 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.4 Testing, adjusting and balancing reports as specified in the relevant section.

.5 Approvals:

.1 Submit 2 copies of draft Operation and Maintenance Manual to Engineer.

.2 Make changes as required and re-submit as directed by Engineer .

.6 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.7 Site records:

.1 Engineer will provide 1 set of mechanical drawings in Aurocad. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring .

.2 Transfer information to Autocad drawings to show work as actually installed.

.3 Make available for reference purposes and inspection.

.8 As-built drawings:

.1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of Autocad as-built drawings.

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" Signature of Contractor, Date.

.3 Submit to Engineer for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for HVAC using as-built drawings.

.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.9 Submit copies of as-built drawings for inclusion in final TAB report.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit in accordance with requirements of this section.

.2 Furnish spare parts as follows:

.1 One set of packing for each pump.

.2 One casing joint gasket for each size pump.

.3 One head gasket set for each heat exchanger.

.4 One glass for each gauge glass.

.5 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

.3 Provide one set of special tools required to service equipment as recommended by manufacturers.

.4 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 HVAC and R Equipment: All systems to use R410A refrigerant.

Part 3 Execution

3.1 EXAMINATION

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

.1 Visually inspect substrate in.

.2 Inform General Contractor and Engineer of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 PAINTING REPAIRS AND RESTORATION

.1 Do painting as required.
.2 Prime and touch up marred finished paintwork to match original.
.3 Restore to new condition, finishes which have been damaged.

3.3 SYSTEM CLEANING

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

3.4 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit.
.2 Provide manufacturer's start up report for all boilers and air handling units.

3.5 DEMONSTRATION

.1 General Contractor, Owner and Engineer will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Trial usage to apply to following equipment and systems:

.1 Boiler and boiler plants
.2 Rooftop and Indoor air handling units
.3 Exhaust and transfer fans
.4 Energy Recovery Ventilators
.5 Heat Pumps
.6 Split Units

.3 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.4 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

.5 Instruction duration time requirements as specified in appropriate sections.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with General Contractor’s instructions. Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

3.7 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Electrical motors, drives and guards for mechanical equipment and systems.

.2 Supplier and installer responsibility indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.

.3 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 22 and 23. Refer to Division 26 for quality of materials and workmanship.

1.2 REFERENCE STANDARDS

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

.1 ASHRAE 90.1-[01] , Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA cosponsored; ANSI approved; Continuous Maintenance Standard).

.2 Electrical Equipment Manufacturers' Association Council (EEMAC)

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals: in accordance with Section 23 05 00.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheets. Include product characteristics, performance criteria, and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS).

.2 Shop Drawings: submit electronic drawings is Acrobat PDF format.

.3 Quality Control:

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.4 Closeout Submittals

.1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 23 05 00.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements: work to be performed in compliance with applicable Provincial and municipal regulations.

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with applicable Health and Safety Requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

Part 2 Products

2.1 GENERAL

.1 Motors: TEFC high efficiency, in accordance with local Hydro company standards and to ASHRAE 90.1.

2.2 MOTORS

.1 Provide motors for mechanical equipment as specified.

.2 Motors under 1/2 HP : speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.

.3 Motors 1/2 HP and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40 degrees C, 3 phase, voltage as specified.

2.3 TEMPORARY MOTORS

.1 If delivery of specified motor will delay completion or commissioning work, install motor approved by Engineer for temporary use. Work will only be accepted when specified motor is installed.

2.4 BELT DRIVES

.1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.

.2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise indicated.

.3 For motors under 10 HP: standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.

.4 For motors [7.5 kW] [10 HP] and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.

.5 Correct size of sheave determined during commissioning.

.6 Minimum drive rating: [1.5] times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

.7 Motor slide rail adjustment plates to allow for centre line adjustment.

.8 Supply one set of spare belts for each set installed.

2.5 DRIVE GUARDS

.1 Provide guards for unprotected drives.

.2 Guards for belt drives;
- .1 Expanded metal screen welded to steel frame.
- .2 Minimum 1.2 mm thick sheet metal tops and bottoms.
- .3 38 mm dia holes on both shaft centres for insertion of tachometer.
- .4 Removable for servicing.

.3 Provide means to permit lubrication and use of test instruments with guards in place.

.4 Install belt guards to allow movement of motors for adjusting belt tension.

.5 Guard for flexible coupling:
- .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
- .2 Securely fasten in place.
- .3 Removable for servicing.

.6 Unprotected fan inlets or outlets:
- .1 Wire or expanded metal screen, galvanized, 19 mm mesh.
- .2 Net free area of guard: not less than 80% of fan openings.
- .3 Securely fasten in place.
- .4 Removable for servicing.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Fasten securely in place.

.2 Make removable for servicing, easily returned into, and positively in position.

3.3 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests:

- .1 Ensure that motors are wired to rotate in the correct direction.

3.4 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 22 05 00 and 23 05 00.

1.2 REFERENCE STANDARDS

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-99 , Ready-Mixed Organic Zinc-Rich Coating.

.2 National Research Council Canada (NRC)

.1 National Fire Code of Canada 2015 (NFC).

.3 Ontario Building Code

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide shop drawings.

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheets for piping and equipment and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove as directed by General Contractor.

Part 2 Execution

2.1 APPLICATION

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

2.2 CONNECTIONS TO EQUIPMENT

.1 In accordance with manufacturer's instructions unless otherwise indicated.

.2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.

.3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

2.3 CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer and National Fire Code of Canada.

.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer and as indicated without interrupting operation of other system, equipment, components.

2.4 DRAINS

.1 Install piping with grade in direction of flow except as indicated.

.2 Install drain valves at low points in piping systems, at equipment and at section isolating valves.

.3 Pipe each drain valve discharge separately to above floor drain.

.1 Discharge to be visible.

.4 Drain valves: NPS 3/4 gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

2.5 AIR VENTS

.1 Install manual or automatic air vents in all piping systems.

.2 Install isolating valve at each automatic air valve.

.3 Install drain piping to approved location and terminate where discharge is visible.

2.6 DIELECTRIC COUPLINGS

.1 General: compatible with system, to suit pressure rating of system.

.2 Locations: where dissimilar metals are joined.

.3 NPS 2 and under: isolating unions or bronze valves.

.4 Over NPS 2: isolating flanges.

2.7 PIPEWORK INSTALLATION

.1 Install pipework to CSA B139.
.2 Screwed fittings jointed with Teflon tape.
.3 Protect openings against entry of foreign material.
.4 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
.5 Assemble piping using fittings manufactured to ANSI standards.
.6 Saddle type branch fittings may be used on mains if branch line is no larger than half size of main.

.1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.

.7 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

.8 Install concealed pipework to minimize furring space, maximize headroom, conserve space.

.9 Slope piping, except where indicated, in direction of flow for positive drainage and venting.

.10 Install, except where indicated, to permit separate thermal insulation of each pipe.

.11 Group piping wherever possible [and as indicated] .

.12 Ream pipes, remove scale and other foreign material before assembly.

.13 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.14 Provide for thermal expansion as indicated.

.15 Valves:

.1 Install in accessible locations.

.2 Remove interior parts before soldering.

.3 Install with stems above horizontal position unless indicated.

.4 Valves accessible for maintenance without removing adjacent piping.

.5 Install globe valves in bypass around control valves.

.6 Use gate or ball valves at branch take-offs for isolating purposes except where specified.

.7 Install butterfly valves on chilled water and related condenser water systems only.

.8 Install butterfly valves between weld neck flanges to ensure full compression of liner.

.9 Install plug cocks and ball valves for glycol service.

.10 Use chain operators on valves NPS 2 1/2 and larger where installed more than 2400 mm above floor in Mechanical Rooms.

.16 Check Valves:

.1 Install silent check valves as indicated.

.2 Install swing check valves in horizontal lines and as indicated.

2.8 SLEEVES

.1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, and as indicated.

.2 Material: schedule 40 black steel pipe.

.3 Construction: use annular fins continuously welded at mid-point at foundation walls and where sleeves extend above finished floors.

.4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.

.5 Installation:

.1 Concrete, masonry walls, concrete floors on grade: terminate flush with finished surface.

.2 Other floors: terminate 25 mm above finished floor.

.3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.

.6 Sealing:

.1 Foundation walls and below grade floors: fire retardant, waterproof non-hardening mastic.

.2 Elsewhere:

.1 Provide space for firestopping.

.2 Maintain fire rating integrity.

.3 Sleeves installed for future use: fill with lime plaster or other easily removable filler.

.4 Ensure no contact between copper pipe or tube and sleeve.

2.9 ESCUTCHEONS

.1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.

.2 Construction: one piece type with set screws.

.1 Chrome or nickel plated brass or type 302 stainless steel..

.3 Sizes: outside diameter to cover opening or sleeve.

.1 Inside diameter to fit around pipe or outside of insulation if so provided.

2.10 PREPARATION FOR FIRE STOPPING

.1 Install firestopping within annular space between pipes, ducts, insulation and adjacent fire separation in accordance with Section [07 84 00- Fire Stopping] .

.2 Uninsulated unheated pipes not subject to movement: no special preparation.

.3 Uninsulated heated pipes subject to movement: wrap with non-combustible smooth material to permit pipe movement without damaging fires topping material or installation.

.4 Insulated pipes and ducts: ensure integrity of insulation and vapour barriers.

2.11 FLUSHING OUT OF PIPING SYSTEMS

.1 Flush system in accordance with Section [23 08 02- Cleaning and start-up of HVAC piping systems] .

.2 Before start-up, clean interior of piping systems as required and supplemented as specified in relevant mechanical sections .

.3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

2.12 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

.1 Advise all trades prior to performance of pressure tests.
.2 Pipework: test as specified in relevant sections of heating, ventilating and air conditioning work.
.3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant mechanical sections.
.4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.
.5 Pay costs for repairs or replacement, retesting, and making good.
.6 Insulate or conceal work only after approval and certification of tests by Authorities having jurisdiction and Engineer.

2.13 EXISTING SYSTEMS

.1 Connect into existing piping systems at times approved by General Contractor.

.2 Be responsible for damage to existing plant caused by this work.

2.14 CLEANING

.1 Clean in accordance with General Contractor's requirements.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 22 05 00 and 23 05 00.

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM A53/A53M-07 , Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A105/A105M-05, Standard Specification for Carbon Steel Forgings, for Piping Applications.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for fixtures, and include product characteristics, performance criteria, physical size, finish and limitations.

.1 Manufacturer, model number, line contents, pressure and temperature rating.

.2 Movement handled, axial, lateral, angular and the amounts of each.

.3 Nominal size and dimensions including details of construction and assembly.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance and operation data for maintenance manuals.

.1 Data to include:

.1 Servicing requirements, including special requirements, stuffing box packing, lubrication and recommended procedures.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance General Contractor’s instructions.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse or disposal as directed by General Contractor.

Part 2 Products

2.1 SLIP TYPE EXPANSION JOINTS

.1 Application: for axial pipe movement, as indicated.

.2 Repacking: under full line pressure.

.3 Body and packing housings: Class 150, 1MPa carbon steel pipe to ASTM A53/A53M, Grade B. Wall thickness to match pipe with ends for welding, slip-on flanges to match pipe.

.4 Slip or traverse sleeves: carbon steel pipe to ASTM A53/A53M, Grade B.

.5 Anchor base: construction steel, welded to body.

.6 Guides (internal and external): embody into packing housing with concentric alignment of slip or traverse sleeve with packing housing.

.7 Extension limit stop: stainless steel, to prevent over-extension with accessible and removable pins.

.8 Packing rings: 6 mm impregnated non-asbestos.

.9 Thermal plastic packing: non-asbestos slug supplied loose.

.10 Lubricating fittings: pet cocks with grease nipple.

.11 Plunger body and plunger:

.1 Plunger body: heavy wall carbon steel welded to body.

.2 Plunger: carbon steel with hex head for use with socket wrench.

.12 Lubricant: to manufacturer's recommendations.

.13 Lubricant gun: complete with hose assembly.

.14 Drip connection: 20 MPa forged steel to ASTM A105/A105M. Include half coupling with drain plug.

2.2 BELLOWS TYPE EXPANSION JOINTS

.1 For axial, lateral or angular movements, as indicated.

.2 Type A: controlled or free flexing, factory tested to 1 ½ times maximum working pressure. Provide test certificates.

.3 Type B: externally pressurized, constant volume, pressure balanced, designed to eliminate pressure thrust, factory tested to 1 ½ times maximum working pressure. Provide test certificates.

.4 Bellows:

.1 Multiple bellows, hydraulically formed, for specified fluid, pressure and temperature, water treatment and pipeline cleaning procedures.

.5 Reinforcing or control rings:

.1 2 piece nickel iron.

.6 Ends: For butt welding, raised face flanges to match pipe] .

.7 Liner: Austenitic stainless steel in direction of flow.

.8 Shroud: Carbon steel, painted.

2.3 GROOVED END EXPANSION JOINTS

.1 Packless, Gasketted, Slip, Expansion Joints:

.1 2413 kPa maximum working pressure.

.2 Steel pipe fitting consisting of telescoping body and slip-pipe sections.

.3 PTFE modified polyphenylene sulfide coated slide section.

.4 Suitable for axial end movement to 75 mm.

.2 Expansion joint consisting of series of grooved end pipe nipples joined in tandem with flexible couplings. Total joint movement dependent on number of couplings and nipples used.

2.4 FLEXIBLE CONNECTION

.1 Application: to suit motion.

.2 Minimum length in accordance with manufacturer's recommendations to suit offset.

.3 Inner hose: stainless steel.

.4 Braided wire mesh or stainless steel outer jacket.

.5 Diameter and type of end connection: as required.

.6 Operating conditions:

.1 To match system requirements.

.7 Three flexible grooved couplings placed in close proximity to vibration source for vibration attenuation and stress relief.

2.5 ANCHORS AND GUIDES

.1 Anchors:

.1 Provide as indicated.

.2 Alignment guides:

.1 Provide as required.

.2 To accommodate specified thickness of insulation.

.3 Vapour barriers, jackets to remain uninterrupted.

Part 3 Execution

3.1 APPLICATION

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

3.2 INSTALLATION

.1 Install expansion joints with cold setting. Make record of cold settings.

.2 Install expansion joints and flexible connections in accordance with manufacturer's instructions.

.3 Install pipe anchors and guides as indicated. Anchors to withstand 150 % of axial thrust.

.4 Do welding Welding] .

3.3 PIPE CLEANING AND START-UP

.1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

3.4 PERFORMANCE VERIFICATION

.1 In accordance with Section 23 08 01- Performance Verification: Mechanical Piping Systems.

3.5 CLEANING

.1 Clean in accordance with General Contractor’s and Engineer’s instructions.

.2 Waste Management: separate waste materials for recycling or disposal in accordance with General Contractor’s requirements.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 22 05 00 and 23 50 00.

1.2 REFERENCE STANDARDS

.1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)

- .1 ANSI/ASME B31.1-2007, Power Piping.
- .2 ANSI/ASME B31.3-2006, Process Piping.
- .3 ANSI/ASME Boiler and Pressure Vessel Code-2007:
  - .1 BPVC 2007 Section I: Power Boilers.
  - .2 BPVC 2007 Section V: Nondestructive Examination.
  - .3 BPVC 2007 Section IX: Welding and Brazing Qualifications.

.2 American National Standards Institute/American Water Works Association (ANSI/AWWA)

- .1 ANSI/AWWA C206-[03] , Field Welding of Steel Water Pipe.

.3 American Welding Society (AWS)

- .1 AWS C1.1M/C1.1-2000(R2006) , Recommended Practices for Resistance Welding.
- .2 AWS Z49.1-2005, Safety in Welding, Cutting and Allied Process.
- .3 AWS W1-2000, Welding Inspection Handbook.

.4 CSA Group (CSA)

- .1 CSA W47.2-M1987(R2008), Certification of Companies for Fusion Welding of Aluminum.
- .2 CSA W48-06 , Filler Metals and Allied Materials for Metal Arc Welding.
- .3 CSA B51-03(R2007) , Boiler, Pressure Vessel and Pressure Piping Code.
- .4 CSA-W117.2-2006, Safety in Welding, Cutting and Allied Processes.
- .5 CSA W178.1-2008, Certification of Welding Inspection Organizations.
- .6 CSA W178.2-2008, Certification of Welding Inspectors.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Sections 22 05 00 and 23 05 00.

1.4 QUALITY ASSURANCE

.1 Qualifications:

.1 Welders:

.1 Welding qualifications in accordance with CSA B51.

.2 Use qualified and licensed welders possessing certificate for each procedure performed from authority having jurisdiction.

.3 Submit welder's qualifications to General Contractor and authorities having jurisdiction upon request.

.4 Each welder to possess identification symbol issued by authority having jurisdiction.

.5 Certification of companies for fusion welding of aluminum in accordance with CSA W47.2.

.2 Inspectors:

.1 Inspectors qualified to CSA W178.2.

.3 Certifications:

.1 Registration of welding procedures in accordance with CSA B51.

.2 Copy of welding procedures available for inspection.

.3 Safety in welding, cutting and allied processes in accordance with CSA-W117.2.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section [01 61 00- Common Product Requirements] .

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse [by manufacturer] [and return] of [packaging materials] [pallets] [crates] [padding] in accordance with Section [01 74 19- Waste Management and Disposal] .

Part 2 Products

2.1 ELECTRODES

.1 Electrodes: in accordance with CSA W48 Series.

Part 3 Execution

3.1 APPLICATION

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

3.2 QUALITY OF WORK

.1 Welding: in accordance with ANSI/ASME B31.3 B31.1 , ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX and ANSI/AWWA C206, using procedures conforming to AWS B3.0, AWS C1.1, applicable requirements of provincial authority having jurisdiction and special procedures specified elsewhere.

3.3 INSTALLATION REQUIREMENTS

.1 Identify each weld with welder's identification symbol.

.2 Backing rings:

.1 Where used, fit to minimize gaps between ring and pipe bore.

.2 Do not install at orifice flanges.

.3 Fittings:

.1 NPS 2 and smaller: install welding type sockets.

.2 Branch connections: install welding tees or forged branch outlet fittings.

3.4 INSPECTION AND TESTS - GENERAL REQUIREMENTS

.1 Review weld quality requirements and defect limits of applicable codes and standards before work is started.

.2 Formulate "Inspection and Test Plan" in co-operation with Authorities Having Jursidiction.

.3 Do not conceal welds until they have been inspected, tested and approved by inspector.

.4 Provide for inspector to visually inspect welds during early stages of welding procedures in accordance with Welding Inspection Handbook. Repair or replace defects as required by codes and as specified.

3.5 SPECIALIST EXAMINATIONS AND TESTS

.1 General:

.1 Perform required examinations and tests by specialist qualified to CSA W178.1 and CSA W178.2 and approved by Authorities Having Jurisdiction.

.2 To ANSI/ASME Boiler and Pressure Vessels Code, Section V, CSA B51 and requirements of authority having jurisdiction.

.3 Inspect and test as directed.

.2 Hydrostatically test welds to ANSI/ASME B31.1.

.3 Visual examinations: include entire circumference of weld externally and wherever possible internally.

.4 Failure of visual examinations:

.1 Upon failure of welds by visual examination, perform additional testing as directed by Authorities Having Jurisdiction.

.2 Spot radiography:

.1 Conduct spot radiographic tests as directed.

.3 Radiographic film:

.1 Identify each radiographic film with date, location, name of welder, and submit to Engineer. Replace film if rejected because of poor quality.

.4 Interpretation of radiographic films:

.1 By qualified radiographer.

.5 Failure of radiographic tests:

.1 Extend tests to welds by welder responsible when those welds fails tests.

3.6 DEFECTS CAUSING REJECTION

.1 As described in ANSI/ASME B31.1 and ANSI/ASME Boiler and Pressure Vessels Code.

.2 In addition, chilled water systems:

.1 Undercutting greater than 0.8 mm adjacent to cover bead on outside of pipe.

.2 Undercutting greater than 0.8 mm adjacent to root bead on inside of pipe.

.3 Undercutting greater than 0.8 mm at combination of internal surface and external surface.

.4 Incomplete penetration and incomplete fusion greater than total length of 38 mm in 1500 mm length of weld depth of such defects being greater than 0.8 mm.

.5 Repair cracks and defects in excess of 0.8 mm in depth.

.6 Repair defects whose depth cannot be determined accurately on basis of visual examination or radiographic tests.

3.7 REPAIR OF WELDS WHICH FAILED TESTS

.1 Re-inspect and re-test repaired or re-worked welds at Contractor's expense.

3.8 CLEANING

.1 Clean in accordance with General Contractor’s and Engineer’s instructions.

.2 Waste Management: separate waste materials for recycling or disposal as directed by General Contractor.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Sections 22 05 00 and 23 05 00.

1.2 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B40.100-2005, Pressure Gauges and Gauge Attachments.

.2 ASME B40.200-2008, Thermometers, Direct Reading and Remote Reading.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-14.4-M88, Thermometers, Liquid-in-Glass, Self Indicating, Commercial/Industrial Type.

.2 CAN/CGSB-14.5-M88, Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.

.3 Efficiency Valuation Organization (EVO)

.1 International Performance Measurement and Verification Protocol (IPMVP)

.1 IPMVP [2007] Version.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Sections 22 05 00 and 23 05 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for thermometers and pressure gauges and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings in Acrobat PDF format.

.4 Certificates:

.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Test and Evaluation Reports:

.1 Submit certified test reports for thermometers and pressure gauges from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store thermometers and pressure gauges in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect thermometers and pressure gauges from [nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 GENERAL

.1 Design point to be at mid-point of scale or range.

.2 Ranges: as indicated.

2.2 DIRECT READING THERMOMETERS

.1 Industrial, variable angle type, mercury-free, 125 mm scale length: to ASME B40.200 and CAN/CGSB-14.4.

.1 Resistance to shock and vibration.

2.3 REMOTE READING THERMOMETERS

.1 100 mm diameter mercury-free activated dial type: to CAN/CGSB-14.5 and ASME B40.200, accuracy within one scale division, brass movement, stainless steel capillary, spiral armour, stainless steel bulb and polished brass case for wall mounting.

2.4 THERMOMETER WELLS

.1 Copper pipe: copper or bronze.

.2 Steel pipe: brass.

2.5 PRESSURE GAUGES

.1 112 mm, dial type: to ASME B40.100 , Grade 2A, stainless steel bourdon tube having 0.5% accuracy full scale unless otherwise specified.

.2 Provide:

.1 Siphon for steam service.

.2 Snubber for pulsating operation.

.3 Diaphragm assembly for corrosive service.

.4 Gasketted pressure relief back with solid front.

.5 Bronze stop cock.

.6 Oil filled for high vibration applications.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions are acceptable for installation in accordance with manufacturer's written instructions.

3.2 GENERAL

.1 Install thermometers and gauges so they can be easily read from floor or platform.
- .1 If this cannot be accomplished, install remote reading units.

.2 Install between equipment and first fitting or valve.

3.3 THERMOMETERS

.1 Install in wells on piping. Include heat conductive material inside well.

.2 Install in locations as indicated and on inlet and outlet of:
- .1 Heat exchangers.
- .2 DX cooling coils.
- .3 Where indicated.

.3 Install wells as indicated for balancing purposes.

.4 Use extensions where thermometers are installed through insulation.

3.4 PRESSURE GAUGES

.1 Install in locations as follows:
- .1 Air Filters.
- .2 Where indicated.

.2 Install gauge cocks for balancing purposes, elsewhere as indicated.

.3 Use extensions where pressure gauges are installed through insulation.

3.5 NAMEPLATES

.1 Install engraved lamicoid nameplates in accordance with Section 23 05 53 - Identification For HVAC Piping and Equipment] , identifying medium.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with General Contractor’s instructions.
- .1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with General Contractor’s directives.

3.7 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by thermometer and gauge installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Sections 22 05 00 and 23 05 00.

1.2 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B31.1-07, Power Piping.

.2 ASTM International (ASTM)

.1 ASTM A125-1996(2007), Standard Specification for Steel Springs, Helical, Heat-Treated.

.2 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A563-07a , Standard Specification for Carbon and Alloy Steel Nuts.

.3 Factory Mutual (FM)

.4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP58-2002, Pipe Hangers and Supports - Materials, Design and Manufacture.

.2 MSS SP69-2003, Pipe Hangers and Supports - Selection and Application.

.3 MSS SP89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.

.5 National Research Council Canada (NRC)

.1 National Plumbing Code of Canada 2015 (NPC).

.6 Underwriter's Laboratories of Canada (ULC)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Sections 22 05 00 and 23 05 00.

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit shop drawings for:

.1 Bases, hangers and supports.

.2 Connections to equipment and structure.

.3 Structural assemblies.

.4 Certificates:

.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Manufacturers' Instructions:

.1 Provide manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into maintenance manual.

1.5 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse or recycling in accordance with General Contractor's instructions.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
.2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP58.
.3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
.4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.

.2 Performance Requirements:

.1 Design supports, platforms, catwalks, hangers to withstand seismic events if specified.

2.2 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with MSS SP58. ANSI B31.1 and

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.3 PIPE HANGERS

.1 Finishes:

.1 Pipe hangers and supports: galvanized after manufacture.

.2 Use electro-plating galvanizing process or hot dipped galvanizing process.

.3 Ensure steel hangers in contact with copper piping are epoxy coated or copper plated.

.2 Upper attachment structural: suspension from lower flange of I-Beam:

.1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut [carbon steel retaining clip] .

.1 Rod: 13 mm FM approved.

.2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed MSS-SP69; FM approved to MSS-SP58.

.3 Upper attachment structural: suspension from upper flange of I-Beam:

.1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, FM approved to MSS SP69; UL listed.

.2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut; FM approved; UL listed.

.4 Upper attachment to concrete:

.1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye is 6 mm minimum greater than rod diameter.

.2 Concrete inserts: wedge shaped body with knockout protector plate UL listed; FM approved to MSS SP69.

.5 Shop and field-fabricated assemblies:

.1 Trapeze hanger assemblies:
.2 Steel brackets:
.3 Sway braces for seismic restraint systems: if specified.

.6 Hanger rods: threaded rod material to MSS SP58:

.1 Ensure that hanger rods are subject to tensile loading only.
.2 Provide linkages where lateral or axial movement of pipework is anticipated.
.3 Do not use 22 mm or 28 mm rod.

.7 Pipe attachments: material to MSS SP58:

.1 Attachments for steel piping: carbon steel [black] [galvanized] .
.2 Attachments for copper piping: copper plated black steel.
.3 Use insulation shields for hot pipework.
.4 Oversize pipe hangers and supports.

.8 Adjustable clevis: material to MSS SP69 UL listed; FM approved, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.

.1 Ensure "U" has hole in bottom for rivetting to insulation shields.

.9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP69.

.10 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563.

.1 Finishes for steel pipework: galvanized or black.

.2 Finishes for copper, glass, brass or aluminum pipework: black; epoxy coated or galvanized, with formed portion plastic coated.

.11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69.

2.4 RISER CLAMPS

.1 Steel or cast iron pipe: galvanized or black carbon steel to MSS SP58, type 42, UL listed; FM approved.

.2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.

.3 Bolts: to ASTM A307.

.4 Nuts: to ASTM A563.

2.5 INSULATION PROTECTION SHIELDS

.1 Insulated cold piping:

.1 64 kg/m^{3}density insulation plus insulation protection shield to: MSS SP69, galvanized sheet carbon steel. Length designed for maximum 3 m span.

.2 Insulated hot piping:

.1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP69.

2.6 CONSTANT SUPPORT SPRING HANGERS

.1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR).

.2 Load adjustability: [10] % minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.

.3 Provide upper and lower factory set travel stops.

.4 Provide load adjustment scale for field adjustments.

.5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.

.6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.7 VARIABLE SUPPORT SPRING HANGERS

.1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.

.2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.

.3 Variable spring hanger complete with factory calibrated travel stops. Provide certificate of calibration for each hanger.

.4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

2.8 EQUIPMENT SUPPORTS

.1 Fabricate equipment supports not provided by equipment manufacturer or other trades from structural grade steel meeting requirements of structural engineer. Submit calculations with shop drawings.

2.9 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

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

2.10 PLATFORMS AND CATWALKS

.1 To relevant section.

2.11 HOUSE-KEEPING PADS

.1 Provide 100 mm high concrete housekeeping pads for base-mounted equipment; size pads 50 mm larger than equipment; chamfer pad edges.

.2 Concrete: to section for Cast-in-Place Concrete.

2.12 OTHER EQUIPMENT SUPPORTS

.1 Fabricate equipment supports from structural grade steel meeting requirements of Section 05 12 23- Structural Steel for Buildings.

.2 Submit structural calculations with shop drawings.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install in accordance with Manufacturer's instructions and recommendations.

.2 Vibration Control Devices:

.1 Install on piping systems at pumps, boilers, chillers, cooling towers, and as indicated.

.3 Clamps on riser piping:

.1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.

.2 Bolt-tightening torques to industry standards.

.3 Steel pipes: install below coupling or shear lugs welded to pipe.

.4 Cast iron pipes: install below joint.

.4 Clevis plates:

.1 Attach to concrete with minimum of 4 concrete inserts, one at each corner.

.5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

.6 Use approved constant support type hangers where:

.1 Vertical movement of pipework is 13 mm or more,
.2 Transfer of load to adjacent hangers or connected equipment is not permitted.

.7 Use variable support spring hangers where:

.1 Transfer of load to adjacent piping or to connected equipment is not critical.
.2 Variation in supporting effect does not exceed 25 % of total load.

3.3 HANGER SPACING

.1 Plumbing piping: to Provincial Plumbing Code and authority having jurisdiction.
.2 Fire protection: to applicable fire code.
.3 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.
.4 Copper piping: up to NPS 1/2: every 1.5 m.

.5 Flexible joint roll groove pipe: in accordance with table below for steel, but not less than one hanger at joints. Table listings for straight runs without concentrated loads and where full linear movement is not required.

.6 Within 300 mm of each elbow.

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

.7 Pipework greater than NPS 12: to MSS SP69.

3.4 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

3.5 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.
.2 Equalize loads.

.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanger performance.
.2 Tighten upper nut after adjustment.

.3 C-clamps:

.1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:

.1 Hammer jaw firmly against underside of beam.

3.7 CLEANING

.1 Clean in accordance with Section [01 74 00- Cleaning] .

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for recycling or reuse in accordance with General Contractor's instructions.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.

.2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 QUALIFICATIONS OF TAB PERSONNEL

.1 Submit names of personnel to perform TAB to Engineer within 30 days of award of contract.

.2 Provide documentation confirming qualifications, successful experience.

.3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:

.1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2002.

.2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-1998.

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.

.4 Recommendations and suggested practices contained in the TAB Standard: mandatory.

.5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.

.6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.

.7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.

.8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.

.1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.

.2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.3 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads

.2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.4 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.5 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.6 PRE-TAB REVIEW

.1 Review Contract Documents before project construction is started, and confirm in writing to Engineer adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to Engineer in writing proposed procedures which vary from standard.

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

1.7 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in Division 23.

1.8 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required for verification of TAB reports.

1.9 START OF TAB

.1 Notify Engineer and General Contractor days prior to start of TAB.
.2 Start TAB when building is essentially completed, including:
.3 Installation of ceilings, doors, windows, other construction affecting TAB.
.4 Application of weatherstripping, sealing, and caulking.
.5 Pressure, leakage, other tests specified elsewhere Division 23.
.6 Provisions for TAB installed and operational.

.7 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.

.2 Air systems:

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

1.10 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:

.1 HVAC systems: plus 5%, minus 5%.

1.11 ACCURACY TOLERANCES

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

1.12 INSTRUMENTS

.1 As part of TAB report, provide list of instruments used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate within 3 months of TAB.

1.13 PRELIMINARY TAB REPORT

.1 Submit for checking and approval of Engineer, prior to submission of formal TAB report, sample of rough TAB sheets. Include:

.1 Details of instruments used.
.2 Details of TAB procedures employed.
.3 Calculations procedures.
.4 Summaries.

1.14 TAB REPORT

.1 Format in accordance with [referenced standard] .

.2 TAB report to show results in SI units and to include:

.1 Project record drawings.
.2 System schematics.

.3 Submit Acrobat PDF copy of TAB Report to Engineer for review.

1.15 VERIFICATION

.1 Reported results subject to verification by Engineer.

.2 Provide personnel and instrumentation to verify up to 30% of reported results.

.3 Number and location of verified results as directed by Engineer.

.4 Pay costs to repeat TAB as required to satisfaction of Engineer.

1.16 SETTINGS

.1 After TAB is completed to satisfaction of Engineer, reinstall drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.

.2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

1.17 COMPLETION OF TAB

.1 TAB considered complete when final TAB Report received and approved by Engineer.

1.18 AIR SYSTEMS

.1 Standard: TAB to most stringent of this section TAB standards of SMACNA, AABC, ASHRAE.

.2 Do TAB of following systems, equipment, components, and controls:

.1 All air systems.

.3 Qualifications: personnel performing TAB qualified to standards of AABC; current member in good standing of AABC.

.4 Quality assurance: perform TAB under direction of supervisor qualified by AABC.

.5 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

.6 Locations of equipment measurements: to include as appropriate:

.1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.

.2 At controllers, controlled device.

.7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.19 OTHER TAB REQUIREMENTS

.1 General requirements applicable to work specified this paragraph:

.1 Qualifications of TAB personnel: as for air systems specified this section.

.2 Quality assurance: as for air systems specified this section.

.2 Building pressure conditions:

.1 Adjust HVAC systems, equipment, controls to ensure specified pressure conditions where specified.

.2 TAB procedures:

Part 2 Products

2.1 HVAC Components

.1 Belts, sheaves and pulleys.

Part 3 Execution

3.1 HVAC Components

.1 Replace belts, sheaves and pulleys as required to meet air flow requirements for belt driven fan systems.

.2 Assist HVAC contractor in changing motor speeds if required for multi-speed motors.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and methods for pressure testing ducts over 5 m in length, forming part of a supply, return or exhaust ductwork system directly or indirectly connected to air handling equipment.

.2 Related Requirements

.1 General Conditions

1.2 REFERENCE STANDARDS

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

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

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Make submittals in accordance with relevant Section.

.2 Co-ordinate submittal requirements and provide submittals required by relevant Section.

.3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties. Include pressure test information and results as follows:

.1 Submit proposed report form and test report format to Consultant for approval at least 30 days before proposed date of tests. Do not start tests until approval received in writing from Consultant.

.2 Prepare report of results and submit to Consultant within 7 days of completion of tests. Include:
.1 Schematic of entire system.
.2 Schematic of section under test showing test site.
.3 Required and achieved static pressures.
.4 Orifice differential pressure at test sites.
.5 Permissible and actual leakage flow rate (L/s) for test sites.
.6 Witnessed certification of results.

.3 Include test reports in final TAB report.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions: submit manufacturer's installation instructions.

.6 Manufacturer's field reports specified.

1.4 QUALITY ASSURANCE

.1 Pre-Installation Meetings:

.1 Convene pre-installation meeting [one] week prior to beginning [work of this Section] [on-site installations] in accordance with [Section [01 32 16.19- Construction Progress Schedules - Bar (GANTT) Chart]] [Section [01 32 16.16- Construction Progress Schedule - Critical Path Method (CPM)]] .

.1 Verify project requirements.

.2 Review installation [and substrate] conditions.

.3 Co-ordination with other building subtrades.

.4 Review [manufacturer's] installation instructions and warranty requirements.

.2 Health and Safety:

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

.3 Sustainable Requirements:

.1 Construction requirements: in accordance with Section [01 47 15- Sustainable Requirements: Construction] .

.2 Verification: contractor's verification in accordance with Section [01 47 17- Sustainable Requirements: Contractor's Verification] .

Part 2 Products

2.1 TEST INSTRUMENTS

.1 Test apparatus to include:

.1 Fan capable of producing required static pressure.

.2 Duct section with calibrated orifice plate mounted and accurately located pressure taps.

.3 Flow measuring instrument compatible with the orifice plate.

.4 Calibration curves for orifice plates used.

.5 Flexible duct for connecting to ductwork under test.

.6 Smoke bombs for visual inspections.

.2 Test apparatus: accurate to within +/- [3] % of flow rate and pressure.

.3 Submit details of test instruments to be used to [Consultant] [Departmental Representative] [DCC Representative] at least [three] months before anticipated start date.

.4 Test instruments: calibrated and certificate of calibration deposited with [DCC Representative] [Departmental Representative] [Consultant] no more than [28] days before start of tests.

.5 Re-calibrated every [six] months thereafter.

2.2 EQUIPMENT LEAKAGE TOLERANCES

.1 Equipment and system components such as VAV boxes, duct heating leakage: 5%

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 TEST PROCEDURES

.1 Maximum lengths of ducts to be tested consistent with capacity of test equipment.

.2 Section of duct to be tested to include:
- .1 Fittings, branch ducts, tap-ins.

.3 Repeat tests until specified pressures are attained. Bear costs for repairs and repetition to tests.

.4 Base partial system leakage calculations on SMACNA HVAC Air Duct Leakage Test Manual.

.5 Seal leaks that can be heard or felt, regardless of their contribution to total leakage.

3.3 SITE TOLERANCES

.1 System leakage tolerances specified are stated as percentage of total flow rate handled by system. Pro-rate specified system leakage tolerances. Leakage for sections of duct systems: not to exceed total allowable leakage.

.2 Leakage tests on following systems not to exceed specified leakage rates.
- .1 Small duct systems up to 250 Pa: leakage 2 %.
- .2 Large low pressure duct systems up to 500 Pa: leakage[2 %.

.3 Evaluation of test results to use surface area of duct and pressure in duct as basic parameters.

3.4 TESTING

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

3.5 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services.

- .1 Have manufacturer of products, supplied under this Section, review Work involved in the handling, installation/application, protection and cleaning, of its product[s] and submit written reports, in acceptable format, to verify compliance of Work with Contract.

.2 Manufacturer's Field Services: provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, at stages listed:

.1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.

.2 Once during progress of Work at 90% complete.

.3 Upon completion of the Work, after cleaning is carried out.

.4 Obtain reports, within 7 days of review, and submit to Consultant.

.2 Performance Verification:

.1 Consultant to witness tests and to verify reported results.

.2 To be certified by same TAB agency approved by Consultant to undertake TAB on this project.

3.6 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Sections 22 05 00 and 23 05 00.

1.2 REFERENCE STANDARDS

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

.1 ANSI/ASHRAE/IESNA 90.1-04, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 ASTM International (ASTM)

.1 ASTM B209M-07, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

.2 ASTM C335-05ae1, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.

.3 ASTM C411-05, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.4 ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.5 ASTM C547-07e1, Standard Specification for Mineral Fiber Pipe Insulation.

.6 ASTM C553-02e1, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.7 ASTM C612-04e1, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

.8 ASTM C795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.9 ASTM C921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.3 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.4 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (2005).

.5 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102-03, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

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

1.3 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - means "not concealed" as previouslydefined.

.3 Insulation systems - insulation material, fasteners, jackets, and other accessories.

.2 TIAC Codes:

.1 CRD: Code Round Ductwork,

.2 CRF: Code Rectangular Finish.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Sections 22 05 00 and 23 05 00.

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for duct insulation, and include product characteristics, performance criteria, physical size, finish and limitations.

.1 Description of equipment giving manufacturer's name, type, model, year and capacity.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list.

.3 Samples:

.1 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed if requested.

.2 Mount sample on 12 mm plywood board.

.3 Affix typewritten label beneath sample indicating service.

.4 Manufacturers' Instructions:

.1 Provide manufacture's written duct insulation jointing recommendations. and special handling criteria, installation sequence, cleaning procedures.

1.5 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project

1.6 DELIVERY, STORAGE AND HANDLING

1.7 Deliver, store and handle in accordance with manufacturer's written instructions.

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address and ULC markings.

.2 Packaging Waste Management: remove for reuse or recycling in accordance with General Contractor's instructions.

Part 2 Products

2.1 FIRE AND SMOKE RATING

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

2.2 INSULATION

.1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.

.3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with factory applied vapour retarder jacket to CGSB 51-GP-52Ma.

.4 TIAC Code C-2: Mineral fibre blanket to ASTM C553 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).

- .1 Mineral fibre: to ASTM C553.
- .2 Jacket: to CGSB 51-GP-52Ma.
- .3 Maximum "k" factor: to ASTM C553.

2.3 JACKETS

.1 Canvas:

- .1 220 gm/m^2cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.2 Lagging adhesive: compatible with insulation.

- .1 Maximum VOC limit as per Authorities Having Jurisdiction.

.3 Aluminum:
- .1 To ASTM B209 with moisture barrier.
- .2 Thickness: 0.50 mm sheet.
- .3 Finish: Smooth.
- .4 Jacket banding and mechanical seals: 12 mm wide, 0.5 mm thick stainless steel.

.4 PVC:
- .1 PVC Jacket provided by manufacturer.

2.4 ACCESSORIES

.1 Vapour retarder lap adhesive:

- .1 Water based, fire retardant type, compatible with insulation.
  - .1 Maximum VOC limit as permitted by AHJ.

.2 Indoor Vapour Retarder Finish:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449.

.4 ULC Listed Canvas Jacket:

.1 220 gm/m^2cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.5 Contact adhesive: quick-setting

.1 Maximum VOC limit as permitted by AHJ.

.6 Canvas adhesive: washable.

.1 Maximum VOC limit as permitted by AHJ.

.7 Tie wire: 1.5 mm stainless steel.

.8 Banding: 12 or 19 mm wide, 0.5 mm thick stainless steel.

.9 Facing: 25 mm galvanized steel hexagonal wire mesh stitched on one face of insulation with expanded metal lath on both faces of insulation.

.10 Fasteners: 4 mm diameter pins with 35 mm square diameter clips, length to suit thickness of insulation.

Part 3 Execution

3.1 APPLICATION

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

3.2 PRE-INSTALLATION REQUIREMENTS

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

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards.
.2 Apply materials in accordance with manufacturers instructions and as indicated.
.3 Use 2 layers with staggered joints when required nominal thickness exceeds 75 mm.
.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
.1 Ensure hangers, and supports are outside vapour retarder jacket.

.5 Hangers and supports in accordance with [Section 23 05 29- Hangers and Supports for HVAC Piping and Equipment] .

.1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.

.6 Fasteners: install at 300 mm on centre in horizontal and vertical directions, minimum [2] rows each side.

3.4 DUCTWORK INSULATION SCHEDULE

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

TIAC Code	Code	Vapour Retarder	Thickness (mm)
Rectangular cold and dual temperature supply air ducts	C-1	Yes	25
Round cold and dual temperatire supply air ducts	C-2	Yes	25
Rectangular warm air ducts	C-1	No	25
Round warm air ducts	C-1	No	25
Supply, return and exhaust ducts exposed in space being served	None		
Outside air ducts to mixing plenum	C-1	Yes	25
Mixing plenums	C-1	Yes	25
Exhaust duct between dampers and louvres	C-1	Yes	25
Rectangular ducts outside	C-1	See drawings	50
Round ducts outside	C-1	See drawings	50
Acoustically lined ducts	none	See drawings	

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

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

.1 Finishes: conform to following table:

TIAC Code		
Rectangular	Round	
Indoor, concealed	None	none
Indoor, exposed within mechanical room	CRF/1	CRD/2
Indoor, exposed elsewhere	CRF/2	CRD/3
Outdoor, exposed to precipitation	CRF/3	CRD/4
Outdoor, elsewhere	CRF/4	CRD/5

3.5 CLEANING

.1 Clean in accordance with Section [01 74 00- Cleaning] .

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for reuse or recycling in accordance with General Contractor’s instructions.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Sections 22 05 00 and 23 05 00.

1.2 REFERENCE STANDARDS

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

.1 ANSI/ASHRAE 90.1-04 -SI Edition, Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 ASTM International (ASTM)

.1 ASTM C335-05ae1, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.2 ASTM C449/C449M-07, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.3 ASTM C533-07, Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.

.4 ASTM C547-07, Standard Specification for Mineral Fiber Pipe Insulation.

.5 ASTM C553-02, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.6 ASTM C612-04e1, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

.7 ASTM C795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.8 ASTM C921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.3 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52MA-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.2 CAN/CGSB 51.53-95, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.5 Thermal Insulation Association of Canada (TIAC)

.1 National Insulation Standards 2005.

.6 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102-07, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Sections 22 05 00 and 23 05 00.

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for insulation and adhesives, include product characteristics, performance criteria, physical size, finish and limitations.

.2 Provide WHMIS MSDS - Material Safety Data Sheets in accordance with Health and Safety Requirements.

.3 Samples:

.1 Provide for review and approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed if requested.

.1 Mount sample on 12 mm plywood board.

.2 Affix typewritten label beneath sample indicating service.

.4 Manufacturer's Instructions:

.1 Include procedures to be used and installation standards to be achieved.

.5 Qualifications:

.1 Installer to be specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with manufacturer’s instructions.
.2 Deliver materials to site in original factory packaging with original labels.
.3 Store at temperatures and conditions recommended by manufacturer.

.4 Packaging Waste Management: remove for reuse or recycling in accordance with General Contractor’s instructions .

Part 2 Products

2.1 FIRE AND SMOKE RATING

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

2.2 INSULATION

.1 Mineral fibre: includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.

.3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.
.1 Mineral fibre: ASTM C547.
.2 Maximum "k" factor: ASTM C547.

.4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.
- .1 Mineral fibre: ASTM C547.
- .2 Jacket: to CGSB 51-GP-52MA.
- .3 Maximum "k" factor: ASTM C547.

.5 TIAC Code C-1: rigid mineral fibre board, unfaced.
- .1 Mineral fibre: ASTM C612.
- .2 Maximum "k" factor: ASTM C612.

.6 TIAC Code C-4: rigid mineral fibre board faced with factory applied vapour retarder jacket.
- .1 Mineral fibre: ASTM C612.
- .2 Jacket: to CGSB 51-GP-52MA.
- .3 Maximum "k" factor: ASTM C612.

.7 TIAC Code C-2: mineral fibre blanket unfaced or faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).
- .1 Mineral fibre: ASTM C553.
- .2 Jacket: to CGSB 51-GP-52MA.
- .3 Maximum "k" factor: ASTM C553.

.8 TIAC Code A.6: flexible unicellular tubular elastomer.
- .1 Insulation: with vapour retarder jacket.
- .2 Jacket: to CGSB 51-GP-52MA.
- .3 Maximum "k" factor.
- .4 Certified by manufacturer free of potential stress corrosion cracking corrodents.

.9 TIAC Code A-2: rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.
- .1 Insulation: ASTM C533.
- .2 Maximum "k" factor: ASTM C533.
- .3 Design to permit periodic removal and re-installation.

2.3 CEMENT

.1 Thermal insulating and finish
- .1 To: ASTM C449/C449M.
- .2 Hydraulic setting or Air drying on mineral wool, to ASTM C449.

2.4 JACKETS

.1 Polyvinyl Chloride (PVC):
- .1 One-piece moulded type to CAN/CGSB 51.53 with pre-formed shapes as required.
- .2 Colours: White.
- .3 Minimum service temperatures: -20 degrees C.
- .4 Maximum service temperature: 65 degrees C.
- .5 Moisture vapour transmission: 0.02 perm.
- .6 Thickness:

.7 Fastenings:

.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.

.2 Tacks.

.3 Pressure sensitive vinyl tape of matching colour.

.8 Special requirements:

.1 Outdoor: UV rated material at least 0.5 mm thick.

.9 Covering adhesive: compatible with insulation.

.1 Maximum VOC limit as per AHJ.

.2 Canvas:

.1 [120] [220] gm/m^2cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.2 Lagging adhesive: compatible with insulation.

.1 Maximum VOC limit [250] [80] [30] g/L [GSES GS-36] [to SCAQMD Rule 1168] and in accordance with Section [01 35 21- LEED Requirements] .

.3 Aluminum:

.1 To ASTM B209.
.2 Thickness: 0.50 mm sheet.
.3 Finish: smooth.
.4 Joining: longitudinal and circumferential slip joints with 50 mm laps.
.5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
.6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

2.5 INSULATION SECUREMENTS

.1 Tape: self-adhesive, aluminum, [reinforced] [plain] , [50] mm wide minimum.

.2 Contact adhesive: quick setting.

.1 Maximum VOC limit [250] [80] [30] g/L [GSES GS-36] [to SCAQMD Rule 1168] and in accordance with Section [01 35 21- LEED Requirements] .

.3 Canvas adhesive: washable.

.1 Maximum VOC limit [250] [30] [80] g/L [to SCAQMD Rule 1168] [GSES GS-36] and in accordance with Section [01 35 21- LEED Requirements] .

.4 Tie wire: [1.5] mm diameter stainless steel.

.5 Bands: Stainless steel, [19] mm wide, [0.5] mm thick.

.6 Facing: 25 mm [galvanized] steel hexagonal wire mesh on [on one face of insulation with expanded metal lath on other face] [[one face] [both faces] of insulation] .

.7 Fasteners: [2] [4] mm diameter pins with [35] mm [diameter] [square] clips. Length of pin to suit thickness of insulation.

2.6 VAPOUR RETARDER LAP ADHESIVE

.1 Water based, fire retardant type, compatible with insulation.
.1 Maximum VOC limit as required by AHJ.

2.7 INDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

2.8 OUTDOOR VAPOUR RETARDER MASTIC

.1 Vinyl emulsion type acrylic, compatible with insulation.
.2 Reinforcing fabric: Fibrous glass, untreated 305 g/m^2.

Part 3 Execution

3.1 APPLICATION

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

3.2 PRE- INSTALLATION REQUIREMENTS

.1 Pressure testing of equipment and adjacent piping systems complete, witnessed and certified.

.2 Surfaces clean, dry, free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards

.1 Hot equipment: To TIAC code 1503-H.
.2 Cold equipment: to TIAC code 1503-C.

.2 Elastomeric Insulation:to remain dry. Overlaps to manufacturer's instructions. Joints tight and sealed properly.

.3 Provide vapour retarder as recommended by manufacturer.

.4 Apply materials in accordance with insulation and equipment manufacturer's instructions and this specification.

.5 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.

.6 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
.1 Hangers, supports outside vapour retarder jacket.

.7 Supports, Hangers:
.1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

.1 Application: At expansion joints , valves, primary flow measuring elements, flanges and unions at equipment.

.2 Installation to permit periodic removal and replacement; to permit movement of expansion joints without damage to adjacent insulation.

3.5 EQUIPMENT INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.

.2 Hot Equipment:

.1 TIAC code C-1 with mechanical fastenings and 13 mm cement reinforced with one layer of reinforcing mesh.

