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IBI Group

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PROJECT MANUAL

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Seal will be added in Construction Issue	Seal will be added in Construction Issue	Seal will be added in Construction Issue
ARCHITECT	STRUCTURAL ENGINEER	MECHANICAL ENGINEER
Seal will be added in Construction Issue		
ELECTRICAL ENGINEER		

Issued For	Date	Issued For	Date

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Appendix B3:	Designated Substance Survey (DSS), Ref. No. FE-P 21-11706, 351 Birchmount Ave, issued December 2021 by Fisher Environmental Ltd.
Appendix B4:	Designated Substance Survey (DSS), Ref. No. FE-P 21-11706, 1313 Woodbine Ave, issued December 2021 by Fisher Environmental Ltd.
Appendix B5:	Designated Substance Survey (DSS), Ref. No. FE-P 21-11706, 1859 Kingston Rd, issued December 2021 by Fisher Environmental Ltd.
Appendix B6:	Designated Substance Survey (DSS), Ref. No. FE-P 21-11706, 1904 Queen St. E, issued December 2021 by Fisher Environmental Ltd.
Appendix B7:	Designated Substance Survey (DSS), Ref. No. FE-P 21-11706, 3600 Danforth Ave, issued December 2021 by Fisher Environmental Ltd.
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- 1 Drawings
- .1 The Drawings upon which Tender and Contract are to be based, including and any subsequent Supplemental Instructions, are to include the following Drawing packages.

Drawing Packages

TAU-G28-TenderDwgs-7BrimleyRdS

TAU-G28-TenderDwgs-87MainSt

TAU-G28-TenderDwgs-116DorsetRd

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TAU-G28-TenderDwgs-351BirmountRd

TAU-G28-TenderDwgs-1313WoodbineAve

TAU-G28-TenderDwgs-1859KingstonRd

TAU-G28-TenderDwgs-1904QueenSt.E

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End of Section

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1 General

1.1 **GENERAL**

- .1 Unless specified otherwise, instructions and requirements specified in this section shall apply to all sections of the Work.
- .2 It is the responsibility of the Contractor to direct and implement all the Work shown and specified, including construction facilities and requirements specified herein.
- .3 Work specified in the Specification has been divided into technical sections for the purpose of ready reference. Division of Work among Subcontractors and Suppliers is solely the Contractor's responsibility and Consultant assumes no liability to act as an arbiter to establish subcontract limits between sections or divisions of Work.
- .4 Do not scale Drawings. Use dimensions indicated.
- .5 The General Requirements in this section are over and above the requirements listed in the City of Toronto Master Services Agreement; wherever there is an overlap or conflict, the more stringent requirement is to be followed.

1.2 **DEFINITIONS**

- .1 Provide: This term means to Furnish, supply, Install and connect, complete and in place, including accessories, finishes, tests, and services required to render item so specified complete ready for use.
- .2 Furnish: This term means fabrication or procurement of materials, equipment, or components, or performance of services to the extent specified and shown. Where used with respect to materials, equipment, or components, the term includes crating and delivery to Project site but is not intended to include installation of item, either temporary or final.
- .3 Install: This term means placement of materials, equipment, or components, including receiving, unloading, transporting, storage, uncrating and installing, and performance of such testing and finish Work as is compatible with degree of installation specified.

1.3 **EXAMINATION OF BID DOCUMENTS**

- .1 The Contractor shall have read all the Bid Documents in conjunction with one another and Consultant shall assume that they are in agreement. Contractor shall have examined all the Bid Documents as soon as possible after receipt thereof and if he had discovered any discrepancies, omissions, errors, ambiguities or conflicts in or among the Bid Documents, or be in doubt as to their meaning or intent, shall have brought the matter to the attention of the Consultant at least four (4) Business Days prior to the date set for receiving Bids.
 - .2 The Contractor shall understand and agree that where a discrepancy in Products or systems between Consultant Drawings exists, Contractor shall have allowed in its Bid for the most expensive Product or system indicated, and a Request for Information (RFI) issued to the Consultant to clarify the issue at no increase in Contract Price.
 - .3 Contractor shall avoid submitting RFI's on information readily available within the Contract Documents.
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1.4 WORK OF CONTRACT

- .1 Work of this Contract comprises the supply of all material, equipment and labour necessary for the complete construction of new works, alterations and additions and all other related Work as shown on the Contract Drawings, specified herein or both, all in accordance with the terms of the Contract.

1.5 SCHEDULING OF THE WORK

- .1 The Contractor shall be required to start work immediately upon the execution of the Contract.
- .2 The Contractor shall include all costs on account of premium time or overtime required and all costs on account of premium prices required in order to obtain labour, plant, materials or equipment or other critical items including waiting time, double handling, after hours delivery and installation, protection of new and existing services at the site in order to meet the completion dates of the scope of work and the project completion date.
- .3 The Contractor shall include all costs on account of schedule interfacing, coordination and cooperation with other Contractors or Subcontractors who will be carrying out work during the progress of this Contract in order to meet the completion date for the work and the overall completion date of the project.
- .4 The Owner will not entertain hardship claims or tolerate delays and interruptions in the work.

1.6 METHODS OF PROCEDURE

- .1 All Work that interfaces with the existing building systems or Work that occurs within critical areas within the building, which include but are not limited to: IT spaces, UPS Rooms, Electrical Rooms, Mechanical Rooms, and Fire Safety Rooms require the production of a Methods of Procedure (MOP) document that must be submitted to the Owner and the Consultant for review and approval. Refer to MOP sample template attached.
- .2 The Contractor is responsible for the production of all Methods of Procedure documents necessary to complete the work. The Contractor shall include all costs associated with the production and revision of Methods of Procedures documents. The Contractor is responsible for all required revisions the Methods of Procedures documents so that they meet the approval of the Owner.
- .3 The Contractor shall include all costs associated with the production of a look ahead schedule that outlines all construction activities occurring within the next predetermined period of the Project. The duration of the schedule and the frequency with which the schedule will be updated shall be determined by the Owner and submitted to the Consultant and the Owner for review. The frequency of updates shall not be less than once in a two-week period. The determination as to which activities will require the production of Methods of Procedures documents will be based on the Consultant's and the Owner's review of the look ahead schedule.

1.7 ADDITIONAL SECURITY

- .1 Some of the buildings included in the scope of work will require security services during construction.
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- .2 The Owner has existing contracts with three security companies. The Contractor is required to coordinate and engage with a security company as directed and specified by the Owner.
 - .1 Preferred Security Companies:
 - .1 G4S Security Services
 - .2 ASP Security Services
 - .3 Garda World
 - .2 Security company contact information will be provided as needed.
 - .3 The Owners reserves the right to direct the Contractor to provide their own security sub-contractor.
 - .1 Contractor to provide cost estimate prior to executing any sub-contract for security.
- .3 The above security services will be compensated by the Owner via the Cash Allowance.
 - .1 TPS buildings not included
- .4 Toronto Police Service (TPS)
 - .1 The Contractor shall engage with Paid Duty Police to provide the necessary security monitoring for TPS buildings. Refer to the Toronto Police website at <http://www.torontopolice.on.ca/paidduty/> for additional information.
 - .2 Contractor to coordinate with the Paid Duty Police regarding secured access to building and rooms during construction.
 - .3 The Contractor must provide the TPS with all the necessary information that it requires to conduct and complete a security background check of the personnel assigned to this project including any Subcontractors.
 - .4 The background check must be completed before any Work commences.
 - .5 The background check will be completed by TPS after the recommendation of award has been approved. The successful Contractor and team (personnel and all Subcontractors) may also be required to have the team all sign non-disclosure confidentiality agreements. During the period of the agreement, the TPS reserves the right to ask that service provider personnel be removed from working within the TPS environment without advance notice. In such a case, the Contractor will immediately remove the individual from the Contract and replace them with a similar or more skilled individual who has successfully passed the TPS background security check, at no additional cost to the TPS or the Owner.
 - .6 Any building access cards that have been issued will remain the property of TPS and must be returned upon request. The TPS reserves the right acting in its sole discretion to disqualify any respondent, who in the opinion of the Service constitutes a security risk.