.2 TIAC code C-2 unfaced with bands and 13 mm cement precede by one layer of reinforcing mesh.

.3 Thicknesses:

.1 Domestic hot water storage tanks - 25 mm
.2 Heat exchangers – 25 mm

.3 Breechings, engine exhausts and mufflers:

.1 TIAC code A-2 with 25 mm air gap, mechanical fastenings and 13 mm cement reinforced with one layer of reinforcing mesh.

.4 Cold equipment:

.1 TIAC C-4 with mechanical fastenings and 13 mm cement reinforced with one layer of reinforcing mesh.

.2 TIAC C-2 faced with vapour retardant jacket and with bands and 13 mm cement preceded by one layer of reinforcing mesh.

.3 TIAC C-4 with mechanical fastenings.

.4 Thicknesses: chillers (except factory insulated) 50 mm.

.5 Finishes:
.1 Engine exhaust piping and muffler: To TIAC code CRF-4.
.2 Equipment in mechanical rooms: TIAC code CEF/1
.3 Equipment elsewhere: TIAC code CEF/2 with 13 mm cement jacket.

3.6 CLEANING

.1 Clean in accordance with General Contractor’s instructions.Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for recycling or reuse in accordance with General Contractor’s instructions.

END OF SECTION

PART 1 - GENERAL

1.1 Scope Of Work

.1 This specification covers the materials, methods, and installation of thermal insulation for refrigeration piping and equipment, including but not limited to, refrigeration suction, sub-cooled liquid piping, and evaporator coil condensate piping, for the purpose of condensation control, freeze prevention, and energy savings.

1.2 References

1. ASTM (American Society for Testing and Materials)
2. ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers)
3. NSF (National Sanitation Foundation)
4. OSHA (Occupational Safety & Health Administration)

1.3 Definitions

1. Thermal Conductivity (K-value): The time rate of steady state heat flow through a unit area of a homogeneous material induced by a unit temperature gradient in a direction perpendicular to that unit area. Typically expressed in units of Btu-inch / hour per square foot per degree F. The lower the K-value, the higher the insulating value.

.2 Water Vapor Transmission Rate: The steady water vapor flow in unit time through unit area of a body, normal to specific parallel surfaces, under specific conditions of temperature and humidity at each surface. Any additional special terms or definitions should be inserted in this section.

1.4 Quality Assurance

.1 All insulation recommendations/design criteria are based on products manufactured by K-Flex USA.

.2 Material shall be delivered in non-broken, factory-furnished packaging and stored in a clean, dry indoor space that provides protection against the weather.

.3 Insulation shall be applied by qualified personnel skilled in this trade.

1.5 Submittals For Information

.1 Product data: To include product description, manufacturer’s installation instructions, types of insulation and recommended thicknesses for each application, and location of materials.

.2 Samples of systems shall be provided upon engineer’s request.

1.6 Codes, Regulations & Standards

.1 Insulation systems, repairs, additions and alterations shall be furnished and installed in accordance with industry standards (ASHRAE) and such statutory provisions (national, state and local codes) as apply to the work under contract. All systems shall be installed according to the manufacturer's recommended practices.

.2 All material shall conform to specified ASTM Standards where applicable, principally ASTM E84 and ASTM C534.

.3 When applicable all materials shall conform to NSF or other requirements that are mandated for the application or equipment.

.4 Contractors shall conform to all OSHA and other published practices for the installation of insulation.

PART 2 – PRODUCTS

2.1 Insulation Materials

.1 Physical Properties:
- .1 Insulation shall have a maximum thermal k value of 0.25 BTU - in./hr. - ft2 - °F (0.036 W/mK) when tested according to ASTM C177 or C518 at 75°F (24°C) mean temperature.
- .2 Insulation shall have a water vapor transmission rate of 0.01 perm - inch or less when tested according to ASTM E96 (dry cup method).
- .3 Insulation shall have a flame spread of 25 or less and a smoke development rating of 50 or less when tested according to ASTM E84 at the installed thickness for applications inside the building envelope.
- 4. Insulation materials shall be manufactured without the use of CFCs, HFCs, or HCFCs and also be free of formaldehyde, fibers and dust.
- 5. Insulation materials shall be UL GREENGUARD® Gold Certified for VOC content.
- 6. Insulation shall be UL Validated as Mold Resistant per UL 2824 / ASTM D6329.
- 7. Insulation materials installed indoors that are exposed to food prep or wash down areas shall be NSF-certified to Standard 169, "Special Purpose Food Equipment and Devices".
- 8. Insulation materials shall be manufactured under the supervision of an independent third party testing program verifying the properties of K-value (thermal conductivity), wvt (water vapor transmission) and fire performance.

.2 Flexible Elastomeric: Closed Cell Flexible Elastomeric Foam Insulation that complies with ASTM C 534, Type I for tubular material and Type II for sheet material.
- .1 Products: Subject to compliance with requirements, available products that may be incorporated include, but are not limited to, the following:
  - a. K-Flex USA; Insul-Tube, Insul-Lock DS, Insul-TubeWhite, Insul-Lock DS White, K-Fit Fittings

.2 Product Recommendations: Recommendations for different applications are as follows:
   a. Pipe and Equipment Insulation: Insul-Tube, Insul-Lock DS, Insul-Tube White, InsulLock DS White tubular insulation supplied up to 2" wall thickness.
   b. Factory Fabricated Fittings (Elbows, Tees, P-Traps): K-Fit

2.2 Adhesives

.1 Flexible Elastomeric Adhesives: For adhering all seams, butts and ends, and adhering sheet insulation to substrates.
   .1 Products: Subject to compliance with requirements, available products that may be incorporated include, but are not limited to, the following:
      a. K-Flex USA; K-Flex Contact Adhesive (373, 320, 420, 620, 720 LVOC, or 1120)
   2. Product Recommendations: Recommendations for different applications are as follows:
      a. Fast Dry Adhesives: K-Flex 320 (Amber Color) or 620 (Black Color)
      b. Comply with MIL-A-24179: K-Flex 373 (Blue Color)
      c. LEED Projects: K-Flex 720 LVOC and K-Flex 1120. These adhesives meet the VOC requirements of South Coast Air Quality Management District (SCAQMD) Regulation 1168.
      d. Water Based: K-Flex 1120
      e. Comply with ASTM C916 Type 1: K-Flex 1120

2.3 Factory Or Field Applied Jackets And Finishes

.1 Jacketing shall be a PVC Composite Jacket (PCJ) in lieu of metal or PVC jacketing:

.2 PCJ shall have a maximum permeance of 0.001 perms when tested according to ASTM E 96 (dry cup method), shall be puncture and dent resistant, shall have a minimum thickness of 0.012", shall have a flame/smoke rating of 25/50 or less when tested according to ASTM E 84 for indoor applications, and shall be NSF-certified for use in food prep or wash down areas.
   1. Products: Subject to compliance with requirements, available products that may be incorporated include, but are not limited to, the following:
      a. K-Flex USA; K-Flex Clad WT, K-Flex Clad AL.

   2. Products Recommendations: Recommendations for different applications are as follows:
      a. Indoor NSF certified applications: K-Flex Clad WT or WT NS
      b. Outdoor Jacket: K-Flex Clad AL or AL NS
      c. Outdoor Finish (UV Protection Only): K-Flex 374 Protective Coating

2.4 Insulated Pipe Supports

.1 Insulated pipe supports shall be used at pipe hanger locations to prevent the insulation from compressing, shall be comprised of a load-bearing rigid foam insert (high-density urethane or equivalent) with elastomeric foam collars, and shall have a minimum compressive strength of 72 psi.

1. Products: Subject to compliance with requirements, available products that may be incorporated include, but are not limited to, the following:
   a. K-Flex USA; K-Flex 360 Insulated Pipe Support

PART 3 – EXECUTION

3.1 Examination And Preparation

.1 All insulation work shall be performed by trained personnel regularly engaged in the insulation trade.

.2 Progressive testing of systems to be insulated shall have been completed, inspected and approved by owner's representative before insulation is applied. Guide Specification: Refrigeration Systems

.3 Insulation shall not be applied until all surfaces are clean, dry and free of dirt, grease, moisture or other imperfections. Insulation should not be applied to surfaces that are wet or frosted. Insulation should not be applied to a system that is in operation.

.4 All refrigerant copper lines must be free of extraneous chemicals, such as corrosive cleaners or building material's dust, prior to installation.

.5 Suitable application temperatures and conditions shall be provided by the Owner and in compliance with the installers design criteria.

.6 All materials, including accessories (i.e. adhesive, coatings, etc.) shall be shipped to the job site in marked, unopened containers as received from the manufacturer. All boxes shall be identified with a manufacturing lot number allowing traceability back to the manufacturing date.

.7 All insulation materials shall comply with specification requirements (material type, thickness and ID).

.8 Insulation shall be protected from moisture and weather during storage and installation. Insulation must be clean and dry prior to installation.

3.2 Installation Of Flexible Elastomeric Insulation

.1 Install refrigeration piping insulation in accordance with ASTM C1710 and manufacturer's recommendations.

.2 Install insulation using the following general guidelines:

1. Install pipe insulation by sliding non-slit sections over the open ends of pipe.
2. Refrigerant pipe shall be sealed while slipping on insulation to prevent foreign matter from entering the tube. Insulation shall be pushed onto the pipe, never pulled. Stretching of insulation may result in open seams and joints.
3. Do not slit tubes for straight pipe sections unless unavoidable.
4. Longitudinal seams shall be installed facing down in order to reduce weight and pressure on the seam.
5. All seams, butts and ends shall be completely sealed to retard moisture vapor from entering the system using K-Flex contact adhesive. Do not tape insulation joints.
6. All fittings (elbows, tees, P-traps) shall be insulated with the same insulation thickness as the adjacent piping. All seams and mitered joints shall be adhered with K-Flex contact adhesive.
7. Insulation shall be adhered directly to the pipe using a two-inch strip of K-Flex contact adhesive on the ID of the insulation and on the pipe at the following locations: high end Guide Specification: Refrigeration Systems of the pipe run, every termination point (supports, valves, flanges, end of pipe run), and every 18 feet of the pipe run.
8. K-Flex 360 Insulated Pipe Supports, comprised of high-density rigid foam inserts with elastomeric foam collars, shall be installed at all pipe hanger locations to prevent the insulation from compressing. The pipe support shall have with the same insulation thickness as the pipe insulation. All joints shall be sealed with K-Flex contact adhesive. Saddles shall be installed under all insulated lines at locations where the hanger may move due to movement in the piping from expansion and contraction.
9. All outdoor piping exposed to sunlight and weather shall be covered with a PCJ field or factory applied, or shall be painted with two coats of K-Flex 374 Protective Coating. Prior to applying 374 Protective Coating, the insulation shall be wiped clean with denatured alcohol. All outdoor exposed piping seams shall face downward.

.3 Piping Insulation Thickness Schedule:

1. All liquid and suction lines shall be insulated continuously from a point 6” inside the display case to the suction service valve at the compressor.
2. Pipes to be insulated include, but may not be limited to, domestic water, roof drain, condensate drain, evaporator condensate, liquid / suction refrigerant, ammonia, glycol secondary loop, and CO2 secondary loop.
3. Miscellaneous piping subject to sweating under normal operating conditions shall be insulated.
4. Piping design must allow for adequate spacing of insulation thickness and cross ventilation around the insulation. Do not crowd the insulation.

Refrigeration Piping System	≤1½”	1½” to 4”	>4” to 6”
Above 25°F	¾”	1”	1”
11°F to 25°F	¾”	1”	1”
-9°F to 10°F	1”	1”	1¼”
-30°F to -10°F	1¼”	1¼”	1½”
<-30°F (-34°C)	Contact K-Flex USA for recommendation		

- End of Section -

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASME

- .1 ASME B16.22-12, Wrought Copper and Copper Alloy Solder - Joint Pressure Fittings.
- .2 ASME B16.24-11, Cast Copper Pipe Flanges and Flanged Fittings: Class 150, 300, 600, 900, 1500 and 2500.
- .3 ASME B16.26-11, Cast Copper Alloy Fittings for Flared Copper Tubes.
- .4 ASME B31.5-10, Refrigeration Piping and Heat Transfer Components.

.2 ASTM International (ASTM)

- .1 ASTM A307-12, Standard Specification for Carbon Steel Bolts and Studs, and Threaded Rod 60,000 PSI Tensile Strength.
- .2 ASTM B280-08, Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

.3 CSA Group (CSA)

- .1 CSA B52-05(R2009), B52 Package, Mechanical Refrigeration Code.

.4 Environment Canada (EC)

- .1 EPS 1/RA/1-96, Environmental Code of Practice for the Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Pre-installation Meetings:

- .1 Convene pre-installation meeting prior to beginning work of this Section with General Contractor and other trades to:
  - .1 Verify project requirements.
  - .2 Review installation and site conditions.
  - .3 Co-ordination with other building construction subtrades.
  - .4 Review manufacturer's written installation instructions and warranty requirements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit shop drawings in Acrobat PDF in accordance with Sections 22 05 00 and 23 05 00.

.2 Product Data:

- .1 Submit manufacturer's instructions, printed product literature and data sheets for refrigerant piping, fittings and equipment and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit WHMIS MSDS sheets. Indicate VOC's for adhesive and solvents during application and curing.

.3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties if requested.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties if requested.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Sections 22 05 00 and 23 05 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for refrigerant piping for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect refrigerant piping, fittings and equipment from [nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 TUBING

.1 Processed for refrigeration installations, deoxidized, dehydrated and sealed.

.1 Hard copper: to ASTM B280, type B ACR.

.2 Annealed copper: to ASTM B280, with minimum wall thickness as per CSA B52 and ASME B31.5.

2.2 FITTINGS

.1 Service: design pressure 2070 kPa and temperature 121 degrees C or as specified.

.2 Brazed:

.1 Fittings: wrought copper to ASME B16.22.

.2 Joints: silver solder, copper-phosphorous, 95% Cu-5%P and non-corrosive flux.

.3 Flanged:

.1 Bronze or brass, to ASME B16.24, Class 150 and Class 300.

.2 Gaskets: suitable for service.

.3 Bolts, nuts and washers: to ASTM A307, heavy series.

.4 Flared:

.1 Bronze or brass, for refrigeration, to ASME B16.26.

2.3 PIPE SLEEVES

.1 Hard copper or steel, sized to provide 6 mm clearance around between sleeve and uninsulated pipe or between sleeve and insulation.

2.4 VALVES

.1 22 mm and under: Class 500, 3.5 Mpa, globe or angle non-directional type, diaphragm, packless type, with forged brass body and bonnet, moisture proof seal for below freezing applications, brazed connections.

.2 Over 22 mm: Class 375, 2.5 Mpa, globe or angle type, diaphragm, packless type, back-seating, cap seal, with cast bronze body and bonnet, moisture proof seal for below freezing applications, brazed connections.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that site conditions are acceptable for refrigerant piping installation in accordance with manufacturer's written instructions.

.1 Visually inspect site conditions before proceeding with work.

.2 Inform Engineer and General Contractor of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 MANUFACTURER'S INSTRUCTIONS

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

3.3 GENERAL

.1 Install in accordance with CSA B52, EPS1/RA/1 and ASME B31.5 Section 23 05 05-Installation of Pipework.

3.4 BRAZING PROCEDURES

.1 Bleed inert gas into pipe during brazing.
.2 Remove valve internal parts, solenoid valve coils, sight glass.
.3 Do not apply heat near expansion valve and bulb.

3.5 PIPING INSTALLATION

.1 General:

.1 Hard drawn copper tubing: do not bend. Minimize use of fittings

.2 Soft annealed copper tubing: bend without crimping or constriction.

.2 Hot gas lines:
- .1 Pitch at least 1:240 down in direction of flow to prevent oil return to compressor during operation.
- .2 Provide trap at base of risers greater than 2400 mm high and at each 7600 mm thereafter.
- .3 Provide inverted deep trap at top of risers.
- .4 Provide double risers for compressors having capacity modulation.
  - .1 Large riser: install traps as specified.
  - .2 Small riser: size for 5.1 m^3/s at minimum load. Connect upstream of traps on large riser.

3.6 PRESSURE AND LEAK TESTING

.1 Close valves on factory charged equipment and other equipment not designed for test pressures.

.2 Leak test to CSA B52 before evacuation to 2 MPa and 1 MPa on high and low sides respectively.

.3 Test procedure: build pressure up to 35 kPa with refrigerant gas on high and low sides. Supplement with nitrogen to required test pressure. Test for leaks with electronic or halide detector. Repair leaks and repeat tests.

3.7 FIELD QUALITY CONTROL

.1 Site Tests/Inspection: Close service valves on factory charged equipment.

.2 Ambient temperatures to be at least 13 degrees C for at least 12 hours before and during dehydration.

.3 Use copper lines of largest practical size to reduce evacuation time.

.4 Use two-stage vacuum pump with gas ballast on 2nd stage capable of pulling 5 Pa absolute and filled with dehydrated oil.

.5 Measure system pressure with vacuum gauge. Take readings with valve between vacuum pump and system closed.

.6 Triple evacuate system components containing gases other than correct refrigerant or having lost holding charge as follows:
- .1 Twice to 14 Pa absolute and hold for 4 hours.
- .2 Break vacuum with refrigerant to 14 kPa.
- .3 Final to 5 Pa absolute and hold for at least 12 hours.
- .4 Isolate pump from system, record vacuum and time readings until stabilization of vacuum.
- .5 Submit test results to Engineer.

.7 Charging:
- .1 Charge system through filter-drier and charging valve on high side. Low side charging not permitted.

.2 With compressors off, charge only amount necessary for proper operation of system. If system pressures equalize before system is fully charged, close charging valve and start up. With unit operating, add remainder of charge to system.

.3 Re-purge charging line if refrigerant container is changed during charging process.

.8 Checks:

.1 Make checks and measurements as per manufacturer's operation and maintenance instructions.

.2 Record and report measurements to [Departmental Representative] [DCC Representative] [Consultant] .

.9 Manufacturer's Field Services:

.1 If requested, have manufacturer of products, supplied under this Section, review Work involved in the handling, installation/application, protection and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of Work with Contract.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.8 CLEANING

.1 Progress Cleaning: clean in accordance with General Contractor’s instructions.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Waste Management: separate waste materials for recycling or reuse in accordance with General Contractor’s instructions.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

.2 ASTM International (ASTM)

.1 ASTM A480/A480M-12 , Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.2 ASTM A635/A635M-09b, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for.

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

.3 National Fire Protection Association (NFPA)

.1 NFPA 90A-12, Standard for the Installation of Air-Conditioning and Ventilating Systems.

.2 NFPA 90B-12, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

.3 NFPA 96-11, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

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

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2005.

.2 SMACNA HVAC Air Duct Leakage Test Manual, 2012.

.3 IAQ Guideline for Occupied Buildings Under Construction 2007.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 23 05 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for metal ducts and include product characteristics, performance criteria, physical size, finish and limitations if requested.

.3 Shop Drawings:

.1 Submit shop drawings if requested for specialized fittings.

.4 Test and Evaluation Reports:

.1 Certification of Ratings:

.1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with General Contractor's instructions.

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

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect metal ducts from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse or recycling as directed by General Contractor.

Part 2 Products

2.1 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
500	C
250	C
125	C

.2 Seal classification:

.1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.

.2 Class B: longitudinal seams, transverse joints and connections made airtight with tape and sealant.

.3 Class C: transverse joints and connections made air tight with gaskets, tape and sealant. Longitudinal seams unsealed.

.4 Unsealed seams and joints.

2.2 SEALANT

.1 Sustainability Characteristics:

.1 Adhesives and sealants: as required.

.2 Adhesives and sealants: VOC limits as per Authorities Having Jurisdiction.

.2 Sealant: oil resistant, water borne, polymer type flame resistant duct sealant. Temperature range of minus 30 degrees C to plus 93 degrees C.

2.3 TAPE

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.4 DUCT LEAKAGE

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

2.5 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radiused elbows:
- .1 Rectangular: standard radius 2 times width of duct.
- .2 Round: smooth radius 2 times diameter.

.3 Mitred elbows, rectangular:
- .1 To 400 mm: with double thickness turning vanes.
- .2 Over 400 mm: with double thickness turning vanes.

.4 Branches:
- .1 Rectangular main and branch: with 45 degrees entry on branch.
- .2 Round main and branch: enter main duct at 45 degrees with conical connection.
- .3 Provide volume control damper in branch duct near connection to main duct.
- .4 Main duct branches: with splitter damper.

.5 Transitions:
- .1 Diverging: 20 degrees maximum included angle.
- .2 Converging: 30 degrees maximum included angle.

.6 Offsets:
- .1 As indicated.

.7 Obstruction deflectors: maintain full cross-sectional area.
- .1 Maximum included angles: as for transitions.

2.6 FIRE STOPPING

.1 Retaining angles around duct, on both sides of fire separation in accordance with AHJ.
.2 Fire stopping material and installation must not distort duct.

2.7 GALVANIZED STEEL

.1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating.
.2 Thickness, fabrication and reinforcement: to ASHRAE and SMACNA.
.3 Joints: to ASHRAE and SMACNA.

2.8 ALUMINUM

.1 To ASHRAE and SMACNA. Aluminum type: as required.
.2 Thickness, fabrication and reinforcement: to SMACNA and ASHRAE.
.3 Joints: to SMACNA and ASHRAE.

2.9 KITCHEN EXHAUST SYSTEMS

.1 Construct in accordance with NFPA 96.
.2 Material: welded steel.
.3 Drainage: as required.
.4 Grease filters: at Commercial Kitchen Hood as specified on drawings.

2.10 HANGERS AND SUPPORTS

.1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

.1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.

.1 Maximum size duct supported by strap hanger: 500.

.2 Hanger configuration: to ASHRAE and SMACNA.

.3 Hangers: galvanized or black steel angle with steel rods to ASHRAE and following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

.4 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.2 For steel joist: manufactured joist clamp.

.3 For steel beams: manufactured beam clamps:

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions are acceptable for metal duct installation in accordance with manufacturer's written instructions.

.1 Visually inspect site conditions.

.2 Inform Engineer and General Contractor of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 GENERAL

.1 Do work in accordance with ASHRAE, NFPA 96 AND SMACNA standards as applicable.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.

.1 Ensure diffusers fully seated. Insulate strap hangers 100 mm beyond insulated duct.

.3 Support risers in accordance with ASHRAE and SMACNA standards.

.4 Install breakaway joints in ductwork on sides of fire separation.

.5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

.6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining where specified.

3.3 HANGERS

.1 Strap hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: as follows:

Duct Size	Spacing
(mm)	(mm)
to 1500	3000
1501 and over	2500

3.4 WATERTIGHT DUCT

.1 Provide watertight duct for:
- .1 Dishwasher exhaust.
- .2 Shower exhaust.
- .3 Fresh air intake.
- .4 Minimum 3000 mm from duct mounted humidifier in all directions.
- .5 As indicated.

.2 Form bottom of horizontal duct without longitudinal seams.
- .1 Seal joints of bottom and side sheets.
- .2 Seal other joints with duct sealer.

.3 Slope horizontal branch ductwork down towards [fume] hoods served.
- .1 Slope header ducts down toward risers.

.4 Fit base of riser with 150 mm deep drain sump and 32 mm drain connected, with deep seal trap discharging to open funnel drain or as indicated.

3.5 KITCHEN EXHAUST SYSTEMS

.1 Install to NFPA 96 and as indicated.

3.6 SEALING AND TAPING

.1 Apply sealant in accordance with manufacturer's recommendations and SMACNA.

.2 Bed tape in sealant and recoat with minimum of 1 coat of sealant to manufacturers recommendations.

3.7 LEAKAGE TESTS

.1 Refer to Section 23 05 94 - Pressure Testing of Ducted Air Systems.
.2 In accordance with SMACNA HVAC Duct Leakage Test Manual.
.3 Do leakage tests in sections.

.4 Make trial leakage tests as instructed to demonstrate workmanship.
.5 Do not install additional ductwork until trial test has been passed.
.6 Test section minimum of 30 m long with not less than three branch takeoffs and two 90 degrees elbows or as designated on site.
.7 Complete test before performance insulation or concealment Work.

3.8 CLEANING

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Waste Management: separate waste materials for reuse or recycling as directed by General Contractor.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 General Requirements

1.2 REFERENCE STANDARDS

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

.1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, [2005] .

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with relevant Section.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for air duct accessories and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Indicate:

.1 Flexible connections.

.2 Duct access doors.

.3 Turning vanes.

.4 Instrument test ports.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect air duct accessories from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 GENERAL

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

2.2 FLEXIBLE CONNECTIONS

.1 Frame: galvanized sheet metal frame.

.2 Material:

.1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, density of 1.3 kg/m^2.

2.3 ACCESS DOORS IN DUCTS

.1 Non-Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.

.2 Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.

.3 Gaskets: neoprene or foam rubber.

.4 Hardware:

.1 Up to 300 x 300 mm: two sash locks complete with safety chain .

.2 301 to 450 mm: four sash locks complete with safety chain .

.3 451 to 1000 mm: piano hinge and minimum two sash locks.

.4 Doors over 1000 mm: piano hinge and two handles operable from both sides.

.5 Hold open devices.

2.4 TURNING VANES

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

2.5 INSTRUMENT TEST

.1 1.6 mm thick steel zinc plated after manufacture.

.2 Cam lock handles with neoprene expansion plug and handle chain.

.3 28 mm minimum inside diameter. Length to suit insulation thickness.

.4 Neoprene mounting gasket.

2.6 SPIN-IN COLLARS

.1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.

.2 Sheet metal thickness to co-responding round duct standards.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for air duct accessories installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

.1 Flexible Connections:

.1 Install in following locations:

.1 Inlets and outlets to supply air units and fans.

.2 Inlets and outlets of exhaust and return air fans.

.3 As indicated.

.2 Length of connection: [100] mm.

.3 Minimum distance between metal parts when system in operation: [75] mm.

.4 Install in accordance with recommendations of SMACNA.

.5 When fan is running:

.1 Ducting on sides of flexible connection to be in alignment.

.2 Ensure slack material in flexible connection.

.2 Access Doors:

.1 For all concealed valves and balancing dampers above drywall ceilings.

.2 As provided by manufacturer of air handling units.

.3 Fire and smoke dampers.

.4 Control dampers.

.5 Devices requiring maintenance.

.6 Required by code.

.7 Reheat coils.

.8 Elsewhere as indicated.

.3 Instrument Test Ports:

.1 General:

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

.2 Locate to permit easy manipulation of instruments.

.3 Install insulation port extensions as required.

.4 Locations:

.1 For traverse readings:

.1 Ducted inlets to roof and wall exhausters.

.2 Inlets and outlets of other fan systems.

.3 Main and sub-main ducts.

.4 And as indicated.

.2 For temperature readings:

.1 At outside air intakes.

.2 In mixed air applications in locations as approved by [DCC Representative] [Departmental Representative] [Consultant] .

.3 At inlet and outlet of coils.

.4 Downstream of junctions of two converging air streams of different temperatures.

.5 And as indicated.

.4 Turning Vanes:

.1 Install in accordance with recommendations of SMACNA and as indicated.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section [01 74 00- Cleaning] .

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

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 General Requirements

1.2 REFERENCE STANDARDS

.1 Sheet Metal and Air Conditioning National Association (SMACNA)

.1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-[2013] .

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section on Submittal Procedures.

.2 Product Data:

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

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section on Closeout Submittals] .

.2 Operation and Maintenance Data: submit operation and maintenance data for dampers for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect dampers from [nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 GENERAL

.1 Manufacture to SMACNA standards.

2.2 SPLITTER DAMPERS

.1 Fabricate from same material as duct but one sheet metal thickness heavier, with appropriate stiffening.

.2 Double thickness construction.

.3 Control rod with locking device and position indicator.

.4 Rod configuration to prevent end from entering duct.

.5 Pivot: piano hinge.

.6 Folded leading edge.

2.3 SINGLE BLADE DAMPERS

.1 Fabricate from same material as duct, but one sheet metal thickness heavier. V-groove stiffened.

.2 Size and configuration to recommendations of SMACNA.

.3 Locking quadrant with shaft extension to accommodate insulation thickness.

.4 Inside and outside nylon or bronze end bearings.

.5 Channel frame of same material as adjacent duct, complete with angle stop.

2.4 MULTI-BLADED DAMPERS

.1 Factory manufactured of material compatible with duct.

.2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.

.3 Maximum blade height: 100 mm.

.4 Bearings: self-lubricating nylon or pin in bronze bushings.

.5 Linkage: shaft extension with locking quadrant.

.6 Channel frame of same material as adjacent duct, complete with angle stop.

.7 Maximum leakage : 5%

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for damper installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed Consultant.

3.2 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 Locate balancing dampers in each branch duct, for supply, return and exhaust systems.

.4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.

.5 Dampers: vibration free.

.6 Ensure damper operators are observable and accessible.

.7 Corrections and adjustments as directed by Consultant.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with General Contractor’s instructions.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with General Contractor’s instructions.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 General Requirements.

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM)

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

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section [01 33 00- Submittal Procedures] .

.2 Product Data:

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

.2 Construction IAQ Management Plan:

.1 During construction meet or exceed the requirements of SMACNA IAQ Guideline for Occupied Buildings Under Construction.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with relevant section.

.2 Operation and Maintenance Data: submit operation and maintenance data for dampers for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials in dry location indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect dampers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MULTI-LEAF DAMPERS

.1 Opposed or parallel blade type as indicated.

.2 Extruded aluminum or Structurally formed steel, interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, structurally formed and welded galvanized steel or extruded aluminum] frame.

.3 Pressure fit self-lubricated bronze bearings.

.4 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.

.5 Operator: provided by BAS contractor

.6 Performance:

.1 Leakage: in closed position less than 2% of rated air flow.

.7 Insulated aluminum dampers:

.1 Frames: insulated with extruded polystyrene foam with RSI 0.88.

.2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, RSI 0.88.

2.2 DISC TYPE DAMPERS

.1 Frame: insulated brake formed, welded, 1.6 mm thick, galvanized steel to ASTM A653/A653M.

.2 Disc: insulated spin formed, 1.6 mm thick, galvanized steel to ASTM A653/A653M.

.3 Gasket: extruded neoprene, field replaceable, with 10 year warranty.

.4 Bearings: roller self lubricated and sealed.

.5 Operator: compatible with damper, linear stroke operator, [spring loaded] actuator, zinc-aluminum foundry alloy casting cam follower.

.6 Performance:

.1 Leakage: in closed position less than 2% of rated air flow.

2.3 BACK DRAFT DAMPERS

.1 Automatic gravity operated, single leaf, aluminum construction with nylon bearings counterweighted.

2.4 RELIEF DAMPERS

.1 Automatic multi-leaf aluminum dampers with ball bearing centre pivoted and counter-weights set to open as indicated.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for damper installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.

.3 Seal multiple damper modules with silicon sealant.

.4 Install access door adjacent to each damper.

.5 Ensure dampers are observable and accessible.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with General Contractor’s instructions.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM C423-09a, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

.2 ASTM C916-85(2007), Standard Specification for Adhesives for Duct Thermal Insulation.

.3 ASTM C1071-12, Standard specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).

.4 ASTM C1338-08, Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.

.5 ASTM G21-09, Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

.2 National Fire Protection Association (NFPA)

.1 NFPA 90A-12, Standard for the Installation of Air Conditioning and Ventilating Systems.

.2 NFPA 90B-12, Standard for the Installation of Warm Air Heating and Air Conditioning Systems.

.3 North American Insulation Manufacturers Association (NAIMA)

.1 NAIMA AH116-2002, Fibrous Glass Duct Construction Standards.

.4 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)

.1 SMACNA, HVAC Duct Construction Standards, Metal and Flexible-2005.

.2 SMACNA IAQ Guideline for Occupied Buildings Under Construction-2007.

.5 Underwriter's Laboratories of Canada (ULC)

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

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Sections 22 05 00 and 23 05 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for duct liners and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Sections 22 05 00 and 23 05 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for duct liners for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:
- .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect duct liners from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse or recycling as directed by Gneeral Contractor.

Part 2 Products

2.1 DUCT LINER

.1 General:
- .1 Mineral Fibre duct liner: air surface coated [mat facing] .
- .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50 when tested in accordance with [CAN/ULC-S102] [NFPA 90B] [NFPA 90A] .
- .3 Recycled Content: [EcoLogo certified] [with minimum [by weight] [35] recycled content] .
- .4 Fungi resistance: to [ASTM G21] [ASTM C1338] .

.2 Rigid:
- .1 [Use on flat surfaces and where indicated.
- .2 25 mm thick, to[ASTM C1071, fibrous glass rigid board duct liner.
- .3 Density: 48 kg/m^3minimum.
- .4 Maximum velocity on faced air side: 20.3 m/s.
- .5 Minimum NRC of 0.70 at 25 mm thickness based on Type A mounting to ASTM C423.

.3 Flexible:
- .1 Use on round or oval surfaces as indicated.
- .2 25 mm thick, to ASTM C1071 Type 1, fibrous glass blanket duct liner.
- .3 Density: 24 kg/m^3minimum.
- .4 Thermal resistance to be minimum [1.11 (m^2.degrees C)/W for 38 mm thickness] [1.41 (m^2.degrees C)/W to 50 mm thickness] [0.74 (m^2.degrees C)/W for 25 mm thickness] [0.37 (m^2.degrees C)/W for 12 mm thickness] when tested in accordance with [ASTM C177] , at 24 degrees C mean temperature.
- .5 Maximum velocity on coated air side: [[25.4] [30.5] m/s] .
- .6 Minimum NRC of [0.65 at 25 mm] thickness based on Type A mounting to ASTM C423.

2.2 ADHESIVE

.1 Adhesive: to NFPA 90A, NFPA 90B and ASTM C916.

.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 29 degrees C to plus 93 degrees C.

.3 Water-based [fire retardant] type.

2.3 FASTENERS

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

2.4 JOINT TAPE

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

2.5 SEALER

.1 Meet requirements of NFPA 90B and NFPA 90A.

.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 68 degrees C to plus 93 degrees C.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for duct liner installation in accordance with manufacturer's written instructions.

.1 Visually inspect site conditions before installation.

.2 Inform Engineer and General Contractor of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 GENERAL

.1 Do work in accordance with SMACNA HVAC Duct Construction Standard and as indicated.

.2 Line inside of ducts where indicated.

.3 Duct dimensions, as indicated, are clear inside duct lining.

3.3 DUCT LINER

.1 Install in accordance with manufacturer's recommendations, and as follows:

.1 Fasten to interior sheet metal surface with [100] [90] % coverage of adhesive [to ASTM C916] .

.1 Exposed leading edges and transverse joints to be factory coated or coated with adhesive during fabrication.

.2 In addition to adhesive, [install weld pins not less than 2 rows per surface and not more than 425 mm on centres] [impact driven mechanical fasteners] to compress duct liner sufficiently to hold it firmly in place.

.1 [Spacing of mechanical fasteners in accordance with [NAIMA AH116] [SMAC HVAC Duct Construction Standard]] .

.2 In systems, where air velocities exceeds [20.3] m/s, install galvanized sheet metal noising to leading edges of duct liner.

3.4 JOINTS

.1 Seal butt joints, exposed edges, weld pin and clip penetrations and damaged areas of liner with joint tape and sealer. Install joint tape in accordance with manufacturer's written recommendations, and as follows:

.1 Bed tape in sealer.

.2 Apply [2] coats of sealer over tape.

.2 Replace damaged areas of liner at discretion of Engineer.

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

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with General Contractor’s instructions.

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

.3 Waste Management: separate waste materials for recycling or reuse in accordance with General Contractor’s instructions.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section for General Requirements.

1.2 REFERENCE STANDARDS

.1 American National Standards Institute/Air-Conditioning and Refrigeration Institute (ANSI/ARI)

.1 ANSI/ARI 210/240, Unitary Air Conditioning and Air-Source Heat Pump Equipment.

.2 American National Standards Institute/American Society of Heating, Refrigeration and Air-Conditioning Engineers (ANSI/ASHRAE)

.1 ANSI/ASHRAE Standard 15, Safety Standard for Refrigeration Systems.

.3 CSA Group (CSA)

.1 CAN/CSA-C656-[05(R2010)] , Performance Standard for Split-System and Single Package Central Air Conditioners and Heat Pumps.

.2 CAN/CSA-C13256-[2001(R2011)] , Water-Source Heat Pumps-Testing and Rating for Performance, Part 1 Water-to-Air and Brine-to-Air Heat Pumps.

.4 Environment Canada, (EC) / Environmental Protection Services (EPS)

.1 EPS 1/RA/2, Code of Practice for Elimination of Fluorocarbons Emissions from Refrigeration and Air Conditioning Systems.

.2 Environment Canada, Ozone-Depleting Substances Alternatives and Suppliers List.

.5 National Fire Protection Association (NFPA)

.1 NFPA 90A-[2009] , Standard for Installation of Air Conditioning and Ventilating Systems.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section for Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for heat pumps and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate on drawings:

.1 Dimensions, weight, performance

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with relevant Section on Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for heat pumps for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials in dry location indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect heat pumps from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.6 WARRANTY

.1 Provide parts and labour warranties.

Part 2 Products

2.1 DESCRIPTION

.1 Heat pumps: to EPS 1/RA/2, CSA [and Ontario Hydro Inspection] approved and with ARI or CSA certification seal.

2.2 REFRIGERANTS

.1 Type of Refrigerant: R410A as per specified model.

2.3 DRAIN PANS

.1 Design and construct condensate drain pans under indoor coils so that no water can accumulate and install to allow for easy cleaning.

2.4 PACKAGED AIR SOURCE HEAT PUMP

.1 General:

.1 To consist of air-to-air outdoor unit and DX fan coil indoor unit, for use with R410A refrigerant.

.2 Performance data: as indicated on project schedule drawings.

.3 Outdoor unit:

.1 Semi-hermetic compressor with crankcase heater, oil pump, internal and external current sensitive overload and over-temperature protection.

.2 Outdoor air fan: propeller type with vertical or horizontal discharge, direct-driven from permanently lubricated motor.

.3 Coil: aluminum plate fins mechanically bonded to copper tubing with joints brazed.

.4 Mounted legs and snow stand to elevate unit.

.5 Finish: primer and corrosion restraint coatings.

.4 Indoor air handling unit:

.1 Refer to project schedules on drawings.

.5 Refrigeration piping:

.1 Between compressor, outdoor coil and indoor coil, complete with refrigerant metering devices and valves.

.6 Controls and protective devices to include:

.1 High pressure stat, loss-of-charge pressure stat.
.2 Crankcase heater.
.3 Suction line accumulator.
.4 Pressure relief device.
.5 Short-cycle protection of compressor.
.6 [Demand defrost] [Defrost control to defrost every 90 minutes based on liquid temperature] .
.7 Defrost interlock relay to ensure only one heat pump can defrost.

.7 Accessories:

.1 Indoor heating/cooling thermostat.
.2 Outdoor thermostat.
.3 Refrigerant head pressure controls.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for heat pumps installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of General Contractor.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

.1 Install where indicated and in accordance with manufacturer's instructions.

.2 Install outdoor units at ground level on RC housekeeping pad.

.3 Install outdoor units on roof with vibration isolation providing 95% isolation efficiency.

.1 Co-ordinate installation with Architect for flashing, weatherproofing and roofing.

.4 Secure with hold-down bolts in accordance with manufacturer's recommendations.

.5 Make duct connections through flexible connections.

.6 Level unit with fans running. Align duct work. flexible connections. Misalignment with fan stopped not to strain or damage flexible connection.

.7 Make piping connections.

.8 Nothing to obstruct ready access to components or to prevent removal of components for servicing.

3.3 DRAIN PANS

.1 Install so that no water can accumulate. Arrange easy access for cleaning.

.2 Include internal or external trap for proper draining.

3.4 START-UP AND COMMISSIONING

.1 Have manufacturer certify installation.

.2 Have manufacturer present [tests and start up units] [during start-up] and certify performance.

.3 Submit written start-up and commissioning reports to [DCC Representative] [Departmental Representative] [Consultant] .

3.5 CLOSEOUT ACTIVITIES

.1 Manufacturer to deliver verbal, [video] , and written instructions to operating personnel.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with General Contractor’s instructions.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with relevant Section.

3.7 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by heat pumps installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section for General Requirements.

1.2 REFERENCE STANDARDS

.1 American National Standards Institute/Air-Conditioning and Refrigeration Institute (ANSI/ARI)

.1 ANSI/ARI 210/240, Unitary Air Conditioning and Air-Source Heat Pump Equipment.

.2 American National Standards Institute/American Society of Heating, Refrigeration and Air-Conditioning Engineers (ANSI/ASHRAE)

.1 ANSI/ASHRAE Standard 15, Safety Standard for Refrigeration Systems.

.3 CSA Group (CSA)

.1 CAN/CSA-C656-[05(R2010)] , Performance Standard for Split-System and Single Package Central Air Conditioners and Heat Pumps.

.2 CAN/CSA-C13256-[2001(R2011)] , Water-Source Heat Pumps-Testing and Rating for Performance, Part 1 Water-to-Air and Brine-to-Air Heat Pumps.

.4 Environment Canada, (EC) / Environmental Protection Services (EPS)

.1 EPS 1/RA/2, Code of Practice for Elimination of Fluorocarbons Emissions from Refrigeration and Air Conditioning Systems.

.2 Environment Canada, Ozone-Depleting Substances Alternatives and Suppliers List.

.5 National Fire Protection Association (NFPA)

.1 NFPA 90A-[2009] , Standard for Installation of Air Conditioning and Ventilating Systems.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section for Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for heat pumps and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate on drawings:

.1 Dimensions, weight, performance

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with relevant Section on Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for heat pumps for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials in dry location indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect heat pumps from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.6 WARRANTY

.1 Provide parts and labour warranties.

Part 2 Products

2.1 DESCRIPTION

.1 Heat pumps: to EPS 1/RA/2, CSA [and Ontario Hydro Inspection] approved and with ARI or CSA certification seal.

2.2 REFRIGERANTS

.1 Type of Refrigerant: R410A as per specified model.

2.3 DRAIN PANS

.1 Design and construct condensate drain pans under indoor coils so that no water can accumulate and install to allow for easy cleaning.

2.4 PACKAGED AIR SOURCE HEAT PUMP

.1 General:

.1 To consist of air-to-air outdoor unit and DX fan coil indoor unit, for use with R410A refrigerant.

.2 Performance data: as indicated on project schedule drawings.

.3 Outdoor unit:

.1 Semi-hermetic compressor with crankcase heater, oil pump, internal and external current sensitive overload and over-temperature protection.

.2 Outdoor air fan: propeller type with vertical or horizontal discharge, direct-driven from permanently lubricated motor.

.3 Coil: aluminum plate fins mechanically bonded to copper tubing with joints brazed.

.4 Mounted legs and snow stand to elevate unit.

.5 Finish: primer and corrosion restraint coatings.

.4 Indoor air handling unit:

.1 Refer to project schedules on drawings.

.5 Refrigeration piping:

.1 Between compressor, outdoor coil and indoor coil, complete with refrigerant metering devices and valves.

.6 Controls and protective devices to include:

.1 High pressure stat, loss-of-charge pressure stat.
.2 Crankcase heater.
.3 Suction line accumulator.
.4 Pressure relief device.
.5 Short-cycle protection of compressor.
.6 [Demand defrost] [Defrost control to defrost every 90 minutes based on liquid temperature] .
.7 Defrost interlock relay to ensure only one heat pump can defrost.

.7 Accessories:

.1 Indoor heating/cooling thermostat.
.2 Outdoor thermostat.
.3 Refrigerant head pressure controls.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for heat pumps installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of General Contractor.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

.1 Install where indicated and in accordance with manufacturer's instructions.

.2 Install outdoor units at ground level on RC housekeeping pad.

.3 Install outdoor units on roof with vibration isolation providing 95% isolation efficiency.

.1 Co-ordinate installation with Architect for flashing, weatherproofing and roofing.

.4 Secure with hold-down bolts in accordance with manufacturer's recommendations.

.5 Make duct connections through flexible connections.

.6 Level unit with fans running. Align duct work. flexible connections. Misalignment with fan stopped not to strain or damage flexible connection.

.7 Make piping connections.

.8 Nothing to obstruct ready access to components or to prevent removal of components for servicing.

3.3 DRAIN PANS

.1 Install so that no water can accumulate. Arrange easy access for cleaning.

.2 Include internal or external trap for proper draining.

3.4 START-UP AND COMMISSIONING

.1 Have manufacturer certify installation.

.2 Have manufacturer present [tests and start up units] [during start-up] and certify performance.

.3 Submit written start-up and commissioning reports to [DCC Representative] [Departmental Representative] [Consultant] .

3.5 CLOSEOUT ACTIVITIES

.1 Manufacturer to deliver verbal, [video] , and written instructions to operating personnel.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with General Contractor’s instructions.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with relevant Section.

3.7 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by heat pumps installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section for General Requirements

1.2 REFERENCE STANDARDS

.1 Ontario Building Code

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with relevant Section.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for [fan coil units] and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Product data to include:

.1 Filters, fan accessibility.

.2 Suspension of cabinet.

.3 Thermostat, transformer, controls where integral.

.4 kW rating, voltage, phase.

.5 Cabinet material thicknesses.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by this contractor.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect fan coil units and accessories from nicks, scratches, and blemishes .

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 FAN COIL UNITS

.1 Cabinet: steel, 1.2 mm thick, ceiling mounting. Rear inlet, front outlet.

.2 Elements: stainless steel sheathed with corrosion protected steel fins covering full length of element.

.3 Blower motors: single phase or as specified.
.4 Wall mounted thermostats to control fan, heating and cooling.
.5 Fan delay switch.
.6 Fresh air duct adapter.
.7 Filter: replaceable.
.8 Finish: as specified.
.9 Assembly fully wired to one outlet location.
.10 Multiple knockouts for up to 38 mm diameter conduit.
.11 DX Cooling/Heating coil for heat pump operation.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for fan coil units installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform general contractor and Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

.1 [Hang] [Mount] units.
.2 Make electrical and control connections.
.3 Co-ordinate ducting of fresh air with Division 23 [at floor] [at sill height] .

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section [26 05 00- Common Work Results for Electrical] .

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section [01 74 00- Cleaning] .

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with General Contractor’s instructions.

END OF SECTION

ELECTRICAL SPECIFICATIONS

TSSS HVAC Phase IV -21 Park

21 Park Road

Toronto, Ontario

DeCARIA ENGINEERING

DeCaria Engineering Limited
1661 Denison St. Unit D12
Markham, ON L3R 6E4
Tel: (647) 498-4397

ELECTRICAL SPECIFIFCATIONS TABLE OF CONTENTS

Section	Title	Pages
DIVISION 26	**ELECTRICAL**	
26 05 00	COMMON WORK RESULTS FOR ELECTRICAL	8
26 05 20	WIRE AND BOX CONNECTORS (0-1000 V)	3
26 05 21	WIRES AND CABLES (0-1000 V)	4
26 05 22	CONNECTORS AND TERMINATIONS	2
26 05 29	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS	2
26 05 31	SPLITTERS, JUNCTION, PULL BOXES AND CABINETS	2
26 05 32	OUTLET BOXES, CONDUIT BOXES AND FITTINGS	2
26 05 34	CONDUITS, CONDUIT FASTENINGS AND CONDUIT FITTINGS	5
26 27 16	ELECTRICAL CABINETS AND ENCLOSURES	3
26 27 26	WIRING DEVICES	4
26 28 13.01	FUSES - LOW VOLTAGE	2
26 28 16.02	MOULDED CASE CIRCUIT BREAKERS	4
26 28 23	DISCONNECT SWITCHES - FUSED AND NON-FUSED	2

Part 1 General

1.1 DEFINITIONS

.1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.2 REFERENCE STANDARDS

.1 CSA Group

.1 Ontario Electrical Safety Code (28th Edition) - 2021

.2 CSA C22.1:21, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.3 CSA C235:19, Preferred Voltage Levels for AC Systems, up to 50,000 V.

.4 CAN/CSA-C22.3 No.1:20, Overhead Systems.

.2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)

.1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for all electrical equipment in PDF format including product characteristics, performance criteria, physical size, finish, limitations, etc.

.3 Submit for review single line electrical diagrams under plexiglass in glazed frames and locate as indicated.

.1 Electrical distribution system in main electrical room.

.2 Electrical power generation and distribution systems in power plant rooms.

.4 Submit for review fire alarm riser diagram, plan and zoning of building in glazed frames under plexiglass at fire alarm control panel and annunciator.

.5 Shop drawings in PDF format:

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

.2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.

.3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

.4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.

.5 Submit full size drawings and product data to inspection authority having jurisdiction.

.6 If changes are required, notify Consultant of these changes before they are made.

.6 Certificates:

.1 Provide CSA certified equipment and material.

.2 Where CSA certified equipment and material is not available, submit such material and equipment to inspection authorities having jurisdiction for special approval before delivery to site.

.3 Submit test results of installed electrical systems and instrumentation.

.4 Permits and fees: in accordance with General Conditions of contract.

.5 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.

.6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Owners Representative and Consultant.

.7 Manufacturer's Field Reports: submit to Consultant and Representative manufacturer's written report, within 5 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for all electrical equipment installed.

.1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.

.2 Operating instructions to include following:

.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

.2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.

.3 Safety precautions.

.4 Procedures to be followed in event of equipment failure.

.5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

.3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.

.4 Post instructions where directed.

.5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.

.6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect all equipment and materials.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 DESIGN REQUIREMENTS

.1 Operating voltages: to CSA-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Language operating requirements: provide identification nameplates for control items in English.

2.2 MATERIALS AND EQUIPMENT

.1 Provide material and equipment in accordance with Section 01 61 00 - Common Product Requirements.

.2 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from inspection authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.3 Factory assemble control panels and component assemblies.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

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

.2 Control wiring and conduit: in accordance with Section 26 29 03 - Control Devices except for conduit, wiring and connections below 50 V which are related to control systems specified in mechanical sections and as shown on mechanical drawings.

2.4 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of Owners Representative having jurisdiction.

.2 Decal signs, minimum size 175 x 250 mm.

2.5 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.6 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates and labels as follows:

.1 Nameplates: lamicoid 3 mm thick plastic engraving sheet melamine , matt white finish with white face and black core, lettering accurately aligned and engraved into core mechanically attached with self tapping screws

.2 Sizes as follows:

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

.2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.

.3 Wording on nameplates and labels to be approved by Consultant prior to manufacture.

.4 Allow for minimum of twenty-five (25) letters per nameplate and/or label.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO. "

.7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.8 Terminal cabinets and pull boxes: indicate system and voltage.