1.8 **DRAWINGS AND INSTALLATION**

- .1 The Drawings are intended to show the general character and scope of the Work and not necessarily the detail design, or exact details of the installation. Contractor shall provide

all items, articles, materials, services and incidentals, including detail design with Drawings, whether or not expressly specified or shown on Drawings, to make finished Work complete and fully operational, consistent with the intent of the Contract Documents.

- .2 The Contractor shall supply and install all items of Work, goods and services that are listed or shown, or that may reasonably be inferred from the Contract Documents, as being required to produce the intended result.
- .3 The location, arrangement and connection of equipment and materials shown on the Drawings represent a close approximation to the intent and requirements of the Contract. The right is reserved by the Consultant to make reasonable changes required to accommodate conditions arising during the progress of the Work, at no extra cost to the Owner.
- .4 The location and size of existing services shown on the Drawings are based on the best available information. The Contractor shall ensure that the actual location of existing services be verified in the field before Work is commenced. Particular attention shall be paid to buried or concealed services and structures.
- .5 Changes and modifications necessary to ensure coordination and avoidance of interference and conflicts with other trades or to accommodate existing conditions, shall be the responsibility of the Contractor and made at no extra cost to the Owner.
- .6 The Contractor shall reimburse the Consultant for the latter's time spent on answering any questions or requests for information where the answer is clearly stated or shown on the Drawings or Specifications.

1.9 **EXISTING CONDITIONS**

- .1 In the case of renovation projects, certain new installations may be dependent upon existing conditions for support as indicated on Drawings. The Contractor shall, by way of a Site visit during Bidding period, carefully examine such existing conditions and satisfy itself as to the structural adequacy of such existing substrates. By commencing Work in the field, Contractor implies acceptance of existing conditions.
- .2 Acoustic Report
 - .1 For Accessibility Preliminary Template for Acoustics, refer to appendices.

1.10 **CULTURAL HERITAGE RESOURCES**

- .1 If cultural heritage resources (such as archaeological sites, artifacts, building and structural remains, and/or human burials) are encountered during performance of Work, contact Consultant immediately and suspend Work in immediate area until assessment has been completed by Ministry of Culture, Tourism and Recreation. Perform required measures to mitigate negative impacts on found resources to acceptance of Consultant.

1.11 **REGULATORY DOCUMENTS**

- .1 Nothing contained in the Drawings and Specifications shall be so construed as to conflict with any law, by-law or regulation of the municipal, provincial or other authorities having jurisdiction. Work shall be performed in conformity with all such laws, by-laws and regulations.
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- .2 Contract forms, codes, Specifications, standards, manuals and installation, application and maintenance instructions referred to in the Specifications are to be of the latest published editions at the date of signing the Contract.
 - .3 In addition to codes and standards specified in individual sections of the Specifications, comply with the latest edition of the following:
 - .1 Association of Heating, Refrigeration and Air-Conditioning Engineers
 - .2 American Society for Testing and Materials
 - .3 Canadian Gas Association
 - .4 Canadian General Standards Board
 - .5 Canadian Standards Association
 - .6 Illuminating Engineering Society of North America
 - .7 National Building Code of Canada
 - .8 National Fire Prevention Association
 - .9 National Standards of Canada
 - .10 Ontario Building Code
 - .11 Ontario Hydro Electrical Safety Code
 - .12 Ontario Ministry of the Environment and Climate Change
 - .13 Ontario Ministry of Labour
 - .14 Ontario Occupational Health and Safety Association
 - .15 Underwriters' Laboratories of Canada
 - 1.12 **PERMITS**
 - .1 The Owner will apply and pay for the building permit. Contractor shall expedite and pick up the building permit.
 - 1.13 **CONSTRUCTOR**
 - .1 The Contractor shall be the "Constructor" as defined in the Occupational Health and Safety Act. As such, the Contractor shall be responsible for ensuring that the provisions of the statutes, regulations and by-laws pertaining to the duties, obligations, and safe performance of the Work in accordance with the obligations of the Constructor as set out in the Occupational Health and Safety Act are observed.
 - 1.14 **MANDATORY PRE-CONSTRUCTION SITE MEETINGS**
 - .1 After the tender award, the Contractor and applicable Subcontractor shall attend a pre-construction site meeting at each building address included as part of the Work.
 - .2 Contractor shall bring their abatement Subcontractor to the pre-construction site meeting of buildings where abatement work is going to occur.
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2 Environmental Protection

2.1 **GENERAL**

- .1 The Contractor shall be responsible for monitoring, reporting and ensuring the Work is done in compliance with the requirements of all environmental legislation and regulations governing the Place of the Project.
- .2 Protection of the environment in all aspects of the Project is of prime importance to the Owner.
- .3 Should the Contractor fail to comply with any environmental requirements when instructed, the Owner will undertake the corrective action and the costs for such corrective action shall be borne by the Contractor.
- .4 Directions given by the Owner or Consultant with respect to action to be taken to correct environmental deficiencies must be acted upon immediately.

3 Project Coordination

3.1 **GENERAL**

- .1 The Contractor shall ensure that the Contract Documents are fully coordinated with all trades involved in the Project.
- .2 The Contractor shall perform a site survey to ensure all buried, embedded, and underground pipes, conduits, power lines, elements and utilities are identified prior to beginning any demolition work both inside and outside of a building
- .3 The Contractor shall coordinate progress of the Work, progress schedules, submittals, use of Site, temporary utilities, construction facilities and construction Work, in conjunction with the progress of work of other Contractors.
- .4 The Contractor shall ensure all trades cooperate with and work together so that the Work will fit together and make a complete and satisfactory job in every detail. Ensure each Subcontractor maintains its own quality assurance program.
- .5 The Contractor shall comply with Owner's instructions for access to Owner occupied areas.
- .6 The Contractor shall coordinate with all government departments and agencies, Authorities Having Jurisdiction and utilities such as the City's Building Department, ESA, TSSA, Toronto Hydro, Enbridge Gas, but not limited to, and organize all required inspections and approvals for the completion of construction Work. It will be the full responsibility of the Contractor to ensure that all conditions of permits and approvals are met during construction Work and all permits are closed.