.9 Transformers: indicate capacity, primary and secondary voltages.

2.7 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1

.4 Use colour coded wires in communication cables, matched throughout system.

2.8 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

Type	Prime	Auxiliary
up to 250 V	Yellow	

up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

2.9 RECEPTACLE AND COMMUNICATIONS IDENTIFICATION

.1 Identify each receptacle with permanent indelible identifying markings, coloured plastic tapes with panel and circuit number.

.2 Identify each communication outlet with permanent indelible identifying markings, coloured plastic tapes with LAN room and port number.

.3 Maintain phase sequence and colour coding throughout.

.4 Colour coding: to CSA C22.1.

2.10 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint outdoor electrical equipment Paint outdoor electrical equipment "equipment green" finish to local utility standard/OESA.

.2 Paint indoor switchgear and distribution enclosures light gray to local utility/OESA standard

Part 3 Execution

3.1 EXAMINATION

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

.1 Visually inspect substrate in presence of Owners Representative and/or Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant or Owners Representative.

3.2 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1 except where specified otherwise

.2 Do overhead and underground systems in accordance with CAN/CSA-C22.3 No.1 except where specified otherwise

3.3 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed

3.4 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete.

.1 Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 100 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.5 LOCATION OF OUTLETS

.1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.4 Locate light switches on latch side of doors.

.1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

3.6 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights unless indicated otherwise.

.1 Local switches: not less than 900 mm and not more than 1200 mm.

.2 Wall receptacles:

.1 General: 300 mm.

.2 Above top of continuous baseboard heater: 200 mm.

.3 Above top of counters or counter splash backs: 175 mm.

.4 In mechanical rooms: 1400 mm.

.3 Panelboards: as required by Code or as indicated.

.4 Telephone and interphone outlets: 300 mm.

.5 Wall mounted telephone and interphone outlets: between 900mm and 1200 mm.

.6 Fire alarm stations: not less than 900 mm and not more than 1200mm.

.7 Fire alarm bells: 2100 mm.

.8 Television outlets: 300 mm.

.9 Wall mounted speakers: 2100 mm.

.10 Clocks: 2100 mm.

.11 Door bell pushbuttons: not less than 900mm and not more than 1200 mm.

3.7 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.8 FIELD QUALITY CONTROL

.1 Load Balance:

.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Provide upon completion of work, load balance report as directed in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS, phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.

.2 Conduct following tests in accordance with Section 01 45 00 - Quality Control.

.1 Power distribution system including phasing, voltage, grounding and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Lighting and its control.

.4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.5 Systems: fire alarm and communications.

.6 Insulation resistance testing:

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Check resistance to ground before energizing.

.3 Carry out tests in presence of Owner Representative and /or Consultant.

.4 Provide instruments, meters, equipment and personnel including necessary after-hours labour as required to conduct tests during and at conclusion of project.

.5 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.9 SYSTEM STARTUP

.1 Instruct operating personnel in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

3.10 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

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

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

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

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

END OF SECTION

Part 1 General

.1 CSA Group (CSA)

.1 CAN/CSA-C22.2 No.65-R2018, Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE).

.2 CAN/CSA-C22.2 No.18.1-13(R2018), Metallic Outlet Boxes. (Tri-national standard, with UL 514A and ANCE NMX- J-023/1).

.3 CSA C22.2 No.18.2-06(R2021), Nonmetallic Outlet Boxes.

.4 CSA C22.2 No.18.3-12(R2017), Conduit, Tubing, and Cable Fittings (Tri-national Standard, with ANCE NMX-J-017 and UL 514B).

.5 CSA C22.2 No.18.4-15(R2019), Hardware for the Support of Conduit, Tubing, and Cable (Bi-National Standard, with UL 2239).

.6 CSA C22.2 No. 18.5-13, Positioning devices (Bi-national standard, with UL 1565).

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC 1Y-2-1961, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.3 National Electrical Manufacturers Association (NEMA)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for wire and box connectors and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for wire and box connectors for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wire and box connectors from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:

- .1 Connector body and stud clamp for conductors copper stranded.
- .2 Clamp for copper conductors.
- .3 Stud clamp bolts.
- .4 Bolts for copper conductors.
- .5 Sized for conductors as indicated.

.4 Clamps or connectors for armoured cable, TECK cable, mineral insulated cable, and flexible conduit as required to: CAN/CSA-C22.2 No.18.3.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wire and box connectors installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate in presence of Consultant and/or Owners Representative.
- .2 Inform Consultant and/or Owners Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from Consultant and/or Owners Representative.

3.2 INSTALLATION

.1 Remove insulation carefully from ends of conductors and cables and:

- .1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.
- .2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA-C22.2 No.65
- .3 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65. Replace insulating cap.
- .4 Install bushing stud connectors in accordance with EEMAC 1Y-2.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

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

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

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

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

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

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

1.2 DELIVERY, STORAGE AND HANDLING

.1 Packaging Waste Management: remove for reuse and return by manufacturer of padding, pallets, packaging materials and crates in accordance with Section 01 74 19- Waste Management and Disposal.

Part 2 Products

2.1 BUILDING WIRES

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: size as indicated on drawings, with 600V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE, Non Jacketed. Where not indicated on drawings conductors shall be copper.

.3 Copper conductors: size as indicated on drawings, with thermoplastic insulation type T90 Nylon rated at 600 V. Where not indicated on drawings conductors shall be copper.

2.2 TECK 90 CABLE

.1 Cable: in accordance with Section 26 05 00- Common Work Results for Electrical.

.2 Conductors:

- .1 Grounding conductor: copper as indicated on drawings.
- .2 Circuit conductors: copper as indicated on drawings; size as indicated.
- .3 Where not indicated on drawings conductors shall be copper.

.3 Insulation:

- .1 Cross-linked polyethylene XLPE.
- .2 Rating: 600V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: galvanized steel.

.6 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project.

.7 Fastenings:

- .1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
- .2 Channel type supports for two or more cables at
- .3 Threaded rods: 6 mm diameter to support suspended channels.

.8 Connectors:

.1 Watertight approved for TECK cable.

2.3 MINERAL-INSULATED CABLES

.1 Conductors: solid bare soft-annealed copper, size as indicated.

.2 Insulation: compressed powdered magnesium oxide or silicon dioxide to form compact homogeneous mass throughout entire length of cable.

.3 Outer covering: annealed seamless copper sheath, Type M1 rated 600 V, 250 degrees C .

.4 Overall jacket: none.

.5 Two hour fire rating.

.6 Connectors: watertight, field installed approved for MI cable.

.7 Termination kits: field installed approved for MI cable

2.4 ARMOURED CABLES

.1 Conductors: insulated, copper, size as indicated on drawings. Where not indicated on drawings conductors shall be copper.

.2 Type: AC90.

.3 Armour: interlocking type fabricated from aluminum strip.

.4 Type: jacket over armour and compliant to applicable Building Code classification for this project.

.5 Connectors: anti short connectors.

2.5 ALUMINUM SHEATHED CABLE

.1 Conductors: ACM alloy or aluminum or copper, size as indicated on drawings. Where not indicated on drawings conductors shall be copper.

.2 Insulation: cross linked polyethylene rated 600 V.

.3 Sheath: aluminum applied to form continuous corrugated seamless sheath.

.4 Outer jacket: none.

.5 Fastenings for aluminum sheathed cable:

.1 One hole steel straps to secure surface cables 25 mm and smaller. Two hole steel straps for cables larger than 25 mm. Use aluminum strap only with single conductor cable.

.2 Channel type supports for two or more cables at

.3 Threaded rods: 6 mm diameter to support suspended channels.

2.6 CONTROL CABLES

.1 Type: LVT: 2 soft annealed copper conductors, sized as indicated:

.1 Insulation: thermoplastic.

.2 Sheath: thermoplastic jacket.

.2 Type: low energy 300 V control cable: stranded annealed copper conductors sized as indicated LVT:2 soft annealed copper conductors, sized as indicated:

.1 Insulation: TWH polyethylene.

.2 Shielding: braid over conductors group.

.3 Overall covering: polyethylene jackets.

.3 Type: 600 V conductors, sizes as indicated :annealed copper

.1 Insulation: RW90 cross-linked polyethylene type.

.2 Shielding: conductors.

.3 Overall covering: thermosetting jackets.

Part 3 Execution

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00- Common Work Results for Electrical.

.2 Perform for Consultant and/or Owner Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

.1 Lay cable in cable trays in accordance with Section 26 05 36- Cable Trays for Electrical Systems.

.2 Terminate cables in accordance with Section 26 05 20- Wire and Box Connectors - (0-1000 V).

.3 Cable Colour Coding: to Section 26 05 00- Common Work Results for Electrical.

.4 Conductor length for parallel feeders to be identical.

.5 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.6 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

.7 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.

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

3.3 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34- Conduits, Conduit Fastenings and Conduit Fittings.

.2 In underground ducts in accordance with Section 33 71 73.02

.3 In surface and lighting fixture raceways in accordance with Section 26 05 33

.4 In wireways and auxiliary gutters in accordance with Section 26 05 37

3.4 INSTALLATION OF TECK90 CABLE (0 -1000 V)

.1 Group cables wherever possible on channels.

.2 Install cable concealed where required by Architect , securely supported by straps and hangers.

3.5 INSTALLATION OF MINERAL-INSULATED CABLES

.1 Install cable concealed or exposed as required , securely supported by straps or hangers.

.2 Support 2 hour fire rated cables at 1 m intervals.

.3 Make cable terminations by using factory-made kits.

.4 Cable terminations: use thermoplastic sleeving over bare conductors.

.5 Do not splice cables unless indicated.

3.6 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible on channels.

3.7 INSTALLATION OF ALUMINUM SHEATHED CABLE

.1 Group cables wherever possible on channels.

3.8 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit.

.2 Ground control cable shield.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group

.1 CSA C22.1:21, Canadian Electrical Code, Part 1 latest edition, Safety Standard for Electrical Installations.

.2 CSA C22.2 No.41-12(R2017), Grounding and Bonding Equipment (Tri-National Standard, with NMX-J-590ANCE and UL 467).

.3 CSA C22.2 No.65-18, Wire connectors (Tri-National Standard, with UL 486A-486B NMX-J-543-ANCE).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

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

.3 Certificates: obtain inspection certificate of compliance covering high voltage stress from inspection authority and include it with maintenance manuals and as-built drawings.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for connectors and terminations for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials in dry location off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect connectors and terminations from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 CONNECTORS AND TERMINATIONS

.1 Copper short barrel compression connectors to CSA C22.2 No.65 as required sized for conductors.

.2 Contact aid for aluminum cables where applicable.

.3 4-way joint boxes dry location type in accordance with Section 26 05 33- Raceway and Boxes for Electrical Systems.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for connectors and terminations installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of General Contractor.

.2 Inform General Contractor of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from General Contractor.

3.2 INSTALLATION

.1 Install stress cones, terminations, and splices in accordance with manufacturer's instructions.

.2 Bond and ground as required to CSA C22.2NO.41:22.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

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

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

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

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

END OF SECTION

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions in PDF format, printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.

1.2 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials indoors, off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect hangers and supports from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SUPPORT CHANNELS

.1 Steel channels, zinc coating, U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted or set in poured concrete walls and ceilings.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for hangers and supports installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant and/or Representative.

.2 Inform Consultant and/or Owners Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant and/or Owners Representative.

3.2 INSTALLATION

.1 Secure equipment to hollow, solid masonry, tile and plaster surfaces with lead anchors.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.

.5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.6 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.

.2 Two-hole steel straps for conduits and cables larger than 50 mm.

.3 Beam clamps to secure conduit to exposed steel work.

.7 Suspended support systems.

.1 Support individual cable or conduit runs with 6 mm diameter threaded rods and spring clips.

.2 Support 2 or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.

.8 For surface mounting of two or more conduits use channels at 5-foot intervals.

.9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.11 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Consultant and/or Owners Representative.

.13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

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

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

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.1:21, Canadian Electrical Code, Part 1.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

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

.3 Provide shop drawings: in accordance with Section 01 33 00- Submittal Procedures.

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

Part 2 Products

2.1 SPLITTERS

.1 Construction: sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Terminations: main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

.3 Spare Terminals: minimum three spare terminals or lugs on each connection or lug block sized less than 400 A.

2.2 JUNCTION AND PULL BOXES

.1 Construction: welded steel enclosure.

.2 Covers Flush Mounted: 25 mm minimum extension all around.

.3 Covers Surface Mounted: screw-on flat covers.

2.3 CABINETS

.1 Construction: welded sheet steel hinged door, and catch

.2 Type E Empty: flush overlapping sides mounting as required.

.3 Type T Terminal: flush overlapping sides mounting as required containing.

Part 3 Execution

3.1 SPLITTER INSTALLATION

.1 Mount plumb, true and square to building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.

.3 Install terminal block as indicated in Type T cabinets.

.4 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

3.3 IDENTIFICATION

.1 Equipment Identification: to Section 26 05 00- Common Work Results for Electrical.

.2 Identification Labels: size 2 indicating, voltage and phase, system name, fed from.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 Ontario Electrical Safety Code, 28th Edition, 2021.

.2 CSA C22.1:21, Canadian Electrical Code,

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit samples for floor box in accordance with Section 01 33 00- Submittal Procedures.

1.3 DELIVERY, STORAGE AND HANDLING

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

.2 Waste Management and Disposal:

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

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 347 V outlet boxes for 347 V switching devices.

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

2.2 GALVANIZED STEEL OUTLET BOXES

.1 One-piece electro-galvanized construction.

.2 Singleand multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated.102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

.4 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.5 Extension and plaster rings for flush mounting devices in finished plaster and tile walls.

2.3 MASONRY BOXES

.1 Electro-galvanized steel masonry and multi and single gang boxes for devices flush mounted in exposed block walls.

2.4 CONCRETE BOXES

.1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 CONDUIT BOXES

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

2.6 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

.1 Electro-galvanized, sectional, screw ganging steel boxes, minimum size 76 x 50 x 63 mm with two double clamps to take non-metallic sheathed cables.

2.7 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

2.8 SERVICE FITTINGS

.1 'High tension' receptacle fitting made of 2 piece die-cast aluminumwith brushed aluminum housing finish for two duplex receptacles. Bottom plate with two knockouts for centered or offset installation.12 x 102 mm extension piece as indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.

.5 Vacuum clean interior of outlet boxes before installation of wiring devices.

.6 Identify systems for outlet boxes as required.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

- .1 CAN/CSA-C22.2 No.18.1-13(R2018), Metallic Outlet Boxes (Tri-national standard, with UL 514A and ANCE NMX- J-023/1).
- .2 CSA C22.2 No.18.2-06(R2021), Non-metallic Outlet Boxes.
- .3 CSA C22.2 No.18.3-12(R2017), Conduit, Tubing, and Cable Fittings (Tri-national Standard, with ANCE NMX-J-017 and UL514B).
- .4 CSA C22.2 No.18.4-15(R2019), Hardware for the Support of Conduit, Tubing, and Cable (Bi-National Standard, with UL 2239).
- .5 CSA C22.2 No. 18.5-13, Positioning devices (Bi-national standard, with UL 1565).
- .6 CSA C22.2 No. 45.1-07(R2017), Electrical Rigid Metal Conduit - Steel (Tri-National standard, with UL 6 and MX-J-534-ANCE-2007)
- .7 CSA C22.2 No. 56-17, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
- .8 CSA C22.2 No. 83.1-07(R2017), Electrical Metallic Tubing.
- .9 CSA C22.2 No. 211.2-06(R2021), Rigid PVC (Unplasticized) Conduit.
- .10 CSA C22.2 No. 227.3:15(R2019), Non-metallic Mechanical Protection Tubing (NMPT), A National Standard of Canada latest edition.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product data: submit manufacturer's printed product literature, specifications and datasheets.

- .1 Submit cable manufacturing data.

.3 Quality assurance submittals:

- .1 Test reports: submit certified test reports.
- .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .3 Instructions: submit manufacturer's installation instructions.

1.3 WASTE MANAGEMENT AND DISPOSAL

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

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

Part 2 Products

2.1 CABLES AND REELS

.1 Provide cables on reels or coils.

.1 Mark or tag each cable and outside of each reel or coil, to indicate cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.

.2 Each coil or reel of cable to contain only one continuous cable without splices.

.3 Identify cables for exclusively dc applications.

.4 Reel and mark shielded cables rated 2,001 volts and above.

2.2 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45.1 hot dipped galvanized steel threaded.

.2 Epoxy coated conduit: to CSA C22.2 No. 45.1, with zinc coating and corrosion resistant epoxy finish inside and outside.

.3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83.1, with couplings.

.4 Rigid PVC conduit: to CSA C22.2 No. 211.2.

.5 Flexible metal conduit: to CSA C22.2 No. 56 , liquid-tight flexible metal.

.6 Flexible PVC conduit: to CSA-C22.2 No. 227.3 .

2.3 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 50 mm and smaller.

.1 Two hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 5 foot intervals.

.4 Threaded rods, 6 mm diameter, to support suspended channels.

2.4 CONDUIT FITTINGS

.1 Fittings: to CSA C22.2 No. 18.3, manufactured for use with conduit specified. Coating: same as conduit.

.2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.

.3 Watertight connectors and couplings for EMT.

.1 Set-screws are not acceptable.

2.5 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 200 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.6 FISH CORD

.1 Polypropylene .

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits except in mechanical and electrical service rooms in unfinished areas.

.3 Surface mount conduits except in finished areas.

.4 Use rigid hot dipped galvanized steel threaded conduit except where specified otherwise.

.5 Use electrical metallic tubing (EMT) except in cast concrete above 2.4 m not subject to mechanical injury.

.6 Use rigid PVC conduit in corrosive areas and underground.

.7 Use flexible metal conduit for recessed lighting fixtures work in movable metal partitions connection to recessed without prewired outlet box, connection to motors and transformers in dry areas.

.8 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.9 Use explosion proof flexible connection for connection to explosion proof motors.

.10 Install conduit sealing fittings in hazardous areas.

.1 Fill with compound.

.11 Minimum conduit size for lighting and power circuits: 19 mm.

.12 Install EMT conduit from computer room branch circuit panel to outlet boxes located in sub floor.

.13 Install EMT conduit from computer room branch circuit panel to junction box in sub-floor immediately below panel.

.1 Run flexible conduit from junction box to outlet boxes for each computer in sub-floor.

.14 Bend conduit cold:

.1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.15 Mechanically bend steel conduit over 19 mm diameter.

.16 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.17 Install fish cord in empty conduits.

.18 Run 2-25 mm spare conduits up to ceiling space and 2-25 mm spare conduits down to ceiling space from each flush panel.

.1 Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface type box.

.19 Remove and replace blocked conduit sections.

.1 Do not use liquids to clean out conduits.

.20 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on surface or suspended channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.5 CONDUITS IN CAST-IN-PLACE CONCRETE

.1 Locate to suit reinforcing steel.

.1 Install in centre one third of slab.

.2 Protect conduits from damage where they stub out of concrete.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed.

.1 Use cold mastic between sleeve and conduit.

.5 Conduits in slabs: minimum slab thickness 4 times conduit diameter.

.6 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.7 Organize conduits in slab to minimize cross-overs.

.8 Refer to civil engineers drawings and/or specifications for exact requirements of concrete installation.

3.6 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

.1 Run conduits 25 mm and larger below slab and encase in 75 mm concrete envelope.

.1 Provide 50 mm of sand over concrete envelope below floor slab.

3.7 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

.2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

3.8 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.2 No. 94.1:15(R2020), Enclosures for Electrical Equipment, Non-Environment Considerations.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA 250-2020, Enclosures for Electrical Equipment (1000 Volts Maximum).

.3 The Munsell System of Colour Notation

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for electrical cabinets and enclosures and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

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

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for electrical cabinets and enclosures for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials in dry location, off ground indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect electrical cabinets and enclosures from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Enclosure constructed with 2.7mm thick minimum steel, with weather and corrosion resistant finish to CSA C22.2 No. 94.1 and NEMA 250 latest edition, Munsell Notation 7.5GY3.5/1.5, size as indicated.

.2 Entire enclosure to be capable of withstanding maximum impact force of 86 MN/m^2area without rupture of material.

.3 Removable enclosure panels with formed edges, galvanized steel external fasteners removable only from inside enclosure.

.4 Equip enclosure with hot dipped galvanized mounting rails 1m adjustable horizontally and vertically to enable mounting of equipment at any location within housing.

.1 Rails: 14 mm holes and 50 x 14 mm slots on 100 mm centres for horizontal adjustment.

.2 Holes in side panel flanges in 60 mm increments for vertical adjustment.

.5 Cover: tamperproof, bolt-on, domed to shed water.

.6 Door: 3-point latching, with padlocking means.

.7 Ventilation panel constructed to allow air circulation yet preventing entry of foreign objects, wild life, and vermin.

.8 Door interlocks:

.9 Enclosure construction such as to allow configuration of single or ganged enclosures.

.10 Enclosure capable of being shipped in knocked-down condition.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for electrical cabinet and enclosure installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant and/or Owners Representative.

.2 Inform Consultant and/or Owners Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant and/or Owners Representative.

3.2 INSTALLATION

.1 Assemble enclosure in accordance with manufacturer's instructions and securely mount on building structure with channels, supports and fastenings.

.2 Mount equipment in enclosure.

.3 Label electrical cabinets and enclosure to Section 26 05 00 - Common Work Results for Electrical.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

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

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

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

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

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.2 No.42:10(R2020), General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CAN/CSA C22.2 No.42.1-13(R2022), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA C22.2 No.55:15(R2020), Special Use Switches.

.4 CAN/CSA-C22.2 No.111-18, General-Use Snap Switches (Tri-national standard, with UL 20 and NMX-J-005-ANCE)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for wiring devices and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

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

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for wiring devices for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials indoors off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wiring devices from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SWITCHES

.1 20A, 120 V and 347 V, single pole, double pole, three-way, four-way switches to: CSA C22.2 No.55 and CSA C22.2 No.111-18.

.2 Manually-operated general purpose AC switches with following features:

.1 Terminal holes approved for No. 10 AWG wire.

.2 Silver alloy contacts.

.3 Urea or melamine moulding for parts subject to carbon tracking.

.4 Suitable for back and side wiring.

.5 White toggle.

.3 Toggle operated locking fully rated for tungsten filament LED and fluorescent lamps, and up to 80% of rated capacity of motor loads heating loads.

.4 Switches of one manufacturer throughout project.

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA C22.2 No.42.1 with following features:

.1 White urea moulded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Break-off links for use as split receptacles.

.4 Eight back wired entrances, four side wiring screws.

.5 Triple wipe contacts and rivetted grounding contacts.

.2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:

.1 White urea moulded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Four back wired entrances, 2 side wiring screws.

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles of one manufacturer throughout project.

2.3 SPECIAL WIRING DEVICES

.1 Special wiring devices:

.1 Clock hanger outlets, 15 A, 125 V, 3 wire, grounding type, suitable for No. 10 AWG for installation in flush outlet box.

2.4 COVER PLATES

.1 Cover plates for wiring devices to: CSA C22.2 No.42.1.

.2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.3 Plastic white cover plates, thickness 2.5 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.

.4 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.5 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

.6 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.

2.5 SOURCE QUALITY CONTROL

.1 Cover plates from one manufacturer throughout project.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wiring devices installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant and/or Owner Representative.

.2 Inform Consultant and/or Owner Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from Consultant and/or Owner Representative.

3.2 INSTALLATION

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at height as indicated in accordance with Section 26 05 00 Common Work Results for Electrical.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height as indicated in accordance with Section 26 05 00-Common Work Results for Electrical.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.4 Install GFI type receptacles as indicated.

.3 Cover plates:

.1 Install suitable common cover plates where wiring devices are grouped.

.2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

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

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

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

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

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.3 Repair damage to adjacent materials caused by wiring device installation.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide fuse performance data characteristics for each fuse type and size.

.3 Shop Drawings:

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

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

1.3 DELIVERY, STORAGE AND HANDLING

.1 Ship fuses in original containers.

.2 Do not ship fuses installed in switchboard.

.3 Store fuses in original containers in moisture free location storage cabinet.

.4 Waste Management and Disposal:

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

1.4 EXTRA MATERIALS

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

.2 Three spare fuses of each type and size installed above 600A.

.3 Six spare fuses of each type and size installed up to and including 600A.

Part 2 Products

2.1 FUSES - GENERAL

.1 Fuse type references L1, L2, J1, R1, etc. have been adopted for use in this specification.

.2 Fuses: product of one manufacturer.

2.2 FUSE TYPES

.1 Class L fuses.

.1 Type L1, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.2 Type L2, fast acting.

.2 Class J fuses.

.1 Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.2 Type J2, fast acting.

.3 Class R -R fuses.

.1 Type R1, (UL Class RK1), time delay, capable of carrying 500% of its rated current for 10 s minimum, to meet UL Class RK1 maximum let-through limits.

.2 Type R2, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.3 Type R3, (UL Class RK1), fast acting Class R, to meet UL Class RK1 maximum let-through limits.

.4 Class C fuses.

2.3 FUSE STORAGE CABINET

.1 Fuse storage cabinet, manufactured from 2.0mm thick 750aluminum mm high, 600mm wide, 300mm deep, hinged, lockable front access door finished in accordance with Section 26 05 00- Common Work Results for Electrical.

Part 3 Execution

3.1 INSTALLATION

.1 Install fuses in mounting devices immediately before energizing circuit.

.2 Ensure correct fuses fitted to physically matched mounting devices.

.1 Install rejection clips for Class R fuses.

.3 Ensure correct fuses fitted to assigned electrical circuit.

.4 Where UL Class RK1 fuses are specified, install warning label "Use only UL Class RK1 fuses for replacement" on equipment.

.5 Install spare fuses in fuse storage cabinet.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.2 No. 5-16(R2021), Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE-2010).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Include time-current characteristic curves for breakers with ampacity of 100A and over with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

.4 Certificates:

.1 Prior to installation of circuit breakers in either new or existing installation, Contractor must submit in PDF format copies of a production certificate of origin from the manufacturer. Production certificate of origin must be duly signed by factory and local manufacturer's representative certifying that circuit breakers come from this manufacturer and are new and meet standards and regulations.

.1 Production certificate of origin must be submitted to Consultant and/or Owners Representative for approval.

.2 Delay in submitting production of certificate of origin will not justify any extension of contract and additional compensation.

.3 Any work of manufacturing, assembly or installation to begin only after acceptance of production certificate of origin by Consultant and/or Owners Representative. Unless complying with this requirement, Consultant and/or Owners Representative reserves the right to mandate manufacturer listed on circuit breakers to authenticate new circuit breakers under the contract, and to Contractor's expense.

.4 Production certificate of origin must contain:

.1 Manufacturer's name and address and person responsible for authentication. Person responsible must sign and date certificate.

.2 Licensed dealer's name and address and person of distributor responsible for Contractor's account.

.3 Contractor's name and address and person responsible for project.

.4 Local manufacturer's representative name and address. Local manufacturer's representative must sign and date certificate.

.5 Name and address of building where circuit breakers will be installed:

.1 Project title: [_____]

.2 End user's reference number: [_____]

.3 List of circuit breakers: [_____]

1.3 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store circuit breakers in dry location off ground indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect circuit breakers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Circuit breakers, accessory high-fault protectors Moulded-case circuit breakers, ground-fault circuit-interrupters: to CSA C22.2 No. 5.

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

.3 Common-trip breakers: with single handle for multi-pole applications.

.4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

.5 Circuit breakers with interchangeable trips as indicated.

.6 Circuit breakers to have minimum interrupting capacity as noted on the drawings.

2.2 THERMAL MAGNETIC BREAKERSDESIGN A

.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.3 MAGNETIC BREAKERS DESIGN B

.1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.

2.4 CURRENT LIMITING AND SERIES RATED THERMAL MAGNETIC BREAKERS DESIGN C

.1 Thermal magnetic breakers with current limiters.

.1 Time current limiting characteristics of fuses limiters coordinated with time current tripping characteristics of circuit breaker.

.2 Co-ordination to result in interruption by breaker of fault-level currents up to interrupting capacity of breaker.

.2 Series rated breakers to be manufacturer tested and listed. Breakers to be applied following manufacturer's guidelines and accepted best practice.

.1 Breakers applied following manufacturer's guidelines and accepted best practice.

2.5 SOLID STATE TRIP BREAKERS DESIGN D

.1 Moulded case circuit breaker to operate by means of solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, long time, instantaneous, short time tripping and for groundphase fault short circuit protection.

2.6 OPTIONAL FEATURES

.1 Include: as noted on the drawings

.1 Shunt trip.

.2 Auxiliary switch.

.3 Motor-operated mechanism c/w time delay unit.

.4 Under-voltage release.

.5 On-off locking device.

.6 Handle mechanism.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant and/or Owners Representative.

.2 Inform Consultant and/or Owners Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant and/or Owners Representative.

3.2 INSTALLATION

.1 Install circuit breakers as indicated.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

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

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

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

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

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group

.1 CAN/CSA-C22.2 No.4:16(R2020), Enclosed and Dead-Front Switches (Tri-National Standard, with ANCE NMX-J-162-2004 and UL 98).

.2 CSA C22.2 No.39-13(R2022), Fuseholder Assemblies.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions in PDF format, printed product literature and data sheets for disconnect switches - fused and non-fused and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect disconnect switches - fused and non-fused from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 Fusible, Horsepower rated and Non-fusible, disconnect switch in CSA enclosure size.

.2 Provision for padlocking in off switch position by locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Fuses: size as indicated, in accordance with Section 26 28 13.01- Fuses - Low Voltage.

.5 Fuseholders: relocatable and to CSA C22.2 No.39 suitable without adaptors, for type and size of fuse indicated.

.6 Quick-make, quick-break action.

.7 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00- Common Work Results for Electrical.

.2 Indicate name of load controlled on size 4 nameplate.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for disconnect switches - fused and non-fused installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant and/or Owners Representative.

.2 Inform Consultant and/or Owners Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant and/or Owners Representative.

3.2 INSTALLATION

.1 Install disconnect switches complete with fuses if applicable.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning .

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

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

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

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

END OF SECTION

ELECTRICAL SPECIFICATIONS

TSSS HVAC Phase IV -126 Pape

126 Pape Ave.

Toronto, Ontario

DeCARIA ENGINEERING

DeCaria Engineering Limited
1661 Denison St. Unit D12
Markham, ON L3R 6E4
Tel: (647) 498-4397

ELECTRICAL SPECIFIFCATIONS TABLE OF CONTENTS

Section	Title	Pages
DIVISION 26	**ELECTRICAL**	
26 05 00	COMMON WORK RESULTS FOR ELECTRICAL	8
26 05 20	WIRE AND BOX CONNECTORS (0-1000 V)	3
26 05 21	WIRES AND CABLES (0-1000 V)	4
26 05 22	CONNECTORS AND TERMINATIONS	2
26 05 29	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS	2
26 05 31	SPLITTERS, JUNCTION, PULL BOXES AND CABINETS	2
26 05 32	OUTLET BOXES, CONDUIT BOXES AND FITTINGS	2
26 05 34	CONDUITS, CONDUIT FASTENINGS AND CONDUIT FITTINGS	5
26 24 16.01	PANELBOARDS BREAKER TYPE	4
26 27 16	ELECTRICAL CABINETS AND ENCLOSURES	3
26 27 26	WIRING DEVICES	4
26 28 13.01	FUSES - LOW VOLTAGE	2
26 28 16.02	MOULDED CASE CIRCUIT BREAKERS	4
26 28 23	DISCONNECT SWITCHES - FUSED AND NON-FUSED	2

Part 1 General

1.1 DEFINITIONS

.1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.2 REFERENCE STANDARDS

.1 CSA Group

.1 Ontario Electrical Safety Code (28th Edition) - 2021

.2 CSA C22.1:21, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.3 CSA C235:19, Preferred Voltage Levels for AC Systems, up to 50,000 V.

.4 CAN/CSA-C22.3 No.1:20, Overhead Systems.

.2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)

.1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for all electrical equipment in PDF format including product characteristics, performance criteria, physical size, finish, limitations, etc.

.3 Submit for review single line electrical diagrams under plexiglass in glazed frames and locate as indicated.

.1 Electrical distribution system in main electrical room.

.2 Electrical power generation and distribution systems in power plant rooms.

.4 Submit for review fire alarm riser diagram, plan and zoning of building in glazed frames under plexiglass at fire alarm control panel and annunciator.

.5 Shop drawings in PDF format:

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

.2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.

.3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

.4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.

.5 Submit full size drawings and product data to inspection authority having jurisdiction.

.6 If changes are required, notify Consultant of these changes before they are made.

.6 Certificates:

.1 Provide CSA certified equipment and material.

.2 Where CSA certified equipment and material is not available, submit such material and equipment to inspection authorities having jurisdiction for special approval before delivery to site.

.3 Submit test results of installed electrical systems and instrumentation.

.4 Permits and fees: in accordance with General Conditions of contract.

.5 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.

.6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Owners Representative and Consultant.

.7 Manufacturer's Field Reports: submit to Consultant and Representative manufacturer's written report, within 5 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for all electrical equipment installed.

.1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.

.2 Operating instructions to include following:

.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

.2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.

.3 Safety precautions.

.4 Procedures to be followed in event of equipment failure.

.5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

.3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.

.4 Post instructions where directed.

.5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.

.6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect all equipment and materials.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 DESIGN REQUIREMENTS

.1 Operating voltages: to CSA-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Language operating requirements: provide identification nameplates for control items in English.

2.2 MATERIALS AND EQUIPMENT

.1 Provide material and equipment in accordance with Section 01 61 00 - Common Product Requirements.

.2 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from inspection authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.3 Factory assemble control panels and component assemblies.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

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

.2 Control wiring and conduit: in accordance with Section 26 29 03 - Control Devices except for conduit, wiring and connections below 50 V which are related to control systems specified in mechanical sections and as shown on mechanical drawings.

2.4 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of Owners Representative having jurisdiction.

.2 Decal signs, minimum size 175 x 250 mm.

2.5 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.6 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates and labels as follows:

.1 Nameplates: lamicoid 3 mm thick plastic engraving sheet melamine , matt white finish with white face and black core, lettering accurately aligned and engraved into core mechanically attached with self tapping screws

.2 Sizes as follows:

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

.2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.

.3 Wording on nameplates and labels to be approved by Consultant prior to manufacture.

.4 Allow for minimum of twenty-five (25) letters per nameplate and/or label.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO. "

.7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.8 Terminal cabinets and pull boxes: indicate system and voltage.

.9 Transformers: indicate capacity, primary and secondary voltages.

2.7 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1

.4 Use colour coded wires in communication cables, matched throughout system.

2.8 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

Type	Prime	Auxiliary
up to 250 V	Yellow	

up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

2.9 RECEPTACLE AND COMMUNICATIONS IDENTIFICATION

.1 Identify each receptacle with permanent indelible identifying markings, coloured plastic tapes with panel and circuit number.

.2 Identify each communication outlet with permanent indelible identifying markings, coloured plastic tapes with LAN room and port number.

.3 Maintain phase sequence and colour coding throughout.

.4 Colour coding: to CSA C22.1.

2.10 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint outdoor electrical equipment Paint outdoor electrical equipment "equipment green" finish to local utility standard/OESA.

.2 Paint indoor switchgear and distribution enclosures light gray to local utility/OESA standard

Part 3 Execution

3.1 EXAMINATION

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

.1 Visually inspect substrate in presence of Owners Representative and/or Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant or Owners Representative.

3.2 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1 except where specified otherwise

.2 Do overhead and underground systems in accordance with CAN/CSA-C22.3 No.1 except where specified otherwise

3.3 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed

3.4 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete.

.1 Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 100 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.5 LOCATION OF OUTLETS

.1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.4 Locate light switches on latch side of doors.

.1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

3.6 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights unless indicated otherwise.

.1 Local switches: not less than 900 mm and not more than 1200 mm.

.2 Wall receptacles:

.1 General: 300 mm.

.2 Above top of continuous baseboard heater: 200 mm.

.3 Above top of counters or counter splash backs: 175 mm.

.4 In mechanical rooms: 1400 mm.

.3 Panelboards: as required by Code or as indicated.

.4 Telephone and interphone outlets: 300 mm.

.5 Wall mounted telephone and interphone outlets: between 900mm and 1200 mm.

.6 Fire alarm stations: not less than 900 mm and not more than 1200mm.

.7 Fire alarm bells: 2100 mm.

.8 Television outlets: 300 mm.

.9 Wall mounted speakers: 2100 mm.

.10 Clocks: 2100 mm.

.11 Door bell pushbuttons: not less than 900mm and not more than 1200 mm.

3.7 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.8 FIELD QUALITY CONTROL

.1 Load Balance:

.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Provide upon completion of work, load balance report as directed in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS, phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.

.2 Conduct following tests in accordance with Section 01 45 00 - Quality Control.

.1 Power distribution system including phasing, voltage, grounding and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Lighting and its control.

.4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.5 Systems: fire alarm and communications.

.6 Insulation resistance testing:

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Check resistance to ground before energizing.

.3 Carry out tests in presence of Owner Representative and /or Consultant.

.4 Provide instruments, meters, equipment and personnel including necessary after-hours labour as required to conduct tests during and at conclusion of project.

.5 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.9 SYSTEM STARTUP

.1 Instruct operating personnel in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

3.10 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

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

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

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

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

END OF SECTION

Part 1 General

.1 CSA Group (CSA)

.1 CAN/CSA-C22.2 No.65-R2018, Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE).

.2 CAN/CSA-C22.2 No.18.1-13(R2018), Metallic Outlet Boxes. (Tri-national standard, with UL 514A and ANCE NMX- J-023/1).

.3 CSA C22.2 No.18.2-06(R2021), Nonmetallic Outlet Boxes.

.4 CSA C22.2 No.18.3-12(R2017), Conduit, Tubing, and Cable Fittings (Tri-national Standard, with ANCE NMX-J-017 and UL 514B).

.5 CSA C22.2 No.18.4-15(R2019), Hardware for the Support of Conduit, Tubing, and Cable (Bi-National Standard, with UL 2239).

.6 CSA C22.2 No. 18.5-13, Positioning devices (Bi-national standard, with UL 1565).

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC 1Y-2-1961, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.3 National Electrical Manufacturers Association (NEMA)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for wire and box connectors and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for wire and box connectors for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wire and box connectors from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:

- .1 Connector body and stud clamp for conductors copper stranded.
- .2 Clamp for copper conductors.
- .3 Stud clamp bolts.
- .4 Bolts for copper conductors.
- .5 Sized for conductors as indicated.

.4 Clamps or connectors for armoured cable, TECK cable, mineral insulated cable, and flexible conduit as required to: CAN/CSA-C22.2 No.18.3.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wire and box connectors installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate in presence of Consultant and/or Owners Representative.
- .2 Inform Consultant and/or Owners Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from Consultant and/or Owners Representative.

3.2 INSTALLATION

.1 Remove insulation carefully from ends of conductors and cables and:

- .1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.
- .2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA-C22.2 No.65
- .3 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65. Replace insulating cap.
- .4 Install bushing stud connectors in accordance with EEMAC 1Y-2.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

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

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

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

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

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

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

1.2 DELIVERY, STORAGE AND HANDLING

.1 Packaging Waste Management: remove for reuse and return by manufacturer of padding, pallets, packaging materials and crates in accordance with Section 01 74 19- Waste Management and Disposal.

Part 2 Products

2.1 BUILDING WIRES

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: size as indicated on drawings, with 600V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE, Non Jacketed. Where not indicated on drawings conductors shall be copper.

.3 Copper conductors: size as indicated on drawings, with thermoplastic insulation type T90 Nylon rated at 600 V. Where not indicated on drawings conductors shall be copper.

2.2 TECK 90 CABLE

.1 Cable: in accordance with Section 26 05 00- Common Work Results for Electrical.

.2 Conductors:

- .1 Grounding conductor: copper as indicated on drawings.
- .2 Circuit conductors: copper as indicated on drawings; size as indicated.
- .3 Where not indicated on drawings conductors shall be copper.

.3 Insulation:

- .1 Cross-linked polyethylene XLPE.
- .2 Rating: 600V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: galvanized steel.

.6 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project.

.7 Fastenings:

- .1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
- .2 Channel type supports for two or more cables at
- .3 Threaded rods: 6 mm diameter to support suspended channels.

.8 Connectors:

.1 Watertight approved for TECK cable.

2.3 MINERAL-INSULATED CABLES

.1 Conductors: solid bare soft-annealed copper, size as indicated.

.2 Insulation: compressed powdered magnesium oxide or silicon dioxide to form compact homogeneous mass throughout entire length of cable.

.3 Outer covering: annealed seamless copper sheath, Type M1 rated 600 V, 250 degrees C .

.4 Overall jacket: none.

.5 Two hour fire rating.

.6 Connectors: watertight, field installed approved for MI cable.

.7 Termination kits: field installed approved for MI cable

2.4 ARMOURED CABLES

.1 Conductors: insulated, copper, size as indicated on drawings. Where not indicated on drawings conductors shall be copper.

.2 Type: AC90.

.3 Armour: interlocking type fabricated from aluminum strip.

.4 Type: jacket over armour and compliant to applicable Building Code classification for this project.

.5 Connectors: anti short connectors.

2.5 ALUMINUM SHEATHED CABLE

.1 Conductors: ACM alloy or aluminum or copper, size as indicated on drawings. Where not indicated on drawings conductors shall be copper.

.2 Insulation: cross linked polyethylene rated 600 V.

.3 Sheath: aluminum applied to form continuous corrugated seamless sheath.

.4 Outer jacket: none.

.5 Fastenings for aluminum sheathed cable:

.1 One hole steel straps to secure surface cables 25 mm and smaller. Two hole steel straps for cables larger than 25 mm. Use aluminum strap only with single conductor cable.

.2 Channel type supports for two or more cables at

.3 Threaded rods: 6 mm diameter to support suspended channels.

2.6 CONTROL CABLES

.1 Type: LVT: 2 soft annealed copper conductors, sized as indicated:

.1 Insulation: thermoplastic.

.2 Sheath: thermoplastic jacket.

.2 Type: low energy 300 V control cable: stranded annealed copper conductors sized as indicated LVT:2 soft annealed copper conductors, sized as indicated:

.1 Insulation: TWH polyethylene.

.2 Shielding: braid over conductors group.

.3 Overall covering: polyethylene jackets.

.3 Type: 600 V conductors, sizes as indicated :annealed copper

.1 Insulation: RW90 cross-linked polyethylene type.

.2 Shielding: conductors.

.3 Overall covering: thermosetting jackets.

Part 3 Execution

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00- Common Work Results for Electrical.

.2 Perform for Consultant and/or Owner Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

.1 Lay cable in cable trays in accordance with Section 26 05 36- Cable Trays for Electrical Systems.

.2 Terminate cables in accordance with Section 26 05 20- Wire and Box Connectors - (0-1000 V).

.3 Cable Colour Coding: to Section 26 05 00- Common Work Results for Electrical.

.4 Conductor length for parallel feeders to be identical.

.5 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.6 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

.7 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.

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

3.3 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34- Conduits, Conduit Fastenings and Conduit Fittings.

.2 In underground ducts in accordance with Section 33 71 73.02

.3 In surface and lighting fixture raceways in accordance with Section 26 05 33

.4 In wireways and auxiliary gutters in accordance with Section 26 05 37

3.4 INSTALLATION OF TECK90 CABLE (0 -1000 V)

.1 Group cables wherever possible on channels.

.2 Install cable concealed where required by Architect , securely supported by straps and hangers.

3.5 INSTALLATION OF MINERAL-INSULATED CABLES

.1 Install cable concealed or exposed as required , securely supported by straps or hangers.

.2 Support 2 hour fire rated cables at 1 m intervals.

.3 Make cable terminations by using factory-made kits.

.4 Cable terminations: use thermoplastic sleeving over bare conductors.

.5 Do not splice cables unless indicated.

3.6 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible on channels.

3.7 INSTALLATION OF ALUMINUM SHEATHED CABLE

.1 Group cables wherever possible on channels.

3.8 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit.

.2 Ground control cable shield.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group

.1 CSA C22.1:21, Canadian Electrical Code, Part 1 latest edition, Safety Standard for Electrical Installations.

.2 CSA C22.2 No.41-12(R2017), Grounding and Bonding Equipment (Tri-National Standard, with NMX-J-590ANCE and UL 467).

.3 CSA C22.2 No.65-18, Wire connectors (Tri-National Standard, with UL 486A-486B NMX-J-543-ANCE).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

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

.3 Certificates: obtain inspection certificate of compliance covering high voltage stress from inspection authority and include it with maintenance manuals and as-built drawings.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for connectors and terminations for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials in dry location off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect connectors and terminations from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 CONNECTORS AND TERMINATIONS

.1 Copper short barrel compression connectors to CSA C22.2 No.65 as required sized for conductors.

.2 Contact aid for aluminum cables where applicable.

.3 4-way joint boxes dry location type in accordance with Section 26 05 33- Raceway and Boxes for Electrical Systems.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for connectors and terminations installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of General Contractor.

.2 Inform General Contractor of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from General Contractor.

3.2 INSTALLATION

.1 Install stress cones, terminations, and splices in accordance with manufacturer's instructions.

.2 Bond and ground as required to CSA C22.2NO.41:22.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

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

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

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

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

END OF SECTION

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions in PDF format, printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.

1.2 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials indoors, off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect hangers and supports from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SUPPORT CHANNELS

.1 Steel channels, zinc coating, U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted or set in poured concrete walls and ceilings.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for hangers and supports installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant and/or Representative.

.2 Inform Consultant and/or Owners Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant and/or Owners Representative.

3.2 INSTALLATION

.1 Secure equipment to hollow, solid masonry, tile and plaster surfaces with lead anchors.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.

.5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.6 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.

.2 Two-hole steel straps for conduits and cables larger than 50 mm.

.3 Beam clamps to secure conduit to exposed steel work.

.7 Suspended support systems.

.1 Support individual cable or conduit runs with 6 mm diameter threaded rods and spring clips.

.2 Support 2 or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.

.8 For surface mounting of two or more conduits use channels at 5-foot intervals.

.9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.11 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Consultant and/or Owners Representative.

.13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

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

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

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.1:21, Canadian Electrical Code, Part 1.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

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

.3 Provide shop drawings: in accordance with Section 01 33 00- Submittal Procedures.

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

Part 2 Products

2.1 SPLITTERS

.1 Construction: sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Terminations: main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

.3 Spare Terminals: minimum three spare terminals or lugs on each connection or lug block sized less than 400 A.

2.2 JUNCTION AND PULL BOXES

.1 Construction: welded steel enclosure.

.2 Covers Flush Mounted: 25 mm minimum extension all around.

.3 Covers Surface Mounted: screw-on flat covers.

2.3 CABINETS

.1 Construction: welded sheet steel hinged door, and catch

.2 Type E Empty: flush overlapping sides mounting as required.

.3 Type T Terminal: flush overlapping sides mounting as required containing.

Part 3 Execution

3.1 SPLITTER INSTALLATION

.1 Mount plumb, true and square to building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.

.3 Install terminal block as indicated in Type T cabinets.

.4 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

3.3 IDENTIFICATION

.1 Equipment Identification: to Section 26 05 00- Common Work Results for Electrical.

.2 Identification Labels: size 2 indicating, voltage and phase, system name, fed from.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 Ontario Electrical Safety Code, 28th Edition, 2021.

.2 CSA C22.1:21, Canadian Electrical Code,

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit samples for floor box in accordance with Section 01 33 00- Submittal Procedures.

1.3 DELIVERY, STORAGE AND HANDLING

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

.2 Waste Management and Disposal:

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

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 347 V outlet boxes for 347 V switching devices.

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

2.2 GALVANIZED STEEL OUTLET BOXES

.1 One-piece electro-galvanized construction.

.2 Singleand multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated.102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

.4 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.5 Extension and plaster rings for flush mounting devices in finished plaster and tile walls.

2.3 MASONRY BOXES

.1 Electro-galvanized steel masonry and multi and single gang boxes for devices flush mounted in exposed block walls.

2.4 CONCRETE BOXES

.1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 CONDUIT BOXES

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

2.6 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

.1 Electro-galvanized, sectional, screw ganging steel boxes, minimum size 76 x 50 x 63 mm with two double clamps to take non-metallic sheathed cables.

2.7 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

2.8 SERVICE FITTINGS

.1 'High tension' receptacle fitting made of 2 piece die-cast aluminumwith brushed aluminum housing finish for two duplex receptacles. Bottom plate with two knockouts for centered or offset installation.12 x 102 mm extension piece as indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.

.5 Vacuum clean interior of outlet boxes before installation of wiring devices.

.6 Identify systems for outlet boxes as required.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

- .1 CAN/CSA-C22.2 No.18.1-13(R2018), Metallic Outlet Boxes (Tri-national standard, with UL 514A and ANCE NMX- J-023/1).
- .2 CSA C22.2 No.18.2-06(R2021), Non-metallic Outlet Boxes.
- .3 CSA C22.2 No.18.3-12(R2017), Conduit, Tubing, and Cable Fittings (Tri-national Standard, with ANCE NMX-J-017 and UL514B).
- .4 CSA C22.2 No.18.4-15(R2019), Hardware for the Support of Conduit, Tubing, and Cable (Bi-National Standard, with UL 2239).
- .5 CSA C22.2 No. 18.5-13, Positioning devices (Bi-national standard, with UL 1565).
- .6 CSA C22.2 No. 45.1-07(R2017), Electrical Rigid Metal Conduit - Steel (Tri-National standard, with UL 6 and MX-J-534-ANCE-2007)
- .7 CSA C22.2 No. 56-17, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
- .8 CSA C22.2 No. 83.1-07(R2017), Electrical Metallic Tubing.
- .9 CSA C22.2 No. 211.2-06(R2021), Rigid PVC (Unplasticized) Conduit.
- .10 CSA C22.2 No. 227.3:15(R2019), Non-metallic Mechanical Protection Tubing (NMPT), A National Standard of Canada latest edition.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product data: submit manufacturer's printed product literature, specifications and datasheets.

- .1 Submit cable manufacturing data.

.3 Quality assurance submittals:

- .1 Test reports: submit certified test reports.
- .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .3 Instructions: submit manufacturer's installation instructions.

1.3 WASTE MANAGEMENT AND DISPOSAL

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

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

Part 2 Products

2.1 CABLES AND REELS

.1 Provide cables on reels or coils.

.1 Mark or tag each cable and outside of each reel or coil, to indicate cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.

.2 Each coil or reel of cable to contain only one continuous cable without splices.

.3 Identify cables for exclusively dc applications.

.4 Reel and mark shielded cables rated 2,001 volts and above.

2.2 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45.1 hot dipped galvanized steel threaded.

.2 Epoxy coated conduit: to CSA C22.2 No. 45.1, with zinc coating and corrosion resistant epoxy finish inside and outside.

.3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83.1, with couplings.

.4 Rigid PVC conduit: to CSA C22.2 No. 211.2.

.5 Flexible metal conduit: to CSA C22.2 No. 56 , liquid-tight flexible metal.

.6 Flexible PVC conduit: to CSA-C22.2 No. 227.3 .

2.3 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 50 mm and smaller.

.1 Two hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 5 foot intervals.

.4 Threaded rods, 6 mm diameter, to support suspended channels.

2.4 CONDUIT FITTINGS

.1 Fittings: to CSA C22.2 No. 18.3, manufactured for use with conduit specified. Coating: same as conduit.

.2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.

.3 Watertight connectors and couplings for EMT.

.1 Set-screws are not acceptable.

2.5 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 200 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.6 FISH CORD

.1 Polypropylene .

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits except in mechanical and electrical service rooms in unfinished areas.

.3 Surface mount conduits except in finished areas.

.4 Use rigid hot dipped galvanized steel threaded conduit except where specified otherwise.

.5 Use electrical metallic tubing (EMT) except in cast concrete above 2.4 m not subject to mechanical injury.

.6 Use rigid PVC conduit in corrosive areas and underground.

.7 Use flexible metal conduit for recessed lighting fixtures work in movable metal partitions connection to recessed without prewired outlet box, connection to motors and transformers in dry areas.

.8 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.9 Use explosion proof flexible connection for connection to explosion proof motors.

.10 Install conduit sealing fittings in hazardous areas.

.1 Fill with compound.

.11 Minimum conduit size for lighting and power circuits: 19 mm.

.12 Install EMT conduit from computer room branch circuit panel to outlet boxes located in sub floor.

.13 Install EMT conduit from computer room branch circuit panel to junction box in sub-floor immediately below panel.

.1 Run flexible conduit from junction box to outlet boxes for each computer in sub-floor.

.14 Bend conduit cold:

.1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.15 Mechanically bend steel conduit over 19 mm diameter.

.16 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.17 Install fish cord in empty conduits.

.18 Run 2-25 mm spare conduits up to ceiling space and 2-25 mm spare conduits down to ceiling space from each flush panel.

.1 Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface type box.

.19 Remove and replace blocked conduit sections.

.1 Do not use liquids to clean out conduits.

.20 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on surface or suspended channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.5 CONDUITS IN CAST-IN-PLACE CONCRETE

.1 Locate to suit reinforcing steel.

.1 Install in centre one third of slab.

.2 Protect conduits from damage where they stub out of concrete.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed.

.1 Use cold mastic between sleeve and conduit.

.5 Conduits in slabs: minimum slab thickness 4 times conduit diameter.

.6 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.7 Organize conduits in slab to minimize cross-overs.

.8 Refer to civil engineers drawings and/or specifications for exact requirements of concrete installation.

3.6 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

.1 Run conduits 25 mm and larger below slab and encase in 75 mm concrete envelope.

.1 Provide 50 mm of sand over concrete envelope below floor slab.

3.7 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

.2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

3.8 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.2 No.29-15(R2019), Panelboards and Enclosed Panelboards.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions in PDF format, printed product literature and data sheets for panelboards and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

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

.2 Include on drawings:

.1 Electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for panelboards for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials in dry location indoors off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect panelboards from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 PANELBOARDS

.1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.2 600V and 250V panelboards: bus and breakers rated as shown on drawings

.3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.5 Minimum of 2 flush locks for each panel board.

.6 Two keys for each panelboard and key panelboards alike.

.7 Aluminum bus with neutral of same ampere rating of mains.

.8 Mains: suitable for bolt-on breakers.

.9 Trim with concealed front bolts and hinges.

.10 Trim and door finish: baked enamel as per colour schedule.

.11 Isolated ground bus.

.12 Include grounding busbar with 3 of terminals for bonding conductor equal to breaker capacity of the panel board.

2.2 BREAKERS

.1 Breakers: to Section 26 28 16.02- Moulded Case Circuit Breakers.

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

.4 Lock-on devices for 10% of 15 to 30 A breakers installed as indicated. Turn over unused lock-on devices to Owners Representative.

.5 Lock-on devices for receptacles, fire alarm, emergency, door supervisory, intercom, stairway, exit and night light circuits.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00- Common Work Results for Electrical.

.2 Nameplate for each panelboard size 4 engraved as indicated.

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

.4 Complete circuit directory with typewritten legend showing location and load of each circuit, mounted in plastic envelope at inside of panel door.

.5 Circuits supplying Patient Care Areas must be entered in circuit directory with Bold Font.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for panelboards installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant and/or Owners Representative.

.2 Inform Consultant and/or Owners Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from Consultant and/or Owners Representative.

3.2 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on plywood backboards in accordance with Section 06 10 00- Rough Carpentry. Where practical, group panelboards on common backboard.

.3 Mount panelboards to height specified in Section 26 05 00- Common Work Results for Electrical or as indicated.

.4 Connect loads to circuits.

.5 Connect neutral conductors to common neutral bus with respective neutral identified.

.6 Where panels of different systems (i.e. Standard and Vital Power) supply a common patient care area, ground busses in panels to be interconnect with a minimum #6 AWG ground conductor.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

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

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

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

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

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by panelboards installation.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.2 No. 94.1:15(R2020), Enclosures for Electrical Equipment, Non-Environment Considerations.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA 250-2020, Enclosures for Electrical Equipment (1000 Volts Maximum).

.3 The Munsell System of Colour Notation

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for electrical cabinets and enclosures and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

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

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for electrical cabinets and enclosures for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials in dry location, off ground indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect electrical cabinets and enclosures from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Enclosure constructed with 2.7mm thick minimum steel, with weather and corrosion resistant finish to CSA C22.2 No. 94.1 and NEMA 250 latest edition, Munsell Notation 7.5GY3.5/1.5, size as indicated.

.2 Entire enclosure to be capable of withstanding maximum impact force of 86 MN/m^2area without rupture of material.

.3 Removable enclosure panels with formed edges, galvanized steel external fasteners removable only from inside enclosure.

.4 Equip enclosure with hot dipped galvanized mounting rails 1m adjustable horizontally and vertically to enable mounting of equipment at any location within housing.

.1 Rails: 14 mm holes and 50 x 14 mm slots on 100 mm centres for horizontal adjustment.

.2 Holes in side panel flanges in 60 mm increments for vertical adjustment.

.5 Cover: tamperproof, bolt-on, domed to shed water.

.6 Door: 3-point latching, with padlocking means.

.7 Ventilation panel constructed to allow air circulation yet preventing entry of foreign objects, wild life, and vermin.

.8 Door interlocks:

.9 Enclosure construction such as to allow configuration of single or ganged enclosures.

.10 Enclosure capable of being shipped in knocked-down condition.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for electrical cabinet and enclosure installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant and/or Owners Representative.

.2 Inform Consultant and/or Owners Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant and/or Owners Representative.

3.2 INSTALLATION

.1 Assemble enclosure in accordance with manufacturer's instructions and securely mount on building structure with channels, supports and fastenings.

.2 Mount equipment in enclosure.

.3 Label electrical cabinets and enclosure to Section 26 05 00 - Common Work Results for Electrical.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

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

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

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

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

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.2 No.42:10(R2020), General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CAN/CSA C22.2 No.42.1-13(R2022), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA C22.2 No.55:15(R2020), Special Use Switches.

.4 CAN/CSA-C22.2 No.111-18, General-Use Snap Switches (Tri-national standard, with UL 20 and NMX-J-005-ANCE)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for wiring devices and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

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

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for wiring devices for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials indoors off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wiring devices from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SWITCHES

.1 20A, 120 V and 347 V, single pole, double pole, three-way, four-way switches to: CSA C22.2 No.55 and CSA C22.2 No.111-18.

.2 Manually-operated general purpose AC switches with following features:

- .1 Terminal holes approved for No. 10 AWG wire.
- .2 Silver alloy contacts.
- .3 Urea or melamine moulding for parts subject to carbon tracking.
- .4 Suitable for back and side wiring.
- .5 White toggle.

.3 Toggle operated locking fully rated for tungsten filament LED and fluorescent lamps, and up to 80% of rated capacity of motor loads heating loads.

.4 Switches of one manufacturer throughout project.

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA C22.2 No.42.1 with following features:

- .1 White urea moulded housing.
- .2 Suitable for No. 10 AWG for back and side wiring.
- .3 Break-off links for use as split receptacles.
- .4 Eight back wired entrances, four side wiring screws.
- .5 Triple wipe contacts and rivetted grounding contacts.

.2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:

- .1 White urea moulded housing.
- .2 Suitable for No. 10 AWG for back and side wiring.
- .3 Four back wired entrances, 2 side wiring screws.

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles of one manufacturer throughout project.

2.3 SPECIAL WIRING DEVICES

.1 Special wiring devices:

- .1 Clock hanger outlets, 15 A, 125 V, 3 wire, grounding type, suitable for No. 10 AWG for installation in flush outlet box.

2.4 COVER PLATES

.1 Cover plates for wiring devices to: CSA C22.2 No.42.1.

.2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.3 Plastic white cover plates, thickness 2.5 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.

.4 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.5 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

.6 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.

2.5 SOURCE QUALITY CONTROL

.1 Cover plates from one manufacturer throughout project.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wiring devices installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant and/or Owner Representative.

.2 Inform Consultant and/or Owner Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from Consultant and/or Owner Representative.

3.2 INSTALLATION

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at height as indicated in accordance with Section 26 05 00 Common Work Results for Electrical.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height as indicated in accordance with Section 26 05 00-Common Work Results for Electrical.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.4 Install GFI type receptacles as indicated.

.3 Cover plates:

.1 Install suitable common cover plates where wiring devices are grouped.

.2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

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

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

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

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

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.3 Repair damage to adjacent materials caused by wiring device installation.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide fuse performance data characteristics for each fuse type and size.

.3 Shop Drawings:

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

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

1.3 DELIVERY, STORAGE AND HANDLING

.1 Ship fuses in original containers.

.2 Do not ship fuses installed in switchboard.

.3 Store fuses in original containers in moisture free location storage cabinet.

.4 Waste Management and Disposal:

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

1.4 EXTRA MATERIALS

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

.2 Three spare fuses of each type and size installed above 600A.

.3 Six spare fuses of each type and size installed up to and including 600A.

Part 2 Products

2.1 FUSES - GENERAL

.1 Fuse type references L1, L2, J1, R1, etc. have been adopted for use in this specification.

.2 Fuses: product of one manufacturer.

2.2 FUSE TYPES

.1 Class L fuses.

.1 Type L1, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.2 Type L2, fast acting.

.2 Class J fuses.

.1 Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.2 Type J2, fast acting.

.3 Class R -R fuses.

.1 Type R1, (UL Class RK1), time delay, capable of carrying 500% of its rated current for 10 s minimum, to meet UL Class RK1 maximum let-through limits.

.2 Type R2, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.3 Type R3, (UL Class RK1), fast acting Class R, to meet UL Class RK1 maximum let-through limits.

.4 Class C fuses.

2.3 FUSE STORAGE CABINET

.1 Fuse storage cabinet, manufactured from 2.0mm thick 750aluminum mm high, 600mm wide, 300mm deep, hinged, lockable front access door finished in accordance with Section 26 05 00- Common Work Results for Electrical.

Part 3 Execution

3.1 INSTALLATION

.1 Install fuses in mounting devices immediately before energizing circuit.

.2 Ensure correct fuses fitted to physically matched mounting devices.

.1 Install rejection clips for Class R fuses.

.3 Ensure correct fuses fitted to assigned electrical circuit.

.4 Where UL Class RK1 fuses are specified, install warning label "Use only UL Class RK1 fuses for replacement" on equipment.

.5 Install spare fuses in fuse storage cabinet.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.2 No. 5-16(R2021), Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE-2010).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Include time-current characteristic curves for breakers with ampacity of 100A and over with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

.4 Certificates:

.1 Prior to installation of circuit breakers in either new or existing installation, Contractor must submit in PDF format copies of a production certificate of origin from the manufacturer. Production certificate of origin must be duly signed by factory and local manufacturer's representative certifying that circuit breakers come from this manufacturer and are new and meet standards and regulations.

.1 Production certificate of origin must be submitted to Consultant and/or Owners Representative for approval.

.2 Delay in submitting production of certificate of origin will not justify any extension of contract and additional compensation.

.3 Any work of manufacturing, assembly or installation to begin only after acceptance of production certificate of origin by Consultant and/or Owners Representative. Unless complying with this requirement, Consultant and/or Owners Representative reserves the right to mandate manufacturer listed on circuit breakers to authenticate new circuit breakers under the contract, and to Contractor's expense.

.4 Production certificate of origin must contain:

.1 Manufacturer's name and address and person responsible for authentication. Person responsible must sign and date certificate.

.2 Licensed dealer's name and address and person of distributor responsible for Contractor's account.

.3 Contractor's name and address and person responsible for project.

.4 Local manufacturer's representative name and address. Local manufacturer's representative must sign and date certificate.

.5 Name and address of building where circuit breakers will be installed:

.1 Project title: [_____]

.2 End user's reference number: [_____]

.3 List of circuit breakers: [_____]

1.3 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store circuit breakers in dry location off ground indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect circuit breakers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Circuit breakers, accessory high-fault protectors Moulded-case circuit breakers, ground-fault circuit-interrupters: to CSA C22.2 No. 5.

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

.3 Common-trip breakers: with single handle for multi-pole applications.

.4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

.5 Circuit breakers with interchangeable trips as indicated.

.6 Circuit breakers to have minimum interrupting capacity as noted on the drawings.

2.2 THERMAL MAGNETIC BREAKERSDESIGN A

.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.3 MAGNETIC BREAKERS DESIGN B

.1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.

2.4 CURRENT LIMITING AND SERIES RATED THERMAL MAGNETIC BREAKERS DESIGN C

.1 Thermal magnetic breakers with current limiters.

.1 Time current limiting characteristics of fuses limiters coordinated with time current tripping characteristics of circuit breaker.

.2 Co-ordination to result in interruption by breaker of fault-level currents up to interrupting capacity of breaker.

.2 Series rated breakers to be manufacturer tested and listed. Breakers to be applied following manufacturer's guidelines and accepted best practice.

.1 Breakers applied following manufacturer's guidelines and accepted best practice.

2.5 SOLID STATE TRIP BREAKERS DESIGN D

.1 Moulded case circuit breaker to operate by means of solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, long time, instantaneous, short time tripping and for groundphase fault short circuit protection.

2.6 OPTIONAL FEATURES

.1 Include: as noted on the drawings

.1 Shunt trip.

.2 Auxiliary switch.

.3 Motor-operated mechanism c/w time delay unit.

.4 Under-voltage release.

.5 On-off locking device.

.6 Handle mechanism.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant and/or Owners Representative.

.2 Inform Consultant and/or Owners Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant and/or Owners Representative.

3.2 INSTALLATION

.1 Install circuit breakers as indicated.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

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

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

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

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

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group

.1 CAN/CSA-C22.2 No.4:16(R2020), Enclosed and Dead-Front Switches (Tri-National Standard, with ANCE NMX-J-162-2004 and UL 98).

.2 CSA C22.2 No.39-13(R2022), Fuseholder Assemblies.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions in PDF format, printed product literature and data sheets for disconnect switches - fused and non-fused and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect disconnect switches - fused and non-fused from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 Fusible, Horsepower rated and Non-fusible, disconnect switch in CSA enclosure size.

.2 Provision for padlocking in off switch position by locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Fuses: size as indicated, in accordance with Section 26 28 13.01- Fuses - Low Voltage.

.5 Fuseholders: relocatable and to CSA C22.2 No.39 suitable without adaptors, for type and size of fuse indicated.

.6 Quick-make, quick-break action.

.7 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00- Common Work Results for Electrical.

.2 Indicate name of load controlled on size 4 nameplate.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for disconnect switches - fused and non-fused installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant and/or Owners Representative.

.2 Inform Consultant and/or Owners Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant and/or Owners Representative.

3.2 INSTALLATION

.1 Install disconnect switches complete with fuses if applicable.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning .

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

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

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

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

END OF SECTION

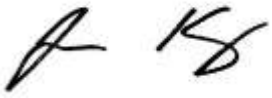
DESIGNATED SUBSTANCES AND HAZARDOUS BUILDING MATERIALS ASSESSMENT REPORT

HVAC Upgrades Project
Asquith Green Social Housing
21 Park Road
Toronto, Ontario
M4W 2N1

Prepared for:
Inder Bhamra (he/him), EP, PMP, CSM
Environmental Coordinator

City of Toronto – Corporate Real Estate Management
Metro Hall
55 John Street, 2nd Floor
Toronto, Ontario
M5V 3C6

Prepared by:
Safetech Environmental Limited



Jason King
Occupational Health and Safety Technician

Reviewed by:



John Mazzulli, B.A.
Project Coordinator

Safetech Project Number: 1-3250703

Date of Site Work: August 7, 2025
Date of Issue: August 15, 2025

3045 Southcreek Road
Unit #14, Mississauga, ON
L4X 2X7

TEL 905.624.2722 1.877.GO.TO.SEL
FAX 905.624.4306
www.safetechenv.com

Professional Engineers Ontario

TABLE OF CONTENTS

EXECUTIVE SUMMARY ..... **i**
1.0 Introduction **1**
1.1 Background and Objectives 1
1.2 Scope of Work 2
1.3 Description of Area(s) Assessed 3
2.0 Results **3**
2.1 Designated Substances 3
2.1.1 Asbestos *3*
2.1.2 Lead *10*
2.1.3 Mercury *11*
2.1.4 Silica *11*
2.1.5 Other Designated Substances *12*
2.2 Other Hazardous Materials 12
2.2.1 Chemical Hazards *12*
2.2.2 Biological Hazards *12*
2.2.3 Environmental Hazards *12*
3.0 Conclusions and Recommendations **13**
3.1 Designated Substances 13
3.1.1 Asbestos *13*
3.1.2 Lead *13*
3.1.3 Mercury *17*
3.1.4 Silica *17*
3.1.5 Other Designated Substances *18*
3.2 Other Hazardous Materials 18
3.2.1 Chemical Hazards *18*
3.2.2 Biological Hazards *19*
3.2.3 Environmental Hazards *19*
4.0 Limitations **21**

LIST OF TABLES

Table 1: Summary of Hazardous Materials and Designated Substances
Table 2: Bulk Sample Analytical Results for Determination of Asbestos Content
Table 3: Results of Assessment for Asbestos-Containing Materials
Table 4: Results of Paint Condition and Lead Content Assessment
Table 5: Results of Assessment for Ozone-Depleting and Global Warming Substances

LIST OF APPENDICES

Appendix I: Hazardous Materials Inventory Sheet
Appendix II: Site Drawings
Appendix III: Laboratory Certificate of Analysis – Asbestos
Appendix IV: Laboratory Certificate of Analysis – Lead
Appendix V: Methodology

EXECUTIVE SUMMARY

Safetech Environmental Limited (Safetech) was commissioned by the City of Toronto – Corporate Real Estate Management to conduct a designated substances and hazardous materials assessment associated with the HVAC Upgrades Project taking place within Asquith Green Social Housing located at 21 Park Road, Toronto, Ontario.

The objective of the assessment was to determine the presence, location, condition and quantities of designated substances and other hazardous materials that have the potential to be disturbed as part of planned construction activities (i.e. HVAC Upgrades Project) so that appropriate control measures can be implemented to protect workers during the work.

A summary of the assessment results and general recommendations based on our findings are provided in the following table. This table should be considered a summary only. Please refer to the Results (Section 2.0), Conclusions and Recommendations (Section 3.0), Hazardous Materials Inventory Sheet (Appendix I) and Site Drawings (Appendix II) of our report for additional details.

Table 1: Summary of Hazardous Materials and Designated Substances

Designated Substance	Findings	Recommendations
Asbestos	No asbestos-containing materials were identified in the areas assessed that would be impacted during the project.	No action required.
Lead	White paint on drywall ceiling contained a concentration of lead below the limit of detection (<0.0064% lead content) Lead Guideline (2014)) and is therefore not considered lead-containing Blue paint on metal air-conditioning unit was confirmed to be a low-level lead-containing paint (≤0.1% lead content). Grey paint on wooden window frame was confirmed to be a low-level lead-containing paint (≥0.5% lead content).	Disturbance of lead-containing materials must be conducted in accordance with the Ontario Ministry of Labour, Training and Skills Development (MLTSD) *Lead on Construction Projects* guideline (2011) and/or the Environmental Abatement Council of Canada (EACC) *Lead Guideline* (October 2014). For additional details, refer to Section 2.1.2 (Results) and Section 3.1.2 (Conclusions and Recommendations). Lead-containing wastes should be recycled if practicable or handled and disposed of according to R.R.O. 1990,

	The following materials are assumed to be lead-containing: - paints and surface coatings (not sampled) - solder in copper pipe fittings - solder in electrical components	Regulation 347, *General- Waste Management.*
Mercury	Sources of mercury were observed in the subject area and include the following: - vapour in fluorescent lamps - thermometers associated with mechanical equipment	If required, handle lamps with care and keep intact. All waste lamps are recommended to be sent to a lamp recycling facility.
Silica	Building materials identified that are suspected to contain crystalline silica and may be disturbed as part of the planned construction project include: - plaster - drywall walls/drywall joint compound - concrete - mortar	Any work involving the disturbance of silica-containing materials should follow the procedures outlined in the Ontario Ministry of Labour, Training and Skills Development *"Silica on Construction Projects"* guideline. For additional information, refer to Section 2.1.4 (Results) and Section 3.1.4 (Conclusions and Recommendations).
Other Designated Substances	No other designated substances are expected to be present in any significant quantities or in a form that would represent an exposure concern.	No protective measures or procedures specific to acrylonitrile, arsenic, benzene, coke oven emissions, ethylene oxide, isocyanates, and vinyl chloride are considered necessary.
Other Hazardous Materials	**Findings**	**Recommendations**
Urea Formaldehyde Foam Insulation	No UFFI was identified or is suspected in the subject area.	No action required.
Mould Contamination	No suspect mould contamination was observed on building finishes in the subject area.	No action required.
Pest Infestation	No pest infestations were observed in the areas assessed.	No action required.
Polychlorinated Biphenyls	Fluorescent light ballasts are assumed to contain PCB's.	PCB-containing ballasts should be removed, separated from other waste and disposed of as PCB waste at an authorized destruction facility.

Ozone Depleting and Global Warming Substances	Two (2) air-conditioning units on the roof of the subject building contained insufficient information and are suspected of containing ozone-depleting substances.	Purge air-conditioning unit(s) of remaining refrigerant prior to removal and disposal. This should be conducted by a certified person who holds a valid Ozone Depletion Prevention Certificate. Servicing and testing of refrigeration equipment should be conducted in accordance with Environment Canada's "*Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems"*.

This assessment satisfies the Owner's requirements under Section 30 of the Ontario Occupational Health and Safety Act (OHSA), Revised Statutes of Ontario 1990, as amended.

Should you have any questions regarding the information contained in the report, please contact our office.

Safetech Environmental Limited

Jason King
Occupational Health & Safety Technician

August 15, 2025

City of Toronto – Corporate Real Estate Management
Metro Hall
55 John Street, 2nd Floor
Toronto, Ontario
M5V 3C6

Attention: Inder Bhamra (he/him), EP, PMP, CSM
Environmental Coordinator

RE: Designated Substances and Hazardous Materials Assessment
HVAC Upgrades Project
Asquith Green Social Housing – Project Specific Locations
21 Park Road, Toronto, Ontario

1.0 INTRODUCTION

1.1 Background and Objectives

Safetech Environmental Limited (Safetech) was commissioned by City of Toronto – Corporate Real Estate Management to conduct a designated substances and hazardous materials assessment within Project Specific Locations (subject area(s)) of Asquith Green Social Housing (subject building) located at 21 Park Road, Toronto, Ontario. The objective of the assessment was to determine the presence, location, condition and quantities of designated substances and other hazardous materials in the subject area(s) that have the potential to be disturbed as part of planned construction activities (i.e. HVAC Upgrades Project) so that appropriate control measures can be implemented to protect workers during the work.

This assessment satisfies the Owner's requirements under Section 30 of the Ontario Occupational Health and Safety Act (OHSA), Revised Statutes of Ontario 1990, as amended. Section 30(1) requires a building owner to determine if there are any designated substances present at a project site prior to construction or demolition activities. Sections 30(2), (3) and (4) require the Owner and constructors for a project to provide the findings in this report as part of the tendering information for any tendered project or to prospective contractors (and subcontractors) of a project before entering into a binding contract.

This report documents findings of our on-site inspection that was conducted on August 7, 2025 and provides conclusions and recommendations based on our findings and knowledge of the planned construction project.

1.2 Scope of Work

In accordance with our fee proposal document, our scope of work included the following activities:

- A review of existing documents, including renovation documents and drawings, floor plans and existing environmental assessment reports, etc., where available;
- A visual assessment of accessible area(s) in the subject area(s) to identify the presence, location, condition and quantities of designated substances and other hazardous materials;
- Collection, analysis and interpretation of representative bulk samples of suspect asbestos-containing building materials for the determination of asbestos content and material classification;
- Collection, analysis and interpretation of representative paint chip samples for the determination of lead content; and
- Preparation of a report to document findings and provide recommendations regarding control measures and/or special handling procedures for designated substances or specific hazardous materials that may be disturbed as part of planned construction activities.

Documents reviewed to aid in the assessment included the following:

- Asquith Green Social Housing Designated Substances Re-Survey Report (project #: 1-3230265) dated December 14, 2023 as prepared by Safetech Environmental Limited. This report is hereafter referred to as the “Safetech DSHM Report”.
- 21 Park Road, Toronto Bulk Sample Report (project #: 1-3250154) dated February 21, 2025 as prepared by Safetech Environmental Limited. This report is hereafter referred to as the “Safetech Bulk Sample Report”
- 21 Park Road, TSSS HVAC Phase IV Drawing (project #: 2425) dated May 2025, as prepared by Workshop Architecture Inc.

This assessment only identified designated substances and hazardous materials that were deemed to be part of the building or somehow otherwise incorporated into the building structure and its finishes. **The following items were not included in our scope of work:**

- Assessing occupant items such as stored products, furnishings, items and materials used or produced as part of a manufacturing process;
- Investigating underground materials or equipment (vessels, drums, underground storage tanks, duct-banks, pipes, or cables);
- Assessing enclosed wall or ceiling cavities; and

- Assessing risers, pipe chases or elevator shafts.

1.3 Description of Area(s) Assessed

The area(s) investigated included all accessible locations of the subject area(s). The extent of the area investigated is indicated on the floor plan(s) provided in Appendix II.

2.0 RESULTS

Results of our visual assessment and bulk sample analytical findings are summarized in the sections below.

2.1 Designated Substances

2.1.1 Asbestos

Results of bulk sample analysis for the determination of asbestos content are summarized in the following table. Materials have been classified as “ACM”, “Non-ACM”, “Suspected ACM” or “Presumed Non-ACM” based on analytical results. Materials classified as Suspected ACM or Presumed Non-ACM may require further analysis (depending on site-specific conditions) to verify whether the material should be classified as ACM or Non-ACM. Please refer to the Limitations section of this report (Section 4.0) for additional details. The Laboratory Certificate of Analysis is included in Appendix III.

Table 2*:* Bulk Sample Analytical Results for Determination of Asbestos Content

Sample No.	Material Description	Layer	Sample Location	Asbestos Content	Material Classification
1a	Green Duct Mastic	N/A	Second Floor Corridor	None Detected	Non-ACM
1b				None Detected	
1c				None Detected	
2a	Drywall Joint Compound (Upper Ceiling)	N/A	Second Floor, Corridor	None Detected	Non-ACM
2b				None Detected	
2c	Drywall Joint Compound (Wall)		Attic, Mechanical Room	None Detected	
2d	Drywall Joint Compound (Ceiling)			None Detected	
2e			Attic, Hot Water Tank Room	None Detected	
3a	Mastic associated with 12”x12” Beige with Grey Flecks Vinyl Floor Tiles	N/A	Attic, Hot Water Tank Room	None Detected	Non-ACM
3b				None Detected	
3c				None Detected	
4a	2-Ply Roof Membrane	Shingle	Lower Roof	None Detected	Non-ACM
		Tar Felt		None Detected	
4b		Shingle		None Detected	
		Tar Felt		None Detected	
4c		Shingle	Upper Roof	None Detected	
		Tar Felt		None Detected	
5a	Paper Insulation	N/A	Lower Roof	None Detected	Non-ACM

Sample No.	Material Description	Layer	Sample Location	Asbestos Content	Material Classification
5b				None Detected	
5c				None Detected	
6a	Asphalt Insulation	Tar	Lower Roof	None Detected	Non-ACM
		Tar Felt		None Detected	
6b		Tar		None Detected	
		Tar Felt		None Detected	
6c		Tar		None Detected	
		Tar Felt		None Detected	
7a	Tar Felt	N/A	Lower Roof	None Detected	Non-ACM
7b				None Detected	
7c				None Detected	
8a	Paper Vapour Barrier	N/A	Lower Roof	None Detected	Non-ACM
8b				None Detected	
8c				None Detected	
9a	Shingles	N/A	Lower Roof	None Detected	Non-ACM
9b				None Detected	
9c				None Detected	
10a	Paper Insulation under Shingles	N/A	Lower Roof	None Detected	Non-ACM
10b				None Detected	
10c				None Detected	
11a	Window Frame Caulking (Brown)	N/A	Lower Roof	None Detected	Non-ACM
11b				None Detected	
11c	Flashing Caulking (Brown)			None Detected	
12a	AC Electrical Penetrate Caulking (White)	N/A	Upper Roof	None Detected	Non-ACM
12b				None Detected	
12c				None Detected	
13a	Window Frame Caulking (White)	White	Lower Roof	None Detected	Non-ACM
		Black		None Detected	
13b		White		None Detected	
		Black		None Detected	
13c		White		None Detected	
		Black		None Detected	
14a	AC Electrical Penetrate Mastic (Brown)	N/A	Lower Roof	None Detected	Non-ACM
14b				None Detected	
14c				None Detected	
15a	Exhaust Penetrate Mastic	N/A	Upper Roof	None Detected	Non-ACM
15b				None Detected	
15c			Lower Roof	None Detected	

As per O.Reg. 278/05, ACM contains ≥0.5% asbestos by dry weight.

Materials assessed for asbestos content are summarized in the following table based on the type/use of the material.

Table 3: Results of Assessment for Asbestos-Containing Materials

Sprayed and Loose Fill Insulating Materials	Location/Description	
Sprayed Fireproofing	None identified in subject area(s).	
Sprayed Insulation	None identified in subject area(s).	
Loose Fill / Vermiculite Insulation	None identified in subject area(s).	
Thermal System Insulation	**Location/Description**	
Mechanical Pipe Insulation – Straights	Pipe insulation was observed to be uninsulated or insulated with fiberglass insulation and therefore non-asbestos containing.	
Mechanical Pipe Insulation – Fittings (elbows, valves, tees, hangars, etc.)	Pipe fitting insulation was observed to be uninsulated or insulated with fiberglass insulation and therefore non-asbestos containing.	
HVAC Duct Insulation	Duct insulation was observed to be insulated with fiberglass insulation and therefore non-asbestos containing.	
Breeching / Exhaust Insulation	None identified in subject area(s).	
Tank Insulation	None identified in subject area(s).	
Boiler Insulation	None identified in subject area(s).	

Other Mechanical Equipment Insulation	Green duct mastic was observed in the subject area(s). Bulk samples were collected during the assessment and results of analysis confirmed that this building material is not asbestos-containing. Refer to sample set 1A-C in Table 2.	
Architectural Finishes & Finishing Materials	**Location/Description**	
Sprayed Texture / Stucco Finishes	None identified in subject area(s).	
Plaster Finishes	None identified in subject area(s).	
Drywall Joint Compound	Drywall joint compound was observed in the subject area(s). Bulk samples were collected during the assessment and results of analysis confirmed that this building material is not asbestos-containing. Refer to sample set 2A-E in Table 2.	
Ceiling Tiles	**Location/Description**	
Lay-in Acoustic Ceiling Tiles	2'x4' textured pinhole pricks lay-in ceiling tiles were previously identified in the Pinchin DSHM Report and found not to contain to be asbestos-containing.	
	2'x4' pinhole/fissures lay-in ceiling tiles were previously identified in the Safetech Bulk Sample Report and found not to contain to be asbestos-containing.	

Glued-on Acoustic Ceiling Tiles	None identified in subject area(s).	
Cement Ceiling Panels	None identified in subject area(s).	
Flooring	**Location/Description**	
Vinyl Floor Tiles	12”x12” beige with grey flecks vinyl floor tiles were previously identified in the Pinchin DSHM Report and found not to contain to be asbestos-containing.	
Vinyl Sheet Flooring	None identified in subject area(s).	
Mastic	Mastic associated with 12”x12” beige with grey flecks vinyl floor tiles were observed in the subject area(s). Bulk samples were collected during the assessment and results of analysis confirmed that this building material is not asbestos-containing. Refer to sample set 3A-C in Table 2.	
Asbestos Cement Products	**Location/Description**	
Piping	None identified in subject area.	
Roofing, Siding, Wallboard	None identified in subject area(s).	
Other Cement Products	None identified in subject area(s).	
Exterior Building Materials	**Location/Description**	
Caulking	Brown window frame/flashing caulking was observed in the subject area(s). Bulk samples were collected during the assessment and results of analysis confirmed that this building material is not asbestos-containing. Refer to sample set 11A-C in Table 2.	

	White electrical penetrate caulking was observed in the subject area(s). Bulk samples were collected during the assessment and results of analysis confirmed that this building material is not asbestos-containing. Refer to sample set 12A-C in Table 2.	
	White window frame caulking was observed in the subject area(s). Bulk samples were collected during the assessment and results of analysis confirmed that this building material is not asbestos-containing. Refer to sample set 13A-C in Table 2.	
Mastic	Brown AC electrical penetrate mastic was observed in the subject area(s). Bulk samples were collected during the assessment and results of analysis confirmed that this building material is not asbestos-containing. Refer to sample set 14A-C in Table 2.	
	Exhaust penetrate mastic was observed in the subject area(s). Bulk samples were collected during the assessment and results of analysis confirmed that this building material is not asbestos-containing. Refer to sample set 15A-C in Table 2.	
Roofing Insulation	2-ply membrane was observed in the subject area(s). Bulk samples were collected during the assessment and results of analysis confirmed that this building material is not asbestos-containing. Refer to sample set 4A-C in Table 2.	

	Paper insulation was observed in the subject area(s). Bulk samples were collected during the assessment and results of analysis confirmed that this building material is not asbestos-containing. Refer to sample set 5A-C in Table 2.	
	Asphalt insulation was observed in the subject area(s). Bulk samples were collected during the assessment and results of analysis confirmed that this building material is not asbestos-containing. Refer to sample set 6A-C in Table 2.	
	Tar felt was observed in the subject area(s). Bulk samples were collected during the assessment and results of analysis confirmed that this building material is not asbestos-containing. Refer to sample set 7A-C in Table 2.	
	Paper vapour barrier was observed in the subject area(s). Bulk samples were collected during the assessment and results of analysis confirmed that this building material is not asbestos-containing. Refer to sample set 8A-C in Table 2.	
Shingles	Shingles were observed in the subject area(s). Bulk samples were collected during the assessment and results of analysis confirmed that this building material is not asbestos-containing. Refer to sample set 9A-C in Table 2.	

	Paper insulation under shingles was observed in the subject area(s). Bulk samples were collected during the assessment and results of analysis confirmed that this building material is not asbestos-containing. Refer to sample set 10A-C in Table 2.	

2.1.2 Lead

Laboratory analytical results for paints tested to determine lead content are summarized in the following table. The Laboratory Certificate of Analysis is included in Appendix IV. Refer to Section 3.1.2 of this report for recommended lead abatement procedures (if any) that correspond to the type of proposed construction, renovation, or demolition work.

Table 4: Results of Paint Condition and Lead Content Assessment

Sample No.	Location	Surface	Paint Colour	Condition	Lead Conc. (% by wt.)	Material Classification
L-01	Upper Roof	Metal AC	Blue	Fair	0.018	LLLP
L-02	Lower Roof	Wooden Window Frame	Grey	Poor	7.8	LBP
L-03	Attic, Mechanical Room	Drywall Ceiling	White	Poor	0.0072	NLC

LBP: Lead-Based Paint (≥0.5% Lead Content); LCP: Lead-Containing Paint (>0.1% Lead Content);
LLLP: Low-Level Lead Paint (≤0.1% Lead Content); NLC: Non-Lead Containing (<0.0064% Lead Content)

Suspect lead-containing materials observed in the subject area(s) included the following:

- paints and surface coatings (not sampled)
- solder in copper pipe fittings
- solder in electrical components

Table 5: Results of Assessment for Lead-Containing Materials

Location/Description	Picture

Blue paint associated with metal AC in subject area(s) was sampled during our investigation. Results of analysis confirmed the paint to be a low-level lead-containing paints (≤0.1% lead content). Refer to sample L-01 in Table 5.	
Grey paint associated with wooden window frame was sampled during our investigation. Results of analysis confirmed the paint to be a lead-containing paint (≥0.5% lead content). Refer to samples L-02 in Table 5.	
White paint associated with drywall ceiling in subject area(s) was sampled during our investigation. Results of analysis did not indicate the presence of any detectable concentrations of lead. Therefore, the white paint is not considered to be lead-containing. Refer to sample L-03 in Table 4.	

2.1.3 Mercury

Mercury is present in the subject area(s) in the form of:

- vapour in fluorescent lamps
- thermometers associated with mechanical equipment

2.1.4 Silica

A number of building materials were identified in the subject area(s) that are ***suspected to contain crystalline silica***. This includes the following materials:

- plaster
- drywall walls/drywall joint compound
- concrete
- mortar

2.1.5 Other Designated Substances

Acrylonitrile, arsenic, benzene, coke oven emissions, ethylene oxide, isocyanates, and vinyl chloride were not included in the assessment as these substances are not expected to be a significant component of building materials or present in a form that would represent an exposure concern. Additionally, no specific information regarding their use was provided to us.

2.2 Other Hazardous Materials

2.2.1 Chemical Hazards

No visible evidence of UFFI installation (i.e. injection openings) or overspray of foam insulation at wall/ceiling joints was identified in the subject area(s).

2.2.2 Biological Hazards

2.2.2.1 Mould Contamination

There was no visible evidence of obvious mould growth on building finishes in the subject area(s) at the time of the assessment. In addition, there was no visible evidence of any significant water staining or discolouration to building finishes in the subject area(s) that would suggest the potential for hidden mould growth behind these finishes.

2.2.2.2 Pest Infestation

There was no visible evidence of a pest infestation in the subject area(s).

2.2.3 Environmental Hazards

2.2.3.1 Polychlorinated Biphenyls (PCBs)

Fluorescent light fixtures were identified in the subject building. Fluorescent light fixtures were noted to be a mixture of four-foot, one lamp and two lamp fixtures. The lamps were noted to be newer T8 lamps. Fluorescent light fixtures could not be accessed for further evaluation to determine the type(s) of ballasts present and therefore the ballasts within these lights are assumed to contain PCBs.

2.2.3.2 Ozone Depleting and Global Warming Substances

Equipment identified in the subject area(s) that are suspected to contain ozone depleting substances (ODS) and/or global warming substances (GWS) are summarized in the following table.

Table 5: Results of Assessment for Ozone-Depleting and Global Warming Substances

Location	Equipment Manufacturer and Type	Type and Quantity of Refrigerant or Fire Extinguishing Agent	ODS/GWS Classification
Upper Roof	Carrier – Air-Conditioning Unit	Insufficient Information	Assumed ODS
Upper Roof	Carrier – Air-Conditioning Unit	Insufficient Information	Assumed ODS

3.0 CONCLUSIONS AND RECOMMENDATIONS

3.1 Designated Substances

3.1.1 Asbestos

As results summarized in Table 2 indicate, no asbestos was detected in any of the bulk samples of green duct mastic, joint compound, mastics, roof insulation, shingles, paper insulation, or caulking retrieved for analysis. Therefore, these building materials are considered to be Non-ACM and there are no requirements for management, disturbance or removal of these materials under O. Reg. 278/05. No other suspect asbestos-containing materials were observed in the subject area.

3.1.2 Lead

Results of paint chip analysis for the determination of lead content indicated that white paint associated with drywall ceiling contained a concentration of lead below the limit of detection (<0.0064% based on requirements of the Environmental Abatement Council of Ontario (EACO) Lead Guideline (2014)) and is therefore not considered lead-containing. No lead related precautions are considered necessary for the removal or disturbance of this material.

Results of paint chip analysis for the determination of lead content indicated that blue paint associated with metal air-conditioning unit is considered a ‘low-level lead paint’ (≤0.1% based on requirements of the Environmental Abatement Council of Canada (EACC) Lead Guideline (2014)). If the ‘low-level lead paint’ is disturbed in a non-aggressive manner (no use of power tools/abrasive blasting, grinding, welding, heating, etc.), then respirators are not considered necessary. However, Class 1 measures and procedures should still be implemented during the non-aggressive disturbance of ‘low-level lead paints’, including, but not limited to, no smoking, eating, drinking and chewing gum in the work area; dust suppression methods must be implemented; and facilities must be made available so that workers can wash their hands and face.

Results of paint chip analysis for the determination of lead content indicated that grey paint associated with wooden window frame was confirmed to be lead-based (≥0.5% lead

content based on required of Environmental Abatement Council of Ontario (EACO) “Lead Guideline” (October 2014)). Any disturbance of lead-based paints should be conducted in accordance the procedures outlined in the Environmental Abatement Council of Ontario (EACO) “Lead Guideline” (October 2014) and/or the Ontario Ministry of Labour (MOL) “Lead on Construction Projects” guideline (April 2011). The extent of procedures (Class or Type of operation) necessary depends on the type of work to be conducted.

Paints and surface coatings not sampled are assumed to be lead-containing (>0.1% lead content) in the subject area. Any disturbance of the lead-containing paints or surface coatings should be conducted in accordance with the procedures outlined in the Environmental Abatement Council of Canada (EACC) “Lead Guideline” (October 2014) and/or the Ontario Ministry of Labour, Training and Skills Development (MLTSD) “Lead on Construction Projects” guideline (April 2011). The extent of procedures required depends on the type of work to be conducted.

Additional suspect lead-containing products not anticipated to be disturbed during construction includes solder on pipe fittings and electrical components. Future testing of these materials and specific handling/disposal requirements may be necessary if/when these materials are to be disturbed.

At this time the method of disturbance, if any, of lead-containing materials is unknown. It is recommended that any contractor whose work requires lead-containing materials to be disturbed consult the EACC or Ontario MLTSD guidelines prior to the start of work to determine the Class/Type of operation(s) and the corresponding control measures (engineering controls, work/hygiene practices, protective clothing and equipment and worker training) necessary to conduct the work in a manner that will prevent worker overexposure to lead. The following table outlines the classification of lead disturbance based on the EACC guideline.

Operation	Description
Class 1	1. Removal of lead-containing or lead-based paints and surface coatings with a chemical gel/stripper or paste; 2. Application of lead-containing or lead-based paints and surface coatings with a brush, roller or sponge. 3. Installation or removal of lead sheeting or flashing. 4. Installation or removal of lead-containing packing, babbitt, caulking, gasket or similar material. 5. Removal of materials coated with lead-containing or lead-based paints and surface coatings, using non-powered hand tools, where the material remains chiefly intact and is not crumbled, pulverized or powdered. 6. Operating construction or demolition equipment (e.g. excavator, bulldozer) during building renovation or demolition where lead-based paints or surface coatings are present on building materials and are being disturbed. 7. Soldering with lead solder. 8. Removing lead-containing or lead-based paints or surface coatings with a heat gun. 9. Removing lead-containing and lead-based paints and surface coatings using a high-pressure water jet (e.g. pressure washer).

Operation	Description
Class 2a	1. Removal of lead-containing or lead-based paints and surface coatings or lead-containing materials using a power tool that has an effective dust collection system equipped with a HEPA filter*. 2. Welding, torching or high temperature cutting of lead-containing materials indoors when using an effective fume collector or smoke eater that filters and exhausts lead fume and expels it directly outdoors (away from occupants, entrances, walkways, rest areas, etc.). Fume collector or smoke eater must have effective source control and capture velocity, minimum of 0.5 metres per second (100 feet per minute) at the work surface. 3. Welding, torching or high temperature cutting of lead-containing and lead-based paints and surface coatings or lead-containing materials outdoors. 4. Removal of lead-containing mortar using handheld non-powered tools. 5. Removal of lead-containing and lead-based paints and surface coatings or lead-containing materials by scraping or sanding (including wet sanding) using non-powered hand tools. 6. Demolition of plaster or building components that crumble, pulverize or powder and are covered with lead-containing or lead-based paints or surface coatings. 7. Clean up and removal of a significant amount of lead-containing dust and debris (that can be made easily airborne) using wet methods or HEPA vacuums.
Class 2b	1. Spray application of lead-containing paints and surface coatings
Class 3a	1. Removal of lead-containing or lead-based paints and surface coatings or lead-containing materials using a power tool without an effective dust collection system equipped with a HEPA filter. 2. Welding, torching or high temperature cutting of lead-containing materials indoors or in a confined space (e.g. within a ditch or pit). 3. Removal of lead-containing mortar using a powered cutting device. 4. Burning of a material containing lead. 5. Removal, cleaning or repair of a ventilation system or ductwork used for controlling lead exposure. 6. Spray application of lead-based paints and surface coatings. 7. In the absence of an exposure assessment: a. demolition or cleanup of a facility where lead-containing products were manufactured and significant dust and debris, which can be made easily airborne, is present. b. cleanup of dust and debris down range of a firing station in an indoor firing range.an operation that may expose a worker to lead dust, fume or mist that is not a Class 1, Class 2, or Class 3B operation.
Class 3b	1. Abrasive blasting of lead-containing and lead-based paints and surface coatings or lead-containing materials (including wet, slurry and dry abrasive blasting and dry-ice blasting).

* Effective implies that the dust collection system should be capable of controlling airborne lead concentration levels to below 0.05 mg/m^3. Employers should follow manufacturer's recommendations and maintenance specifications for optimal function.

The following table outlines the classification of lead disturbance based on the Ontario MLTSD guideline.

Operation	Description
Type 1	1. Application of lead-containing coatings with a brush or roller. 2. Removal of lead-containing coatings with a chemical gel or paste and fibrous laminated cloth wrap. 3. Removal of lead-containing coatings or materials using a power tool that has an effective* dust collection system equipped with a HEPA filter. 4. Installation or removal of lead-containing sheet metal. 5. Installation or removal of lead-containing packing, babbit or similar material. 6. Removal of lead-containing coatings or materials using non-powered hand tools, other than manual scraping or sanding. 7. Soldering.
Type 2a	1. Welding or high temperature cutting of lead-containing coatings or materials outdoors. This operation is considered a Type 2a operation only if it is short-term, not repeated, and if the material has been stripped prior to welding or high temperature cutting. Otherwise, it will be considered a Type 3a operation. 2. Removal of lead-containing coatings or materials by scraping or sanding using non-powered hand tools. 3. Manual demolition of lead-painted plaster walls or building components by striking a wall with a sledgehammer or similar tool.
Type 2b	2. Spray application of lead-containing paints and surface coatings
Type 3a	8. Welding or high temperature cutting of lead-containing coatings or materials indoors or in a confined space. 9. Burning of a surface containing lead. 10. Dry removal of lead-containing mortar using an electric or pneumatic cutting device. 11. Removal of lead-containing coatings or materials using power tools without an effective dust collection system equipped with a HEPA filter. 12. Removal or repair of a ventilation system used for controlling lead exposure. 13. Demolition or cleanup of a facility where lead-containing products were manufactured. 14. An operation that may expose a worker to lead dust, fume or mist that is not a Type 1, Type 2, or Type 3b operation.
Type 3b	1. Abrasive blasting of lead-containing coatings or materials. 2. Removal of lead-containing dust using an air mist extraction system.

* Effective implies that the dust collection system should be capable of controlling airborne lead concentration levels to below 0.05 mg/m^3. Employers should follow manufacturer's recommendations and maintenance specifications for optimal function.

If practicable, all bulk lead waste materials should be separated from other wastes and sent to a recycling facility. If not practicable, lead-containing waste should be handled and disposed of according to R.R.O. 1990, Regulation 347, *General - Waste Management* (Reg. 347) made under the Environmental Protection Act. Under this regulation (and depending on the quantity of waste generated) the waste may be subject to analysis following the Toxicity Characteristic Leaching Procedure (TCLP) to determine if it is a “leachate toxic waste” based on the leachate quality criteria provided in Schedule 4 of the regulation. Such wastes must meet specific treatment requirements (Schedule 5) or undergo alternative treatment for hazardous debris (Schedule 8) prior to land disposal.

3.1.3 Mercury

Fluorescent and lamps that require removal should be handled with care and kept intact to avoid potential exposure to mercury vapour present within the lamps. To prevent the release of mercury into the environment, Safetech recommends that all waste lamps be sent to a lamp recycling facility and not disposed of in landfill.

Liquid mercury is suspected to be present in thermometers, thermostats, barometers and other measuring devices (pressure gauges/sensors, vacuum gauges, manometers, etc.), thermostats and a variety of other electrical switches (temperature sensitive, tilt switches, float switches, etc.) associated with mechanical equipment. These items are expected to be removed as part of the construction project. Care should be taken not to disturb these items during the work as breakage could cause a spill of liquid mercury. If any of these items are to be removed it should be done so carefully to avoid spillage and stored/packaged in a manner that will prevent breakage or spillage. Any mercury-containing equipment that is to be removed is recommended to be recycled rather than disposed of in landfill.

Although no mercury was visibly identified in other equipment, dismantling of equipment was not conducted to verify the presence/absence of mercury. It is cautioned that thermometers, barometers and other measuring devices (pressure gauges/sensors, vacuum gauges, manometers, etc.), thermostats and a variety of other electrical switches (temperature sensitive, tilt switches, float switches, etc.) may contain mercury that may not be visible without dismantling the equipment. Such devices should be assumed to contain mercury until proven otherwise and similar precautions to those outlined above should be taken if any of these items are to be disturbed or taken out of service in the future.