3.2 **CONSTRUCTION ORGANIZATION AND START-UP**

- .1 The Contractor shall comply with Contract requirements for staging areas of the Site; field offices and storage areas; access and parking facilities, and temporary utilities and construction facilities.
 - .2 Refer to Division 00 and 01 and Drawings for required staging.
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3.3 **WORK SEQUENCE**

- .1 The Contractor shall coordinate the stages of Work to accommodate Project requirements during construction; and the sequence and direction of execution to meet Project schedule.
- .2 The Contractor shall coordinate the progress schedule with the Owner's requirements during construction.
- .3 The Contractor shall construct Work in stages or manner to provide for continuous operation of all facilities under this Contract. Do not close off public or Owner usage of any area of the Site which are not defined as part of the Contractor's work areas.
- .4 Work is not to proceed on site until all required materials are in place for each stage or area of Work, including demolition of areas and spaces. It is the Contractor's sole responsibility to ensure that material is on site prior to starting demolition or Work. No delays for supplier delivery times will be accepted.

3.4 **COORDINATION AND INTERFERENCE DRAWINGS**

- .1 The Contractor shall coordinate placement of materials and equipment to ensure that all components will be properly accommodated within the spaces provided prior to commencement of Work.
- .2 The Contractor shall take complete responsibility for any remedial Work that results from failure to coordinate any aspect of the Work prior to its fabrication/installation.
- .3 The Contractor shall ensure that all accesses and clearances required by jurisdictional authorities and/or for easy maintenance of equipment are provided in the layout of equipment and services.
- .4 The Contractor shall prepare interference Drawings indicating the co-relation of the architectural, mechanical, electrical, security/communications and process systems and the building structure, and review with trades at Contractor's coordination meetings. Agree with trades on proposed installation and routing of systems prior to installation. Interference Drawings shall contain information based on reviewed Shop Drawings.
- .5 The purpose of the interference Drawings coordination is to enable efficient use of available space, proper sequencing of the Work, and to resolve conflicts or interferences at no extra cost to the Owner. The Contractor shall sequence the production and review of interference Drawings in advance of the actual Work being performed to allow construction to proceed as scheduled.
- .6 The Contractor shall prepare and distribute minutes of interference coordination meetings to all parties.

3.5 **CONTRACTOR'S USE OF PREMISES**

- .1 The Contractor shall carry out Work in such manner as to cause a minimum of noise or interference to adjacent properties. Secure the approval of authorities having jurisdiction before proceeding with any Work which may cause interference. Provide all necessary precautions to protect existing property and people.
 - .2 To ensure coordination and communication is maintained between the Contractor, Owner, and building occupants, the Contractor is required to provide an up-to-date Construction Schedule and phasing plan to the building occupants 2 weeks prior to the start of Work. Day to day operations and housekeeping rules are to be discussed and
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adhered to by the Contractor. Schedule and Phasing plan to be discussed with the Owner and building occupants and revised as needed prior to commencing Work. Any changes to the Schedule and Phasing Plan are to be discussed first with the Owner and building occupants.

- .3 The Contractor shall coordinate use of premises with Owner and building end users to avoid interference with the Owner's normal operations of the facility. Day to day operations and housekeeping rules are to be discussed and adhered to by the Contractor.
- .4 The Contractor shall assume full responsibility for protection and security of Products and Work under this Contract.
- .5 The Contractor shall limit operations to the prescribed areas including installation operations, storage areas and movement of vehicles and equipment.
- .6 Access and egress to and from the Site of Work areas shall be by the prescribed routes only.
- .7 The Contractor shall allow free and unrestrictive access to the Site by Owner, Consultant or his Representatives, or by any authorized person representing the Owner, and allow them to enter upon and inspect any or all parts of the Work under this Contract.

3.6 **NOISE**

- .1 Construction Work undertaken shall not contravene the requirements of local noise and pollution by-laws and all other regulatory requirements. Any construction Work that requires drilling, cutting, coring or hammering, must be undertaken after hours and/or on weekends. No additional overtime charges will be paid for the Work performed after hours and/or on weekends.

3.7 **OWNER'S OCCUPANCY**

- .1 The Owner will occupy existing premises during entire construction period for execution of normal operations.
 - .1 The Contractor shall coordinate with the Owner in scheduling operations to minimize conflict and to facilitate Owner's usage.
 - .2 The Contractor shall provide an emergency contact list to the Owner and building occupants.
 - .3 Contractor shall allow for:
 - .1 Access for Owner's personnel
 - .2 Maintenance and use of parking facilities outside of the Contractor's areas as defined in the Contract Documents
 - .3 Owner's movement of equipment, vehicles and material
 - .4 Operation of HVAC, electrical systems and equipment

3.8 **SUPERINTENDENCE**

- .1 The Contractor shall provide the following full-time staff with responsibilities as stated below. All staff shall have relevant formal training and experience with similar Project size and complexity.
 - .1 Project Manager or Construction Manager and Site Supervisor whose responsibilities include managing all administrative aspects of the Project including administration of Contracts and changes with the Owner, the Subcontractors and Suppliers. This role will also include for administration of all Contract administration documents required by the Contract Documents including schedules, logs, reports, meeting minutes, RFI's, Site instruction, change orders, change directives, and monthly progress payment invoice. This person shall be on Site full time for the complete duration of the Project and must chair the site kick-off meeting, and the regular progress and coordination meetings. The Project Manager will be the main point of contact for the City and for the Consultant on this Project, shall maintain complete involvement, coordinate with all stakeholders (internal and external to the City) and attend regular construction progress on site bi weekly meetings.
 - .2 Site Engineer or Site Coordinator whose responsibility includes planning and coordination of the Work, review of submittals and Shop Drawings, maintaining as-built records, and assisting the Site Superintendent and Construction Manager. This person shall be on Site full time for the complete duration of the Project.
- .2 The Contractor shall provide other foremen as necessary to direct and control the Work on Site, such personnel to be well experienced, competent in their specialized fields and having full knowledge and experience in directing the Work under their charge.
- .3 In addition to the full time Superintendent that the Contractor shall place in full charge of the Work on Site, ensure that each major Subcontractor maintains a full time Superintendent to be in charge and responsible for their respective Work and who shall report to the Contractor's site superintendent.
- .4 In addition to the above, a Representative of the Contractor is required to be present when work is occurring on a building.

4 Cutting and Patching

4.1 **APPROVALS**

- .1 The Contractor shall submit written request in advance of cutting or alteration which affects:
 - .1 Structural integrity of any element of the Project.
 - .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 separate Contractor.
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4.2 **INSPECTION**

- .1 The Contractor shall inspect existing conditions, including elements subject to damage or movement during cutting and patching.
- .2 After uncovering, Contractor shall inspect conditions affecting performance of Work.
- .3 Beginning of cutting or patching means acceptance of existing conditions.