3.1.4 Silica

Suspect silica-containing materials were identified to be present in the subject area(s). In their current state, building materials containing silica do not represent a risk to building occupants or construction workers. Risks associated with exposure to silica arise during demolition activities that cause silica dust to be created (particularly grinding, drilling or cutting operations and during major demolition), resulting in a crystalline silica inhalation hazard.

If any materials suspected to contain silica are to be removed or otherwise disturbed as a result of renovation/demolition activities it is recommended that procedures be put in place to control the generation of dust (such as routine water misting) and thus reduce the potential for worker exposure. Workers that have the potential to be exposed to airborne silica should also wear appropriate protective clothing and respiratory protection. Any work involving the disturbance of silica-containing materials should follow the procedures outlined in the Ontario MLTSD “Silica on Construction Projects” guideline (April 2011). The appropriate engineering controls, work practices, hygiene practices, personal protective measures and training necessary to conduct the work in a safe

manner are provided in this guideline. The general measures and procedures (or Type of operation) necessary depends on the type of work to be conducted. The following table outlines the classification of silica disturbance based on the Ontario MLTSD guideline.

Operation	Description
Type 1	1. The drilling of holes in concrete or rock that is not part of a tunneling operation or road construction. 2. Milling of asphalt from concrete highway pavement 3. Charging mixers and hoppers with silica sand (sand consisting of at least 95% silica) or silica flour (finely ground sand consisting of at least 95% silica) 4. Any other operation at a project that requires the handling of silica-containing material in a way that may results in a worker being exposed to airborne silica. 5. Entry into a dry mortar removal or abrasive blasting area while airborne dust is visible for less than 15 minutes for inspection and/or sampling. 6. Working within 25 metres of an area where compressed air is being used to remove silica-containing dust outdoors.
Type 2	1. Removal of silica containing refractory materials with a jackhammer 2. The drilling of holes in concrete or rock that is part of a tunneling or road construction. 3. The use of a power tool to cut, grind, or polish concrete, masonry, terrazzo or refractory materials. 4. The use of a power tool to remove silica containing materials. 5. Tunneling (operation of the tunnel boring machine, tunnel drilling, and tunnel mesh installation). 6. Tuckpoint and surface grinding 7. Dry mortar removal with an electric or pneumatic cutting device 8. Dry method dust cleanup from abrasive blasting operations 9. The use of compress air outdoors for removing silica dust 10. Entry into area where abrasive blasting is being carried out for more than 15 minutes
Type 3	1. Abrasive blasting with an abrasive that contains >1% silica 2. Abrasive blasting or a material that contains >1% silica

3.1.5 Other Designated Substances

No other designated substances are expected to be a component of building materials in the subject area(s) in a form that would represent an exposure concern. Therefore, no protective measures or procedures specific to acrylonitrile, arsenic, benzene, coke oven emissions, ethylene oxide, isocyanates, and vinyl chloride are considered necessary.

3.2 Other Hazardous Materials

3.2.1 Chemical Hazards

As no UFFI was identified or is suspected to be present in the subject area(s), no further action is required. However, given that no destructive testing was conducted, there is a remote possibility that UFFI could be hidden within locations such as exterior wall cavities. If suspect foam insulation is identified during renovation/demolition activities work should be stopped and the area should be re-assessed to evaluate conditions and determine appropriate control measures and worker protection, if necessary.

3.2.2 Biological Hazards

3.2.2.1 Mould Contamination

No mould contamination was identified in the subject area(s) and no further action is required at this time. Although no obvious mould contamination or evidence to suggest possible hidden mould contamination was identified in the subject area(s), there is still a potential for hidden mould growth to exist behind or underneath building finishes. Should suspect mould growth be discovered during the course of renovation or demolition work, Safetech recommends that all work stop so that the area can be assessed to evaluate proper control measures and remediation protocols in order to avoid worker exposure to mould and possible contamination of adjacent areas.

3.2.2.2 Pest Infestation

No visual evidence of any significant pest infestation was observed in the subject area(s). Therefore, no additional precautionary measures are deemed necessary for protection against biological contaminants potentially associated with pest infestation.

3.2.3 Environmental Hazards

3.2.3.1 Polychlorinated Biphenyls (PCBs)

The federal government has set strict regulations for the handling, storage and disposal of PCBs. The PCB Regulations (SOR/2008-273) came into effect on September 5th, 2008 and consolidates and replaces the Chlorobiphenyls Regulations (SOR/91-152) and the Storage of PCB Material Regulations (SOR/92-507). The purpose of the PCB Regulations is to improve the protection of Canada's environment and the health of Canadians by minimizing the risks posed by the use, storage and release of PCBs by accelerating the elimination of these substances.

As of December 31, 2009 all current PCB storage sites are to have been eliminated and there should no longer be any electrical capacitors, electrical transformers, electromagnets, heat transfer equipment or any other equipment in service that contains PCBs at a concentration greater than 500 mg/kg (500 ppm). As of this time, all of this equipment should have been removed from service and sent for destruction. Furthermore, the PCB Regulations restricts the use of equipment containing PCBs (other than light ballasts or pole-top electrical transformers) at concentrations exceeding 50 mg/kg (50 ppm) in sensitive areas (such as drinking water treatment plants, schools, hospitals and senior citizen care facilities) by the same date. All other locations have until December 31, 2025 to decommission equipment containing 50 ppm to 500 ppm PCBs. The assessment confirmed that some of the existing fluorescent light ballasts contain PCB's.

When light fixtures are to be decommissioned all PCB-containing ballasts should be removed and separated from other waste and disposed of as PCB waste at an authorized destruction facility. The PCB content of "assumed PCB-containing" fluorescent light ballasts and HID lamp ballasts should be verified at this time by determining the date of

manufacture and other pertinent information by referring to the Environment Canada document entitled “Identification of Lamp Ballasts Containing PCBs” (Report EPS 2/CC/2 (revised) August 1991) to aid in identification.

Existing fluorescent light ballasts are assumed to contain PCBs. When light fixtures are to be decommissioned, all ballasts should be verified at this time by determining the date of manufacture and other pertinent information by referring to the Environment Canada document entitled “Identification of Lamp Ballasts Containing PCBs” (Report EPS 2/CC/2 (revised) August 1991) to aid in identification. Any ballasts that meet the criteria outlined in this document must be treated as PCB containing.

When PCB-containing equipment is taken out of service, jurisdiction falls under provincial regulations. As per R.R.O 1990, Regulation 347, *General - Waste Management*, the land disposal of PCB waste is prohibited. PCB wastes in Ontario are regulated under R.R.O 1990, Regulation 362, *Waste Management – PCBs* (Reg. 362), made under the Environmental Protection Act. Under this regulation, PCB waste is defined as any waste material containing PCBs at a concentration of more than fifty (50) parts per million by weight (i.e. >50mg/kg), with the exception of an electrical capacitor that has never contained over 1 kg of PCB’s. Any PCB-containing equipment taken out of service should be properly handled and disposed of at an authorized destruction facility in accordance with the requirements of Federal Regulation SOR/2008-273 and Reg. 362.

3.2.3.2 Ozone Depleting and Global Warming Substances

Ontario Regulation 463/10, *Ozone Depleting Substances and Other Halocarbons* (O.Reg. 463/10, made under the Environmental Protection Act) controls the use, discharge, sale, transfer, transport, storage and disposal of ozone depleting substances and halocarbons in Ontario. This regulation enhances the control and management of ODS and other halocarbons to prevent or minimize emissions, which serves a dual environmental benefit of lowering emissions of substances that deplete the ozone layer and contribute to global warming.

Two (2) air-conditioning units were noted at the upper roof of the subject building. These air-conditioning units will require removal as part of the HVAC Upgrades Project. The units contained insufficient information and are assumed to containing “class 2” ozone depleting substances.

O.Reg. 463/10 restricts the discharge of a class 1 and class 2 ozone depleting substance or a halocarbon into the natural environment or within a building. Servicing and testing of refrigeration equipment should be conducted in accordance with Environment Canada’s “Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems”. This work must be conducted by a certified person who holds a valid Ozone Depletion Prevention (ODP) Certificate. Refrigeration equipment and containers that are to be dismantled and disposed of need to be properly purged of remaining refrigerant by a certified person and a notice must be

affixed to the equipment or container that indicates it no longer contains a refrigerant (in addition to other information required by the regulation).

Any refrigerant that is removed from an air-conditioning unit, heat pump, refrigeration or freezer unit (that is not mobile) is defined as a Stationary Refrigerant Waste under Reg. 347 and must be collected, handled, transported and recycled or disposed of in accordance with the requirements set forth in Sections 30 to 35 of this regulation.

4.0 LIMITATIONS

The information and recommendations detailed in this report were carried out by trained professional and technical staff in accordance with generally accepted environmental and industrial hygiene work practices and procedures. Recommendations provided in this report have been generated in accordance with accepted industry guidelines and practices. These guidelines and practices are considered acceptable as of the date of this report.

In preparation of this report, Safetech relied on information supplied by others, including without limitation, information pertaining to the history and operation of the site, test results and reports of other consultants and testing services provided by independent laboratories. Except as expressly set out in this report, Safetech has not made any independent verification of information provided by independent entities.

The collection of samples at the location noted was consistent with the scope of work agreed-upon with the person or entity to whom this report is addressed and the information obtained concerning prior site investigations. As conditions between samples may vary, the potential remains for the presence of unknown additional contaminants for which there were no known indicators.

The analytical method used for determination of asbestos content meets the requirements of O. Reg. 278/05. However, small asbestos fibres may be missed by PLM due to resolution limitations of the optical microscope. Interfering binder/matrix and/or low asbestos content may also hinder positive identification by PLM. These conditions are common for vermiculite attic insulation (VAI) and non-friable organically bound (NOB) materials such as vinyl floor tiles, roofing materials, mastics and caulking and can lead to “false negative” results. If PLM analytical results for these types of materials indicate no asbestos detected they have been reported as “Presumed Non-ACM”. Due to limitations of the analytical method we cannot confirm that low quantities of asbestos are not present in these samples using solely PLM analysis. Additional analytical procedures should be considered for such materials to rule out false negative results.

Conclusions are based on site conditions at the time of inspection and can only be extrapolated to an undefined limited area around inspected locations. The extent of the limited area depends on building construction and conditions. Building materials that are not detailed within this survey due to inaccessibility during the time of survey and/or are uncovered during renovation/demolition activities should be properly assessed by a

qualified person prior to their disturbance. Safetech cannot warrant against undiscovered environmental liabilities. If any information becomes available that differs from the findings in this report, we request that we be notified immediately to reassess the conclusions provided herein.

No other person or entity is entitled to use or rely upon this report without the express written consent of Safetech and the person or entity to who it is addressed. Any use that a third party makes of this report, or any reliance based on conclusions and recommendations made, are the responsibility of such third parties. Safetech accepts no responsibility for damages suffered by third parties as a result of actions based on this report.

Appendix I: Hazardous Materials Inventory Sheet

Building Address	21 Park Road, Toronto	Date(s) of DSS:	August 7, 2025
Building Name	Asquith Green - Shelter and Housing Administration	Organization completing Asbestos Reassessment:	Safetech Environmental Limited
Original Survey Conducted By:	Fisher Environmental Ltd.		
Date(s) of Original Survey:	December 10, 2008		

Summary of Findings

All suspect or assumed asbestos containing building materials were observed to be in good condition.

Location Number	Location Name	Building System	Potential ACM Observed	Sample ID	Asbestos Type/Content	Quantity	Condition	Notes/Required Action
0-00	Building Exterior	Wall	N/A	N/A	N/A	N/A	N/A	
0-00	Building Exterior	Roof	2-Ply Roof Membrane	4A-4C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
0-00	Building Exterior	Roof	Paper Insulation	5A-5C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
0-00	Building Exterior	Roof	Ashphalt Insulation	6A-6C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
0-00	Building Exterior	Roof	Tar Felt	7A-7C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
0-00	Building Exterior	Roof	Paper Vapour Barrier	8A-8C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
0-00	Building Exterior	Roof	Shingles	9A-9C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
0-00	Building Exterior	Roof	Paper Insulation	10A-10C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
0-00	Building Exterior	Roof	Window Caulking	11A-11C	None Detected	N/A	N/A	Brown Safetech DSHM Project No. 1-3250703
0-00	Building Exterior	Roof	Flashing Caulking	11A-11C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
0-00	Building Exterior	Roof	Electrical Penetrate Caulking	12A-12C	None Detected	N/A	N/A	AC, White Safetech DSHM Project No. 1-3250703
0-00	Building Exterior	Roof	Window Caulking	13A-13C	None Detected	N/A	N/A	White Safetech DSHM Project No. 1-3250703
0-00	Building Exterior	Roof	Electrical Penetrate Caulking	14A-14C	None Detected	N/A	N/A	AC, Brown Safetech DSHM Project No. 1-3250703
0-00	Building Exterior	Roof	Electrical Penetrate Mastic	15A-15C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
0-00	Building Exterior	Window	Window Caulking	Not Sampled	ACM Assumed	20 ft²	Good	Safetech DSHM Project No. 1-3250703
B-01	Training Room	Floor	Laminate	N/A	No Potential ACM Identified	N/A	N/A	
B-01	Training Room	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
B-01	Training Room	Ceiling	Ceiling Tile 1 (CT1)	Not Sampled	ACM Assumed	415 ft²	Good	CT1, 2"x4", pin-prick and fissures
B-01	Training Room	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
B-01	Training Room	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
B-02	Electricity Room	Floor	Vinyl Floor Tile 1 (VFT1)	2014-A0003 A-C; 2009-140806568-0007 12642-A-07-01A,B	None Detected	N/A	N/A	VFT1, 12x 12 Beige with Grey Fleck; 2014 Pinchin DSS Management Report

Location Number	Location Name	Building System	Potential ACM Observed	Sample ID	Asbestos Type/Content	Quantity	Condition	Notes/Required Action
B-02	Electricity Room	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
B-02	Electricity Room	Ceiling	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
B-02	Electricity Room	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
B-02	Electricity Room	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
B-03	Storage Room	Floor	Carpet	N/A	No Potential ACM Identified	N/A	N/A	
B-03	Storage Room	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
B-03	Storage Room	Ceiling	Acoustic Ceiling Tile	2014-A0001 A-C	None Detected	N/A	N/A	ACT-1 - 2x 4 Lay-in Textured; 2014 Pinchin DSS Management Report
B-03	Storage Room	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
B-03	Storage Room	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
B-04	Training Room	Floor	Laminate	N/A	No Potential ACM Identified	N/A	N/A	
B-04	Training Room	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
B-04	Training Room	Ceiling	Acoustic Ceiling Tile (ACT1)	2014-A0001 A-C	None Detected	N/A	N/A	ACT, 1 - 2x 4 Lay-in Textured; 2014 Pinchin DSS Management Report
B-04	Training Room	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
B-04	Training Room	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
B-05	Lounge	Floor	Laminate	N/A	No Potential ACM Identified	N/A	N/A	
B-05	Lounge	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
B-05	Lounge	Ceiling	Acoustic Ceiling Tile (ACT1)	2014-A0001 A-C	None Detected	N/A	N/A	ACT, 1 - 2x 4 Lay-in Textured; 2014 Pinchin DSS Management Report
B-05	Lounge	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
B-05	Lounge	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
B-06	Pump Room	Floor	Vinyl Floor Tile 1 (VFT1)	2014-A0003 A-C; 2009-140806568-0007 12642-A-07-01A,B	None Detected	N/A	N/A	VFT01- 12x 12 Beige with Grey Fleck; 2014 Pinchin DSS Management Report
B-06	Pump Room	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
B-06	Pump Room	Ceiling	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
B-06	Pump Room	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	

Location Number	Location Name	Building System	Potential ACM Observed	Sample ID	Asbestos Type/Content	Quantity	Condition	Notes/Required Action
B-06	Pump Room	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
B-07	Kitchenette	Floor	Ceramic Tile	N/A	No Potential ACM Identified	N/A	N/A	
B-07	Kitchenette	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
B-07	Kitchenette	Ceiling	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
B-07	Kitchenette	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
B-07	Kitchenette	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
B-08	Washroom	Floor	Laminate	N/A	No Potential ACM Identified	N/A	N/A	
B-08	Washroom	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
B-08	Washroom	Ceiling	Acoustic Ceiling Tile	2014-A0001 A-C	None Detected	N/A	N/A	ACT-1 - 2x 4 Lay-in Textured; 2014 Pinchin DSS Management Report
B-08	Washroom	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
B-08	Washroom	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
B-09	Washroom	Floor	Ceramic Tile	N/A	No Potential ACM Identified	N/A	N/A	
B-09	Washroom	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
B-09	Washroom	Ceiling	Acoustic Ceiling Tile (ACT1)	2014-A0001 A-C	None Detected	N/A	N/A	ACT-1 - 2x 4 Lay-in Textured; 2014 Pinchin DSS Management Report
B-09	Washroom	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
B-09	Washroom	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
B-10	Hallway Area	Floor	Ceramic Tile	N/A	No Potential ACM Identified	N/A	N/A	
B-10	Hallway Area	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
B-10	Hallway Area	Ceiling	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
B-10	Hallway Area	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
B-10	Hallway Area	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
1-01	Office Area	Floor	Laminate	N/A	No Potential ACM Identified	N/A	N/A	
1-01	Office Area	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report

Location Number	Location Name	Building System	Potential ACM Observed	Sample ID	Asbestos Type/Content	Quantity	Condition	Notes/Required Action
1-01	Office Area	Ceiling	Acoustic Ceiling Tile (ACT1)	2014-A0001 A-C	None Detected	N/A	N/A	ACT-1 - 2x 4 Lay-in Textured; 2014 Pinchin DSS Management Report
1-01	Office Area	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
1-01	Office Area	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
1-02	Reception	Floor	Laminate	N/A	No Potential ACM Identified	N/A	N/A	
1-02	Reception	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
1-02	Reception	Ceiling	Acoustic Ceiling Tile	2014-A0001 A-C	None Detected	N/A	N/A	ACT-1 - 2x 4 Lay-in Textured; 2014 Pinchin DSS Management Report
1-02	Reception	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
1-02	Reception	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
1-03	Kitchenette	Floor	Ceramic Tile	N/A	No Potential ACM Identified	N/A	N/A	
1-03	Kitchenette	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
1-03	Kitchenette	Ceiling	Acoustic Ceiling Tile (ACT1)	2014-A0001 A-C	None Detected	N/A	N/A	ACT-1 - 2x 4 Lay-in Textured; 2014 Pinchin DSS Management Report
1-03	Kitchenette	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
1-03	Kitchenette	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
1-04	Hallway	Floor	Laminate	N/A	No Potential ACM Identified	N/A	N/A	
1-04	Hallway	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
1-04	Hallway	Ceiling	Acoustic Ceiling Tile (ACT1)	2014-A0001 A-C	None Detected	N/A	N/A	ACT-1 - 2x 4 Lay-in Textured; 2014 Pinchin DSS Management Report
1-04	Hallway	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
1-04	Hallway	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
1-05	Office	Floor	Laminate	N/A	No Potential ACM Identified	N/A	N/A	
1-05	Office	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
1-05	Office	Ceiling	Acoustic Ceiling Tile (ACT1)	2014-A0001 A-C	None Detected	N/A	N/A	ACT-1 - 2x 4 Lay-in Textured; 2014 Pinchin DSS Management Report
1-05	Office	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
1-05	Office	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
1-06	Washroom	Floor	Vinyl Floor Tile 1 (VFT1)	2014-A0003 A-C; 2009-140806568-0007 12642-A-07-01A,B	None Detected	N/A	N/A	VFT01- 12x 12 Beige with Grey Fleck; 2014 Pinchin DSS Management Report

Location Number	Location Name	Building System	Potential ACM Observed	Sample ID	Asbestos Type/Content	Quantity	Condition	Notes/Required Action
1-06	Washroom	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
1-06	Washroom	Ceiling	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
1-06	Washroom	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
1-06	Washroom	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
1-07	Office	Floor	Laminate	N/A	No Potential ACM Identified	N/A	N/A	
1-07	Office	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	380 ft²	Good	
1-07	Office	Ceiling	Acoustic Ceiling Tile (ACT1)	2014-A0001 A-C	None Detected	N/A	N/A	ACT-1 - 2x 4 Lay-in Textured; 2014 Pinchin DSS Management Report
1-07	Office	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
1-07	Office	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
1-08	Storage	Floor	Vinyl Floor Tile 1 (VFT1)	2014-A0003 A-C; 2009-140806568-0007; 12642-A-07-01A,B	None Detected	N/A	N/A	VFT01- 12x 12 Beige with Grey Fleck; 2014 Pinchin DSS Management Report
1-08	Storage	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	250 ft²	Good	
1-08	Storage	Ceiling	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	40 ft²	Good	
1-08	Storage	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
1-08	Storage	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
1-09	Office	Floor	Laminate	N/A	No Potential ACM Identified	N/A	N/A	
1-09	Office	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	450 ft²	Good	
1-09	Office	Ceiling	Acoustic Ceiling Tile	2014-A0001 A-C	None Detected	N/A	N/A	ACT-1 - 2x 4 Lay-in Textured; 2014 Pinchin DSS Management Report
1-09	Office	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
1-09	Office	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
1-10	Janitor Closet	Floor	Vinyl Floor Tile 1 (VFT1)	2014-A0003 A-C; 2009-140806568-0007 12642-A-07-01A,B	None Detected	N/A	N/A	VFT01- 12x 12 Beige with Grey Fleck; 2014 Pinchin DSS Management Report
1-10	Janitor Closet	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
1-10	Janitor Closet	Ceiling	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report

Location Number	Location Name	Building System	Potential ACM Observed	Sample ID	Asbestos Type/Content	Quantity	Condition	Notes/Required Action
1-10	Janitor Closet	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
1-10	Janitor Closet	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
1-11	Elevator Vestibule	Floor	Ceramic Tile	N/A	No Potential ACM Identified	N/A	N/A	
1-11	Elevator Vestibule	Wall	Drywall Joint Compound	Not Sampled	ACM Assumed	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey
1-11	Elevator Vestibule	Ceiling	Drywall Joint Compound	Not Sampled	ACM Assumed	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey
1-11	Elevator Vestibule	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
1-11	Elevator Vestibule	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
2-01	Office	Floor	Laminate	N/A	No Potential ACM Identified	N/A	N/A	
2-01	Office	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
2-01	Office	Ceiling	Acoustic Ceiling Tile (ACT1)	2014-A0001 A-C	None Detected	N/A	N/A	ACT-1 - 2x 4 Lay-in Textured; 2014 Pinchin DSS Management Report
2-01	Office	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
2-01	Office	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
2-02	Office	Floor	Laminate	N/A	No Potential ACM Identified	N/A	N/A	
2-02	Office	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
2-02	Office	Ceiling	Acoustic Ceiling Tile (ACT1)	2014-A0001 A-C	None Detected	N/A	N/A	ACT-1 - 2x 4 Lay-in Textured; 2014 Pinchin DSS Management Report
2-02	Office	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
2-02	Office	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
2-03	Office Area	Floor	Laminate	N/A	No Potential ACM Identified	N/A	N/A	
2-03	Office Area	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
2-03	Office Area	Ceiling	Acoustic Ceiling Tile (ACT1)	2014-A0001 A-C	None Detected	N/A	N/A	ACT-1 - 2x4 Lay-in Textured; 2014 Pinchin DSS Management Report
2-03	Office Area	Ceiling	Acoustic Ceiling Tile (ACT2)	3A-3C	None Detected	N/A	N/A	ACT-2 - 2x4 Lay-in Pinhole/Fissures Safetech Bulk Sample Project No. 1-3250154
2-03	Office Area	Ceiling	Drywall Joint Compound	1A-1C; 2A-2B	None Detected	N/A	N/A	Upper Ceiling Safetech Bulk Sample Project No. 1-3250154 Safetech DSHM Project No. 1-3250703
2-03	Office Area	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
2-03	Office Area	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
2-03	Office Area	Mastic	Duct Mastic	1A-1C	None Detected	N/A	N/A	
2-04	Kitchenette	Floor	Ceramic Tile	N/A	No Potential ACM Identified	N/A	N/A	

Location Number	Location Name	Building System	Potential ACM Observed	Sample ID	Asbestos Type/Content	Quantity	Condition	Notes/Required Action
2-04	Kitchenette	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
2-04	Kitchenette	Ceiling	Acoustic Ceiling Tile	2014-A0001 A-C	None Detected	N/A	N/A	ACT-1 - 2x 4 Lay-in Textured; 2014 Pinchin DSS Management Report
2-04	Kitchenette	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
2-04	Kitchenette	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
2-05	Washroom	Floor	Ceramic Tile	N/A	No Potential ACM Identified	N/A	N/A	
2-05	Washroom	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C; 2B	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report Safetech Bulk Sample Project No. 1-3250154
2-05	Washroom	Ceiling	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
2-05	Washroom	Ceiling	Drywall Joint Compound	1C	None Detected	N/A	N/A	Upper Ceiling Safetech Bulk Sample Project No. 1-3250154
2-05	Washroom	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
2-05	Washroom	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
2-06	Office	Floor	Laminate	N/A	No Potential ACM Identified	N/A	N/A	
2-06	Office	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C; 2C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report Safetech Bulk Sample Project No. 1-3250154
2-06	Office	Ceiling	Acoustic Ceiling Tile (ACT1)	2014-A0001 A-C	None Detected	N/A	N/A	ACT-1 - 2x 4 Lay-in Textured; 2014 Pinchin DSS Management Report
2-06	Office	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
2-06	Office	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
2-07	Washroom	Floor	Ceramic Tile	N/A	No Potential ACM Identified	N/A	N/A	
2-07	Washroom	Wall	Ceramic Tile	N/A	No Potential ACM Identified	N/A	N/A	
2-07	Washroom	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
2-07	Washroom	Ceiling	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
2-07	Washroom	Ceiling	Drywall Joint Compound	1D	None Detected	N/A	N/A	Upper Ceiling Safetech Bulk Sample Project No. 1-3250154
2-07	Washroom	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
2-07	Washroom	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
2-08	Closet	Floor	Carpet	N/A	No Potential ACM Identified	N/A	N/A	

Location Number	Location Name	Building System	Potential ACM Observed	Sample ID	Asbestos Type/Content	Quantity	Condition	Notes/Required Action
2-08	Closet	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
2-08	Closet	Ceiling	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
2-08	Closet	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
2-08	Closet	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
2-09	Office	Floor	Laminate	N/A	No Potential ACM Identified	N/A	N/A	
2-09	Office	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
2-09	Office	Ceiling	Acoustic Ceiling Tile (ACT1)	2014-A0001 A-C	None Detected	N/A	N/A	ACT-1 - 2x 4 Lay-in Textured; 2014 Pinchin DSS Management Report
2-09	Office	Ceiling	Drywall Joint Compound	1E	None Detected	N/A	N/A	Upper Ceiling Safetech Bulk Sample Project No. 1-3250154
2-09	Office	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
2-09	Office	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
A-01	Mezzanine	Floor	Vinyl Floor Tile 1 (VFT1)	2014-A0003 A-C; 2009-140806568-0007 12642-A-07-01A,B	None Detected	N/A	N/A	VFT01- 12x 12 Beige with Grey Fleck; 2014 Pinchin DSS Management Report
A-01	Mezzanine	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
A-01	Mezzanine	Ceiling	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
A-01	Mezzanine	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
A-01	Mezzanine	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
A-02	Storage Room	Floor	Vinyl Floor Tile 1 (VFT1)	2014-A0003 A-C; 2009-140806568-0007 12642-A-07-01A,B	None Detected	N/A	N/A	VFT01- 12x 12 Beige with Grey Fleck; 2014 Pinchin DSS Management Report
A-02	Storage Room	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
A-02	Storage Room	Ceiling	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
A-02	Storage Room	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
A-02	Storage Room	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
A-03	Boiler Room	Floor	Concrete Floor	N/A	No Potential ACM Identified	N/A	N/A	
A-03	Boiler Room	Floor	Mastic	3A-3C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
A-03	Boiler Room	Floor	Vinyl Floor Tile 1 (VFT1)	2014-A0003 A-C; 2009-140806568-0007 12642-A-07-01A,B	None Detected	N/A	N/A	VFT01- 12x 12 Beige with Grey Fleck; 2014 Pinchin DSS Management Report
A-03	Boiler Room	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report

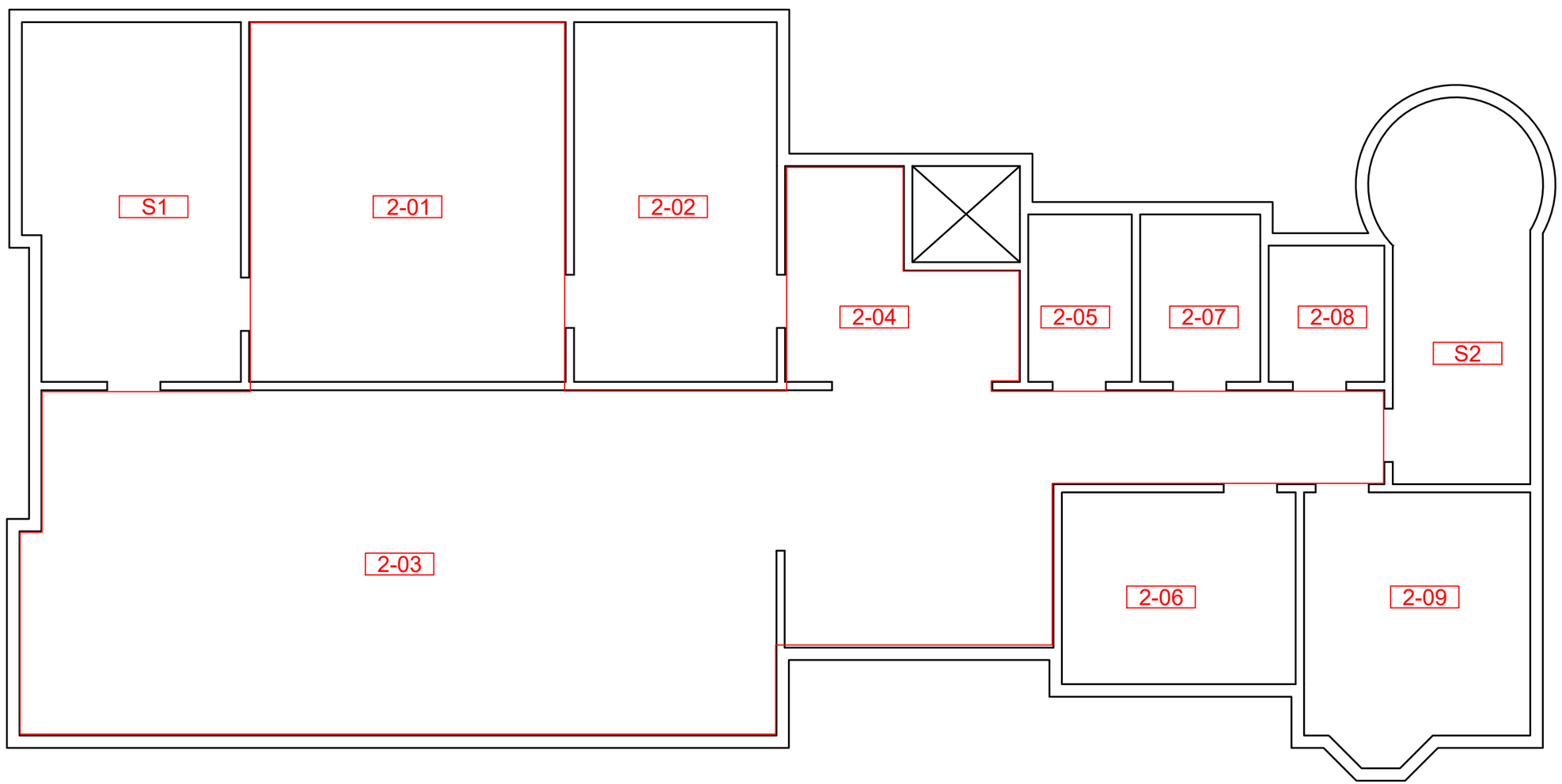
Location Number	Location Name	Building System	Potential ACM Observed	Sample ID	Asbestos Type/Content	Quantity	Condition	Notes/Required Action
A-03	Boiler Room	Ceiling	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C 2E	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report Safetech DSHM Project No. 1-3250703
A-03	Boiler Room	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
A-03	Boiler Room	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
A-04	Storage Room	Floor	Vinyl Floor Tile 1 (VFT1)	2014-A0003 A-C; 2009-140806568-0007 12642-A-07-01A,B	None Detected	N/A	N/A	VFT01- 12x 12 Beige with Grey Fleck; 2014 Pinchin DSS Management Report
A-04	Storage Room	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
A-04	Storage Room	Ceiling	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
A-04	Storage Room	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
A-04	Storage Room	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
A-05	Mechanical Room	Floor	N/A	N/A	No Potential ACM Identified	N/A	N/A	
A-05	Mechanical Room	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C 2D	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report Safetech DSHM Project No. 1-3250703
A-05	Mechanical Room	Ceiling	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C 2C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report Safetech DSHM Project No. 1-3250703
A-05	Mechanical Room	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
A-05	Mechanical Room	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
S1	Stairwell	Floor	Vinyl Floor Tile 1 (VFT1)	2014-A0003 A-C; 2009-140806568-0007 12642-A-07-01A,B	None Detected	N/A	N/A	VFT01- 12x 12 Beige with Grey Fleck; 2014 Pinchin DSS Management Report NOT IDENTIFIED
S1	Stairwell	Floor	Carpet	N/A	No Potential ACM Identified	N/A	N/A	
S1	Stairwell	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
S1	Stairwell	Ceiling	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
S1	Stairwell	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
S1	Stairwell	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	
S2	Stairwell	Floor	Laminate	N/A	No Potential ACM Identified	N/A	N/A	
S2	Stairwell	Wall	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
S2	Stairwell	Ceiling	Drywall Joint Compound	2008-140906568; 2009-12642-A07-02; 2010-13085-A07-01; 2014-A0001 A-C	None Detected	N/A	N/A	2008 Fisher DSS Report; 2009 ECOH Reassessment Survey 2010 ECOH Reassessment Survey 2014 Pinchin DSS Management Report
S2	Stairwell	Pipe	N/A	N/A	No Potential ACM Identified	N/A	N/A	
S2	Stairwell	Structure	N/A	N/A	No Potential ACM Identified	N/A	N/A	

Appendix II: Site Drawings

LEGEND

B-09 Location Number

Areas Assessed



1) THIS FLOOR PLAN MUST BE READ IN CONJUNCTION WITH THE DESIGNATED SUBSTANCE AND HAZARDOUS MATERIALS ASSESSMENT REPORT.
2) NOT ALL ASBESTOS-CONTAINING MATERIALS ARE INDICATED IN THE FLOOR PLAN. REFER TO THE DESIGNATED SUBSTANCE AND HAZARDOUS MATERIALS REPORT FOR FURTHER DETAILS.
3) REMOVAL OR DISTURBANCE OF ASBESTOS-CONTAINING BUILDING MATERIALS MUST BE CONDUCTED IN ACCORDANCE WITH ONTARIO REGULATION 278/05 "DESIGNATED SUBSTANCE-ASBESTOS ON CONSTRUCTION PROJECTS AND IN BUILDINGS AND REPAIR OPERATIONS".

2ND FLOOR

HVAC UPGRADES PROJECT

21 PARK ROAD

DRAWING NO.

DS-1

DATE: AUGUST 7, 2025

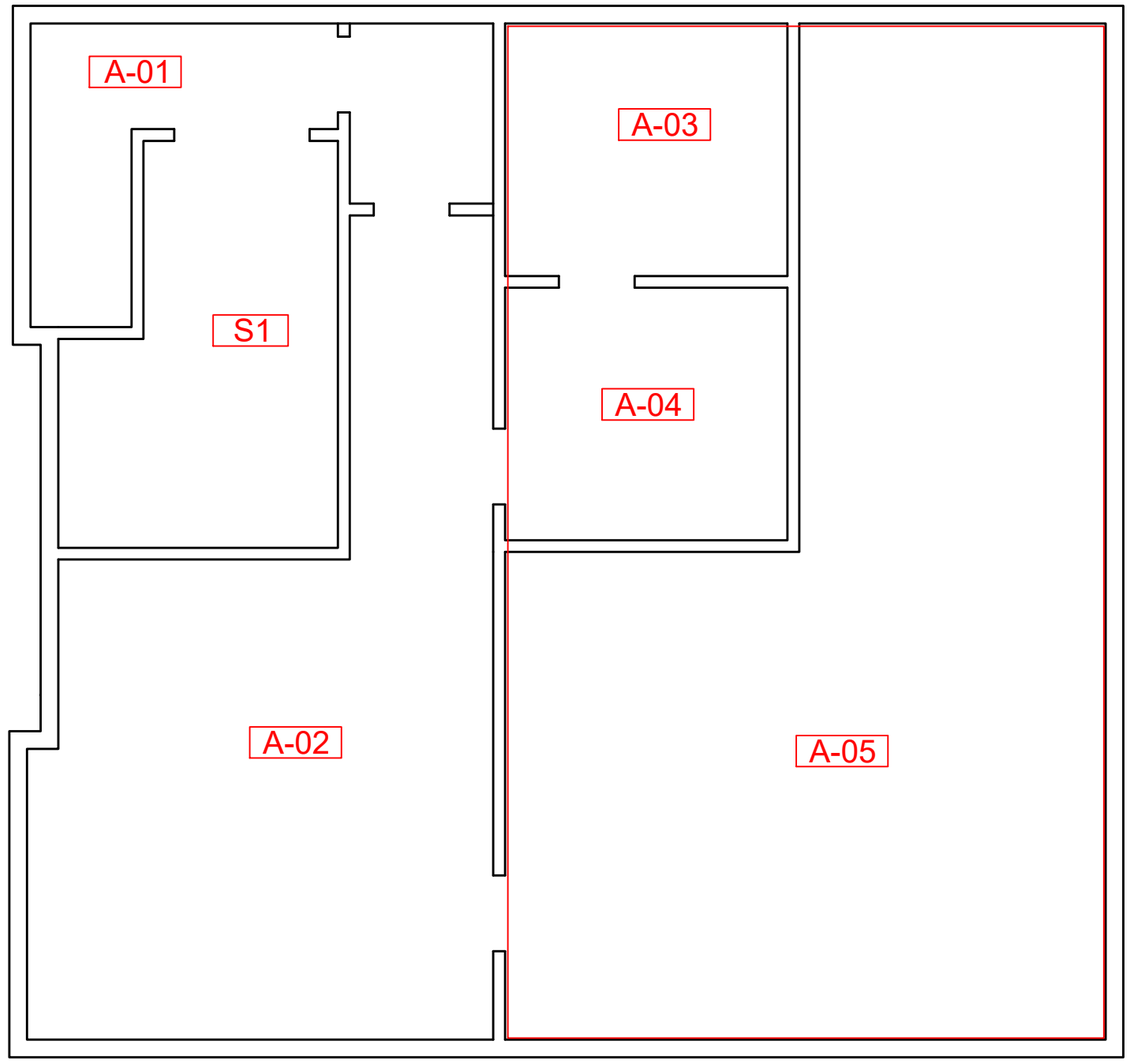
SAFETECH PROJECT NO.
1-3250702

safeTECH ENVIRONMENTAL LTD.
3045 SOUTHCREEK ROAD, UNIT 14
MISSISSAUGA, ONTARIO
L4X 2X7

LEGEND

B-09 Location Number

Areas Assessed



N

1) THIS FLOOR PLAN MUST BE READ IN CONJUNCTION WITH THE DESIGNATED SUBSTANCE AND HAZARDOUS MATERIALS ASSESSMENT REPORT.
2) NOT ALL ASBESTOS-CONTAINING MATERIALS ARE INDICATED IN THE FLOOR PLAN. REFER TO THE DESIGNATED SUBSTANCE AND HAZARDOUS MATERIALS REPORT FOR FURTHER DETAILS.
3) REMOVAL OR DISTURBANCE OF ASBESTOS-CONTAINING BUILDING MATERIALS MUST BE CONDUCTED IN ACCORDANCE WITH ONTARIO REGULATION 278/05 "DESIGNATED SUBSTANCE-ASBESTOS ON CONSTRUCTION PROJECTS AND IN BUILDINGS AND REPAIR OPERATIONS".

ATTIC FLOOR

HVAC UPGRADES PROJECT

21 PARK ROAD

DRAWING NO.

DS-2

DATE: AUGUST 7, 2025

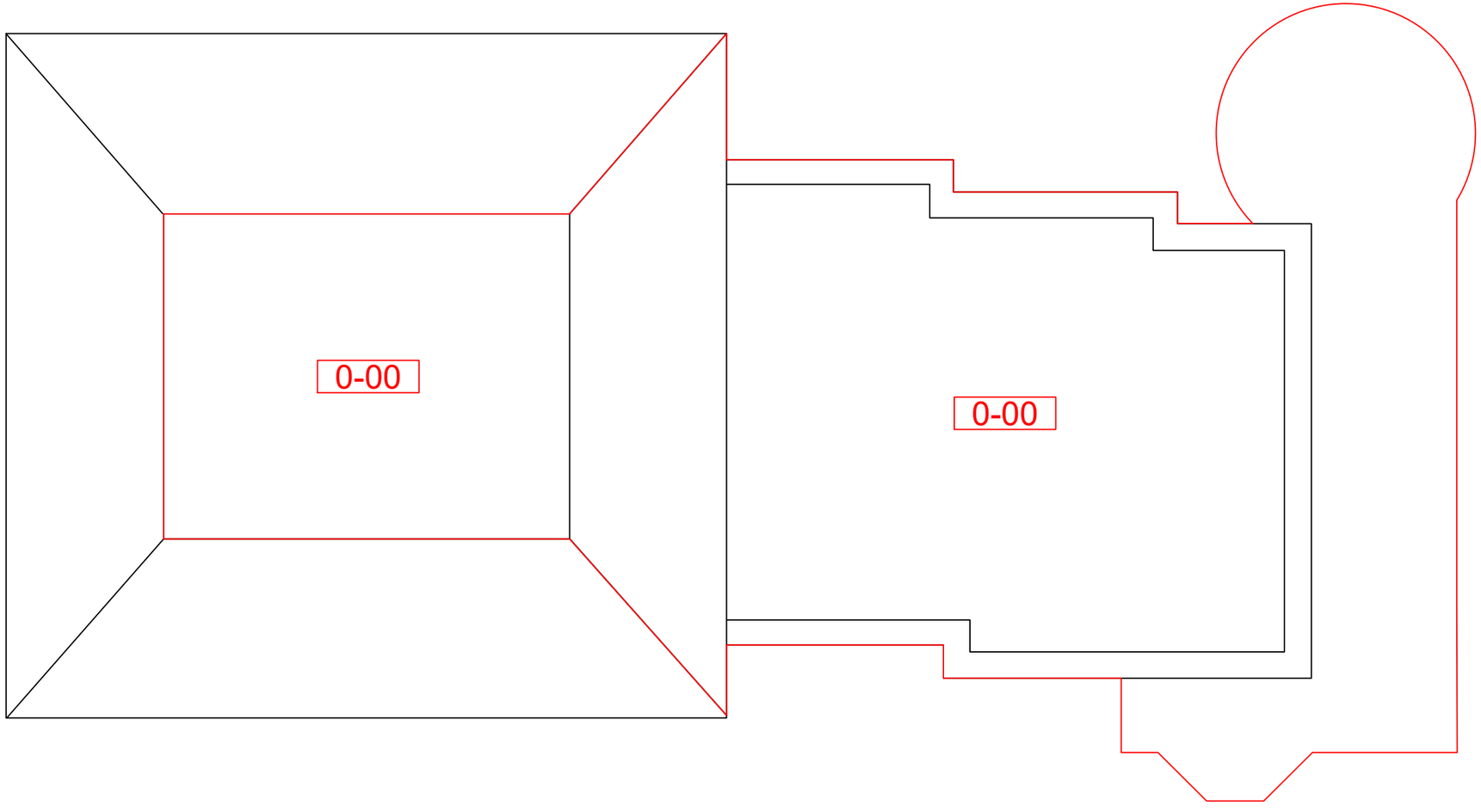
SAFETECH PROJECT NO.
1-3250702

safeTECH ENVIRONMENTAL LTD.
3045 SOUTHCREEK ROAD, UNIT 14
MISSISSAUGA, ONTARIO
L4X 2X7

LEGEND

B-09 Location Number

Areas Assessed



1) THIS FLOOR PLAN MUST BE READ IN CONJUNCTION WITH THE DESIGNATED SUBSTANCE AND HAZARDOUS MATERIALS ASSESSMENT REPORT.
2) NOT ALL ASBESTOS-CONTAINING MATERIALS ARE INDICATED IN THE FLOOR PLAN. REFER TO THE DESIGNATED SUBSTANCE AND HAZARDOUS MATERIALS REPORT FOR FURTHER DETAILS.
3) REMOVAL OR DISTURBANCE OF ASBESTOS-CONTAINING BUILDING MATERIALS MUST BE CONDUCTED IN ACCORDANCE WITH ONTARIO REGULATION 278/05 "DESIGNATED SUBSTANCE-ASBESTOS ON CONSTRUCTION PROJECTS AND IN BUILDINGS AND REPAIR OPERATIONS".

ROOF

HVAC UPGRADES PROJECT

21 PARK ROAD

DRAWING NO.