4.3 **EXECUTION**

- .1 The Contractor shall execute cutting, fitting, and patching to complete the Work.
 - .2 The Contractor shall provide supports to assure structural integrity of surroundings; including devices and methods to protect other portions of the Project from damage.
 - .3 The Contractor shall employ appropriate trades with skilled labour to perform cutting Work.
 - .4 Cut materials using proper equipment and methods.
 - .5 The Contractor shall remove and replace defective and non-conforming Work.
 - .6 The Contractor shall execute Work to avoid damage to other Work.
 - .7 Prepare proper surfaces to receive patching and finishing.
 - .8 Fit all Work segments together to integrate with penetrations through surfaces and with other Work.
 - .9 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.
 - .10 Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to minimize interruption of services to occupied area.
 - .11 Additional measures required to reduce the risk of unexpectedly encountering concealed and buried services
 - .12 At penetration of fire-rated wall, ceiling, or floor construction, completely seal voids with fire-rated or fire-resistant material, specified to the full thickness of the construction element.
 - .13 Existing exterior walls with glazing when exposed to construction in progress must be protected by 5/8" type "X" gypsum board on suitable framing for the duration of the construction. Other openings in the existing exterior walls such as doors, louvers, etc., must be similarly protected.
 - .14 Refinish surfaces to match adjacent finishes; for continuous surfaces refinish to nearest intersection; for an assembly, refinish entire unit.
 - .15 Where Drawings indicate or Specifications call for items to be relocated, perform Work to the same quality of workmanship specified for new Work. Replace damaged or missing items at no extra cost to the Owner. Provide new fasteners; for exterior, use stainless steel.
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5 Field Engineering

5.1 **NOT USED**

6 Project Meetings

6.1 **ADMINISTRATIVE**

- .1 The Consultant will schedule and chair bi-weekly Project meetings throughout the progress of the Work.
- .2 The Consultant will record the minutes of the meetings. Minutes to include significant proceedings and decisions and identify "action by" parties. Meeting minutes will be issued to all attendees within 42 hours after the meeting is concluded.
- .3 Representatives of Contractor, Subcontractor and Suppliers attending meetings shall be qualified and authorized to act on behalf of the party each represents.
- .4 The Contractor shall present, at each meeting, scheduled Work activities in the format acceptable to the Owner. Contractor to prepare and issue Work performance dashboards to be included in the meeting minutes. Dashboards are to visually convey key performance indicators, Work progress, financial information, outstanding issues, risks, achievements etc. Refer to Section 01 10 00.2 for a Dashboard Template that the Contractor shall use.

6.2 **KICK-OFF MEETING**

- .1 The Consultant will arrange a kick-off meeting immediately upon award of Contract. Attendance by authorized Representatives of Owner, Consultant and Contractor is mandatory. The purpose of this meeting is to commence the Work under this Contract, to acquaint the Contractor's and Owner's designated personnel with each other, and to discuss methods and means by which full cooperation and coordination of all participants can be achieved during the execution of the Work.

6.3 **SAFETY MEETING**

- .1 The Contractor shall conduct safety meetings as required by the Owner and OHSA.
- .2 Agenda may include the following:
 - .1 Safe work practices
 - .2 Accident reporting and investigations
 - .3 Health and safety inspections
 - .4 Health and safety committees
 - .5 Orientation and training
 - .6 Emergency preparedness

6.4 **PROGRESS AND COORDINATION MEETINGS**

- .1 The Consultant will conduct and record bi-weekly progress and coordination meetings and other extraordinary meetings as may be required from time to time by the Owner.
 - .2 Agenda may include the following:
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- .1 Review, approval of minutes of previous meeting;
- .2 Review of Work progress since previous meeting;
- .3 Field observations, problems, conflicts and interferences
- .4 Problems which impede construction schedule;
- .5 Review of off-site fabrication delivery schedules;
- .6 Corrective measures and procedures to regain Project schedule;
- .7 Revisions to construction schedule;
- .8 Progress, schedule, during forthcoming work period;
- .9 Review submittal schedules; expedite as required;
- .10 Maintenance of quality standards;
- .11 Pending changes and substitutions;
- .12 Review proposed changes for effect on construction schedule and on completion date;
- .13 Other business.

7 Submittals

- .1 Refer to Section 01 33 00 Submittal Procedures.

7.2 **MONTHLY EARNED VALUE PROGRESS**

- .1 With each monthly progress claim provide an “S” curve indicating the actual earned progress compared against the planned earned progress.

7.3 **REQUEST FOR INFORMATION (RFI)**

- .1 Requests for Information shall be completed and submitted by the Contractor if items are not indicated on the Drawings or contained in the Project Manual that is required to properly perform the Work. RFI's shall include a detailed written statement that indicates the specific Drawings or specification sections that require clarification.
- .2 Upon receipt of a RFI the Consultant will provide a response to the Contractor within five Business Days. Business Days are considered Monday to Friday.

7.4 **CONTEMPLATED CHANGE ORDERS**

- .1 The Contractor shall prepare, as a minimum, a detailed, itemized Contemplated Change Order breakdown in accordance with, but not limited to, the requirements below. Subcontractor or Material Supplier pricing shall follow the same requirements.
 - .1 Labour: Include hourly wage, number of hours including overtime.
 - .2 Equipment rentals: No rental charges will be allowed for hand tools, minor equipment, etc.
 - .3 Materials: Material purchased by the Contractor and incorporated into the Work, showing costs, quantities or unit prices of all items, as appropriate.

- .4 Delivery charges for material or equipment.
- .5 Overhead and taxes.
- .2 The following shall *not* be included in a Contemplated Change Order breakdown:
 - .1 Owned equipment costs.
- .3 The Contract Administrator or the Owner reserves the right to request reasonable additional information to support the Contemplated Change Order.

8 Schedules

8.1 **SCHEDULES REQUIRED**

- .1 One Group Construction schedule by building with all tasks and critical path shown for the entire Group.
- .2 Detailed building Schedules with all tasks and critical path shown.
- .3 Work schedule with workforce loading.
- .4 Submittal Schedule for System Design and Engineering, Shop Drawings, Product Data, As-Built Drawings, Operating and Maintenance Manuals, Samples.
- .5 Delineation Plan

8.2 **SUBMISSION**

- .1 The Contractor shall submit initial schedules within seven days after award of Contract.
- .2 Consultant and Owner will review schedule and return reviewed copy within ten (10) Business Days after receipt.
- .3 The Contractor shall resubmit finalized schedule within three days after return of reviewed copy.
- .4 Submit updated progress schedule with each application for payment and as otherwise instructed by Owner.
- .5 Distribute copies of the reviewed schedule to job Site, Subcontractors and other concerned parties.

8.3 **RESPONSIBILITY**

- .1 The Contractor shall perform overall planning and control of the Project.
 - .2 Plan and schedule the Work to provide a continuous and efficient flow of the Work to achieve the Contract completion date.
 - .3 The Contractor shall develop a detailed schedule as previously described, based on sequencing, phasing, and direction of installation required by the Project.
 - .4 At the regular scheduling meetings, The Contractor shall report on the actual progress of each element of Work, including work of Subcontractors.
 - .5 The Contractor shall report on firm established delivery and/or start dates for all critical material and equipment, of own trades and of Subcontractors. Immediate notice shall be
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given to the Owner of all problems or anticipated problems in respect of deliveries of critical materials or trade operations.

8.4 **CONSTRUCTION SCHEDULES**

- .1 The Contractor shall prepare and submit to the Owner a detailed schedule. Schedule shall be created using the scheduling software Microsoft Project at no extra cost to the Owner, based on sequencing, phasing, and direction of installation required by the Project.
 - .1 Prepare schedule in the form of a horizontal bar chart and with manpower loading figures based on average weekly loading.
 - .2 Provide a separate bar line for each trade or operation. Identify all tie-ins to Owner's existing facilities.
 - .3 Provide horizontal time scale identifying the first work day of each week.
 - .4 Format in chronological order of the start of each item of Work.
 - .5 Format schedules to allow plotting of actual progress against scheduled progress.
- .2 Update for progress and submit weekly or as requested by Owner.

8.5 **WEEKLY SCHEDULE WITH MANPOWER LOADING**

- .1 For weekly coordination meeting provide a detailed two-week work schedule outlining Work activities and manpower requirements (by trade) planned for that period. Update and submit weekly.
- .2 Identify problems on the past week's operation and submit proposed solutions at coordination meetings.

8.6 **SHOP DRAWINGS AND PRODUCT DATA**

- .1 Contractor's detailed schedule of Work or a separate schedule shall identify the development and submission of Shop Drawings and submission of Product data.
 - .2 The Contractor shall provide Shop Drawings in the form specified and in an orderly sequence as directed by the Consultant.
 - .3 The Contractor to shall provide sufficient information for comprehensive review of Shop Drawings.
 - .4 At the start of the Project, review the Contract Documents and compile a submittal schedule which shall include all submittals required by the Contract Documents. Coordinate the submittal schedule with the construction schedule, show all scheduled dates the submittals are to be submitted, and the latest review return date from the Consultant.
 - .5 At the time of submission, the Contractor shall notify the Owner in writing of deviations in Shop Drawings from the requirements of the Contract Documents.
 - .6 Shop Drawings and all other submittals to be issued to the Consultant via a browser based contract administration software such as Part3 .
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- .1 Part3 is a browser Contract Administration software the Consultant is using exclusively for the program.
- .2 The Consultant will provide access and log information for Part3 to the Contractor prior to the start of Work.
- .7 Shop drawings and all other submittals issued in any other form outside of Part3 will not be accepted
- .8 Upon receipt of a Shop Drawing the Consultant will provide a response to the Contractor within ten Business Days. Business days are considered Monday to Friday.

8.7 **DELINEATION**

- .1 The Contractor shall coordinate with other contractors at the facility and arrange for delineation in time and space as required for the completion of construction Work. There could be multiple contractors performing Work at the facility. No additional/overtime charges will be paid if the construction Work is delayed because of coordination with other contractors performing Work at the facility.
- .2 The Contractor shall develop Construction Delineation Plan and implement to ensure that delineation in both time and space is established and maintained among two or more Contractors. Additionally, ensure site coordination during construction Work activities performed at the facility and that there is only one Constructor (Contractor) at the facility at any point in time in the construction Work area.

9 **Quality Control**

9.1 **INSPECTION AND TESTING BY CONTRACTOR**

- .1 The Contractor shall be responsible for inspection and testing as required by the Contract Documents, statutes, regulations, by-laws, standards or codes or any other jurisdictional authority. Give the Consultant timely notice of the readiness for inspection, date and time for such inspection for attendance by the Consultant.

9.2 **INSPECTION AND TESTING BY INDEPENDENT AGENCIES**

- .1 Independent inspection/testing firms may be engaged by Owner for the purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Owner.
- .2 Employment of inspection/testing firms does not relieve the Contractor's responsibility to perform Work in accordance with Contract Documents. Defective materials and/or workmanship may be rejected, regardless of previous inspection, whenever found.
- .3 The Contractor shall provide assistance required for executing inspection and testing by the appointed firms. Allow access and facilities for inspection and testing.
- .4 If defects are revealed during inspection and/or testing, the Owner will request additional inspection and/or testing to ascertain the full degree of the defect. Correct defects and irregularities as advised by Owner at no cost to Owner. Pay costs for retesting and re-inspection.

9.3 **PROCEDURES**

- .1 The Contractor shall allow inspection/testing agencies access to the Work on the Site, at off-site manufacturing and fabrication plants.

- .2 The Contractor shall notify the appropriate agency and Owner and Consultant in advance of the requirement for tests, in order that attendance arrangements can be made.
- .3 The Contractor shall submit samples and/or materials required for testing. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in the Work.

9.4 **REPORTS**

- .1 Copies of inspection and test reports will be issued to prime Contractor, Owner and Consultant.
- .2 The Contractor shall provide copies to Subcontractor of work being inspected/tested.

9.5 **EQUIPMENT/SYSTEMS**

- .1 The Contractor shall submit adjustment and balancing reports for mechanical, electrical and building equipment systems.

10 Temporary Construction Facilities and Controls

10.1 **INSTALLATION/REMOVAL**

- .1 The Contractor shall provide construction facilities and temporary controls to execute the Work expeditiously.
- .2 The Contractor shall remove from Site all such Work after use.

10.2 **GUARD RAILS, BARRICADES AND TRAFFIC CONTROL**

- .1 The Contractor shall provide secure, rigid guard railings and barricades where required for protection of Work, workers and public.
- .2 The Contractor shall provide flag-persons, traffic signals, flares, lights or lanterns as required to perform the Work and protect the public.
- .3 Provide as required by governing authorities.

10.3 **CONSTRUCTION TRAILERS AND TEMPORARY BUILDINGS**

- .1 Where applicable, provide temporary facilities, including but not limited to washroom, locker rooms and office space. If required, move existing equipment into the temporary facility to ensure continuity of space use. Provide signage and ensure the path of travel to temporary facilities is kept clean and safe for all building occupants.
 - .2 Stay within the working limits defined in the Contract Documents. If the Contractor can prove that there are additional or alternate requirements, the Contractor shall define the extent of space required for construction trailers, laydown areas, storage containers or buildings, construction access roads, etc. and submit a proposal to the Contract Administrator for review and approval.
 - .3 Where not available, provide means of storage and protection of furniture, equipment and existing Work moved or altered to facilitate construction.
 - .4 Locate construction trailers, laydown areas, and temporary buildings as arranged with the stakeholders and Contract Administrator.
 - .5 When temporary building facilities and/or laydown areas are no longer required, promptly remove all contractor equipment, including all construction waste, unless otherwise
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specified or directed. Restore all areas to conditions at start of Contract to the satisfaction of the Contract Administrator.

10.4 **PORTABLE WASHROOM TRAILERS – BUILDING STAFF**

- .1 Provide portable washroom trailers where indicated. The trailer shall comprise of the following:
 - .1 Warm and cold running water
 - .2 Fresh water holding capacity: 137 gallons
 - .3 Waste water holding capacity: 43 gallons
 - .4 Laminated wood flooring
 - .5 Formica walls and countertops
 - .6 Heated and air conditioned
 - .7 Each washroom shall be fully enclosed.
- .2 Each washroom shall include the following:
 - .1 1 foot pump operated toilet (recirculating flush)
 - .2 1 foot pump operated sink
 - .3 1 Soap dispenser
 - .4 Paper supplies
- .3 Trailer power requirements:
 - .1 Provide 2 x 110V/15 amp power supply for pumps and lights during warm months.

10.5 **HOARDING**

- .1 Contractor shall submit Shop Drawings indicating locations of hoarding, barriers, fencing and dust tight screens prior to commencement of Work. Shop drawings shall illustrate plan for maintaining clear exits during each stage of the Work. Refer to Section 02 41 19 for specific requirements for construction hoarding and dust tight screens.
 - .2 Provide hoarding where required to protect the public, workers and private property from injury or damage.
 - .3 Provide protection from damage for all existing trees and plants that are not indicated to be removed.
 - .4 Install hoarding, fencing, barriers and dust-tight partitions to protect the parts of the building that are not under construction.
 - .5 Provide alternative exits when an existing exit is closed off due to construction activities. Alternative exits must be acceptable to both the Owner and to Authorities Having Jurisdiction. All temporary exits must be clearly identified with appropriate signage.
 - .6 Provide and maintain, at all times, appropriate protection to fully weatherproof areas of the facility which may become exposed due to demolition, removals, and construction.
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Prevent ingress of water, snow, etc., into the interior or building components. All costs for clean-up and restoration of damages resulting from failure to comply are the responsibility of the Contractor.