DS-3

DATE: AUGUST 7, 2025

SAFETECH PROJECT NO.
1-3250702

safeTECH ENVIRONMENTAL LTD.
3045 SOUTHCREEK ROAD, UNIT 14
MISSISSAUGA, ONTARIO
L4X 2X7

Appendix III: Laboratory Certificate of Analysis – Asbestos

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: (289) 997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

EMSL Canada Order 552514311
Customer ID: 55SELI62
Customer PO: 1-3250702
Project ID:

Attn: Jason King
Safetech Environmental Limited
3045 Southcreek Road
Unit 14
Mississauga, ON L4X 2X7

Proj: 21 Park Road/ 1-3250702

Phone: (905) 624-2722
Fax: (905) 624-4306
Collected: 8/ 7/2025
Received: 8/13/2025
Analyzed: 8/15/2025

Summary Test Report for Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05

Client Sample ID: 1a **Lab Sample ID:** **552514311-0001**
Sample Description: Green Duct Mastic/ Second Floor Corridor

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Green	0.0%	100.0%	None Detected	

Client Sample ID: 1b **Lab Sample ID:** **552514311-0002**
Sample Description: Green Duct Mastic/ Second Floor Corridor

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Green	0.0%	100.0%	None Detected	

Client Sample ID: 1c **Lab Sample ID:** **552514311-0003**
Sample Description: Green Duct Mastic/ Second Floor Corridor

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Green	0.0%	100.0%	None Detected	

Client Sample ID: 2a **Lab Sample ID:** **552514311-0004**
Sample Description: Drywall Joint Compound (Upper Ceiling)/ Second Floor, Corridor

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 2b **Lab Sample ID:** **552514311-0005**
Sample Description: Drywall Joint Compound (Upper Ceiling)/ Second Floor, Corridor

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	White/Beige	0.0%	100.0%	None Detected	

Client Sample ID: 2c **Lab Sample ID:** **552514311-0006**
Sample Description: Drywall Joint Compound (Wall)/ Attic, Mechanical Room

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Gray/White	0.0%	100.0%	None Detected	

Client Sample ID: 2d **Lab Sample ID:** **552514311-0007**
Sample Description: Drywall Joint Compound (Ceiling)/ Attic, Mechanical Room

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	White	0.0%	100.0%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: (289) 997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

EMSL Canada Order 552514311
Customer ID: 55SELI62
Customer PO: 1-3250702
Project ID:

Summary Test Report for Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05

Client Sample ID: 2e ***Lab Sample ID:*** **552514311-0008**

Sample Description: Drywall Joint Compound (Ceiling)/ Attic, Hot Water Tank Room

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 3a ***Lab Sample ID:*** **552514311-0009**

Sample Description: Mastic associated with Vinyl Floor Tiles/ Attic, Hot Water Tank Room

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 3b ***Lab Sample ID:*** **552514311-0010**

Sample Description: Mastic associated with Vinyl Floor Tiles/ Attic, Hot Water Tank Room

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 3c ***Lab Sample ID:*** **552514311-0011**

Sample Description: Mastic associated with Vinyl Floor Tiles/ Attic, Hot Water Tank Room

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 4a-Shingle ***Lab Sample ID:*** **552514311-0012**

Sample Description: 2-Ply Roof Membrane/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Gray/Black	15.0%	85.0%	None Detected	

Client Sample ID: 4a-Tar Felt ***Lab Sample ID:*** **552514311-0012A**

Sample Description: 2-Ply Roof Membrane/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Black	15.0%	85.0%	None Detected	

Client Sample ID: 4b-Shingle ***Lab Sample ID:*** **552514311-0013**

Sample Description: 2-Ply Roof Membrane/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Gray/Black	15.0%	85.0%	None Detected	

Client Sample ID: 4b-Tar Felt ***Lab Sample ID:*** **552514311-0013A**

Sample Description: 2-Ply Roof Membrane/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Black	15.0%	85.0%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: (289) 997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

EMSL Canada Order 552514311
Customer ID: 55SELI62
Customer PO: 1-3250702
Project ID:

Summary Test Report for Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05

Client Sample ID: 4c-Shingle ***Lab Sample ID:*** **552514311-0014**
Sample Description: 2-Ply Roof Membrane/ Upper Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Gray/Black	15.0%	85.0%	None Detected	

Client Sample ID: 4c-Tar Felt ***Lab Sample ID:*** **552514311-0014A**
Sample Description: 2-Ply Roof Membrane/ Upper Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Black	20.0%	80.0%	None Detected	

Client Sample ID: 5a ***Lab Sample ID:*** **552514311-0015**
Sample Description: Paper Insulation/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Brown	80.0%	20.0%	None Detected	

Client Sample ID: 5b ***Lab Sample ID:*** **552514311-0016**
Sample Description: Paper Insulation/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Brown	80.0%	20.0%	None Detected	

Client Sample ID: 5c ***Lab Sample ID:*** **552514311-0017**
Sample Description: Paper Insulation/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Brown	80.0%	20.0%	None Detected	

Client Sample ID: 6a-Tar ***Lab Sample ID:*** **552514311-0018**
Sample Description: Asphalt Insulation/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 6a-Tar Felt ***Lab Sample ID:*** **552514311-0018A**
Sample Description: Asphalt Insulation/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Black	20.0%	80.0%	None Detected	

Client Sample ID: 6b-Tar ***Lab Sample ID:*** **552514311-0019**
Sample Description: Asphalt Insulation/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Black	0.0%	100.0%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: (289) 997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

EMSL Canada Order 552514311
Customer ID: 55SELI62
Customer PO: 1-3250702
Project ID:

Summary Test Report for Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05

Client Sample ID: 6b-Tar Felt **Lab Sample ID:** **552514311-0019A**
Sample Description: Asphalt Insulation/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Black	20.0%	80.0%	None Detected	

Client Sample ID: 6c-Tar **Lab Sample ID:** **552514311-0020**
Sample Description: Asphalt Insulation/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 6c-Tar Felt **Lab Sample ID:** **552514311-0020A**
Sample Description: Asphalt Insulation/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Black	25.0%	75.0%	None Detected	

Client Sample ID: 7a **Lab Sample ID:** **552514311-0021**
Sample Description: Tar Felt/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Black	20.0%	80.0%	None Detected	

Client Sample ID: 7b **Lab Sample ID:** **552514311-0022**
Sample Description: Tar Felt/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Black	20.0%	80.0%	None Detected	

Client Sample ID: 7c **Lab Sample ID:** **552514311-0023**
Sample Description: Tar Felt/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Black	25.0%	75.0%	None Detected	

Client Sample ID: 8a **Lab Sample ID:** **552514311-0024**
Sample Description: Paper Vapour Barrier/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Beige	75.0%	25.0%	None Detected	

Client Sample ID: 8b **Lab Sample ID:** **552514311-0025**
Sample Description: Paper Vapour Barrier/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Beige	75.0%	25.0%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: (289) 997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

EMSL Canada Order 552514311
Customer ID: 55SELI62
Customer PO: 1-3250702
Project ID:

Summary Test Report for Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05

Client Sample ID: 8c ***Lab Sample ID:*** **552514311-0026**

Sample Description: Paper Vapour Barrier/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Brown	80.0%	20.0%	None Detected	

Client Sample ID: 9a ***Lab Sample ID:*** **552514311-0027**

Sample Description: Shingles/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 9b ***Lab Sample ID:*** **552514311-0028**

Sample Description: Shingles/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 9c ***Lab Sample ID:*** **552514311-0029**

Sample Description: Shingles/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 10a ***Lab Sample ID:*** **552514311-0030**

Sample Description: Paper Insulation under Shingles/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Brown	70.0%	30.0%	None Detected	

Client Sample ID: 10b ***Lab Sample ID:*** **552514311-0031**

Sample Description: Paper Insulation under Shingles/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Brown	70.0%	30.0%	None Detected	

Client Sample ID: 10c ***Lab Sample ID:*** **552514311-0032**

Sample Description: Paper Insulation under Shingles/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Brown	70.0%	30.0%	None Detected	

Client Sample ID: 11a ***Lab Sample ID:*** **552514311-0033**

Sample Description: Window Frame Caulking (Brown)/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/14/2025	Brown	0.0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: (289) 997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

EMSL Canada Order 552514311
Customer ID: 55SELI62
Customer PO: 1-3250702
Project ID:

Summary Test Report for Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05

Client Sample ID: 11b **Lab Sample ID:** **552514311-0034**
Sample Description: Window Frame Caulking (Brown)/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/14/2025	Brown	0.0%	100%	None Detected	

Client Sample ID: 11c **Lab Sample ID:** **552514311-0035**
Sample Description: Flashing Caulking (Brown)/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/14/2025	Brown	0.0%	100%	None Detected	

Client Sample ID: 12a **Lab Sample ID:** **552514311-0036**
Sample Description: AC Electrical Penetrate Caulking (White)/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 12b **Lab Sample ID:** **552514311-0037**
Sample Description: AC Electrical Penetrate Caulking (White)/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/14/2025	White	0.0%	100%	None Detected	

Client Sample ID: 12c **Lab Sample ID:** **552514311-0038**
Sample Description: AC Electrical Penetrate Caulking (White)/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/14/2025	White	0.0%	100%	None Detected	

Client Sample ID: 13a-Caulk **Lab Sample ID:** **552514311-0039**
Sample Description: Window Frame Caulking (White)/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/14/2025	White	0.0%	100%	None Detected	

Client Sample ID: 13a-Caulk 2 **Lab Sample ID:** **552514311-0039A**
Sample Description: Window Frame Caulking (White)/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/14/2025	Black	0.0%	100%	None Detected	

Client Sample ID: 13b-Caulk **Lab Sample ID:** **552514311-0040**
Sample Description: Window Frame Caulking (White)/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/14/2025	White	0.0%	100%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: (289) 997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

EMSL Canada Order 552514311
Customer ID: 55SELI62
Customer PO: 1-3250702
Project ID:

Summary Test Report for Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05

Client Sample ID: 13b-Caulk 2 ***Lab Sample ID:*** **552514311-0040A**

Sample Description: Window Frame Caulking (White)/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/14/2025	Black	0.0%	100%	None Detected	

Client Sample ID: 13c-Caulk ***Lab Sample ID:*** **552514311-0041**

Sample Description: Window Frame Caulking (White)/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/14/2025	White	0.0%	100%	None Detected	

Client Sample ID: 13c-Caulk 2 ***Lab Sample ID:*** **552514311-0041A**

Sample Description: Window Frame Caulking (White)/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/14/2025	Black	0.0%	100%	None Detected	

Client Sample ID: 14a ***Lab Sample ID:*** **552514311-0042**

Sample Description: AC Electrical Penetrate Mastic (Brown)/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Brown	0.0%	100.0%	None Detected	

Client Sample ID: 14b ***Lab Sample ID:*** **552514311-0043**

Sample Description: AC Electrical Penetrate Mastic (Brown)/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Brown	0.0%	100.0%	None Detected	

Client Sample ID: 14c ***Lab Sample ID:*** **552514311-0044**

Sample Description: AC Electrical Penetrate Mastic (Brown)/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Brown	0.0%	100.0%	None Detected	

Client Sample ID: 15a ***Lab Sample ID:*** **552514311-0045**

Sample Description: Exhaust Penetrate Mastic/ Upper Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Black	15.0%	85.0%	None Detected	

Client Sample ID: 15b ***Lab Sample ID:*** **552514311-0046**

Sample Description: Exhaust Penetrate Mastic/ Upper Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Black	15.0%	85.0%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: (289) 997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

EMSL Canada Order 552514311
Customer ID: 55SELI62
Customer PO: 1-3250702
Project ID:

Summary Test Report for Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05

Client Sample ID: 15c ***Lab Sample ID:*** **552514311-0047**

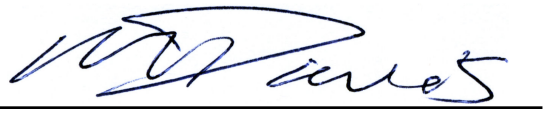
Sample Description: Exhaust Penetrate Mastic/ Lower Roof

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/15/2025	Black	15.0%	85.0%	None Detected	

Analyst(s):

Antonio Peluso	PLM (11)
Diana Costantino	PLM (8)
Kira Ramphal	PLM (25)
Nickesh Mistry	PLM Grav. Reduction (8)
Vanessa Gallego	PLM (1) PLM Grav. Reduction (3)

Reviewed and approved by:



Matthew Davis or other approved signatory
or Other Approved Signatory

None Detected = <0.1%. EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This is a summary report; official reports are available on LabConnect or upon request and relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted. The above analyses were performed in general compliance with Appendix E to Subpart E of 40 CFR (previously EPA 600/M4-82-020 "Interim Method") but augmented with procedures outlined in the 1993 ("final") version of the method. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the federal government. Non-friable organically bound materials present a problem matrix and therefore EMSL recommends gravimetric reduction prior to analysis. Unless requested by the client, building materials manufactured with multiple layers (i.e. linoleum, wallboard, etc.) are reported as a single sample. Estimation of uncertainty is available on request.

Samples analyzed by EMSL Canada Inc. Mississauga, ON NVLAP Lab Code 200877-0

Initial report from: 08/15/202510:00:04

Appendix IV: Laboratory Certificate of Analysis – Lead

EMSL Canada Inc.
2756 Slough Street, Mississauga, ON L4T 1G3
Phone/Fax: (289) 997-4602 / (289) 997-4607
http://www.EMSL.com torontolab@emsl.com

EMSL Canada Or	552514286
CustomerID:	55SELI62
CustomerPO:	1-3250702
ProjectID:	

Attn: **Jason King**
Safetech Environmental Limited
3045 Southcreek Road
Unit 14
Mississauga, ON L4X 2X7

Phone: (905) 624-2722
Fax: (905) 624-4306
Received: 8/13/2025 09:00 AM
Collected: 8/7/2025

Project: **21 Park Road/ 1-3250702**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client SampleDescription	Collected	Analyzed	Weight	RDL	Lead Concentration
L-01	8/7/2025	8/13/2025	0.2550 g	0.0064 % wt	0.018 % wt
552514286-0001	Site: Upper Roof/ Metal AC/ Blue				
L-02	8/7/2025	8/13/2025	0.2504 g	0.32 % wt	7.8 % wt
552514286-0002	Site: Lower Roof/ Wooden Window Frame/ Grey				
L-03	8/7/2025	8/13/2025	0.2544 g	0.0064 % wt	0.0072 % wt
552514286-0003	Site: Attic, Mechanical Room/ Drywall Ceiling/ White				

Rowena Fanto, Lead Supervisor
or other approved signatory

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted. * Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.0064% wt based on the minimum sample weight per our SOP. "<" (less than) result signifies the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. Definitions of modifications are available upon request.

Samples analyzed by EMSL Canada Inc. Mississauga, ON AIHA LAP, LLC-ELLAP Accredited #196142

Initial report from 08/15/2025 07:12:55

Appendix V: Methodology

A. METHODOLOGY

The presence of hazardous materials was assessed by visual inspection. For the purpose of this assessment and this document, hazardous materials include designated substances as well as other chemical, biological and environmental hazards as defined below:

- Designated Substances (as prescribed by Ontario Regulation 490/09):
    - Acrylonitrile, Arsenic, Asbestos, Benzene, Coke Oven Emissions, Ethylene Oxide, Isocyanates, Lead, Mercury, Silica and Vinyl Chloride.
- Other Hazardous Materials:
    - **Chemical Hazards** – Urea Formaldehyde Foam Insulation (UFFI)
    - **Biological Hazards** – Mould Contamination and Pest Infestation
    - **Environmental Hazards** – Polychlorinated Biphenyls (PCBs) and Ozone Depleting & Global Warming Substances

Concealed locations such as above solid plaster or drywall ceilings, within plaster or drywall wall cavities, enclosed mechanical/pipe shafts and bulkheads, etc. were not investigated, unless otherwise stated in Section 1.3. Similarly, motors, blowers, electrical panels, etc., were not de-energized or disassembled to examine concealed conditions. Building materials that are not detailed within this assessment due to inaccessibility at the time of our site visit and/or uncovered during renovation/demolition activities should be assessed by a qualified person prior to their disturbance.

Bulk sampling followed by laboratory analysis was also conducted to confirm the presence/absence of select hazardous materials. Bulk sampling was limited to asbestos in building materials and lead in paint on building finishes (if flaking paint was present). All other hazardous materials were identified by visual inspection only. Where possible, observations regarding the location, quantity and condition of the hazardous materials identified were made in order to determine the potential for exposure and provide appropriate recommendations for remedial action, if necessary. Specific methodology for each individual hazardous material assessed is further detailed below.

A.1 Designated Substances

A.1.1 Asbestos

A visual inspection for the presence of both friable and non-friable asbestos-containing material (ACM) was performed in the subject area.

If an existing asbestos survey was available for review, Safetech relied on the information present. Building materials that were visually similar to materials previously tested and that were confirmed to be either ACM or non-ACM were considered to have consistent content and were not re-sampled. Additional sampling was only conducted where the investigator believed a need existed.
Bulk samples of building materials suspected to contain asbestos were retrieved by Safetech only for materials that were deemed to have a potential to be disturbed as part

of the construction project. Some suspect materials may not have been sampled during our investigation. Bulk samples were retrieved in accordance with Section 3 and Table 1 of Ontario Regulation 278/05, "Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations". The number of samples collected for each material was based on the type and quantity of the material present in the subject area. Each individual sample was placed in a labeled zip-lock bag for transportation to an independent laboratory (EMSL). EMSL is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) for bulk asbestos fiber analysis.

Analysis for asbestos content was performed by the independent laboratory in accordance with the U.S. Environmental Protection Agency (EPA) Test Method *EPA/600/R-93-116: Method for the Determination of Asbestos in Bulk Building Materials (June 1993)*. This method identifies the asbestos fibre content of building materials using polarized light microscopy (PLM) analytical techniques, with confirmation of presence and type of asbestos made by dispersion staining optical microscopy. This analytical method meets the requirements set forth in Section 3 of O. Reg. 278/05.

In accordance with O. Reg. 278/05, an asbestos-containing material is defined as material that contains 0.5 per cent or more asbestos by dry weight. The laboratory was instructed to conduct "stop-positive" analysis for all materials. If a sample was found to be asbestos-containing no further analysis was conducted for samples taken from the same homogeneous material.

Locations where ACM have been identified are detailed in this report. Recommendations pertaining to ACM were made based on the friability, accessibility and condition of the material in conjunction with the potential for the planned renovation work to disturb the ACM.

A.1.2 Assessment of Asbestos-Containing Building Materials

Accessibility, Condition and Action (Priority) ratings for individual items, or defined areas were developed by Safetech to determine remedial action plans specific to the facility's needs.

A.1.2.1 Accessibility

Accessibility has been assessed as: (A) Accessible to all non-maintenance occupants of the building; (B) Accessible to maintenance staff without a ladder; (C) Accessible to maintenance staff with a ladder and exposed to view without moving a building component; (D) Accessible to maintenance staff with a ladder and concealed from view due to a building component; (E) Not accessible without demolition or removal of fixed building components or building systems

A.1.2.2 Condition

The condition of asbestos-containing materials identified in the subject area was assessed as Good (G), Fair (F) or Poor (P). The assessment criteria used to determine condition is dependent on material characteristics, such as friability. The following table summarizes the criteria used by Safetech to evaluate the condition of ACM.

Sprayed Fireproofing, Sprayed Insulation and Sprayed Texture Finishes	
Good	• Surface shows no significant signs of damage, deterioration, or delamination (i.e. <1%). • Unencapsulated or unpainted fireproofing or texture finishes, where no delamination or damage is observed. • Encapsulated fireproofing or texture finishes where encapsulation applied after damage or fallout.
Fair	• Not utilized as part of condition assessment for these materials.
Poor	• Greater than 1% damage, delamination, or deterioration to surface.
In areas where damage exists in isolated locations, both Good and Poor may be applicable.	
Mechanical Insulation (boilers, breeching, ductwork, piping, tanks, equipment, etc.)	
Good	• Insulation completely covered in jacketing and exhibits no evidence of damage or deterioration. • Jacketing may have minor damage (i.e. scuffs or stains), but is not penetrated.
Fair	• Minor penetrating damage to jacketed insulation (cuts, tears, nicks, deterioration or delamination). • Undamaged insulation that had never been jacketed. • Insulation is exposed but not showing surface disintegration. • Extent of missing insulation ranges from minor to none. • Damage that can be repaired.
Poor	• Original insulation jacket is missing, damaged, deteriorated, or delaminated. • Insulation is exposed and significant areas have been dislodged. • Damage that cannot be easily repaired.
Non-Friable and Potentially Friable Materials (includes materials such as plaster finishes, drywall compound, ceiling tiles, asbestos cement products, vinyl asbestos tile and asbestos paper backed vinyl sheet flooring, etc., which have the potential to become friable when handled)	
Good	• No significant damage. • Material may be cracked or broken but is stable and not likely to become friable upon casual contact. • No friable debris present
Fair	• Not utilized as part of condition assessment for these materials.
Poor	• Material is severely damaged. • Debris is present or binder has disintegrated to the point where the material has become friable.
Asbestos-Containing Debris (noted separately from the presumed source material)	
Poor	• Debris is always considered to be in Poor condition.

A.1.2.3 Action

Recommended ACTION for compliance and for management of identified asbestos-containing materials has been provided for each condition and component outlined in the above table. Recommendations have been classified under the following 8 ACTIONS:

1. Action dealing with the immediate clean-up of fallen ACM likely to be disturbed.

2. Action dealing with the need to use Type 2 asbestos procedures to enter an area (other than a ceiling space).
3. Action dealing with performing asbestos removal for compliance with regulations.
4. Action dealing with Type 2 asbestos procedures for ceiling entry where friable ACM debris is present on the top side of a ceiling system.
5. Action dealing with the removal of asbestos that goes beyond compliance requirements but simplifies the asbestos management.
6. Action dealing with the repair of asbestos.
7. Action dealing with ACM surveillance requirements of the regulation.
8. Action for dealing with material that may contain asbestos but was not conclusively identified in the survey.

A.1.2.4 Quantity

The approximate quantity and the units of measure related to the quantity (i.e.: linear feet (LF), square feet (SF) or each (EACH) as appropriate to the item) have only been provided for materials requiring remedial or corrective action (i.e. materials in Fair or Poor condition). In such circumstances any quantities provided should be considered rough estimates only and should not be solely relied upon for bidding purposes. It is the responsibility of the selected Contractor to obtain actual quantities.

A.2 Lead

If paint samples were collected, they would be collected by scraping the paint down to the base material substrate to ensure collection of all layers of paint. Care would be taken to avoid collection of the underlying substrate to reduce analytical substrate matrix interference.

If collected, paint samples would be submitted to an independent laboratory for the determination of lead content. The laboratory would participate in and accredited by the EPA (U.S. Environmental Protection Agency) for analysis of lead in paint chips through the American Industrial Hygiene Association (AIHA) Environmental Lead Laboratory Accreditation Program (ELLAP). Analysis would be conducted by the laboratory following the EPA “Test Methods for Evaluating Solid Waste, Physical/Chemical Methods” (SW-846), Method 7000B “Flame Atomic Absorption Spectrophotometry”. Result of analysis would be reported by the laboratory as the percentage of lead by weight of the total sample (% by wt.).

The presence of lead in other materials, such as lead sheeting, pigmented mortar, lead piping, lead solder, etc. would be noted where observed but not sampled to verify lead content. Lead can be present in these materials to varying degrees, depending on their age of application and should be considered lead-containing until proven otherwise.

A.3 Mercury

The type, quantity and location of mercury-containing equipment and devices in the subject area were determined by visual inspection based on appearance, age and knowledge of historical uses. Sampling for mercury-containing building materials and dismantling of suspect mercury-containing equipment was not performed. Where possible, attempts were made to verify the presence/absence of mercury by gathering additional information such as equipment model number, serial number, etc.

A.4 Silica

The presence of crystalline silica in building materials was determined through visual inspection of building materials only, based on knowledge of the historic use of silica-containing materials in certain building materials. Sampling to verify the presence/absence of silica in building materials was not performed.

A.5 Other Designated Substances

Other designated substances (i.e. acrylonitrile, arsenic, benzene, coke oven emissions, ethylene oxide, isocyanates, and vinyl chloride) are typically not expected to be encountered in building materials as significant constituents or in a form that would represent an exposure concern. These substances were not included in the assessment unless specific information regarding their use (e.g. in a manufacturing process) was provided to us. No sampling for these designated substances was performed.

A.6 Other Hazardous Materials

A.6.1 Chemical Hazards

A.6.1.1 Urea Formaldehyde Foam Insulation (UFFI)

A visual inspection to evaluate the possible presence of Urea Formaldehyde Foam Insulation (UFFI) was conducted in the subject area. Our visual inspection was limited to identifying evidence of possible UFFI installation (i.e. repaired nozzle holes in walls) and overspray at wall/ceiling joints, etc. No destructive testing or material sampling was conducted as part of the assessment.

A.7 Biological Hazards

A.7.1.1 Mould Contamination

A visual inspection to determine the possibility of mould growth was conducted in the subject area. The assessment was limited to identifying evidence of mould growth and water damage (staining, material deterioration, efflorescence, etc.) on the surface of building materials, which may be an indicator of hidden mould growth. No moisture content readings of building materials were taken to determine their current condition. Additionally, destructive testing to confirm the presence/absence of hidden mould growth and material sampling to verify the presence/absence of mould on suspect surfaces was beyond the scope of this assessment.

A.7.1.2 Pest Infestation

The presence and extent of pest infestation in the subject area was based on visually inspecting for evidence of significant pest activity, including signs of nesting, droppings/fecal accumulation, dead insects/carcass accumulation, etc. Evidence of minor pest presence was not considered to be indicative of pest infestation.

A.8 Environmental Hazards

A.8.1 Polychlorinated Biphenyls (PCBs)

The presence of PCB-containing electrical equipment in the subject area was identified through visual inspection and knowledge of the timeline of historical use.

For stand-alone transformers and capacitors, information from the manufacturer nameplate (such as the date of manufacture, dielectric fluid trade name or "Type Number", etc.) was gathered, where possible, to further evaluate if the equipment may contain PCBs. This information was then compared to the information provided in the Environment Canada document entitled "Handbook on PCB's in Electrical Equipment" (Third Edition, April 1988) to aid in identification. Transformers and capacitors confirmed to be manufactured after 1979 were assumed to not contain PCBs. If appropriate information could not be obtained it was assumed that the transformer or capacitor contained PCBs.

For fluorescent light ballasts, a representative number of fixtures were inspected, if possible, for assessment areas that were constructed prior to 1980 and where there was no history or evidence of a complete lighting retrofit. The light fixtures were examined by removing any lenses and ballast covers to expose the ballast and identify information such as ballast make, model number, serial number, and date code. This information was then compared to the information provided in the Environment Canada document entitled "Identification of Lamp Ballasts Containing PCBs" (Report EPS 2/CC/2 (revised) August 1991) to aid in identification. Ballasts that could not be confirmed Non-PCB-containing were assumed to contain PCBs. The light fixtures were not de-energized and ballasts were not removed to obtain manufacturer information that may be on the back of the ballast. If visual confirmation of ballast type could not be made it was assumed that light fixtures in areas constructed prior to 1980 that have not undergone a complete lighting retrofit have PCB-containing ballasts until proven otherwise.

No sampling of materials or fluids within equipment was conducted to verify the presence/absence of PCBs. Inspection and testing of other materials for PCB content, including (but not limited to) caulking, asphalt, oil-based paint, plastics, switches, electric cables and hydraulic fluids was beyond the scope of the assessment.

A.8.2 Ozone Depleting and Global Warming Substances

The presence of fixed equipment likely to contain ozone-depleting substances (ODS) and/or global-warming substances (GWS) was identified through visual inspection and

knowledge of the timeline of historical use. This included equipment such as chillers, air-conditioners, walk-in refrigeration and freezer units and fixed dry-chemical fire extinguishers, where chemicals such as hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs) or halons may be present. Where possible, information regarding the type and quantity of refrigerant present was obtained from the manufacturer nameplate. Our visual assessment was limited to fixed equipment in the subject area and did not include portable equipment such as stand-alone refrigerators, freezers, water coolers, air-conditioners and fire extinguishers, etc.

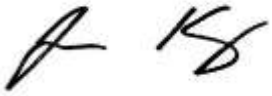
DESIGNATED SUBSTANCES AND HAZARDOUS BUILDING MATERIALS ASSESSMENT REPORT

HVAC Upgrades Project
Project Specific Locations
Amelie House
126 Pape Avenue
Toronto, Ontario
M4M 2V8

Prepared for:
Inder Bhamra (he/him), EP, PMP, CSM
Environmental Coordinator

City of Toronto – Corporate Real Estate Management
Metro Hall
55 John Street, 2nd Floor
Toronto, Ontario
M5V 3C6

Prepared by:
Safetech Environmental Limited



Jason King
Occupational Health and Safety Technician

Reviewed by:



John Mazzulli, B.A.
Project Coordinator

Safetech Project Number: 1-3250703

Date of Site Work: August 8, 2025
Date of Issue: August 15, 2025

3045 Southcreek Road
Unit #14, Mississauga, ON
L4X 2X7

TEL 905.624.2722 1.877.GO.TO.SEL
FAX 905.624.4306
www.safetechenv.com

Professional Engineers Ontario

TABLE OF CONTENTS

EXECUTIVE SUMMARY ..... **i**
1.0 Introduction **1**
1.1 Background and Objectives 1
1.2 Scope of Work 2
1.3 Description of Area(s) Assessed 3
2.0 Results **3**
2.1 Designated Substances 3
2.1.1 Asbestos *3*
2.1.2 Lead *10*
2.1.3 Mercury *12*
2.1.4 Silica *12*
2.1.5 Other Designated Substances *12*
2.2 Other Hazardous Materials 12
2.2.1 Chemical Hazards *12*
2.2.2 Biological Hazards *12*
2.2.3 Environmental Hazards *13*
3.0 Conclusions and Recommendations **14**
3.1 Designated Substances 14
3.1.1 Asbestos *14*
3.1.2 Lead *15*
3.1.3 Mercury *19*
3.1.4 Silica *19*
3.1.5 Other Designated Substances *20*
3.2 Other Hazardous Materials 20
3.2.1 Chemical Hazards *20*
3.2.2 Biological Hazards *20*
3.2.3 Environmental Hazards *21*
4.0 Limitations **23**

3045 Southcreek Road
Unit #14, Mississauga, ON
L4X 2X7

TEL 905.624.2722 1.877.GO.TO.SEL
FAX 905.624.4306
www.safetechenv.com

Professional Engineers Ontario

LIST OF TABLES

Table 1: Summary of Hazardous Materials and Designated Substances
Table 2: Bulk Sample Analytical Results for Determination of Asbestos Content
Table 3: Results of Assessment for Asbestos-Containing Materials
Table 4: Results of Paint Condition and Lead Content Assessment
Table 5: Results of Assessment for Ozone-Depleting and Global Warming Substances

LIST OF APPENDICES

Appendix I: Hazardous Materials Inventory Sheet
Appendix II: Site Drawings
Appendix III: Laboratory Certificate of Analysis – Asbestos
Appendix IV: Laboratory Certificate of Analysis – Lead
Appendix V: Methodology

EXECUTIVE SUMMARY

Safetech Environmental Limited (Safetech) was commissioned by the City of Toronto – Corporate Real Estate Management to conduct a designated substances and hazardous materials assessment associated with the HVAC Upgrade Project within the Amelie House located at 126 Pape Avenue, Toronto, Ontario.

The objective of the assessment was to determine the presence, location, condition and quantities of designated substances and other hazardous materials that have the potential to be disturbed as part of planned construction activities (i.e. HVAC Upgrades Project) so that appropriate control measures can be implemented to protect workers during the work.

A summary of the assessment results and general recommendations based on our findings are provided in the following table. This table should be considered a summary only. Please refer to the Results (Section 2.0), Conclusions and Recommendations (Section 3.0), Hazardous Materials Inventory Sheet (Appendix I) and Site Drawings (Appendix II) of our report for additional details.

Table 1: Summary of Hazardous Materials and Designated Substances

Designated Substance	Findings	Recommendations
Asbestos	The following asbestos-containing materials were identified in the subject area that may be impacted during the project: - textured ceiling - VFT11, 12”x12” red vinyl floor tiles - VFT9, 12”x12” yellow with white streaks vinyl floor tiles.	Disturbance of asbestos-containing materials must be conducted in accordance with Ontario Regulation 278/05 *Designated Substance – Asbestos on Construction Projects and in Building and Repair Operations.* Refer to Table 3 (Results of Assessment for Asbestos-Containing Materials), Section 3.1.1 (Conclusions and Recommendations), Appendix I (Hazardous Materials Inventory Sheet) and Appendix II (Site Drawings). Asbestos-containing waste must be disposed of in accordance with R.R.O. 1990, Regulation 347, *General - Waste Management*.
Lead	Yellow paint on smooth plaster wall contained a concentration of lead below the limit of detection (<0.0064% lead content) and is therefore not considered lead-containing. Beige paint on brick wall and white paint on smooth plaster ceiling were confirmed to be a low-level lead-containing paint (≤0.1% lead content).	Disturbance of lead-containing materials must be conducted in accordance with the Ontario Ministry of Labour, Training and Skills Development (MLTSD) *Lead on Construction Projects* guideline (2011) and/or the Environmental Abatement Council of Canada (EACC) *Lead Guideline* (October 2014). For additional details, refer to Section 2.1.2

	The following materials are assumed to be lead-containing: - paints and surface coatings (not sampled) - glazing associated with ceramic tiles - batteries associated with emergency lighting - solder in copper pipe fittings - solder in electrical components	(Results) and Section 3.1.2 (Conclusions and Recommendations). Lead-containing wastes should be recycled if practicable or handled and disposed of according to R.R.O. 1990, Regulation 347, *General- Waste Management.*
Mercury	Sources of mercury were observed in the subject area and include the following: - vapour in fluorescent lamps	If required, handle lamps with care and keep intact. All waste lamps are recommended to be sent to a lamp recycling facility.
Silica	Building materials identified that are suspected to contain crystalline silica and may be disturbed as part of the planned construction project include: - plaster - drywall walls/drywall joint compound - concrete - mortar	Any work involving the disturbance of silica-containing materials should follow the procedures outlined in the Ontario Ministry of Labour, Training and Skills Development *"Silica on Construction Projects"* guideline. For additional information, refer to Section 2.1.4 (Results) and Section 3.1.4 (Conclusions and Recommendations).
Other Designated Substances	No other designated substances are expected to be present in any significant quantities or in a form that would represent an exposure concern.	No protective measures or procedures specific to acrylonitrile, arsenic, benzene, coke oven emissions, ethylene oxide, isocyanates, and vinyl chloride are considered necessary.
Other Hazardous Materials	**Findings**	**Recommendations**
Urea Formaldehyde Foam Insulation	No UFFI was identified or is suspected in the subject area.	No action required.
Mould Contamination	No suspect mould contamination was observed on building finishes in the subject area.	No action required.
Pest Infestation	No pest infestations were observed in the areas assessed.	No action required.
Polychlorinated Biphenyls	Fluorescent light ballasts are assumed to contain PCB's.	PCB-containing ballasts should be removed, separated from other waste and disposed of as PCB waste at an authorized destruction facility.

Ozone Depleting and Global Warming Substances	Two (2) small air-conditioning units within the subject areas contain 9.9 oz of HCFC-22. One (1) small air-conditioning units within the subject areas contains 13.4 oz of HCFC-22.	Purge air-conditioning unit(s) of remaining refrigerant prior to removal and disposal. This should be conducted by a certified person who holds a valid Ozone Depletion Prevention Certificate. Servicing and testing of refrigeration equipment should be conducted in accordance with Environment Canada's "*Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems"*.

This assessment satisfies the Owner's requirements under Section 30 of the Ontario Occupational Health and Safety Act (OHSA), Revised Statutes of Ontario 1990, as amended.

Should you have any questions regarding the information contained in the report, please contact our office.

Safetech Environmental Limited



Jason King
Occupational Health & Safety Technician

August 15, 2025

City of Toronto – Corporate Real Estate Management
Metro Hall
55 John Street, 2nd Floor
Toronto, Ontario
M5V 3C6

Attention: Inder Bhamra (he/him), EP, PMP, CSM
Environmental Coordinator

RE: Designated Substances and Hazardous Materials Assessment
HVAC Upgrades Project
Amelie House – Project Specific Locations
126 Pape Avenue, Toronto, Ontario

1.0 INTRODUCTION

1.1 Background and Objectives

Safetech Environmental Limited (Safetech) was commissioned by City of Toronto – Corporate Real Estate Management to conduct a designated substances and hazardous materials assessment within Project Specific Locations (subject areas) of Amelie House (subject building) located at 126 Pape Avenue, Toronto, Ontario. The objective of the assessment was to determine the presence, location, condition and quantities of designated substances and other hazardous materials in the subject areas that have the potential to be disturbed as part of planned construction activities (i.e. HVAC Upgrades Project) so that appropriate control measures can be implemented to protect workers during the work.

This assessment satisfies the Owner's requirements under Section 30 of the Ontario Occupational Health and Safety Act (OHSA), Revised Statutes of Ontario 1990, as amended. Section 30(1) requires a building owner to determine if there are any designated substances present at a project site prior to construction or demolition activities. Sections 30(2), (3) and (4) require the Owner and constructors for a project to provide the findings in this report as part of the tendering information for any tendered project or to prospective contractors (and subcontractors) of a project before entering into a binding contract.

This report documents findings of our on-site inspection that was conducted on August 8, 2025 and provides conclusions and recommendations based on our findings and knowledge of the planned construction project.

1.2 Scope of Work

In accordance with our fee proposal document, our scope of work included the following activities:

- A review of existing documents, including renovation documents and drawings, floor plans and existing environmental assessment reports, etc., where available;
- A visual assessment of accessible area(s) in the subject areas to identify the presence, location, condition and quantities of designated substances and other hazardous materials;
- Collection, analysis and interpretation of representative bulk samples of suspect asbestos-containing building materials for the determination of asbestos content and material classification;
- Collection, analysis and interpretation of representative paint chip samples for the determination of lead content; and
- Preparation of a report to document findings and provide recommendations regarding control measures and/or special handling procedures for designated substances or specific hazardous materials that may be disturbed as part of planned construction activities.

Documents reviewed to aid in the assessment included the following:

- Amelie House Designated Substances Re-Survey Report (project #: 1-3230265) dated June 19, 2024 as prepared by Pinchin Limited. This report is hereafter referred to as the “Pinchin DSHM Report”.
- 126 Pape Avenue, TSSS HVAC Phase IV Drawing (project #: 2425) dated May 2025, as prepared by Workshop Architecture Inc.

This assessment only identified designated substances and hazardous materials that were deemed to be part of the building or somehow otherwise incorporated into the building structure and its finishes. **The following items were not included in our scope of work:**

- Assessing occupant items such as stored products, furnishings, items and materials used or produced as part of a manufacturing process;
- Investigating underground materials or equipment (vessels, drums, underground storage tanks, duct-banks, pipes, or cables);
- Assessing enclosed wall or ceiling cavities; and
- Assessing risers, pipe chases or elevator shafts.

1.3 Description of Area(s) Assessed

The area(s) investigated included all accessible locations of the subject areas. The extent of the area investigated is indicated on the floor plan(s) provided in Appendix II.

2.0 RESULTS

Results of our visual assessment and bulk sample analytical findings are summarized in the sections below.

2.1 Designated Substances

2.1.1 Asbestos

Results of bulk sample analysis for the determination of asbestos content are summarized in the following table. Materials have been classified as “ACM”, “Non-ACM”, “Suspected ACM” or “Presumed Non-ACM” based on analytical results. Materials classified as Suspected ACM or Presumed Non-ACM may require further analysis (depending on site-specific conditions) to verify whether the material should be classified as ACM or Non-ACM. Please refer to the Limitations section of this report (Section 4.0) for additional details. The Laboratory Certificate of Analysis is included in Appendix III.

Table 2*:* Bulk Sample Analytical Results for Determination of Asbestos Content

Sample No.	Material Description	Layer	Sample Location	Asbestos Content	Material Classification
1a	**Textured Ceiling**	**Texture**	**Basement, Corridor (B-04)**	**2% Chrysotile**	**ACM**
		Compound		**None Detected**	
1b		**Texture**		**Positive Stop**	
		Compound		**None Detected**	
1c		**Texture**		**Positive Stop**	
		Compound		**None Detected**	
2a	Smooth Plaster Ceiling	Skim Coat	Second Floor, Corridor (2-01)	None Detected	Non-ACM
		Rough		None Detected	
2b	Smooth Plaster Wall	Compound		None Detected	
		Skim		None Detected	
		Rough		None Detected	
2c		Skim	Second Floor, Stairwell (1-16)	None Detected	
		Rough		None Detected	
3a	Drywall Joint Compound (Wall)	N/A	Basement, Stairwell/Hallway (B-02)	None Detected	Non-ACM
3b			Basement, Corridor (B-04)	None Detected	
3c			Basement, Kitchen (B-07)	None Detected	
3d	Drywall Joint Compound (Ceiling)		Basement, Kitchen (B-07)	None Detected	
3e			Basement, Boiler Room (B-01)	None Detected	

Sample No.	Material Description	Layer	Sample Location	Asbestos Content	Material Classification
3f			First Floor, Main Lobby (1-03)	None Detected	
3g			First Floor, Corridor (1-06)	None Detected	
4a	12”x12” Vinyl Floor Tiles (White with Grey Flecks)	N/A	Second Floor, Stairwell (1-16)	None Detected	Non-ACM
4b				None Detected	
4c				None Detected	
5a	12”x12” Vinyl Floor Tiles (Off-White with Grey Flecks)	N/A	Second Floor, Stairwell (1-16)	None Detected	Non-ACM
5b				None Detected	
5c				None Detected	
6a	12”x12” Vinyl Floor Tiles (Orange with Brown Flecks)	N/A	Basement, Stairwell/Hallway (B-02)	None Detected	Non-ACM
6b				None Detected	
6c				None Detected	
7a	Black Mastic associated with Orange with Brown Flecks Vinyl Floor Tiles	N/A	Second Floor, Stairwell (1-16)	None Detected	Non-ACM
7b	Black Mastic associated with Grey with with White Flecks Vinyl Floor Tiles		Second Floor, Stairwell (1-16)	None Detected	
7c	Black Mastic associate with White with Grey Flecks Vinyl Floor Tiles		Second Floor, Stairwell (1-16)	None Detected	
8a	Flashing Caulking	N/A	Lower Roof (0-00)	None Detected	Non-ACM
8b				None Detected	
8c				None Detected	
9a	2-Ply Roof Membrane	Shingle	Lower Roof (0-00)	None Detected	Non-ACM
		Tar Felt		None Detected	
9b		Shingle	Lower Roof (0-00) (Raised Roof)	None Detected	
		Tar Felt		None Detected	
9c		Shingle		None Detected	
		Tar Felt		None Detected	
10a	Paper Barrier	N/A	Lower Roof (0-00) (Raised Roof)	None Detected	Non-ACM
10b				None Detected	
10c			Lower Roof (0-00)	None Detected	
11a	Tar Felt	N/A	Lower Roof (0-00) (Raised Roof)	None Detected	Non-ACM
11b				None Detected	
11c			Lower Roof (0-00)	None Detected	
12a	Ceramic Wall Tile Grout	N/A	Second Floor, Washroom (2-14)	None Detected	Non-ACM
12b				None Detected	
12c				None Detected	

Sample No.	Material Description	Layer	Sample Location	Asbestos Content	Material Classification
13a	Ceramic Floor Tile Grout	N/A	Second Floor Corridor (2-08)	None Detected	Non-ACM
13b				None Detected	
13c				None Detected	
14a	Brick Mortar	Mortar 1	Front Exterior (0-00)	None Detected	Non-ACM
		Mortar 2		None Detected	
14b		White	Basement, Stairwell/Vestibule (B-02)	None Detected	
		Mortar		None Detected	
14c		White	Basement, Electrical Closet (B-10)	None Detected	
		Yellow		None Detected	
		Mortar		None Detected	
14d		N/A	Lower Roof (0-00)	None Detected	

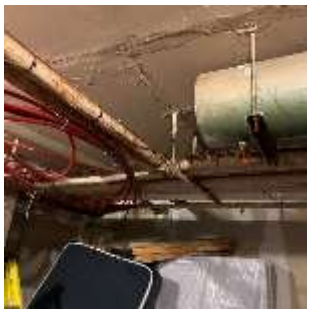
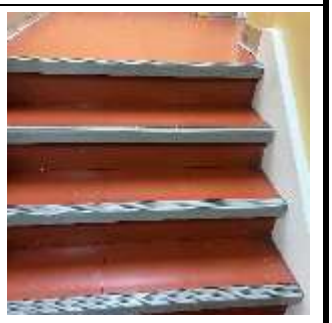
As per O.Reg. 278/05, ACM contains ≥0.5% asbestos by dry weight.

Materials assessed for asbestos content are summarized in the following table based on the type/use of the material.

Table 3: Results of Assessment for Asbestos-Containing Materials

Sprayed and Loose Fill Insulating Materials	Location/Description	
Sprayed Fireproofing	None identified in subject areas.	
Sprayed Insulation	None identified in subject areas.	
Loose Fill / Vermiculite Insulation	None identified in subject areas. Interior portions of concrete block walls could not be assessed. However, it is not expected that these walls are insulated with loose fill or vermiculite insulation	
Thermal System Insulation	**Location/Description**	
Mechanical Pipe Insulation – Straights	Pipe insulation was observed to be uninsulated or insulated with fiberglass insulation and is therefore non-asbestos containing.	

Mechanical Pipe Insulation – Fittings (elbows, valves, tees, hangars, etc.)	Pipe fitting insulation was observed to be uninsulated or insulated with fiberglass insulation and is therefore non-asbestos containing.	
HVAC Duct Insulation	None identified in subject areas.	
Breeching / Exhaust Insulation	None identified in subject areas.	
Tank Insulation	None identified in subject areas.	
Boiler Insulation	None identified in subject areas.	
Other Mechanical Equipment Insulation	Blue firestop was observed to be constructed of silicone caulking and is therefore non-asbestos containing.	
Architectural Finishes & Finishing Materials	**Location/Description**	
Sprayed Texture / Stucco Finishes	***Textured ceiling*** was observed in the subject areas. Bulk samples were collected during the assessment and results of analysis confirmed that this building material contains ***1% chrysotile asbestos***. Refer to sample set 1A-C in Table 2 and the location, condition, friability, and estimated quantity in Appendix I.	

Plaster Finishes	Smooth plaster finish was observed in the subject areas. Bulk samples were collected during the assessment and results of analysis confirmed that this building material is not asbestos-containing. Refer to sample set 2A-C in Table 2.	
Drywall Joint Compound	Drywall joint compound was observed in the subject areas. Bulk samples were collected during the assessment and results of analysis confirmed that this building material is not asbestos-containing. Refer to sample set 3A-C in Table 2.	
Ceiling Tiles	**Location/Description**	
Lay-in Acoustic Ceiling Tiles	None identified in subject areas.	
Glued-on Acoustic Ceiling Tiles	None identified in subject areas.	
Cement Ceiling Panels	None identified in subject areas.	
Flooring	**Location/Description**	
Vinyl Floor Tiles	***12"x12" yellow with white streaks vinyl floor tiles*** were previously identified in the Pinchin DSHM Report and found to contain ***0.5-5% chrysotile asbestos***. Refer Appendix I for the location, condition, friability, and estimated quantity.	
	12"x12" red vinyl floor tiles were previously identified in the Pinchin DSHM Report and found to contain ***0.5-5% chrysotile asbestos***. Refer Appendix I for the location, condition, friability, and estimated quantity.	

	12”x12” beige mosaic vinyl floor tiles were previously identified in the Pinchin DSHM Report and found not to contain to be asbestos-containing.	
	12”x12” grey mosaic vinyl floor tiles were previously identified in the Pinchin DSHM Report and found not to contain to be asbestos-containing.	
	12”x12” off-white with black flecks vinyl floor tiles were observed in the subject areas. Bulk samples were collected during the assessment and results of analysis confirmed that this building material is not asbestos-containing. Refer to sample set 4A-C in Table 2.	
	12”x12” white with grey flecks vinyl floor tiles were observed in the subject areas. Bulk samples were collected during the assessment and results of analysis confirmed that this building material is not asbestos-containing. Refer to sample set 5A-C in Table 2.	
	12”x12” off-red with brown streaks vinyl floor tiles were observed in the subject areas. Bulk samples were collected during the assessment and results of analysis confirmed that this building material is not asbestos-containing. Refer to sample set 6A-C in Table 2.	
Vinyl Sheet Flooring	None identified in subject areas.	

Mastic	Mastic associated with vinyl floor tiles was observed in the subject areas. Bulk samples were collected during the assessment and results of analysis confirmed that this building material is not asbestos-containing. Refer to sample set 7A-C in Table 2.	
Asbestos Cement Products	**Location/Description**	
Piping	None identified in subject area.	
Roofing, Siding, Wallboard	None identified in subject areas.	
Other Cement Products	None identified in subject areas.	
Exterior Building Materials	**Location/Description**	
Caulking	Flashing caulking was observed in the subject areas. Bulk samples were collected during the assessment and results of analysis confirmed that this building material is not asbestos-containing. Refer to sample set 8A-C in Table 2.	
Roof Insulation	2-ply membrane was observed in the subject areas. Bulk samples were collected during the assessment and results of analysis confirmed that this building material is not asbestos-containing. Refer to sample set 9A-C in Table 2.	
	Paper barrier was observed in the subject areas. Bulk samples were collected during the assessment and results of analysis confirmed that this building material is not asbestos-containing. Refer to sample set 10A-C in Table 2.	

	Tar felt was observed in the subject areas. Bulk samples were collected during the assessment and results of analysis confirmed that this building material is not asbestos-containing. Refer to sample set 11A-C in Table 2.	
Shingles	None identified in subject areas.	
Misc. Materials	**Location/Description**	
Grout	Ceramic wall tile grout was observed in the subject areas. Bulk samples were collected during the assessment and results of analysis confirmed that this building material is not asbestos-containing. Refer to sample set 12A-C in Table 2.	
	Ceramic floor tile grout was observed in the subject areas. Bulk samples were collected during the assessment and results of analysis confirmed that this building material is not asbestos-containing. Refer to sample set 13A-C in Table 2.	
	Brick mortar was observed in the subject areas. Bulk samples were collected during the assessment and results of analysis confirmed that this building material is not asbestos-containing. Refer to sample set 14A-C in Table 2.	

2.1.2 Lead

Laboratory analytical results for paints tested to determine lead content are summarized in the following table. The Laboratory Certificate of Analysis is included in Appendix IV. Refer to Section 3.1.2 of this report for recommended lead abatement procedures (if any) that correspond to the type of proposed construction, renovation, or demolition work.

Table 4: Results of Paint Condition and Lead Content Assessment

Sample No.	Location	Surface	Paint Colour	Condition	Lead Conc. (% by wt.)	Material Classification
L-01	Boiler Room (B-01)	Brick Wall	Beige	Poor	0.078	LLLP
L-02	Corridor (2-01)	Smooth Plaster Ceiling	White	Fair	0.073	LLLP
L-03	Corridor (2-01)	Smooth Plaster Wall	Yellow	Good	<0.0064	NLC

LCP: Lead-Containing Paint (>0.1% Lead Content); LLLP: Low-Level Lead Paint (≤0.1% Lead Content); NLC: Non-Lead Containing (<0.0064% Lead Content)

Suspect lead-containing materials observed in the subject areas included the following:

- paints and surface coatings (not sampled)
- glazing associated with ceramic tiles
- batteries associated with emergency lighting
- solder in copper pipe fittings
- solder in electrical components

Table 5: Results of Assessment for Lead-Containing Materials

Location/Description	Picture
Beige paint associated with brick wall in subject areas was sampled during our investigation. Results of analysis confirmed the paint to be a low-level lead-containing paint (≤0.1% lead content). Refer to samples L-01 in Table 4.	
White paint associated with smooth plaster ceiling in subject areas was sampled during our investigation. Results of analysis confirmed the paint to be a low-level lead-containing paint (≤0.1% lead content). Refer to samples L-02 in Table 4.	

Yellow paint associated with smooth plaster wall in subject areas was sampled during our investigation. Results of analysis did not indicate the presence of any detectable concentrations of lead. Therefore, the yellow paint is not considered to be lead-containing. Refer to sample L-03 in Table 4.	

2.1.3 Mercury

Mercury is present in the subject areas in the form of:

- vapour in fluorescent lamps

2.1.4 Silica

A number of building materials were identified in the subject areas that are ***suspected to contain crystalline silica***. This includes the following materials:

- plaster
- drywall walls/drywall joint compound
- concrete
- mortar

2.1.5 Other Designated Substances

Acrylonitrile, arsenic, benzene, coke oven emissions, ethylene oxide, isocyanates, and vinyl chloride were not included in the assessment as these substances are not expected to be a significant component of building materials or present in a form that would represent an exposure concern. Additionally, no specific information regarding their use was provided to us.

2.2 Other Hazardous Materials

2.2.1 Chemical Hazards

No visible evidence of UFFI installation (i.e. injection openings) or overspray of foam insulation at wall/ceiling joints was identified in the subject areas.

2.2.2 Biological Hazards

2.2.2.1 Mould Contamination

Table 6: Summary of Mould Site Assessment Findings

Basement, Corridor (B-04)

Findings: • Minor suspect mould growth damage (4 LF) was identified on fiberglass pipe insulation within the subject area.	

2.2.2.2 Pest Infestation

There was no visible evidence of a pest infestation in the subject areas.

2.2.3 Environmental Hazards

2.2.3.1 Polychlorinated Biphenyls (PCBs)

Fluorescent light fixtures were identified in the subject building. Fluorescent light fixtures were noted to be a mixture of four-foot, one lamp and two lamp fixtures. The lamps were noted to be newer T8 lamps. Fluorescent light fixtures could not be accessed for further evaluation to determine the type(s) of ballasts present and therefore the ballasts within these lights are assumed to contain PCBs.

2.2.3.2 Ozone Depleting and Global Warming Substances

Equipment identified in the subject areas that are suspected to contain ozone depleting substances (ODS) and/or global warming substances (GWS) are summarized in the following table.

Table 5: Results of Assessment for Ozone-Depleting and Global Warming Substances

Location	Equipment Manufacturer and Type	Type and Quantity of Refrigerant or Fire Extinguishing Agent	ODS/GWS Classification
Second Floor, Corridor	Vissani – Air-Conditioning Unit	R-32 (HFC-32) – 9.8oz	GWS
First Floor, Corridor	Simplicity – Air-Conditioning Unit	R-22 (HCFC-22) – 13.4oz	ODS
Basement, Kitchen	Vissani – Air-Conditioning Unit	R-32 (HFC-32) – 9.8oz	GWS

3.0 CONCLUSIONS AND RECOMMENDATIONS

3.1 Designated Substances

3.1.1 Asbestos

As results summarized in Table 2 indicate, no asbestos was detected in any of the bulk samples of smooth plaster, joint compound, vinyl floor tiles, associated mastic, flashing caulking, roof insulation, grout, or mortar retrieved for analysis. Therefore, these building materials are considered to be Non-ACM and there are no requirements for management, disturbance or removal of these materials under O. Reg. 278/05.

Results of the assessment indicated that the following asbestos-containing materials are present in the subject areas that may be disturbed as part of the construction project.

- textured ceiling
- VFT11, 12”x12” red vinyl floor tiles
- VFT9, 12”x12” yellow with white streaks vinyl floor tiles.

Refer to Appendix I (Hazardous Materials Inventory Sheet) and Appendix II (Site Drawings) for types, locations, estimated quantities, and condition of asbestos-containing materials identified in the subject area.