- .7 All Furniture, Equipment and existing Work moved or altered to facilitate construction or movement of material or equipment to be stored and protected with dust-tight covers. Storage space to be provided by the Contractor where not possible to store on site. All Furniture, Equipment and existing Work to be subsequently returned to its original location by the Contractor.

- .8 Contractor is responsible for ensuring at all times any hoarding within a building, and/or outside of a building is not obstructing or impeding any Fire Exiting routes and Emergency access routes.

- .1 Contractor shall prepare a hoarding schedule for the duration of the Contract prior to start of the Work so as to not impact the Construction Schedule. Hoarding around emergency exits and emergency exit pathways is to be coordinated with the Fire Inspectors for their review and approval prior to commencement of the Work.

- .9 The Contractor shall not use any areas inside or outside of a building for hoarding, storage, or activity unless with the written consent of the building stakeholder

10.6 **DUST TIGHT SCREENS**

- .1 The Contractor shall provide dust tight screens or partitions to localize dust generating activities and for the protection of workers, finished areas of the Work and the public.
- .2 Maintain and relocate protection until such Work is complete.

10.7 **ACCESS AND CONSTRUCTION PARKING**

- .1 The Contractor shall use entrances, exits and on-Site routes as directed by Owner.
- .2 Parking is not permitted on any Site. Contractor to arrange for their own parking. Comply with the Owner's requirements for daily site access.
- .3 Before Contractor enters the Site with his vehicles or equipment, he shall coordinate with the Owner and appropriately barricade, stake off or snow fence the access routes and storage areas and around the construction area in order to prevent damage to buildings, grounds, plantings, turf and surrounding facilities at the Site, and to restrict unauthorized persons from entering the construction area. The Contractor shall be responsible for making good any and all damages caused by his operations on Site. Restoration of such damages shall be to the original condition or better, and to the satisfaction of, and at no extra cost to, the Owner.
- .4 All construction activities must not obstruct the access roadways designated for fire department equipment. If it is necessary that existing access be obstructed or removed, alternative access, acceptable to the fire department, must be pre-planned and provided prior to commencement of construction.

10.8 **USE OF THE WORK**

- .1 Confine the Work and the operations of employees to limits indicated by the Contract Documents. Do not unreasonably encumber the premises with Products.

- .2 Storage of material shall be outside of the building with exception of material for each day's work requirements.
- .3 Fabrication shops shall not be set up within the building except as directed by the Owner.
- .4 Do not load or permit to be loaded any part of the Work with a weight or force that will endanger the Work.
- .5 The Contractor shall be responsible for careful and reasonable use of any Owner-supplied water and power.

10.9 **TEMPORARY SIGNAGE**

- .1 Ensure that employees and the public are informed of the Work being performed in the work area a minimum of 5 days in advance of Work commencing and that signage is installed noting the nature of Work being performed, anticipated start and end dates and any dangers that may result from the Work.
- .2 Provide temporary wayfinding signage as needed around hoarding, area and room closures, stair closures, exit closures, or otherwise as needed to ensure safe passage and exiting.
- .3 Replace existing signage as it is removed in the course of the Work with temporary signage. Replace with new signage where indicated on Drawings upon completion of the Work.
- .4 Fabricate temporary signage from corrugated plastic. Where required, add grommets for installation.

10.10 **SANITARY FACILITIES**

- .1 The Contractor shall provide weatherproof sanitary facilities as required portable, trailer type washrooms which consist of flush toilets and wash basins in accordance with local health and other authorities.
- .2 The Contractor shall maintain in clean condition.
- .3 Contractors and Subcontractors are not allowed to use the buildings existing facilities.

10.11 **WATER SUPPLY**

- .1 For water required for construction, refer to City of Toronto Master Services Agreement.

10.12 **TEMPORARY POWER AND LIGHTING**

- .1 Refer to the City of Toronto Master Services Agreement.

10.13 **EQUIPMENT/TOOL/MATERIALS STORAGE**

- .1 The Contractor shall provide and maintain, in a clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials. Locate as directed by Owner.
 - .2 The Contractor shall locate materials not required to be stored in weatherproof sheds on Site in a manner to cause the least interference with Work activities, as directed by Owner.
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10.14 **SECURITY**

- .1 Be responsible for the security of Work and material supplied, stored and installed until all Work is complete and accepted by Owner.
- .2 Any security guard patrol or service provided by Owner is for the protection of the Owner's interest in the Work on the Site, and shall not relieve the Contractor of his responsibility to protect the Work of the Contract.

10.15 **PROJECT CLEANLINESS**

- .1 The Owner reserves the right to perform clean-up Work not expeditiously completed by the Contractor and deduct such costs from the Contract Price.

10.16 **COVID 19 PROTOCOL**

- .1 The Contractor shall take all necessary precautions to minimize the risk of COVID-19 transmission and illness to themselves, workers and others at the construction site as well as the public sharing common spaces or accessing areas of the project after turn-over.
- .2 The Contractor and Subcontractors shall ensure that individuals assigned to perform the work on this project are fully vaccinated with the COVID-19 vaccine series. This requirement shall be met in addition to any other policies regarding COVID-19 vaccination under regulations, legislation or guidelines applicable to them.
- .3 When directed by the City of Toronto, the Contractor shall provide a written attestation of compliance with the City's COVID-19 Vaccination requirements in accordance with the COVID-19 Vaccination Policy for Contractors, including proof of compliance as required by the City.
 - .1 Refer to the link below for the City of Toronto's COVID-19 Vaccination Policy for Contractors:

<https://www.toronto.ca/city-government/accountability-operations-customer-service/city-administration/corporate-policies/people-equity-policies/covid-19-vaccination-policy-for-contractors/>
- .4 Prior to the start of construction, the Contractor shall develop and submit a written site safety plan. This plan is to be submitted two (2) weeks prior to the start of construction and shall outline the policies and procedures that reflect the recommendations of the Provincial Health Officer and the City of Toronto COVID-19 guidance in force at the time. The written plan shall include, but is not limited to the following:
 - .1 Implementation of a workplace vaccination policy.
 - .2 Cleaning and decontamination procedures for all common areas and surfaces.
 - .3 A preparedness and response plan in the event that someone becomes ill with the symptoms of transmittable illness or disease.
 - .4 A separation plan indicating how the Contractor will provide separation of the plant staff from the Contractor's staff, especially in crowded and congestion area with poor ventilation.
 - .5 Health screening of all personnel on site prior to entry and exit of the worksite.

- .5 The Contractor shall provide the following:
 - .1 Adequate personal protective equipment supplies such as masks and gloves as required.
 - .2 Adequate handwashing and sanitation facilities that are visible and easily accessed on site for all workers and visitors.

10.17 **ROAD CLEAN-UP**

- .1 The Contractor shall take all precautions to avoid depositing materials, debris and mud on the Owner's roadways and parking areas and on roads and streets adjoining the Owner's property from vehicles and equipment operating to and from the construction Site, and be responsible for removal of such deposits by brooming and washing.

11 Fire and Life Safety

11.1 **SAFETY PLAN**

- .1 The Contractor shall submit to the Owner for review, prior to the Commencement date or as directed by the Owner, the following:
 - .1 The Contractor's occupational health and safety policy and procedures.
 - .2 The Contractor's site-specific safety plan and associated procedures.
 - .3 The site-specific emergency response plan listed below:
 - .1 Site-specific emergency response plan guideline.
 - .2 Emergency Response Planning for Construction Projects by the Provincial Labour-Management Health and Safety Committee.
 - .4 The site-specific traffic control plan.
 - .5 The Contractor's site orientation package.
- .2 Depending on the nature of the construction, it may be necessary to modify the fire emergency procedures. Such changes may be temporary to accommodate revised exits, modifications to the fire alarm system operation, etc., in which case the procedures must be returned to the original format at the completion of the Project. In some cases, permanent revisions to the emergency procedures are required when the construction is completed.

11.2 **TRAINING, AWARENESS AND ORIENTATION**

- .1 The Contractor shall provide the Owner, Consultant and visitors to the Site, training, awareness, orientation, or familiarization in advance of Site visit.

11.3 **FIRE PROTECTION**

- .1 The Contractor shall provide and maintain temporary fire protection equipment e.g. portable fire extinguishers, during performance of Work required by authorities having jurisdiction, governing codes, regulations and by-laws, to the satisfaction of the Owner and all local and insurance authorities in order to protect the property of the Owner and the Contractor against fire hazards during construction.

- .2 Bulk storage of flammable liquids and other hazardous materials is not allowed on the Site.
- .3 Flammable liquids must be handled in approved containers.
- .4 The bringing in, use, and disposal of gasoline, benzine or other flammable materials shall be handled with good and safe practice as required by authorities having jurisdiction.
- .5 The Contractor shall provide fire extinguishers of the non-freezing chemical type in each temporary building, enclosure, and trailer.
- .6 The Contractor shall use fire-proofed tarpaulins.
- .7 A technical representative from the fire alarm manufacturer shall be assigned to the Project to coordinate the stages of modifications and/or extensions to the fire alarm system. Whenever there is an outage of at least a portion of the fire alarm system, the Contractor must notify the municipal fire department and the building stakeholders of the temporary shutdown two weeks in advance.
- .8 A fire watch shall be required for each of the following activities regardless of the number, duration, or size of the activity in operation on a single floor:
 - .1 Any open flame activities (e.g. soldering and welding);
 - .2 Shutdown of fire detection system;
 - .3 Shutdown of sprinkler system;
 - .4 Connection to drain line.
- .9 Temporary fire separations of steel studs and gypsum board construction equivalent to a 45 minute fire resistance rating must be erected in existing corridors on occupied floor areas exposed to new corridors under construction. Where access is required, protect the opening with a solid core wood or hollow metal door with self-closing and latching hardware. If temporary fire separations cut off or eliminate the required access to exits, alternative access must be provided.

11.4 **OCCUPATIONAL HEALTH AND SAFETY**

- .1 Safety is of prime importance on this Project.
 - .2 The Contractor shall conform to safe Work practices in accordance with regulations and authorities having jurisdiction.
 - .3 The Contractor shall promptly report to Owner all accidents or if any claim is made by anyone against the Contractor or Subcontractor on account of any accident.
 - .4 The Contractor shall provide at the Site, equipment to supply first aid service.
 - .5 The Contractor shall enforce proper Work methods and act immediately on directions regarding safety and Work practices given by authorities having jurisdiction or the Owner at no additional cost to Owner.
 - .6 Failure of Contractor to comply with verbal or written instructions or orders from the Ministry of Labour inspector or other authorities as well as instructions from the Owner or Consultant regarding safe Work practices or provision of specified requirements under the act shall be considered non-compliance of the Contract.
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- .7 The Contractor shall maintain on Site a copy of the latest edition of the "Occupational Health and Safety Act, Construction Projects, issued April 2009", and "Occupational Health and Safety Act, Industrial Establishments, issued October 2006".
- .8 The Contractor shall ensure that all personnel are adequately equipped to comply with safety regulations and that sufficient safety equipment is available.
- .9 Lack of equipment will not be reason for non-compliance.

11.5 **SAFETY SUPERVISOR**

- .1 The Contractor shall designate a senior employee as Contractor's safety supervisor.
 - .1 Duties will include involvement in training, instruction, planning, safety patrols, and enforcement of rules.
 - .2 The Contractor shall provide name and telephone number (site, office and residential) to Owner.
- .2 The Contractor shall ensure that a designated person is certified by IHSA (Infrastructure Health and Safety Association).
- .3 The designated safety supervisor must be familiar with Workplace Hazardous Materials Information System (WHMIS) regulations and be responsible for compliance.
- .4 The Contractor shall ensure that Controlled Products shall be properly labeled.
- .5 The Contractor shall provide proper warning labels and training at the workplace.
- .6 The Contractor shall provide copies of material safety data sheets for any controlled Product in the workplace.
- .7 The Contractor shall be responsible for all other requirements of the regulations as applicable to employers.
- .8 Before commencing any Work on the Site, The Contractor shall attend Owner's safety orientation meeting and provide Owner with a proposal as to how hazardous materials will be stored and dispensed on the Site area, in addition, specifically outline the measures which Contractor will undertake to prevent damage or injury in the event of an accidental spill.
- .9 The Contractor's "Handling Procedure" will be provided no later than ten days following the health and safety orientation meeting.

12 Material and Equipment

12.1 **PRODUCTS - GENERAL**

- .1 The Specifications may contain Product brands that form the basis of some design, and the Specifications will explicitly state so. Such "basis of design" Products are indicated as first listed item in the Product Specifications.
 - .1 Other listed manufacturers' Products are acceptable only on the condition that they comply with, or are modified as necessary, to comply with specified and indicated requirements and conform to quality levels and functional requirements of "basis of design" Product.

- .2 Inclusion of a manufacturer's model number does not void any specified or indicated requirements.
- .2 When manufacturers' catalogued trade name and model number is specified for a Product, any specified Product will be acceptable.
- .3 When a Product is specified by reference to a standard only, any Product that meets the specified standard may be selected. Products meeting minimum reference standards will be accepted subject to the Consultant's review for compliance with the Specifications.
- .4 When a Product is specified by performance Specification without manufacturers specified, any Product meeting the requirements of the Specification may be accepted subject to Consultant's review.
- .5 Unless otherwise indicated in the Specifications, maintain uniformity of manufacture for any particular or like item throughout the Work.
- .6 Where a warranty is not specified in the specification section, the manufacturer's standard warranty shall apply.

12.2 **PRODUCT AND MATERIAL QUALITY**

- .1 Products, materials, equipment, and articles referred to as Products throughout the Specifications incorporated in the Work shall be new, not damaged or defective, and of the best quality compatible with Specifications for the purpose intended. If requested, furnish evidence as to type, source and quality of Products provided.
- .2 Defective Products will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is a precaution against oversight or error. Remove and replace defective Products at own expense and be responsible for delays and expenses caused by rejection.
- .3 Unless otherwise indicated in the Specifications, maintain uniformity of manufacturers for any particular or like item.

12.3 **SUBSTITUTIONS**

- .1 Refer to Section 01 62 01 Substitution Request Form.