Removal or disturbance of identified asbestos-containing materials must be conducted in accordance with O.Reg. 278/05. Asbestos containing materials in Poor condition must be removed and/or repaired immediately following applicable asbestos abatement procedures. Asbestos-containing materials in Good condition can remain in place until major system upgrading, maintenance or demolition which could result in disturbance of this material.

Texture Ceiling: Textured ceiling identified to be asbestos-containing is recommended to be treated as friable ACM since disturbance of this material typically results in significant degradation and subsequent dust/debris generation that cannot be adequately controlled through wetting. Therefore, removal or disturbance of 1 square metre or less of textured ceiling should be conducted following Type 2 operations. If more than 1 square metre of textured ceiling is to be removed or disturbed then work should be conducted following Type 3 operations.

Vinyl Floor Tiles: Vinyl floor tiles are considered to be a non-friable ACM. As per O. Reg. 278/05, removal of non-friable ACM can be conducted following Type 1 operations; as long as the material can be removed without being broken, cut, drilled or otherwise similarly disturbed. If the material cannot be removed without it breaking or being similarly disturbed then the work should be conducted using non-powered hand tools and the material should be wetted to control the spread of dust. If the material cannot be wetted or if power tools attached to dust-collecting devices equipped with HEPA (high efficiency

particulate aerosol) filters are used during removal or disturbance, then work should be performed following Type 2 operations. If non-friable materials are removed or disturbed using power tools that are not attached to dust-collecting devices that are equipped with HEPA filters then work should be conducted following Type 3 operations.

General Recommendations: The removal or disturbance of ACM must follow the measures and procedures indicated in O. Reg. 278/05. This work should be conducted by workers who have received proper training by a "competent person" in the hazards of asbestos exposure, personal hygiene and work practices, and the use and care of respirators and protective clothing. Any worker/supervisor who works in a Type 3 operation must successfully complete the Asbestos Abatement Worker or Supervisor Training Program approved by the Ministry of Training, Colleges and Universities. It is recommended that all work involving the removal or disturbance of ACM be subject to inspection and testing to document conformance with O. Reg. 278/05 requirements. The degree of inspection and testing is dependent on site-specific conditions such as the type, duration, size and location of the work. In most circumstances Type 3 operations require a visual inspection and clearance air testing to be conducted by a competent worker on completion of the work. The inspection should be conducted to ensure that the enclosure and the work area inside the enclosure are free from visible dust, debris or residue that may contain asbestos. Clearance air testing for Type 3 operations requires a minimum number of air samples to be taken (depending on the size of the work area) following specific sampling and analytical procedures and all samples taken must meet the clearance criteria set out in O. Reg. 278/05.

3.1.2 Lead

Results of paint chip analysis for the determination of lead content indicated that yellow paint associated with smooth plaster wall contained a concentration of lead below the limit of detection (<0.0064% based on requirements of the Environmental Abatement Council of Ontario (EACO) Lead Guideline (2014)) and is therefore not considered lead-containing. No lead related precautions are considered necessary for the removal or disturbance of this material.

Results of paint chip analysis for the determination of lead content indicated that beige paint associated with brick wall and white paint associated with smooth plaster ceiling are considered a 'low-level lead painst' (≤0.1% based on requirements of the Environmental Abatement Council of Canada (EACC) Lead Guideline (2014)). If the 'low-level lead paint' is disturbed in a non-aggressive manner (no use of power tools/abrasive blasting, grinding, welding, heating, etc.), then respirators are not considered necessary. However, Class 1 measures and procedures should still be implemented during the non-aggressive disturbance of 'low-level lead paints', including, but not limited to, no smoking, eating, drinking and chewing gum in the work area; dust suppression methods must be implemented; and facilities must be made available so that workers can wash their hands and face.

Paints and surface coatings not sampled are assumed to be lead-containing (>0.1% lead content) in the subject area. Any disturbance of the lead-containing paints or surface coatings should be conducted in accordance with the procedures outlined in the Environmental Abatement Council of Canada (EACC) "Lead Guideline" (October 2014) and/or the Ontario Ministry of Labour, Training and Skills Development (MLTSD) "Lead on Construction Projects" guideline (April 2011). The extent of procedures required depends on the type of work to be conducted.

Emergency lighting is present in the subject building and are suspected to contain lead-acid batteries. If emergency lighting is removed/replaced as part of the scheduled work activities, the batteries are recommended to be sent to a recycling facility for proper treatment.

Additional suspect lead-containing products not anticipated to be disturbed during construction includes solder on pipe fittings and electrical components. Future testing of these materials and specific handling/disposal requirements may be necessary if/when these materials are to be disturbed.

At this time the method of disturbance, if any, of lead-containing materials is unknown. It is recommended that any contractor whose work requires lead-containing materials to be disturbed consult the EACC or Ontario MLTSD guidelines prior to the start of work to determine the Class/Type of operation(s) and the corresponding control measures (engineering controls, work/hygiene practices, protective clothing and equipment and worker training) necessary to conduct the work in a manner that will prevent worker overexposure to lead. The following table outlines the classification of lead disturbance based on the EACC guideline.

Operation	Description
Class 1	1. Removal of lead-containing or lead-based paints and surface coatings with a chemical gel/stripper or paste; 2. Application of lead-containing or lead-based paints and surface coatings with a brush, roller or sponge. 3. Installation or removal of lead sheeting or flashing. 4. Installation or removal of lead-containing packing, babbitt, caulking, gasket or similar material. 5. Removal of materials coated with lead-containing or lead-based paints and surface coatings, using non-powered hand tools, where the material remains chiefly intact and is not crumbled, pulverized or powdered. 6. Operating construction or demolition equipment (e.g. excavator, bulldozer) during building renovation or demolition where lead-based paints or surface coatings are present on building materials and are being disturbed. 7. Soldering with lead solder. 8. Removing lead-containing or lead-based paints or surface coatings with a heat gun. 9. Removing lead-containing and lead-based paints and surface coatings using a high-pressure water jet (e.g. pressure washer).

Operation	Description
Class 2a	1. Removal of lead-containing or lead-based paints and surface coatings or lead-containing materials using a power tool that has an effective dust collection system equipped with a HEPA filter*. 2. Welding, torching or high temperature cutting of lead-containing materials indoors when using an effective fume collector or smoke eater that filters and exhausts lead fume and expels it directly outdoors (away from occupants, entrances, walkways, rest areas, etc.). Fume collector or smoke eater must have effective source control and capture velocity, minimum of 0.5 metres per second (100 feet per minute) at the work surface. 3. Welding, torching or high temperature cutting of lead-containing and lead-based paints and surface coatings or lead-containing materials outdoors. 4. Removal of lead-containing mortar using handheld non-powered tools. 5. Removal of lead-containing and lead-based paints and surface coatings or lead-containing materials by scraping or sanding (including wet sanding) using non-powered hand tools. 6. Demolition of plaster or building components that crumble, pulverize or powder and are covered with lead-containing or lead-based paints or surface coatings. 7. Clean up and removal of a significant amount of lead-containing dust and debris (that can be made easily airborne) using wet methods or HEPA vacuums.
Class 2b	1. Spray application of lead-containing paints and surface coatings
Class 3a	1. Removal of lead-containing or lead-based paints and surface coatings or lead-containing materials using a power tool without an effective dust collection system equipped with a HEPA filter. 2. Welding, torching or high temperature cutting of lead-containing materials indoors or in a confined space (e.g. within a ditch or pit). 3. Removal of lead-containing mortar using a powered cutting device. 4. Burning of a material containing lead. 5. Removal, cleaning or repair of a ventilation system or ductwork used for controlling lead exposure. 6. Spray application of lead-based paints and surface coatings. 7. In the absence of an exposure assessment: a. demolition or cleanup of a facility where lead-containing products were manufactured and significant dust and debris, which can be made easily airborne, is present. b. cleanup of dust and debris down range of a firing station in an indoor firing range.an operation that may expose a worker to lead dust, fume or mist that is not a Class 1, Class 2, or Class 3B operation.
Class 3b	1. Abrasive blasting of lead-containing and lead-based paints and surface coatings or lead-containing materials (including wet, slurry and dry abrasive blasting and dry-ice blasting).

* Effective implies that the dust collection system should be capable of controlling airborne lead concentration levels to below 0.05 mg/m^3. Employers should follow manufacturer's recommendations and maintenance specifications for optimal function.

The following table outlines the classification of lead disturbance based on the Ontario MLTSD guideline.

Operation	Description
Type 1	1. Application of lead-containing coatings with a brush or roller. 2. Removal of lead-containing coatings with a chemical gel or paste and fibrous laminated cloth wrap. 3. Removal of lead-containing coatings or materials using a power tool that has an effective* dust collection system equipped with a HEPA filter. 4. Installation or removal of lead-containing sheet metal. 5. Installation or removal of lead-containing packing, babbit or similar material. 6. Removal of lead-containing coatings or materials using non-powered hand tools, other than manual scraping or sanding. 7. Soldering.
Type 2a	1. Welding or high temperature cutting of lead-containing coatings or materials outdoors. This operation is considered a Type 2a operation only if it is short-term, not repeated, and if the material has been stripped prior to welding or high temperature cutting. Otherwise, it will be considered a Type 3a operation. 2. Removal of lead-containing coatings or materials by scraping or sanding using non-powered hand tools. 3. Manual demolition of lead-painted plaster walls or building components by striking a wall with a sledgehammer or similar tool.
Type 2b	2. Spray application of lead-containing paints and surface coatings
Type 3a	8. Welding or high temperature cutting of lead-containing coatings or materials indoors or in a confined space. 9. Burning of a surface containing lead. 10. Dry removal of lead-containing mortar using an electric or pneumatic cutting device. 11. Removal of lead-containing coatings or materials using power tools without an effective dust collection system equipped with a HEPA filter. 12. Removal or repair of a ventilation system used for controlling lead exposure. 13. Demolition or cleanup of a facility where lead-containing products were manufactured. 14. An operation that may expose a worker to lead dust, fume or mist that is not a Type 1, Type 2, or Type 3b operation.
Type 3b	1. Abrasive blasting of lead-containing coatings or materials. 2. Removal of lead-containing dust using an air mist extraction system.

* Effective implies that the dust collection system should be capable of controlling airborne lead concentration levels to below 0.05 mg/m^3. Employers should follow manufacturer's recommendations and maintenance specifications for optimal function.

If practicable, all bulk lead waste materials should be separated from other wastes and sent to a recycling facility. If not practicable, lead-containing waste should be handled and disposed of according to R.R.O. 1990, Regulation 347, *General - Waste Management* (Reg. 347) made under the Environmental Protection Act. Under this regulation (and depending on the quantity of waste generated) the waste may be subject to analysis following the Toxicity Characteristic Leaching Procedure (TCLP) to determine if it is a “leachate toxic waste” based on the leachate quality criteria provided in Schedule 4 of the regulation. Such wastes must meet specific treatment requirements (Schedule 5) or undergo alternative treatment for hazardous debris (Schedule 8) prior to land disposal.

3.1.3 Mercury

Fluorescent lamps that require removal should be handled with care and kept intact to avoid potential exposure to mercury vapour present within the lamps. To prevent the release of mercury into the environment, Safetech recommends that all waste lamps be sent to a lamp recycling facility and not disposed of in landfill.

Although no mercury was visibly identified in other equipment, dismantling of equipment was not conducted to verify the presence/absence of mercury. It is cautioned that thermometers, barometers and other measuring devices (pressure gauges/sensors, vacuum gauges, manometers, etc.), thermostats and a variety of other electrical switches (temperature sensitive, tilt switches, float switches, etc.) may contain mercury that may not be visible without dismantling the equipment. Such devices should be assumed to contain mercury until proven otherwise and similar precautions to those outlined above should be taken if any of these items are to be disturbed or taken out of service in the future.

3.1.4 Silica

Suspect silica-containing materials were identified to be present in the subject areas. In their current state, building materials containing silica do not represent a risk to building occupants or construction workers. Risks associated with exposure to silica arise during demolition activities that cause silica dust to be created (particularly grinding, drilling or cutting operations and during major demolition), resulting in a crystalline silica inhalation hazard.

If any materials suspected to contain silica are to be removed or otherwise disturbed as a result of renovation/demolition activities it is recommended that procedures be put in place to control the generation of dust (such as routine water misting) and thus reduce the potential for worker exposure. Workers that have the potential to be exposed to airborne silica should also wear appropriate protective clothing and respiratory protection. Any work involving the disturbance of silica-containing materials should follow the procedures outlined in the Ontario MLTSD “Silica on Construction Projects” guideline (April 2011). The appropriate engineering controls, work practices, hygiene practices, personal protective measures and training necessary to conduct the work in a safe manner are provided in this guideline. The general measures and procedures (or Type of operation) necessary depends on the type of work to be conducted. The following table outlines the classification of silica disturbance based on the Ontario MLTSD guideline.

Operation	Description
Type 1	1. The drilling of holes in concrete or rock that is not part of a tunneling operation or road construction. 2. Milling of asphalt from concrete highway pavement 3. Charging mixers and hoppers with silica sand (sand consisting of at least 95% silica) or silica flour (finely ground sand consisting of at least 95% silica) 4. Any other operation at a project that requires the handling of silica-containing material in a way that may results in a worker being exposed to airborne silica. 5. Entry into a dry mortar removal or abrasive blasting area while airborne dust is visible for less than 15 minutes for inspection and/or sampling. 6. Working within 25 metres of an area where compressed air is being used to remove silica-containing dust outdoors.
Type 2	1. Removal of silica containing refractory materials with a jackhammer 2. The drilling of holes in concrete or rock that is part of a tunneling or road construction. 3. The use of a power tool to cut, grind, or polish concrete, masonry, terrazzo or refractory materials. 4. The use of a power tool to remove silica containing materials. 5. Tunneling (operation of the tunnel boring machine, tunnel drilling, and tunnel mesh installation). 6. Tuckpoint and surface grinding 7. Dry mortar removal with an electric or pneumatic cutting device 8. Dry method dust cleanup from abrasive blasting operations 9. The use of compress air outdoors for removing silica dust 10. Entry into area where abrasive blasting is being carried out for more than 15 minutes
Type 3	1. Abrasive blasting with an abrasive that contains >1% silica 2. Abrasive blasting or a material that contains >1% silica

3.1.5 Other Designated Substances

No other designated substances are expected to be a component of building materials in the subject areas in a form that would represent an exposure concern. Therefore, no protective measures or procedures specific to acrylonitrile, arsenic, benzene, coke oven emissions, ethylene oxide, isocyanates, and vinyl chloride are considered necessary.

3.2 Other Hazardous Materials

3.2.1 Chemical Hazards

As no UFFI was identified or is suspected to be present in the subject areas, no further action is required. However, given that no destructive testing was conducted, there is a remote possibility that UFFI could be hidden within locations such as exterior wall cavities. If suspect foam insulation is identified during renovation/demolition activities work should be stopped and the area should be re-assessed to evaluate conditions and determine appropriate control measures and worker protection, if necessary.

3.2.2 Biological Hazards

3.2.2.1 Mould Contamination

Table 8: Summary of Mould Site Assessment Recommendations

Basement, Corridor (B-04)	Level of Remediation: 1
Recommendations: • Remove mould-contaminated pipe canvassing (4 LF) within the subject area. • Surface clean all remaining building materials with the use of an antimicrobial solution. All cleaning activities are to be performed using a HEPA-filtered air filtration device. • Implement accelerated drying techniques (i.e. air movement, dehumidification, etc.).	

3.2.2.2 Pest Infestation

No visual evidence of any significant pest infestation was observed in the subject areas. Therefore, no additional precautionary measures are deemed necessary for protection against biological contaminants potentially associated with pest infestation.

3.2.3 Environmental Hazards

3.2.3.1 Polychlorinated Biphenyls (PCBs)

The federal government has set strict regulations for the handling, storage and disposal of PCBs. The PCB Regulations (SOR/2008-273) came into effect on September 5th, 2008 and consolidates and replaces the Chlorobiphenyls Regulations (SOR/91-152) and the Storage of PCB Material Regulations (SOR/92-507). The purpose of the PCB Regulations is to improve the protection of Canada's environment and the health of Canadians by minimizing the risks posed by the use, storage and release of PCBs by accelerating the elimination of these substances.

As of December 31, 2009 all current PCB storage sites are to have been eliminated and there should no longer be any electrical capacitors, electrical transformers, electromagnets, heat transfer equipment or any other equipment in service that contains PCBs at a concentration greater than 500 mg/kg (500 ppm). As of this time, all of this equipment should have been removed from service and sent for destruction. Furthermore, the PCB Regulations restricts the use of equipment containing PCBs (other than light ballasts or pole-top electrical transformers) at concentrations exceeding 50 mg/kg (50 ppm) in sensitive areas (such as drinking water treatment plants, schools, hospitals and senior citizen care facilities) by the same date. All other locations have until December 31, 2025 to decommission equipment containing 50 ppm to 500 ppm PCBs. The assessment confirmed that some of the existing fluorescent light ballasts contain PCB's.

When light fixtures are to be decommissioned all PCB-containing ballasts should be removed and separated from other waste and disposed of as PCB waste at an authorized destruction facility. The PCB content of "assumed PCB-containing" fluorescent light ballasts and HID lamp ballasts should be verified at this time by determining the date of manufacture and other pertinent information by referring to the Environment Canada document entitled "Identification of Lamp Ballasts Containing PCBs" (Report EPS 2/CC/2 (revised) August 1991) to aid in identification.

Existing fluorescent light ballasts are assumed to contain PCBs. When light fixtures are to be decommissioned, all ballasts should be verified at this time by determining the date of manufacture and other pertinent information by referring to the Environment Canada document entitled “Identification of Lamp Ballasts Containing PCBs” (Report EPS 2/CC/2 (revised) August 1991) to aid in identification. Any ballasts that meet the criteria outlined in this document must be treated as PCB containing.

When PCB-containing equipment is taken out of service, jurisdiction falls under provincial regulations. As per R.R.O 1990, Regulation 347, *General - Waste Management*, the land disposal of PCB waste is prohibited. PCB wastes in Ontario are regulated under R.R.O 1990, Regulation 362, *Waste Management – PCBs* (Reg. 362), made under the Environmental Protection Act. Under this regulation, PCB waste is defined as any waste material containing PCBs at a concentration of more than fifty (50) parts per million by weight (i.e. >50mg/kg), with the exception of an electrical capacitor that has never contained over 1 kg of PCB’s. Any PCB-containing equipment taken out of service should be properly handled and disposed of at an authorized destruction facility in accordance with the requirements of Federal Regulation SOR/2008-273 and Reg. 362.

3.2.3.2 Ozone Depleting and Global Warming Substances

Ontario Regulation 463/10, *Ozone Depleting Substances and Other Halocarbons* (O.Reg. 463/10, made under the Environmental Protection Act) controls the use, discharge, sale, transfer, transport, storage and disposal of ozone depleting substances and halocarbons in Ontario. This regulation enhances the control and management of ODS and other halocarbons to prevent or minimize emissions, which serves a dual environmental benefit of lowering emissions of substances that deplete the ozone layer and contribute to global warming.

Three (3) air-conditioning units were noted within the subject areas. These air-conditioning unit will require removal as part of the HVAC Upgrades Project. One (1) small air-conditioning units was noted to contain 13.4oz of the refrigerant R-22, a “class 2” ozone depleting substances.

Further, two (2) air-conditioning units contain 9.8oz of the refrigerant R-32 (HFC-32). Hydrofluorocarbons (HFCs) are not classified as ozone depleting substances but they do have high global-warming potential. Under O.Reg. 463/10 HFCs are classified as halocarbons.

O.Reg. 463/10 restricts the discharge of a class 1 and class 2 ozone depleting substance or a halocarbon into the natural environment or within a building. Servicing and testing of refrigeration equipment should be conducted in accordance with Environment Canada’s “Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems”. This work must be conducted by a certified person who holds a valid Ozone Depletion Prevention (ODP) Certificate. Refrigeration equipment and containers that are to be dismantled and disposed of need to be properly purged of remaining refrigerant by a certified person and a notice must be

affixed to the equipment or container that indicates it no longer contains a refrigerant (in addition to other information required by the regulation).

Any refrigerant that is removed from an air-conditioning unit, heat pump, refrigeration or freezer unit (that is not mobile) is defined as a Stationary Refrigerant Waste under Reg. 347 and must be collected, handled, transported and recycled or disposed of in accordance with the requirements set forth in Sections 30 to 35 of this regulation.

4.0 LIMITATIONS

The information and recommendations detailed in this report were carried out by trained professional and technical staff in accordance with generally accepted environmental and industrial hygiene work practices and procedures. Recommendations provided in this report have been generated in accordance with accepted industry guidelines and practices. These guidelines and practices are considered acceptable as of the date of this report.

In preparation of this report, Safetech relied on information supplied by others, including without limitation, information pertaining to the history and operation of the site, test results and reports of other consultants and testing services provided by independent laboratories. Except as expressly set out in this report, Safetech has not made any independent verification of information provided by independent entities.

The collection of samples at the location noted was consistent with the scope of work agreed-upon with the person or entity to whom this report is addressed and the information obtained concerning prior site investigations. As conditions between samples may vary, the potential remains for the presence of unknown additional contaminants for which there were no known indicators.

The analytical method used for determination of asbestos content meets the requirements of O. Reg. 278/05. However, small asbestos fibres may be missed by PLM due to resolution limitations of the optical microscope. Interfering binder/matrix and/or low asbestos content may also hinder positive identification by PLM. These conditions are common for vermiculite attic insulation (VAI) and non-friable organically bound (NOB) materials such as vinyl floor tiles, roofing materials, mastics and caulking and can lead to “false negative” results. If PLM analytical results for these types of materials indicate no asbestos detected they have been reported as “Presumed Non-ACM”. Due to limitations of the analytical method we cannot confirm that low quantities of asbestos are not present in these samples using solely PLM analysis. Additional analytical procedures should be considered for such materials to rule out false negative results.

Conclusions are based on site conditions at the time of inspection and can only be extrapolated to an undefined limited area around inspected locations. The extent of the limited area depends on building construction and conditions. Building materials that are not detailed within this survey due to inaccessibility during the time of survey and/or are uncovered during renovation/demolition activities should be properly assessed by a

qualified person prior to their disturbance. Safetech cannot warrant against undiscovered environmental liabilities. If any information becomes available that differs from the findings in this report, we request that we be notified immediately to reassess the conclusions provided herein.

No other person or entity is entitled to use or rely upon this report without the express written consent of Safetech and the person or entity to who it is addressed. Any use that a third party makes of this report, or any reliance based on conclusions and recommendations made, are the responsibility of such third parties. Safetech accepts no responsibility for damages suffered by third parties as a result of actions based on this report.

Appendix I: Hazardous Material Inventory Sheet

Building Address:	126 Pape Avenue, Toronto, Ontario	Date(s) of Current DSHM	August 14, 2025
Building Name:	Amelie House	Organization Completing Reassessment:	Safetech Environmental Limited
Original Survey Conducted By:	ECOH Management Inc.		
Date(s) of Original Survey:	July 24, 2007		

NOTES:
Since 2018 the Amelie House and Toronto Paramedic Services (TPS) Station were separated into two different surveys and reports. Locations 1-17 to 1-31 are not included in this survey and are included in the TPS Station 43 report.

Location Number	*Location Name*	*Building System*	*Material Observed*	*Potential Hazardous Material*	*Sample ID*	*Analytical Result*	*Quantity*	*Condition*	*Notes / Recommended Actions*
0-00	Exterior	Roof	Roofing Materials	Asbestos	A0001A-E*	None Detected	N/A	N/A	*Pinchin Project No. 239474
0-00	Exterior	Windows	Window Caulking	Asbestos	A0006A-C*	None Detected	N/A	N/A	White caulking, Second Floor *Pinchin Project No. 266147
0-00	Exterior	Windows	Window Caulking	PCB	PCB1	<0.5ppm	N/A	N/A	White caulking, Second Floor *Pinchin Project No. 266147
0-00	Exterior	Windows	Window Caulking	Asbestos	A0007A-C*	None Detected	N/A	N/A	Off-white caulking, Second Floor *Pinchin Project No. 266147
0-00	Exterior	Windows	Window Caulking	PCB	PCB2	<0.5ppm	N/A	N/A	Off-white caulking, Second Floor *Pinchin Project No. 266147
0-00	Exterior	Windows	Window Caulking	Asbestos	A0008A-C*	None Detected	N/A	N/A	White caulking, Second Floor, Newer metal framed windows *Pinchin Project No. 266147
0-00	Exterior	Windows	Window Caulking	PCB	PCB3	<0.5ppm	N/A	N/A	White caulking, Second Floor, Newer metal framed windows *Pinchin Project No. 266147
0-00	Exterior	Windows	Window Caulking	Asbestos	A0009A-C*	None Detected	N/A	N/A	Cream caulking, Second Floor *Pinchin Project No. 266147
0-00	Exterior	Windows	Window Caulking	Asbestos	A0010A-C*	None Detected	N/A	N/A	Beige caulking, Second Floor *Pinchin Project No. 266147
0-00	Exterior	Windows	Window Caulking	PCB	PCB4	<0.5ppm	N/A	N/A	Beige caulking, Second Floor *Pinchin Project No. 266147
0-00	Exterior	Windows	Window Caulking	Asbestos	A0012A-C*	Abated	50 LF	Good	Previously confirmed Chrysotile This was not observed in the exterior, it was replaced with newer white color caulking
0-00	Exterior	Windows	Window Caulking	PCB	PCB5	<0.5ppm	N/A	N/A	Black caulking, Second Floor *Pinchin Project No. 266147
0-00	Exterior	Windows	Window Caulking	Asbestos	A0013A-C*	None Detected	N/A	N/A	Grey caulking, Second Floor *Pinchin Project No. 266147
0-00	Exterior	Windows	Window Caulking	PCB	PCB6	<0.5ppm	N/A	N/A	Grey caulking, Second Floor *Pinchin Project No. 266147
0-00	Exterior	Windows	Window Caulking	Asbestos	A0014A-C*	None Detected	N/A	N/A	White caulking, Second Floor *Pinchin Project No. 266147
0-00	Exterior	Windows	Window Caulking	PCB	PCB7	<0.5ppm	N/A	N/A	White caulking, Second Floor *Pinchin Project No. 266147
0-00	Exterior	Windows	Window Caulking	Asbestos	A0015A-C*	None Detected	N/A	N/A	White, Ground Floor *Pinchin Project No. 266147
0-00	Exterior	Windows	Window Caulking	PCB	PCB8	<0.5ppm	N/A	N/A	White, Ground Floor *Pinchin Project No. 266147
0-00	Exterior	Windows	Window Caulking	Asbestos	A0016A-C*	None Detected	N/A	N/A	White, Ground Floor *Pinchin Project No. 266147
0-00	Exterior	Windows	Window Caulking	PCB	PCB10	<0.5ppm	N/A	N/A	White, Ground Floor *Pinchin Project No. 266147
0-00	Exterior	Windows	Paint	Lead	L0007*	1.40%	All	Good	Pale yellow on wood window frames *Pinchin File No. 266147
0-00	Exterior	Walls	Brick	Asbestos	14A	None Detected	N/A	N/A	Mortar Safetech DSHM Project No. 1-3250703
0-00	Exterior	Door	Door Caulking	Asbestos	16-3579-07 to 09*	None Detected	N/A	N/A	Cream door and garage door caulking *From Fisher Project No. 16-7662, dated March 2016

0-00	Exterior	Door	Paint	Lead	16-3514-18*	0.02%	N/A	N/A	Eggshell paint *From Fisher Project No.16-7662, dated March 2016
0-00	Exterior	Door	Paint	Lead	16-3579-10*	0.04%	N/A	N/A	Cream paint on exterior garage/door *From Fisher Project No.16-7662, dated March 2016
0-00	Exterior	Roof	Flashing Caulking	Asbestos	8A-8C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
0-00	Exterior	Roof	2-Ply Membrane	Asbestos	9A-9C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
0-00	Exterior	Roof	Paper Barrier	Asbestos	10A-10C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
0-00	Exterior	Roof	Tar Felt	Asbestos	11A-11c	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
B-01	Boiler Room	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
B-01	Boiler Room	Walls	Drywall (DJC)	Asbestos	b59850-002A*	None Detected	N/A	N/A	* From Pre-Construction Sampling Report dated 2009
B-01	Boiler Room	Walls	Brick	N/A	N/A	N/A	N/A	N/A	
B-01	Boiler Room	Walls	Paint	Lead	2019-L0001*	0.074%	N/A	N/A	Beige on brick wall *Pinchin File No. 237110.002
B-01	Boiler Room	Walls	Paint	Lead	15-1143-04*	0.1%	320 SF	Good	Off-white paint *From Fisher Project No. 15-7215, dated February 2015
B-01	Boiler Room	Ceiling	Plaster	Asbestos	b59850-001A-C* 13085-A20-01a**	None Detected	N/A	N/A	* From Pre-Construction Sampling Report dated 2009 ** Sampled during ECOH 2010 Reassessment Survey
B-01	Boiler Room	Ceiling	Drywall (DJC)	Asbestos	3E	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
B-02	Hallway & Stairwell	Floor	Vinyl Floor Tile (VFT13)	Asbestos	Visually Similar to 6A-6C	None Detected	N/A	N/A	VFT13, 12" x 12", off-red with brown streaks Safetech DSHM Project No. 1-3250703
B-02	Hallway & Stairwell	Walls	Drywall (DJC)	Asbestos	3A	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
B-02	Hallway & Stairwell	Walls	Brick	Asbestos	14B	None Detected	N/A	N/A	Mortar, Safetech DSHM Project No. 1-3250703
B-02	Hallway & Stairwell	Ceiling	Drywall (DJC)	Asbestos	Visually Similar to 3A-3G	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
B-02	Hallway & Stairwell	Pipe	Uninsulated	N/A	N/A	N/A	N/A	N/A	
B-03	Washroom	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
B-03	Washroom	Walls	Drywall (DJC)	Asbestos	b59850-002A 14075-A20-01b 15-2681-03 and 04 13085-A20-02c 15-2681-02 b59850-002B and C 16-3514-10	None Detected	N/A	N/A	
B-03	Washroom	Walls	Ceramic	N/A	N/A	N/A	N/A	N/A	
B-03	Washroom	Ceiling	Drywall (DJC)	Asbestos	Visually Similar to 3A-3G	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
B-04	Hallway	Floor	Vinyl Floor Tile (VFT13)	Asbestos	Visually Similar to 6A-6C	None Detected	N/A	N/A	VFT13, 12" x 12", off-red with brown streaks Safetech DSHM Project No. 1-3250703

B-04	Hallway	Walls	Drywall (DJC)	Asbestos	b59850-002A 14075-A20-01b 15-2681-03 and 04 13085-A20-02c 15-2681-02 b59850-002B and C 16-3514-10	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
B-04	Hallway	Walls	Brick	N/A	N/A	N/A	N/A	N/A	
B-04	Hallway	Ceiling	Drywall (DJC)	Asbestos	Visually Similar to 3A-3G	None Detected	N/A	N/A	
B-04	Hallway	Ceiling	Textured Ceiling	Asbestos	1A-1C	2% Chrysotile	80 SF	Good	Safetech DSHM Project No. 1-3250703
B-05	Resource Room	Floor	Vinyl Floor Tile (VFT13)	Asbestos	Visually Similar to 6A-6C	None Detected	N/A	N/A	VFT13, 12" x 12", off-red with brown streaks Safetech DSHM Project No. 1-3250703
B-05	Resource Room	Walls	Brick	N/A	N/A	N/A	N/A	N/A	
B-05	Resource Room	Walls	Drywall (DJC)	Asbestos	b59850-002A 14075-A20-01b 15-2681-03 and 04 13085-A20-02c 15-2681-02 b59850-002B and C 16-3514-10	None Detected	N/A	N/A	
B-05	Resource Room	Ceiling	Drywall (DJC)	Asbestos	Visually Similar to 3A-3G	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
B-05	Resource Room	Pipe	Fibreglass	N/A	N/A	N/A	N/A	N/A	
B-06	Laundry	Floor	Vinyl Floor Tile (VFT13)	Asbestos	Visually Similar to 6A-6C	None Detected	N/A	N/A	VFT13, 12" x 12", off-red with brown streaks Safetech DSHM Project No. 1-3250703
B-06	Laundry	Walls	Brick/Block	N/A	N/A	N/A	N/A	N/A	
B-06	Laundry	Walls	Paint	Lead	L0002*	<0.0071%	N/A	N/A	Blue paint on brick wal *Pinchin File No. 266147
B-06	Laundry	Walls	Paint	Lead	15-2681-08*	0.01%	N/A	N/A	NOT OBSERVED Green paint on concrete block *From Fisher Project No. 15-7315, dated October 2015
B-06	Laundry	Pipe	Paint	Lead	15-2681-09*	0.004%	N/A	N/A	NOT OBSERVED Green paint on metal pipe *From Fisher Project No. 15-7315, dated October 2015
B-06	Laundry	Walls	Drywall (DJC)	Asbestos	Visually Similar to 3A-3G	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
B-06	Laundry	Ceiling	Drywall (DJC)	Asbestos	Visually Similar to 3A-3G	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
B-06	Laundry	Pipe	Fibreglass	N/A	N/A	N/A	N/A	N/A	
B-06	Laundry	Duct	Uninsulated	N/A	N/A	N/A	N/A	N/A	
B-07	Kitchen/Dining Room	Floor	Vinyl Floor Tile (VFT13)	Asbestos	Visually Similar to 6A-6C	None Detected	N/A	N/A	VFT13, 12" x 12", off-red with brown streaks Safetech DSHM Project No. 1-3250703
B-07	Kitchen/Dining Room	Walls	Plaster	Asbestos	Visually Similar to 2A-2C	None Detected	560 SF	Good	
B-07	Kitchen/Dining Room	Walls	Drywall (DJC)	Asbestos	14075-A20-01b* A0001C**	None Detected	N/A	N/A	* Sampled during ECOH 2012 Reassessment Survey ** Pinhin Project No. 266147
B-07	Kitchen/Dining Room	Walls	Wood	N/A	N/A	N/A	N/A	N/A	
B-07	Kitchen/Dining Room	Ceiling	Plaster	Asbestos	b59850-001A to C 13085-A20-01a	None Detected	N/A	N/A	
B-07	Kitchen/Dining Room	Ceiling	Drywall (DJC)	Asbestos	A0002C*	None Detected	N/A	N/A	*Pinchin Project No. 266147
B-08	Pantry	Floor	Vinyl Floor Tile (VFT13)	Asbestos	Visually Similar to 6A-6C	None Detected	N/A	N/A	VFT13, 12" x 12", off-red with brown streaks Safetech DSHM Project No. 1-3250703

B-08	Pantry	Walls	Drywall (DJC)	Asbestos	A0001A-B*	None Detected	N/A	N/A	*Pinchin Project No. 266147
B-08	Pantry	Walls	Paint	Lead	L0003*	<0.0072%	N/A	N/A	Blue on drywall wall *Pinchin File No. 266147
B-08	Pantry	Ceiling	Drywall (DJC)	Asbestos	A0002A-B*	None Detected	N/A	N/A	*Pinchin Project No. 266147
B-08	Pantry	Walls	Paint	Lead	L0004*	<0.0052%	N/A	N/A	White on drywall ceiling *Pinchin File No. 266147
B-08	Pantry	Pipe	Uninsulated	N/A	N/A	N/A	N/A	N/A	
B-09	Storage Room	Floor	Vinyl Floor Tile (VFT13)	Asbestos	Visually Similar to 6A-6C	None Detected	N/A	N/A	VFT13, 12" x 12", off-red with brown streaks Safetech DSHM Project No. 1-3250703
B-09	Storage Room	Walls	Drywall (DJC)	Asbestos	Visually Similar to 2A-2C	None Detected	120 SF	Good	
B-09	Storage Room	Walls	Brick	N/A	N/A	N/A	N/A	N/A	
B-09	Storage Room	Ceiling	Drywall (DJC)	Asbestos	Visually Similar to 3A-3G	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
B-09	Storage Room	Pipe	Uninsulated	N/A	N/A	N/A	N/A	N/A	
B-10	Electrical Room	Floor	Vinyl Floor Tile (VFT13)	Asbestos	Visually Similar to 6A-6C	None Detected	N/A	N/A	VFT13, 12" x 12", off-red with brown streaks Safetech DSHM Project No. 1-3250703
B-10	Electrical Room	Walls	Brick	Asbestos	14C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
B-10	Electrical Room	Walls	Drywall (DJC)	Asbestos	Visually Similar to 3A-3G	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
B-10	Electrical Room	Ceiling	Drywall (DJC)	Asbestos	Visually Similar to 3A-3G	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
C-01	Crawlspace	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**No Access to Room**
1-01	Entrance Vestibule	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
1-01	Entrance Vestibule	Walls	Plaster	Asbestos	Visually Similar to 2A-2C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
1-01	Entrance Vestibule	Ceiling	Plaster	Asbestos	16-3579-01 to 03 13-5544-01 to 03 16-3514-13 to 15	None Detected	N/A	N/A	
1-01	Entrance Vestibule	Pipe	Uninsulated	N/A	N/A	N/A	N/A	N/A	
1-02	Office	Floor	Vinyl Floor Tile (VFT06)	Asbestos	15-2681-05 to 07	None Detected	N/A	N/A	VFT06, 12" x 12", Grey Mosaic
1-02	Office	Walls	Plaster	Asbestos	A0003A*	None Detected	N/A	N/A	*Pinchin Project No. 266147
1-02	Office	Ceiling	Plaster	Asbestos	16-3579-01 to 03 13-5544-01 to 03 16-3514-13 to 15	None Detected	N/A	N/A	
1-02	Office	Pipe	Uninsulated	N/A	N/A	N/A	N/A	N/A	
1-03	Main Lobby	Floor	Vinyl Floor Tile (VFT06)	Asbestos	15-2681-05*	None Detected	N/A	N/A	VFT06, 12" x 12", Grey Mosaic *From Fisher Project No. 15-7315, dated October 2015
1-03	Main Lobby	Walls	Plaster	Asbestos	Visually Similar to 2A-2C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
1-03	Main Lobby	Walls	Drywall (DJC)	Asbestos	15-2681-03 and 04*	None Detected	N/A	N/A	*From Fisher Project No. 15-7315, dated October 2015
1-03	Main Lobby	Ceiling	Plaster	Asbestos	16-3579-01 to 03 13-5544-01 to 03 16-3514-13 to 15	None Detected	N/A	N/A	
1-04	Library	Floor	Vinyl Floor Tile (VFT06)	Asbestos	15-2681-05 to 07	None Detected	N/A	N/A	VFT06, 12" x 12", Grey Mosaic
1-04	Library	Walls	Plaster	Asbestos	Visually Similar to 2A-2C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703

1-04	Library	Walls	Drywall (DJC)	Asbestos	b59850-002A 14075-A20-01b 15-2681-03 and 04 13085-A20-02c 15-2681-02 b59850-002B and C 16-3514-10	None Detected	N/A	N/A	
1-04	Library	Walls	Paint	Lead	L0005*	0.021%	N/A	Good	Yellow on drywall wall *Pinchin File No. 266147
1-04	Library	Walls	Paint	Lead	L0001*	0.19%	10 SF	Good	White, wood windowsil *Pinchin File No. 266147
1-04	Library	Ceiling	Plaster	Asbestos	16-3579-01 to 03 13-5544-01 to 03 16-3514-13 to 15	None Detected	N/A	N/A	
1-04	Library	Pipe	Uninsulated	N/A	N/A	N/A	N/A	N/A	
1-05	Bedroom	Floor	Vinyl Floor Tile (VFT11)	Asbestos	15-1141-01 to 03	Chrysotile	100 SF	Good	VFT11, 12" x 12", Red
1-05	Bedroom	Walls	Drywall (DJC)	Asbestos	A0004A*	None Detected	N/A	N/A	*Pinchin Project No. 266147
1-05	Bedroom	Walls	Plaster	Asbestos	Visually Similar to 2A-2C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
1-05	Bedroom	Ceiling	Plaster	Asbestos	16-3579-01 to 03 13-5544-01 to 03 16-3514-13 to 15	None Detected	N/A	N/A	
1-06	Hallway	Floor	Vinyl Floor Tile (VFT06)	Asbestos	15-2681-07*	None Detected	N/A	N/A	VFT06, 12" x 12", Grey Mosaic *From Fisher Project No. 15-7315, dated October 2015
1-06	Hallway	Walls	Drywall (DJC)	Asbestos	13085-A20-02c*	None Detected	N/A	N/A	* Sampled during ECOH 2010 Reassessment Survey
1-06	Hallway	Ceiling	Drywall (DJC)	Asbestos	3G	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
1-06	Hallway	Pipe	Uninsulated	N/A	N/A	N/A	N/A	N/A	
1-07	Closet	Floor	Vinyl Floor Tile (VFT06)	Asbestos	15-2681-05 to 07	None Detected	N/A	N/A	VFT06, 12" x 12", Grey Mosaic
1-07	Closet	Floor	Vinyl Floor Tile (VFT11)	Asbestos	15-1143-01 to 03	0.5-5% Chrysotile	12 SF	Good	VFT11, 12" x 12", Red * Assumed present underneath VFT06
1-07	Closet	Walls	Drywall (DJC)	Asbestos	b59850-002A 14075-A20-01b 15-2681-03 and 04 13085-A20-02c 15-2681-02 b59850-002B and C 16-3514-10	None Detected	N/A	N/A	
1-07	Closet	Walls	Paint	Lead	15-2681-01*	0.004%	N/A	N/A	Not observed during 2020 survey Blue paint *From Fisher Project No. 15-7315, dated October 2015
1-07	Closet	Ceiling	Drywall (DJC)	Asbestos	Visually Similar to 3A-3G	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
1-07	Closet	Pipe	Uninsulated	N/A	N/A	N/A	N/A	N/A	
1-08	Washroom	Floor	Vinyl Floor Tile (VFT12)	Asbestos	2019-A0001A-C*	None Detected	N/A	N/A	VFT12, 12" x 12", Beige Mosaic *Pinchin Project No. 237110.002
1-08	Washroom	Walls	Drywall (DJC)	Asbestos	A0004C*	None Detected	N/A	N/A	*Pinchin Project No. 266147
1-08	Washroom	Walls	Plaster	Asbestos	Visually Similar to 2A-2C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
1-08	Washroom	Ceiling	Drywall (DJC)	Asbestos	Visually Similar to 3A-3G	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
1-09	Bedroom	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	

1-09	Bedroom	Walls	Drywall (DJC)	Asbestos	b59850-002A 14075-A20-01b 15-2681-03 and 04 13085-A20-02c 15-2681-02 b59850-002B and C 16-3514-10	None Detected	N/A	N/A	
1-09	Bedroom	Walls	Plaster	Asbestos	Visually Similar to 2A-2C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
1-09	Bedroom	Walls	Brick	N/A	N/A	N/A	N/A	N/A	
1-09	Bedroom	Ceiling	Drywall (DJC)	Asbestos	Visually Similar to 3A-3G	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
1-10	Bedroom	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-10	Bedroom	Walls	Drywall (DJC)	Asbestos	b59850-002A 14075-A20-01b 15-2681-03 and 04 13085-A20-02c 15-2681-02 b59850-002B and C 16-3514-10	None Detected	N/A	N/A	
1-10	Bedroom	Walls	Plaster	Asbestos	Visually Similar to 2A-2C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
1-10	Bedroom	Ceiling	Drywall (DJC)	Asbestos	Visually Similar to 2A-2C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
1-11	Bedroom	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-11	Bedroom	Walls	Drywall (DJC)	Asbestos	b59850-002A 14075-A20-01b 15-2681-03 and 04 13085-A20-02c 15-2681-02 b59850-002B and C 16-3514-10	None Detected	N/A	N/A	
1-11	Bedroom	Walls	Plaster	Asbestos	Visually Similar to 2A-2C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
1-11	Bedroom	Ceiling	Drywall (DJC)	Asbestos	Visually Similar to 3A-3G	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
1-12	Bedroom	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-12	Bedroom	Walls	Brick	N/A	N/A	N/A	N/A	N/A	
1-12	Bedroom	Walls	Drywall (DJC)	Asbestos	15-2681-02* A0004B**	None Detected	N/A	N/A	*From Fisher Project No. 15-7315, dated October 2015 **Pinchin File No. 266147
1-12	Bedroom	Ceiling	Drywall (DJC)	Asbestos	Visually Similar to 3A-3G	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
1-13	Shower	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
1-13	Shower	Walls	Ceramic	N/A	N/A	N/A	N/A	N/A	
1-13	Shower	Ceiling	Ceramic	N/A	N/A	N/A	N/A	N/A	
1-14	Shower	Floor	Ceramic	Asbestos	Visually Similar to 13A-13C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
1-14	Shower	Walls	Ceramic	Asbestos	Visually Similar to 12A-12C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
1-14	Shower	Ceiling	Ceramic	N/A	N/A	N/A	N/A	N/A	
1-15	Office/Supply Room	Floor	Carpet	N/A	N/A	N/A	N/A	N/A	
1-15	Office/Supply Room	Walls	Brick	N/A	N/A	N/A	N/A	N/A	

1-15	Office/Supply Room	Walls	Drywall (DJC)	Asbestos	b59850-002A 14075-A20-01b 15-2681-03 and 04 13085-A20-02c 15-2681-02 b59850-002B and C 16-3514-10	None Detected	N/A	N/A	
1-15	Office/Supply Room	Ceiling	Drywall (DJC)	Asbestos	Visually Similar to 3A-3G	None Detected	N/A	N/A	
1-15	Office/Supply Room	Pipe	Uninsulated	N/A	N/A	N/A	N/A	N/A	
1-16	Stairwell	Floor	Vinyl Floor Tile (VFT06)	Asbestos	15-2681-05 to 07	None Detected	N/A	N/A	VT06, 12" x 12", Grey Mosaic
1-16	Stairwell	Floor	Vinyl Floor Tile (VFT14)	Asbestos	5A-5C	None Detected	N/A	N/A	VFT14, 12" x 12", off-white with black flecks Safetech DSHM Project No. 1-3250703
1-16	Stairwell	Floor	Vinyl Floor Tile (VFT15)	Asbestos	4A-4C	None Detected	N/A	N/A	VFT15 12" x 12", white with grey flecks Safetech DSHM Project No. 1-3250703
1-16	Stairwell	Walls	Plaster	Asbestos	A0005A* 2C	None Detected	N/A	N/A	*Pinchin Project No. 266147 Safetech DSHM Project No. 1-3250703
1-16	Stairwell	Ceiling	Plaster	Asbestos	16-3579-01 to 03 13-5544-01 to 03 16-3514-13 to 15	None Detected	N/A	N/A	
1-16	Stairwell	Pipe	Uninsulated	N/A	N/A	N/A	N/A	N/A	
2-01	Hallway	Floor	Vinyl Floor Tile (VFT09)	Asbestos	2018-A0001A-C*	0.5-5% Chrysotile	255 SF	Good	VFT09, 12" x 12", Yellow with White Streaks and non-asbestos black mastic *Pinchin 2018 Survey
2-01	Hallway	Floor	Vinyl Floor Tile (VFT11)	Asbestos	15-1143-01 to 03	0.5-5% Chrysotile	50 SF	Good	VFT11, 12" x 12", Red Present on stairs leading to fire exit
2-01	Hallway	Floor	Vinyl Floor Tile (VFT12)	Asbestos	2019-A0001A-C*	None Detected	N/A	N/A	VFT12, 12" x 12", Beige Mosaic *Pinchin Project No. 237110.001
2-01	Hallway	Walls	Plaster	Asbestos	2B	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
2-01	Hallway	Walls	Paint	Lead	L-03	<0.0064	N/A	N/A	Safetech DSHM Project No. 1-3250703
2-01	Hallway	Ceiling	Plaster	Asbestos	2A	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
2-01	Hallway	Ceiling	Paint	Lead	L-02	0.073	700 SF	Fair	Safetech DSHM Project No. 1-3250703
2-02	Office	Floor	Vinyl Floor Tile (VFT09)	Asbestos	2018-A0001A-C	0.5-5% Chrysotile	310 SF	Unknown	**No Access to Room** VFT09, 12" x 12", Yellow with White Streaks and non-asbestos black mastic
2-02	Office	Walls	Plaster	Asbestos	A0005B*	None Detected	N/A	N/A	**No Access to Room** *Pinchin Project No. 266147
2-02	Office	Ceiling	Plaster	Asbestos	N/A	N/A	310 SF	Unknown	**No Access to Room**
2-02	Office	Pipe	Uninsulated	N/A	N/A	N/A	N/A	N/A	**No Access to Room**
2-03	Bedroom	Floor	Vinyl Floor Tile (VFT09)	Asbestos	2018-A0001A-C	0.5-5% Chrysotile	145 SF	Good	VFT09, 12" x 12", Yellow with White Streaks and non-asbestos black mastic
2-03	Bedroom	Walls	Plaster	Asbestos	Visually Similar to 2A-2C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
2-03	Bedroom	Walls	Paint	Lead	L0008*	0.43%	10 SF	Good	White, wood windowsil *Pinchin File No. 266147
2-03	Bedroom	Ceiling	Plaster	Asbestos	Visually Similar to 2A-2C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
2-04	Lounge	Floor	Vinyl Floor Tile (VFT09)	Asbestos	2018-A0001A-C	0.5-5% Chrysotile	340 SF	Good	VFT09, 12" x 12", Yellow with White Streaks and non-asbestos black mastic
2-04	Lounge	Walls	Plaster	Asbestos	A0005D*	None Detected	N/A	N/A	*Pinchin Project No. 266147
2-04	Lounge	Ceiling	Plaster	Asbestos	Visually Similar to 2A-2C	None Detected	340 SF	Good	
2-04	Lounge	Pipe	Uninsulated	N/A	N/A	N/A	N/A	N/A	

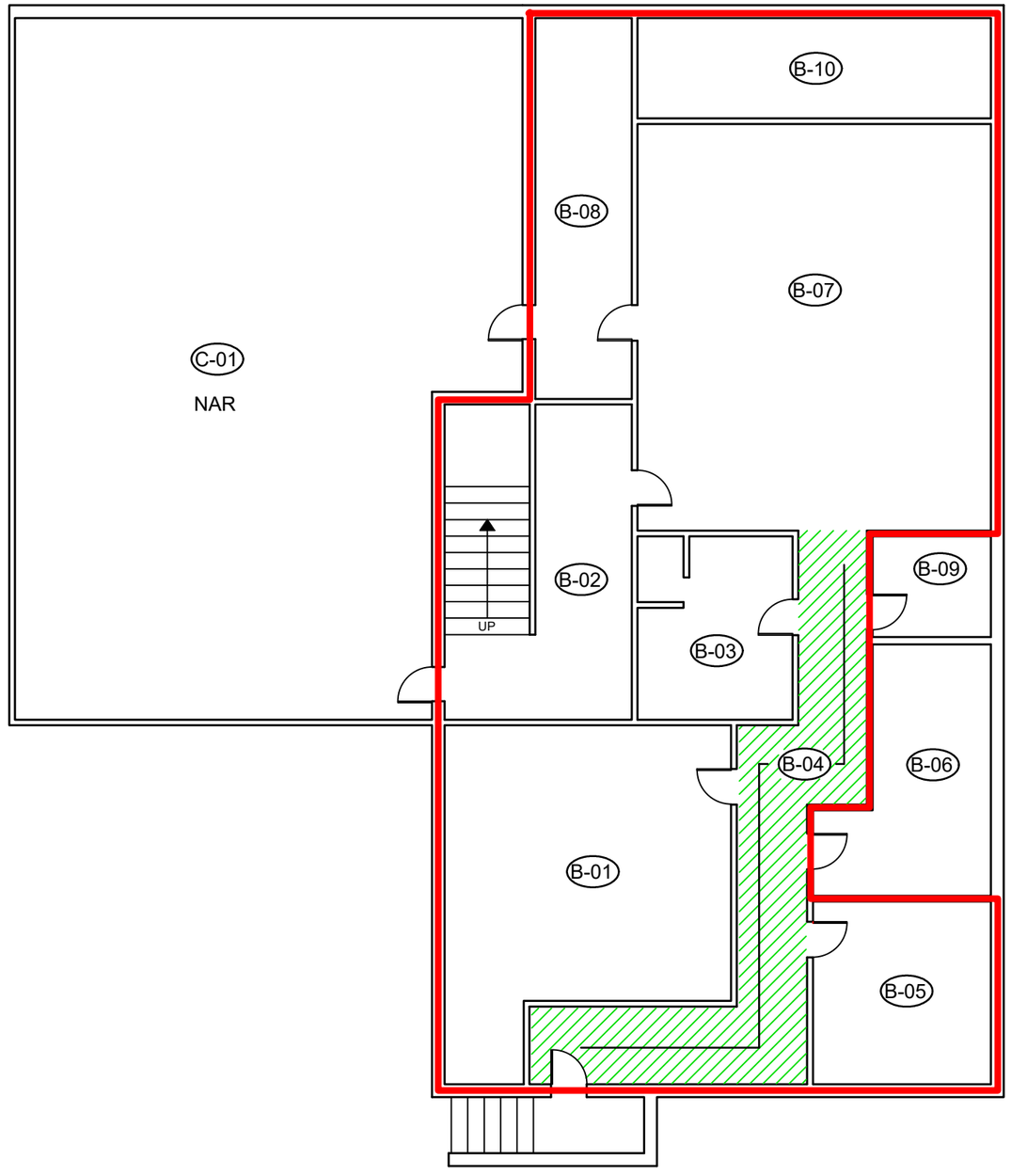
2-05	Washroom	Floor	Ceramic	Asbestos	Visually Similar to 13A-13C	None Detected	N/A	N/A	Grout, Safetech DSHM Project No. 1-3250703
2-05	Washroom	Walls	Plaster	Asbestos	Visually Similar to 2A-2C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
2-05	Washroom	Walls	Ceramic	Asbestos	Visually Similar to 13A-13C	None Detected	N/A	N/A	Grout, Safetech DSHM Project No. 1-3250703
2-05	Washroom	Ceiling	Plaster	Asbestos	Visually Similar to 2A-2C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
2-05	Washroom	Pipe	Uninsulated	N/A	N/A	N/A	N/A	N/A	
2-06	Bedroom	Floor	Vinyl Floor Tile (VFT09)	Asbestos	2018-A0001A-C	0.5-5% Chrysotile	125 SF	Good	VFT09, 12" x 12", Yellow with White Streaks and non-asbestos black mastic
2-06	Bedroom	Walls	Plaster	Asbestos	Visually Similar to 2A-2C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
2-06	Bedroom	Ceiling	Plaster	Asbestos	Visually Similar to 2A-2C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
2-07	Bedroom	Floor	Vinyl Floor Tile (VFT09)	Asbestos	2018-A0001A-C	0.5-5% Chrysotile	405 SF	Good	VFT09, 12" x 12", Yellow with White Streaks and non-asbestos black mastic
2-07	Bedroom	Walls	Plaster	Asbestos	A0005C*	None Detected	N/A	N/A	*Pinchin Project No. 266147
2-07	Bedroom	Walls	Paint	Lead	L0006*	0.24%	500 SF	Good	Yellow on plaster wall *Pinchin File No. 266147
2-07	Bedroom	Ceiling	Plaster	Asbestos	S0001A-C	None-Detected	405 SF	Good	2024/b317670-S0001A-C (2 DJC samples - 2024/b317670-S0001B-C phase c)
2-07	Bedroom	Ceiling	Plaster	Lead	L0001	2.60%	405 SF	Good	White paint on non-asbestos plaster 2024-C4K4852
2-08	Washroom Hallway	Floor	Ceramic	Asbestos	13A-13C	None Detected	N/A	N/A	Grout, Safetech DSHM Project No. 1-3250703
2-08	Washroom Hallway	Walls	Plaster	Asbestos	Visually Similar to 2A-2C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
2-08	Washroom Hallway	Ceiling	Plaster	Asbestos	Visually Similar to 2A-2C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
2-09	Closet	Floor	Vinyl Floor Tile (VFT09)	Asbestos	2018-A0001A-C	0.5-5% Chrysotile	10 SF	Good	VFT09, 12" x 12", Yellow with White Streaks and non-asbestos black mastic
2-09	Closet	Walls	Plaster	Asbestos	Visually Similar to 2A-2C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
2-09	Closet	Ceiling	Plaster	Asbestos	Visually Similar to 2A-2C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
2-10	Bedroom	Floor	Vinyl Floor Tile (VFT09)	Asbestos	2018-A0001A-C	0.5-5% Chrysotile	100 SF	Good	VFT09, 12" x 12", Yellow with White Streaks and non-asbestos black mastic
2-10	Bedroom	Walls	Plaster	Asbestos	A0005E*	None Detected	N/A	N/A	*Pinchin Project No. 266147
2-10	Bedroom	Ceiling	Plaster	Asbestos	Visually Similar to 2A-2C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
2-11	Bedroom	Floor	Vinyl Floor Tile (VFT09)	Asbestos	2018-A0001A-C	0.5-5% Chrysotile	255 SF	Good	VFT09, 12" x 12", Yellow with White Streaks and non-asbestos black mastic
2-11	Bedroom	Walls	Plaster	Asbestos	Visually Similar to 2A-2C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
2-11	Bedroom	Ceiling	Plaster	Asbestos	Visually Similar to 2A-2C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
2-12	Washroom	Floor	Ceramic	Asbestos	Visually Similar to 13A-13C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
2-12	Washroom	Walls	Drywall (DJC)	Asbestos	Visually Similar to 3A-3G	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
2-12	Washroom	Ceiling	Drywall (DJC)	Asbestos	Visually Similar to 3A-3G	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
2-13	Staff Washroom	Floor	Ceramic	N/A	Visually Similar to 13A-13C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
2-13	Staff Washroom	Walls	Drywall (DJC)	Asbestos	Visually Similar to 3A-3G	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
2-13	Staff Washroom	Ceiling	Drywall (DJC)	Asbestos	Visually Similar to 3A-3G	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
2-14	Washroom	Floor	Ceramic	Asbestos	Visually Similar to 13A-13C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703

2-14	Washroom	Walls	Drywall (DJC)	Asbestos	Visually Similar to 3A-3G	None Detected	N/A	N/A	
2-14	Washroom	Walls	Ceramic	Asbestos	12A-12C	None Detected	N/A	N/A	Safetech DSHM Project No. 1-3250703
2-14	Washroom	Ceiling	Drywall (DJC)	Asbestos	Visually Similar to 3A-3G	None Detected	N/A	N/A	
2-14	Washroom	Duct	Uninsulated	N/A	N/A	N/A	N/A	N/A	

Appendix II: Site Drawings

LEGEND

- Assumed/Confirmed ACM
- B09 — Location Number
- NAR — No Access to Room
- Areas Assessed



1) THIS FLOOR PLAN MUST BE READ IN CONJUNCTION WITH THE DESIGNATED SUBSTANCE AND HAZARDOUS MATERIALS ASSESSMENT REPORT.
2) NOT ALL ASBESTOS-CONTAINING MATERIALS ARE INDICATED IN THE FLOOR PLAN. REFER TO THE DESIGNATED SUBSTANCE AND HAZARDOUS MATERIALS REPORT FOR FURTHER DETAILS.
3) REMOVAL OR DISTURBANCE OF ASBESTOS-CONTAINING BUILDING MATERIALS MUST BE CONDUCTED IN ACCORDANCE WITH ONTARIO REGULATION 278/05 "DESIGNATED SUBSTANCE-ASBESTOS ON CONSTRUCTION PROJECTS AND IN BUILDINGS AND REPAIR OPERATIONS".

BASEMENT

HVAC UPGRADES PROJECT

126 PAPE AVENUE
TORONTO, ON

DRAWING NO.
DS-1

DATE: AUGUST 8, 2025

SAFETECH PROJECT NO.
1-3250703

safeTECH ENVIRONMENTAL LTD.
3045 SOUTHCREEK ROAD, UNIT 14
MISSISSAUGA, ONTARIO
L4X 2X7

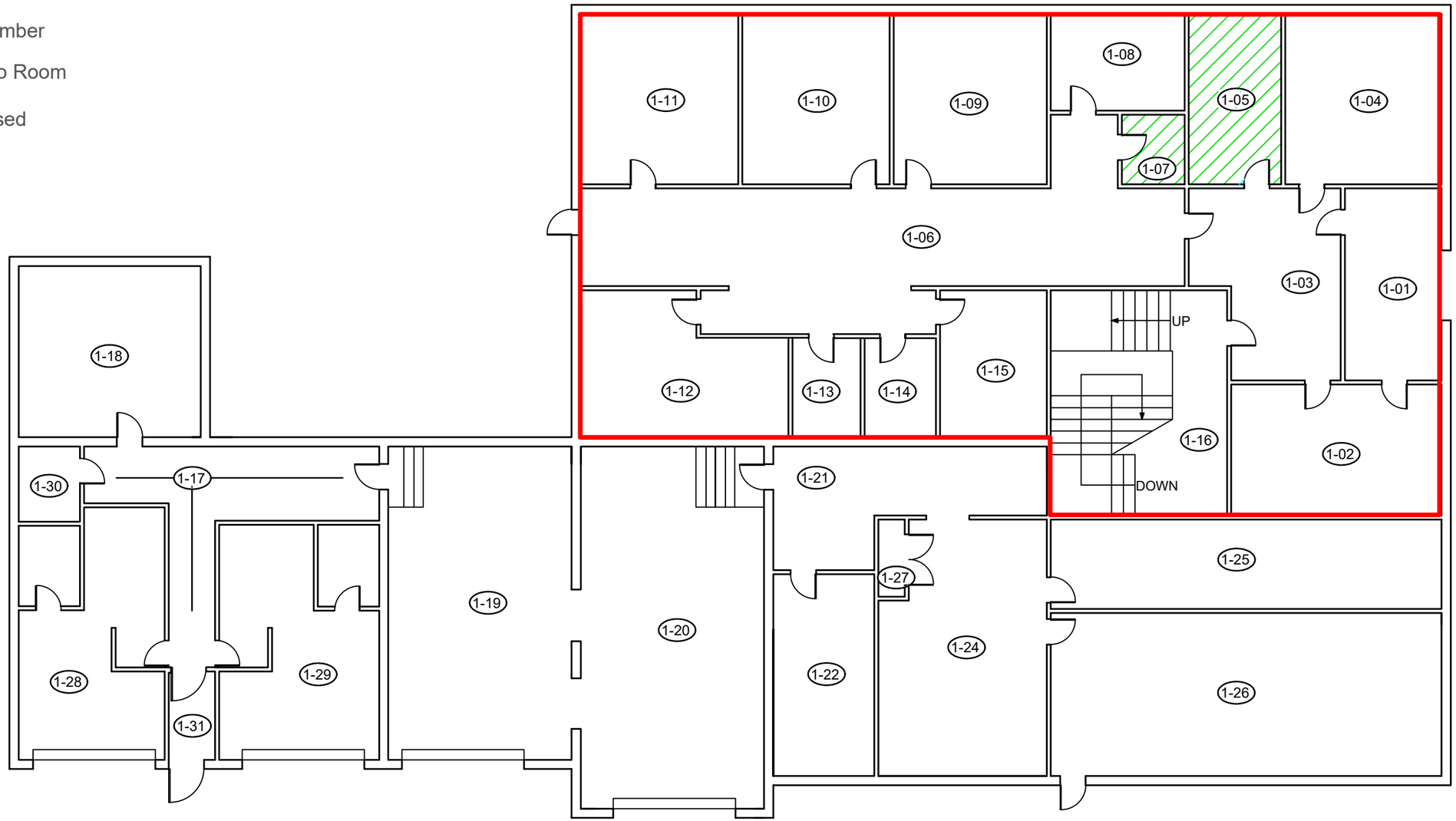
LEGEND

Assumed/Confirmed ACM

B09 Location Number

NAR No Access to Room

Area Assessed



1) THIS FLOOR PLAN MUST BE READ IN CONJUNCTION WITH THE DESIGNATED SUBSTANCE AND HAZARDOUS MATERIALS ASSESSMENT REPORT.
2) NOT ALL ASBESTOS-CONTAINING MATERIALS ARE INDICATED IN THE FLOOR PLAN. REFER TO THE DESIGNATED SUBSTANCE AND HAZARDOUS MATERIALS REPORT FOR FURTHER DETAILS.
3) REMOVAL OR DISTURBANCE OF ASBESTOS-CONTAINING BUILDING MATERIALS MUST BE CONDUCTED IN ACCORDANCE WITH ONTARIO REGULATION 278/05 "DESIGNATED SUBSTANCE-ASBESTOS ON CONSTRUCTION PROJECTS AND IN BUILDINGS AND REPAIR OPERATIONS".

1ST FLOOR

HVAC UPGRADES PROJECT

126 PAPE AVENUE
TORONTO, ON

DRAWING NO.

DS-2

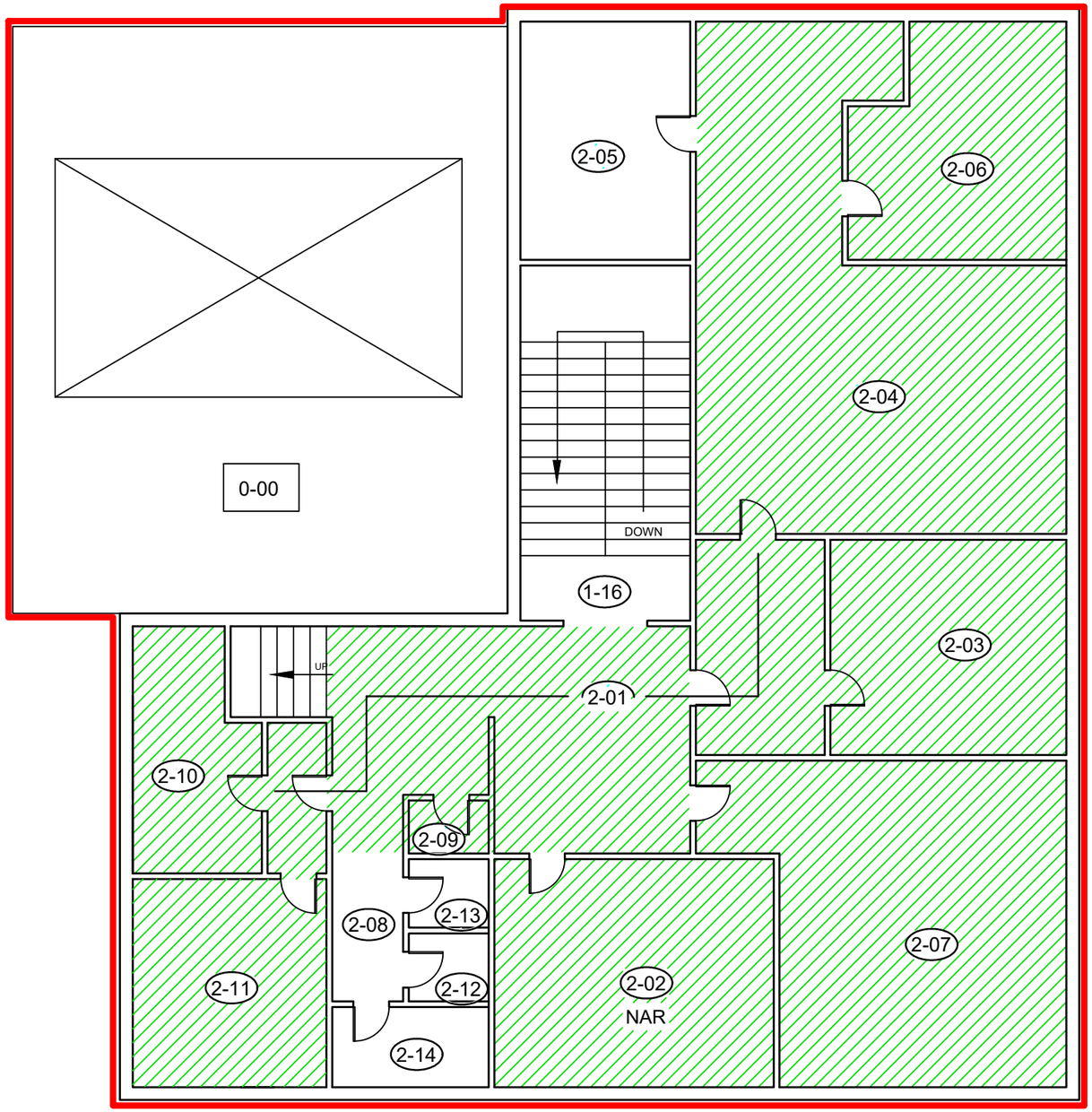
DATE: AUGUST 8, 2025

SAFETECH PROJECT NO.
1-3250703

safeTECH ENVIRONMENTAL LTD.
3045 SOUTHCREEK ROAD, UNIT 14
MISSISSAUGA, ONTARIO
L4X 2X7

LEGEND

- Assumed/Confirmed ACM
- B09 — Location Number
- NAR — No Access to Room
- Area Assessed



1) THIS FLOOR PLAN MUST BE READ IN CONJUNCTION WITH THE DESIGNATED SUBSTANCE AND HAZARDOUS MATERIALS ASSESSMENT REPORT.
2) NOT ALL ASBESTOS-CONTAINING MATERIALS ARE INDICATED IN THE FLOOR PLAN. REFER TO THE DESIGNATED SUBSTANCE AND HAZARDOUS MATERIALS REPORT FOR FURTHER DETAILS.
3) REMOVAL OR DISTURBANCE OF ASBESTOS-CONTAINING BUILDING MATERIALS MUST BE CONDUCTED IN ACCORDANCE WITH ONTARIO REGULATION 278/05 "DESIGNATED SUBSTANCE-ASBESTOS ON CONSTRUCTION PROJECTS AND IN BUILDINGS AND REPAIR OPERATIONS".

2ND FLOOR/LOWER ROOF

HVAC UPGRADES PROJECT

126 PAPE AVENUE
TORONTO, ON

DRAWING NO.

DS-3

DATE: AUGUST 8, 2025

SAFETECH PROJECT NO.
1-3250703

safeTECH ENVIRONMENTAL LTD.
3045 SOUTHCREEK ROAD, UNIT 14
MISSISSAUGA, ONTARIO
L4X 2X7

Appendix III: Laboratory Certificate of Analysis – Asbestos

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: (289) 997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

EMSL Canada Order 552514282
Customer ID: 55SELI62
Customer PO: 1-3250703
Project ID:

Attn: Jason King
Safetech Environmental Limited
3045 Southcreek Road
Unit 14
Mississauga, ON L4X 2X7

Proj: 126 Pape Ave/ 1-3250703

Phone: (905) 624-2722
Fax: (905) 624-4306
Collected: 7/11/2025
Received: 8/13/2025
Analyzed: 8/14/2025

Summary Test Report for Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05

Client Sample ID: 1a-Texture **Lab Sample ID:** 552514282-0001
Sample Description: Basement, Corridor (B-04)/Textured Ceiling

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Beige	0.0%	98.0%	2% Chrysotile	

Client Sample ID: 1a-Joint Compound **Lab Sample ID:** 552514282-0001A
Sample Description: Basement, Corridor (B-04)/Textured Ceiling

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Beige	0.0%	100.0%	None Detected	

Client Sample ID: 1b-Texture **Lab Sample ID:** 552514282-0002
Sample Description: Basement, Corridor (B-04)/Textured Ceiling

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 1b-Joint Compound **Lab Sample ID:** 552514282-0002A
Sample Description: Basement, Corridor (B-04)/Textured Ceiling

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Beige	0.0%	100.0%	None Detected	

Client Sample ID: 1c-Texture **Lab Sample ID:** 552514282-0003
Sample Description: Basement, Corridor (B-04)/Textured Ceiling

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025				Positive Stop (Not Analyzed)	

Client Sample ID: 1c-Joint Compound **Lab Sample ID:** 552514282-0003A
Sample Description: Basement, Corridor (B-04)/Textured Ceiling

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Beige	0.0%	100.0%	None Detected	

Client Sample ID: 2a-Skim Coat **Lab Sample ID:** 552514282-0004
Sample Description: Second Floor, Corridor (2-01)/Smooth Plaster Ceiling

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	White	0.0%	100.0%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: (289) 997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

EMSL Canada Order 552514282
Customer ID: 55SELI62
Customer PO: 1-3250703
Project ID:

Summary Test Report for Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05

Client Sample ID: 2a-Rough Coat ***Lab Sample ID:*** **552514282-0004A**
Sample Description: Second Floor, Corridor (2-01)/Smooth Plaster Ceiling

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 2b-Joint Compound ***Lab Sample ID:*** **552514282-0005**
Sample Description: Second Floor, Corridor (2-01)/Smooth Plaster Wall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Beige	0.0%	100.0%	None Detected	

Client Sample ID: 2b-Skim Coat ***Lab Sample ID:*** **552514282-0005A**
Sample Description: Second Floor, Corridor (2-01)/Smooth Plaster Wall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 2b-Rough Coat ***Lab Sample ID:*** **552514282-0005B**
Sample Description: Second Floor, Corridor (2-01)/Smooth Plaster Wall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 2c-Skim Coat ***Lab Sample ID:*** **552514282-0006**
Sample Description: Second Floor, Stairwell (1-16)/Smooth Plaster Wall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 2c-Rough Coat ***Lab Sample ID:*** **552514282-0006A**
Sample Description: Second Floor, Stairwell (1-16)/Smooth Plaster Wall

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 3a ***Lab Sample ID:*** **552514282-0007**
Sample Description: Basement, Stairwell/Hallway (B-02)/Drywall Joint Compound (Wall)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Beige	0.0%	100.0%	None Detected	

Client Sample ID: 3b ***Lab Sample ID:*** **552514282-0008**
Sample Description: Basement, Corridor (B-04)/Drywall Joint Compound (Wall)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Beige	0.0%	100.0%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: (289) 997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

EMSL Canada Order 552514282
Customer ID: 55SELI62
Customer PO: 1-3250703
Project ID:

Summary Test Report for Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05

Client Sample ID: 3c ***Lab Sample ID:*** **552514282-0009**

Sample Description: Basement, Kitchen (B-07)/Drywall Joint Compound (Wall)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 3d ***Lab Sample ID:*** **552514282-0010**

Sample Description: Basement, Kitchen (B-07)/Drywall Joint Compound (Ceiling)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 3e ***Lab Sample ID:*** **552514282-0011**

Sample Description: Basement, Boiler Room (B-01)/Drywall Joint Compound (Ceiling)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 3f ***Lab Sample ID:*** **552514282-0012**

Sample Description: First Floor, Main Lobby (1-03)/Drywall Joint Compound (Ceiling)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Beige	0.0%	100.0%	None Detected	

Client Sample ID: 3g ***Lab Sample ID:*** **552514282-0013**

Sample Description: First Floor, Corridor (1-06)/Drywall Joint Compound (Ceiling)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Beige	0.0%	100.0%	None Detected	

Client Sample ID: 4a ***Lab Sample ID:*** **552514282-0014**

Sample Description: Second Floor, Stairwell (1-16)/12"x12" Vinyl Floor Tiles (White with Grey Flecks)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 4b ***Lab Sample ID:*** **552514282-0015**

Sample Description: Second Floor, Stairwell (1-16)/"12""x12"" Vinyl Floor Tiles (White with Grey Flecks)"

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 4c ***Lab Sample ID:*** **552514282-0016**

Sample Description: Second Floor, Stairwell (1-16)/"12""x12"" Vinyl Floor Tiles (White with Grey Flecks)"

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Gray	0.0%	100.0%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: (289) 997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

EMSL Canada Order 552514282
Customer ID: 55SELI62
Customer PO: 1-3250703
Project ID:

Summary Test Report for Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05

Client Sample ID: 5a ***Lab Sample ID:*** **552514282-0017**

Sample Description: Second Floor, Stairwell (1-16)/"12""x12"" Vinyl Floor Tiles (Off-White with Grey Flecks)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Beige	0.0%	100.0%	None Detected	

Client Sample ID: 5b ***Lab Sample ID:*** **552514282-0018**

Sample Description: Second Floor, Stairwell (1-16)/"12""x12"" Vinyl Floor Tiles (Off-White with Grey Flecks)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Beige	0.0%	100.0%	None Detected	

Client Sample ID: 5c ***Lab Sample ID:*** **552514282-0019**

Sample Description: Second Floor, Stairwell (1-16)/"12""x12"" Vinyl Floor Tiles (Off-White with Grey Flecks)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Beige	0.0%	100.0%	None Detected	

Client Sample ID: 6a ***Lab Sample ID:*** **552514282-0020**

Sample Description: Basement, Stairwell/Hallway (B-02)/12"x12" Vinyl Floor Tiles (Orange with Brown Flecks)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Brown	0.0%	100.0%	None Detected	

Client Sample ID: 6b ***Lab Sample ID:*** **552514282-0021**

Sample Description: Basement, Stairwell/Hallway (B-02)/12"x12" Vinyl Floor Tiles (Orange with Brown Flecks)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Brown	0.0%	100.0%	None Detected	

Client Sample ID: 6c ***Lab Sample ID:*** **552514282-0022**

Sample Description: Basement, Stairwell/Hallway (B-02)/12"x12" Vinyl Floor Tiles (Orange with Brown Flecks)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Brown	0.0%	100.0%	None Detected	

Client Sample ID: 7a ***Lab Sample ID:*** **552514282-0023**

Sample Description: Second Floor, Stairwell (1-16)/Black Mastic associated with Orange with Brown Flecks Vinyl Floor Tiles

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Gray/Yellow	0.0%	100.0%	None Detected	

Client Sample ID: 7b ***Lab Sample ID:*** **552514282-0024**

Sample Description: Second Floor, Stairwell (1-16)/Black Mastic associated with Orange with Brown Flecks Vinyl Floor Tiles

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Gray/Black	0.0%	100.0%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: (289) 997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

EMSL Canada Order 552514282
Customer ID: 55SELI62
Customer PO: 1-3250703
Project ID:

Summary Test Report for Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05

Client Sample ID: 7c **Lab Sample ID:** **552514282-0025**

Sample Description: Second Floor, Stairwell (1-16)/Black Mastic associated with Orange with Brown Flecks Vinyl Floor Tiles

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Black	0.0%	100.0%	None Detected	

Client Sample ID: 8a **Lab Sample ID:** **552514282-0026**

Sample Description: Lower Roof (0-00)/Flashing Caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/14/2025	Beige	0.0%	100%	None Detected	

Client Sample ID: 8b **Lab Sample ID:** **552514282-0027**

Sample Description: Lower Roof (0-00)/Flashing Caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/14/2025	Beige	0.0%	100%	None Detected	

Client Sample ID: 8c **Lab Sample ID:** **552514282-0028**

Sample Description: Lower Roof (0-00)/Flashing Caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	8/14/2025	Beige	0.0%	100%	None Detected	

Client Sample ID: 9a-Shingle **Lab Sample ID:** **552514282-0029**

Sample Description: Lower Roof (0-00)/2-Ply Roof (0-00) Membrane

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Black	15.0%	85.0%	None Detected	

Client Sample ID: 9a-Tar Felt **Lab Sample ID:** **552514282-0029A**

Sample Description: Lower Roof (0-00)/2-Ply Roof (0-00) Membrane

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Black	10.0%	90.0%	None Detected	

Client Sample ID: 9b-Shingle **Lab Sample ID:** **552514282-0030**

Sample Description: Lower Roof (0-00) (Pitched Roof (0-00))/2-Ply Roof (0-00) Membrane

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Black	15.0%	85.0%	None Detected	

Client Sample ID: 9b-Tar Felt **Lab Sample ID:** **552514282-0030A**

Sample Description: Lower Roof (0-00) (Pitched Roof (0-00))/2-Ply Roof (0-00) Membrane

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Black	10.0%	90.0%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: (289) 997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

EMSL Canada Order 552514282
Customer ID: 55SELI62
Customer PO: 1-3250703
Project ID:

Summary Test Report for Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05

Client Sample ID: 9c-Shingle ***Lab Sample ID:*** **552514282-0031**

Sample Description: Lower Roof (0-00) (Pitched Roof (0-00))/2-Ply Roof (0-00) Membrane

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Black	15.0%	85.0%	None Detected	

Client Sample ID: 9c-Tar Felt ***Lab Sample ID:*** **552514282-0031A**

Sample Description: Lower Roof (0-00) (Pitched Roof (0-00))/2-Ply Roof (0-00) Membrane

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Black	10.0%	90.0%	None Detected	

Client Sample ID: 10a ***Lab Sample ID:*** **552514282-0032**

Sample Description: Lower Roof (0-00) (Pitched Roof (0-00))/Paper Barrier

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Brown/Yellow	80.0%	20.0%	None Detected	

Client Sample ID: 10b ***Lab Sample ID:*** **552514282-0033**

Sample Description: Lower Roof (0-00) (Pitched Roof (0-00))/Paper Barrier

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Brown/Yellow	80.0%	20.0%	None Detected	

Client Sample ID: 10c ***Lab Sample ID:*** **552514282-0034**

Sample Description: Lower Roof (0-00)/Paper Barrier

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Brown/Yellow	80.0%	20.0%	None Detected	

Client Sample ID: 11a ***Lab Sample ID:*** **552514282-0035**

Sample Description: Lower Roof (0-00) (Pitched Roof (0-00))/Tar Felt

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Black	15.0%	85.0%	None Detected	

Client Sample ID: 11b ***Lab Sample ID:*** **552514282-0036**

Sample Description: Lower Roof (0-00) (Pitched Roof (0-00))/Tar Felt

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Black	15.0%	85.0%	None Detected	

Client Sample ID: 11c ***Lab Sample ID:*** **552514282-0037**

Sample Description: Lower Roof (0-00)/Tar Felt

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Black	15.0%	85.0%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: (289) 997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

EMSL Canada Order 552514282
Customer ID: 55SELI62
Customer PO: 1-3250703
Project ID:

Summary Test Report for Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05

Client Sample ID: 12a **Lab Sample ID:** **552514282-0038**
Sample Description: Second Floor, Washroom (2-14)/Ceramic Wall Tile Grout

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 12b **Lab Sample ID:** **552514282-0039**
Sample Description: Second Floor, Washroom (2-14)/Ceramic Wall Tile Grout

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 12c **Lab Sample ID:** **552514282-0040**
Sample Description: Second Floor, Washroom (2-14)/Ceramic Wall Tile Grout

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 13a **Lab Sample ID:** **552514282-0041**
Sample Description: Second Floor, Corridor (2-08)/Ceramic Wall Tile Grout

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 13b **Lab Sample ID:** **552514282-0042**
Sample Description: Second Floor, Corridor (2-08)/Ceramic Wall Tile Grout

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 13c **Lab Sample ID:** **552514282-0043**
Sample Description: Second Floor, Corridor (2-08)/Ceramic Wall Tile Grout

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 14a-Mortar 1 **Lab Sample ID:** **552514282-0044**
Sample Description: Front Exterior/Brick Mortar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 14a-Mortar 2 **Lab Sample ID:** **552514282-0044A**
Sample Description: Front Exterior/Brick Mortar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Beige	0.0%	100.0%	None Detected	

EMSL Canada Inc.
2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: (289) 997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

EMSL Canada Order 552514282
Customer ID: 55SELI62
Customer PO: 1-3250703
Project ID:

Summary Test Report for Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05

Client Sample ID: 14b-White Material ***Lab Sample ID:*** **552514282-0045**
Sample Description: Basement, Stairwell/ Vestibule (B-02)/Brick Mortar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 14b-Mortar ***Lab Sample ID:*** **552514282-0045A**
Sample Description: Basement, Stairwell/ Vestibule (B-02)/Brick Mortar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 14c-White Material ***Lab Sample ID:*** **552514282-0046**
Sample Description: Basement, Electrical Closet (b-10)/Brick Mortar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	White	0.0%	100.0%	None Detected	

Client Sample ID: 14c-Yellow Material ***Lab Sample ID:*** **552514282-0046A**
Sample Description: Basement, Electrical Closet (b-10)/Brick Mortar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Yellow	0.0%	100.0%	None Detected	

Client Sample ID: 14c-Mortar ***Lab Sample ID:*** **552514282-0046B**
Sample Description: Basement, Electrical Closet (b-10)/Brick Mortar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Gray	0.0%	100.0%	None Detected	

Client Sample ID: 14d ***Lab Sample ID:*** **552514282-0047**
Sample Description: Lower Roff (0-00)/Brick Mortar

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	8/14/2025	Gray	0.0%	100.0%	None Detected	

EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3
Phone/Fax: (289) 997-4602 / (289) 997-4607
http://www.EMSL.com / torontolab@emsl.com

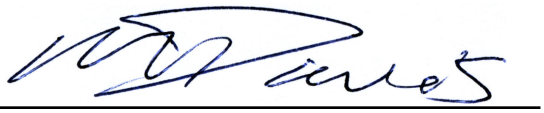
EMSL Canada Order 552514282
Customer ID: 55SELI62
Customer PO: 1-3250703
Project ID:

Summary Test Report for Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05

Analyst(s):

Diana Costantino	PLM (10) PLM Grav. Reduction (2)
Nickesh Mistry	PLM (26) PLM Grav. Reduction (1)
Vanessa Gallego	PLM (20)

Reviewed and approved by:



Matthew Davis or other approved signatory
or Other Approved Signatory

None Detected = <0.1%. EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This is a summary report; official reports are available on LabConnect or upon request and relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted. The above analyses were performed in general compliance with Appendix E to Subpart E of 40 CFR (previously EPA 600/M4-82-020 "Interim Method") but augmented with procedures outlined in the 1993 ("final") version of the method. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the federal government. Non-friable organically bound materials present a problem matrix and therefore EMSL recommends gravimetric reduction prior to analysis. Unless requested by the client, building materials manufactured with multiple layers (i.e. linoleum, wallboard, etc.) are reported as a single sample. Estimation of uncertainty is available on request.

Samples analyzed by EMSL Canada Inc. Mississauga, ON NVLAP Lab Code 200877-0

Initial report from: 08/14/202520:25:15

Appendix IV: Laboratory Certificate of Analysis – Lead

EMSL Canada Inc.
2756 Slough Street, Mississauga, ON L4T 1G3
Phone/Fax: (289) 997-4602 / (289) 997-4607
http://www.EMSL.com torontolab@emsl.com

EMSL Canada Or	552514283
CustomerID:	55SELI62
CustomerPO:	1-3250703
ProjectID:	

Attn: **Jason King**
Safetech Environmental Limited
3045 Southcreek Road
Unit 14
Mississauga, ON L4X 2X7

Phone:	(905) 624-2722
Fax:	(905) 624-4306
Received:	8/13/2025 09:00 AM
Collected:	8/7/2025

Project: **126 Pape Ave/ 1-3250703**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client SampleDescription	Collected	Analyzed	Weight	RDL	Lead Concentration
L-01 *552514283-0001*	8/7/2025	8/14/2025 Site: Boiler Room (B-01) / Brick Wall Desc: Beige	0.2569 g	0.0064 % wt	0.078 % wt
L-02 *552514283-0002*	8/7/2025	8/14/2025 Site: Corridor (2-01) / Smooth Plaster Ceiling Desc: White	0.2582 g	0.0064 % wt	0.073 % wt
L-03 *552514283-0003*	8/7/2025	8/14/2025 Site: Corridor (2-01) / Smooth Plaster Wall Desc: Yellow	0.2591 g	0.0064 % wt	<0.0064 % wt

Rowena Fanto, Lead Supervisor
or other approved signatory

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted. * Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.0064% wt based on the minimum sample weight per our SOP. "<" (less than) result signifies the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. Definitions of modifications are available upon request.

Samples analyzed by EMSL Canada Inc. Mississauga, ON AIHA LAP, LLC-ELLAP Accredited #196142

Initial report from 08/15/2025 07:15:06

Appendix V: Methodology

A. METHODOLOGY

The presence of hazardous materials was assessed by visual inspection. For the purpose of this assessment and this document, hazardous materials include designated substances as well as other chemical, biological and environmental hazards as defined below:

- Designated Substances (as prescribed by Ontario Regulation 490/09):
    - Acrylonitrile, Arsenic, Asbestos, Benzene, Coke Oven Emissions, Ethylene Oxide, Isocyanates, Lead, Mercury, Silica and Vinyl Chloride.
- Other Hazardous Materials:
    - **Chemical Hazards** – Urea Formaldehyde Foam Insulation (UFFI)
    - **Biological Hazards** – Mould Contamination and Pest Infestation
    - **Environmental Hazards** – Polychlorinated Biphenyls (PCBs) and Ozone Depleting & Global Warming Substances

Concealed locations such as above solid plaster or drywall ceilings, within plaster or drywall wall cavities, enclosed mechanical/pipe shafts and bulkheads, etc. were not investigated, unless otherwise stated in Section 1.3. Similarly, motors, blowers, electrical panels, etc., were not de-energized or disassembled to examine concealed conditions. Building materials that are not detailed within this assessment due to inaccessibility at the time of our site visit and/or uncovered during renovation/demolition activities should be assessed by a qualified person prior to their disturbance.

Bulk sampling followed by laboratory analysis was also conducted to confirm the presence/absence of select hazardous materials. Bulk sampling was limited to asbestos in building materials and lead in paint on building finishes (if flaking paint was present). All other hazardous materials were identified by visual inspection only. Where possible, observations regarding the location, quantity and condition of the hazardous materials identified were made in order to determine the potential for exposure and provide appropriate recommendations for remedial action, if necessary. Specific methodology for each individual hazardous material assessed is further detailed below.

A.1 Designated Substances

A.1.1 Asbestos

A visual inspection for the presence of both friable and non-friable asbestos-containing material (ACM) was performed in the subject area.

If an existing asbestos survey was available for review, Safetech relied on the information present. Building materials that were visually similar to materials previously tested and that were confirmed to be either ACM or non-ACM were considered to have consistent content and were not re-sampled. Additional sampling was only conducted where the investigator believed a need existed.
Bulk samples of building materials suspected to contain asbestos were retrieved by Safetech only for materials that were deemed to have a potential to be disturbed as part

of the construction project. Some suspect materials may not have been sampled during our investigation. Bulk samples were retrieved in accordance with Section 3 and Table 1 of Ontario Regulation 278/05, "Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations". The number of samples collected for each material was based on the type and quantity of the material present in the subject area. Each individual sample was placed in a labeled zip-lock bag for transportation to an independent laboratory (EMSL). EMSL is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) for bulk asbestos fiber analysis.

Analysis for asbestos content was performed by the independent laboratory in accordance with the U.S. Environmental Protection Agency (EPA) Test Method *EPA/600/R-93-116: Method for the Determination of Asbestos in Bulk Building Materials (June 1993)*. This method identifies the asbestos fibre content of building materials using polarized light microscopy (PLM) analytical techniques, with confirmation of presence and type of asbestos made by dispersion staining optical microscopy. This analytical method meets the requirements set forth in Section 3 of O. Reg. 278/05.

In accordance with O. Reg. 278/05, an asbestos-containing material is defined as material that contains 0.5 per cent or more asbestos by dry weight. The laboratory was instructed to conduct "stop-positive" analysis for all materials. If a sample was found to be asbestos-containing no further analysis was conducted for samples taken from the same homogeneous material.

Locations where ACM have been identified are detailed in this report. Recommendations pertaining to ACM were made based on the friability, accessibility and condition of the material in conjunction with the potential for the planned renovation work to disturb the ACM.

A.1.2 Assessment of Asbestos-Containing Building Materials

Accessibility, Condition and Action (Priority) ratings for individual items, or defined areas were developed by Safetech to determine remedial action plans specific to the facility's needs.

A.1.2.1 Accessibility

Accessibility has been assessed as: (A) Accessible to all non-maintenance occupants of the building; (B) Accessible to maintenance staff without a ladder; (C) Accessible to maintenance staff with a ladder and exposed to view without moving a building component; (D) Accessible to maintenance staff with a ladder and concealed from view due to a building component; (E) Not accessible without demolition or removal of fixed building components or building systems

A.1.2.2 Condition

The condition of asbestos-containing materials identified in the subject area was assessed as Good (G), Fair (F) or Poor (P). The assessment criteria used to determine condition is dependent on material characteristics, such as friability. The following table summarizes the criteria used by Safetech to evaluate the condition of ACM.

Sprayed Fireproofing, Sprayed Insulation and Sprayed Texture Finishes	
Good	• Surface shows no significant signs of damage, deterioration, or delamination (i.e. <1%). • Unencapsulated or unpainted fireproofing or texture finishes, where no delamination or damage is observed. • Encapsulated fireproofing or texture finishes where encapsulation applied after damage or fallout.
Fair	• Not utilized as part of condition assessment for these materials.
Poor	• Greater than 1% damage, delamination, or deterioration to surface.
In areas where damage exists in isolated locations, both Good and Poor may be applicable.	
Mechanical Insulation (boilers, breeching, ductwork, piping, tanks, equipment, etc.)	
Good	• Insulation completely covered in jacketing and exhibits no evidence of damage or deterioration. • Jacketing may have minor damage (i.e. scuffs or stains), but is not penetrated.
Fair	• Minor penetrating damage to jacketed insulation (cuts, tears, nicks, deterioration or delamination). • Undamaged insulation that had never been jacketed. • Insulation is exposed but not showing surface disintegration. • Extent of missing insulation ranges from minor to none. • Damage that can be repaired.
Poor	• Original insulation jacket is missing, damaged, deteriorated, or delaminated. • Insulation is exposed and significant areas have been dislodged. • Damage that cannot be easily repaired.
Non-Friable and Potentially Friable Materials (includes materials such as plaster finishes, drywall compound, ceiling tiles, asbestos cement products, vinyl asbestos tile and asbestos paper backed vinyl sheet flooring, etc., which have the potential to become friable when handled)	
Good	• No significant damage. • Material may be cracked or broken but is stable and not likely to become friable upon casual contact. • No friable debris present
Fair	• Not utilized as part of condition assessment for these materials.
Poor	• Material is severely damaged. • Debris is present or binder has disintegrated to the point where the material has become friable.
Asbestos-Containing Debris (noted separately from the presumed source material)	
Poor	• Debris is always considered to be in Poor condition.

A.1.2.3 Action

Recommended ACTION for compliance and for management of identified asbestos-containing materials has been provided for each condition and component outlined in the above table. Recommendations have been classified under the following 8 ACTIONS:

1. Action dealing with the immediate clean-up of fallen ACM likely to be disturbed.

2. Action dealing with the need to use Type 2 asbestos procedures to enter an area (other than a ceiling space).
3. Action dealing with performing asbestos removal for compliance with regulations.
4. Action dealing with Type 2 asbestos procedures for ceiling entry where friable ACM debris is present on the top side of a ceiling system.
5. Action dealing with the removal of asbestos that goes beyond compliance requirements but simplifies the asbestos management.
6. Action dealing with the repair of asbestos.
7. Action dealing with ACM surveillance requirements of the regulation.
8. Action for dealing with material that may contain asbestos but was not conclusively identified in the survey.

A.1.2.4 Quantity

The approximate quantity and the units of measure related to the quantity (i.e.: linear feet (LF), square feet (SF) or each (EACH) as appropriate to the item) have only been provided for materials requiring remedial or corrective action (i.e. materials in Fair or Poor condition). In such circumstances any quantities provided should be considered rough estimates only and should not be solely relied upon for bidding purposes. It is the responsibility of the selected Contractor to obtain actual quantities.

A.2 Lead

If paint samples were collected, they would be collected by scraping the paint down to the base material substrate to ensure collection of all layers of paint. Care would be taken to avoid collection of the underlying substrate to reduce analytical substrate matrix interference.

If collected, paint samples would be submitted to an independent laboratory for the determination of lead content. The laboratory would participate in and accredited by the EPA (U.S. Environmental Protection Agency) for analysis of lead in paint chips through the American Industrial Hygiene Association (AIHA) Environmental Lead Laboratory Accreditation Program (ELLAP). Analysis would be conducted by the laboratory following the EPA “Test Methods for Evaluating Solid Waste, Physical/Chemical Methods” (SW-846), Method 7000B “Flame Atomic Absorption Spectrophotometry”. Result of analysis would be reported by the laboratory as the percentage of lead by weight of the total sample (% by wt.).

The presence of lead in other materials, such as lead sheeting, pigmented mortar, lead piping, lead solder, etc. would be noted where observed but not sampled to verify lead content. Lead can be present in these materials to varying degrees, depending on their age of application and should be considered lead-containing until proven otherwise.

A.3 Mercury

The type, quantity and location of mercury-containing equipment and devices in the subject area were determined by visual inspection based on appearance, age and knowledge of historical uses. Sampling for mercury-containing building materials and dismantling of suspect mercury-containing equipment was not performed. Where possible, attempts were made to verify the presence/absence of mercury by gathering additional information such as equipment model number, serial number, etc.

A.4 Silica

The presence of crystalline silica in building materials was determined through visual inspection of building materials only, based on knowledge of the historic use of silica-containing materials in certain building materials. Sampling to verify the presence/absence of silica in building materials was not performed.

A.5 Other Designated Substances

Other designated substances (i.e. acrylonitrile, arsenic, benzene, coke oven emissions, ethylene oxide, isocyanates, and vinyl chloride) are typically not expected to be encountered in building materials as significant constituents or in a form that would represent an exposure concern. These substances were not included in the assessment unless specific information regarding their use (e.g. in a manufacturing process) was provided to us. No sampling for these designated substances was performed.

A.6 Other Hazardous Materials

A.6.1 Chemical Hazards

A.6.1.1 Urea Formaldehyde Foam Insulation (UFFI)

A visual inspection to evaluate the possible presence of Urea Formaldehyde Foam Insulation (UFFI) was conducted in the subject area. Our visual inspection was limited to identifying evidence of possible UFFI installation (i.e. repaired nozzle holes in walls) and overspray at wall/ceiling joints, etc. No destructive testing or material sampling was conducted as part of the assessment.

A.7 Biological Hazards

A.7.1.1 Mould Contamination

A visual inspection to determine the possibility of mould growth was conducted in the subject area. The assessment was limited to identifying evidence of mould growth and water damage (staining, material deterioration, efflorescence, etc.) on the surface of building materials, which may be an indicator of hidden mould growth. No moisture content readings of building materials were taken to determine their current condition. Additionally, destructive testing to confirm the presence/absence of hidden mould growth and material sampling to verify the presence/absence of mould on suspect surfaces was beyond the scope of this assessment.

A.7.1.2 Pest Infestation

The presence and extent of pest infestation in the subject area was based on visually inspecting for evidence of significant pest activity, including signs of nesting, droppings/fecal accumulation, dead insects/carcass accumulation, etc. Evidence of minor pest presence was not considered to be indicative of pest infestation.

A.8 Environmental Hazards

A.8.1 Polychlorinated Biphenyls (PCBs)

The presence of PCB-containing electrical equipment in the subject area was identified through visual inspection and knowledge of the timeline of historical use.

For stand-alone transformers and capacitors, information from the manufacturer nameplate (such as the date of manufacture, dielectric fluid trade name or "Type Number", etc.) was gathered, where possible, to further evaluate if the equipment may contain PCBs. This information was then compared to the information provided in the Environment Canada document entitled "Handbook on PCB's in Electrical Equipment" (Third Edition, April 1988) to aid in identification. Transformers and capacitors confirmed to be manufactured after 1979 were assumed to not contain PCBs. If appropriate information could not be obtained it was assumed that the transformer or capacitor contained PCBs.

For fluorescent light ballasts, a representative number of fixtures were inspected, if possible, for assessment areas that were constructed prior to 1980 and where there was no history or evidence of a complete lighting retrofit. The light fixtures were examined by removing any lenses and ballast covers to expose the ballast and identify information such as ballast make, model number, serial number, and date code. This information was then compared to the information provided in the Environment Canada document entitled "Identification of Lamp Ballasts Containing PCBs" (Report EPS 2/CC/2 (revised) August 1991) to aid in identification. Ballasts that could not be confirmed Non-PCB-containing were assumed to contain PCBs. The light fixtures were not de-energized and ballasts were not removed to obtain manufacturer information that may be on the back of the ballast. If visual confirmation of ballast type could not be made it was assumed that light fixtures in areas constructed prior to 1980 that have not undergone a complete lighting retrofit have PCB-containing ballasts until proven otherwise.

No sampling of materials or fluids within equipment was conducted to verify the presence/absence of PCBs. Inspection and testing of other materials for PCB content, including (but not limited to) caulking, asphalt, oil-based paint, plastics, switches, electric cables and hydraulic fluids was beyond the scope of the assessment.

A.8.2 Ozone Depleting and Global Warming Substances

The presence of fixed equipment likely to contain ozone-depleting substances (ODS) and/or global-warming substances (GWS) was identified through visual inspection and

knowledge of the timeline of historical use. This included equipment such as chillers, air-conditioners, walk-in refrigeration and freezer units and fixed dry-chemical fire extinguishers, where chemicals such as hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs) or halons may be present. Where possible, information regarding the type and quantity of refrigerant present was obtained from the manufacturer nameplate. Our visual assessment was limited to fixed equipment in the subject area and did not include portable equipment such as stand-alone refrigerators, freezers, water coolers, air-conditioners and fire extinguishers, etc.