12.4 **EXPEDITING**

- .1 Immediately after award of Contract, The Contractor shall review Product delivery requirements and anticipate foreseeable supply delays for any item. If delays in supply of Products are foreseeable, notify the Owner of such, in order that substitutions or other remedial action may be authorized in sufficient time to prevent delay in performance of Work.
- .2 In the event of failure to notify the Owner at commencement of Work and should it subsequently appear that Work may be delayed for such reason, the Owner reserves the right to substitute more readily available Products of similar character at no increase in Contract Price.
- .3 The Contractor shall utilize Canadian materials and Products if available and equivalent in price and quality.
- .4 The Contractor shall submit, when requested by Owner, an updated material procurement/expediting record clearly indicating the status of material delivery and fabrication. Particulars to be covered by this record shall include the item identification,

sub-vendor, order date, order number, Shop Drawing submission date(s) and review date(s), required delivery date, promised delivery date, date received, date checked and general remarks.

.5 The Contractor shall accumulate and submit similar records from (assigned) Subcontractors and ensure that Subcontractors are properly and frequently expediting all equipment and material to meet delivery deadlines to suit installation schedule.

.6 Allow the Owner or their Representative free access to the Contractor's plant and to Subcontractor's plants for visual inspection of allotted material and/or progress of the Work.

12.5 **TRANSPORTATION**

.1 The Contractor shall pay transportation costs to Site of Products required in the performance of Work.

12.6 **STORAGE, HANDLING AND PROTECTION**

.1 The Contractor shall handle and store Products in a manner to prevent damage and deterioration.

.2 The Contractor shall remove and replace damaged Products at own expense and to the satisfaction of Owner.

12.7 **WORKMANSHIP**

.1 Workmanship shall be the best quality, executed by workers experienced and skilled in the respective duties for which they are employed.

.2 The Contractor shall immediately notify the Owner if required Work is such as to make it impractical to produce required results.

.3 Do not employ any unfit person or anyone unskilled in their required duties. The Owner reserves the right to require the dismissal from the Site of workers deemed incompetent, careless, insubordinate, or otherwise objectionable.

12.8 **CUTTING AND REMEDIAL WORK**

.1 Refer to article - Cutting and Patching.

12.9 **FASTENINGS**

.1 The Contractor shall provide metal fastenings and accessories in same texture, colour and finish as adjacent material unless indicated otherwise.

.2 The Contractor shall prevent electrolytic action between dissimilar metals and materials.

.3 The Contractor shall use non-corrosive hot dipped galvanized steel fasteners and anchors for securing exterior Work, unless stainless steel or other material is specifically requested in the affected Specification section.

.4 Space anchors within their load limit or shear capacity and ensure that they provide positive permanent anchorage. Wood or any other organic material plugs are not acceptable.

.5 The Contractor shall keep exposed fastenings to a minimum, space evenly and install neatly.

- .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

12.10 **PROTECTION OF WORK**

- .1 The Contractor shall adequately protect Work completed or in progress. Work damaged or defaced due to failure in providing such protection is to be removed and replaced, or repaired, as directed by the Owner, at no increase in Contract Price.
- .2 The Contractor shall prevent overloading of any part of the Work or building. Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated without written approval of the Owner.
- .3 The Contractor shall maintain and monitor protection of roofing membrane when Work is done on or above finished roofing system.

12.11 **EXISTING UTILITIES**

- .1 Connect to existing services or utilities at times directed by Owner or local governing authorities, with a minimum of disturbance to Work, building occupants, pedestrian and vehicular traffic.
- .2 The Contractor shall protect and maintain existing active services. When inactive services are encountered cap off in a manner approved by authority having jurisdiction and stake or otherwise record location of capped service.

13 Systems Demonstrations

13.1 **NOT USED**

14 Contract Closeout

14.1 **FINAL CLEANING**

- .1 When the Work is substantially performed, the Contractor shall remove surplus Products, tools, construction machinery and equipment not required for the performance of the remaining Work. Final cleaning shall include, but are not limited to the following:
 - .1 Remove waste materials and debris from the Site at regularly scheduled times or dispose of as directed by the Owner. Do not burn waste materials on Site, unless approved by the Owner.
 - .2 Use professional cleaners for final cleaning. Use only cleaning material recommended by manufacturer of surface to be cleaned.
 - .3 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation system is not permitted for this purpose.
 - .4 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on previously cleaned surfaces
 - .5 Remove dirt and broom clean, wash and sweep exterior walks, steps and paved surfaces. Leave exterior Work broom clean before the inspection process commences.
 - .6 Remove dust, dirt and other foreign disfigurations from exposed surfaces.

- .7 Vacuum clean and dust building interiors, behind grilles, louvres and screens. Leave Work vacuum-clean before the inspection process commences.
- .8 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, mechanical and electrical fixtures and equipment. Replace broken, scratched or disfigured items at no extra cost to the Owner.
- .9 Remove grease, stains, spots, marks, dust and dirt from decorative Work, electrical and mechanical fixtures, furniture, fitments, and walls and floors.
- .10 Remove from building and site, snow and ice that would prevent operation and activities of the facility.

14.2 **WARRANTY**

- .1 Refer to Division 00 for Warranty information.

14.3 **DOCUMENTS**

- .1 The Contractor shall submit close-out documents to the Consultant and the City of Toronto in electronic and printed copy formats within 45 days of the issuance of Substantial Performance. Provide electronic copies and printed in 3-ring binders of close-out documents to the Consultant for prior review. Closeout documents submissions includes, but is not limited to:
 - .1 As-Built Drawings in electronic (USB) AUTOCAD live files as per the latest drawing standard.
 - .2 Notice of Project
 - .3 Health & Safety Pre-start report and Policy.
 - .4 Project Schedules
 - .5 Warranties and bonds, including the Two-Year Warranty Certification for all Work.
 - .6 Section 01 33 00 Submittal Procedures: Shop Drawings, As-Built Drawings, Building Manuals, Operation and Maintenance Manuals, Samples.
 - .7 Change Orders and Change Directives
 - .8 Testing and inspection certificates required by municipal, provincial and other authorities having jurisdiction.
 - .9 Final adjustment in cash allowances.
 - .10 Product data, materials and finishes and related information.
 - .11 Commissioning reports.
 - .12 Individual Specifications sections: Specific requirements for operation and maintenance data.
 - .13 Substantial Performance Certificate and Advertisement
 - .14 Contact List for Design and Construction Teams

- .15 Prime Consultant Final Completion Certificate.
- .16 New Asset & Equipment PM Details Form
 - .1 Refer to Section 01 10 00.3 for sample sheet
 - .2 Contractor to request digital form from the Consultant and/or Owner
- .17 Access Database
 - .1 As part of the Closeout documents, the Contractor shall provide a breakdown of tasks under each specification division and fill out pricing and quantities.
 - .2 Access Database to be submitted to the Consultant as an excel file. Template to be provided to the General Contractor at a later date.
- .2 Collect reviewed submittals and assemble documents executed by Subcontractors, Suppliers, and manufacturers.
- .3 Submit material in a neatly indexed package, prior to final application for payment.
- .4 All Warranties shall commence from date of Certificate of Substantial Performance unless indicated otherwise.
- .5 Contractor shall be responsible for obtaining and enforcing all required warranties.
- .6 Examine all sections of the Specification to ensure inclusion of all warranties specified.

14.4 **INSPECTION/TAKEOVER PROCEDURES**

- .1 Prior to application for certificate of Substantial Performance, The Contractor shall carefully inspect the Work and ensure it is complete, that major and minor construction deficiencies are complete, defects are corrected and the building is clean and in condition for occupancy. Notify the Owner in writing of satisfactory completion of the Work and request an inspection.
- .2 The Contractor shall conform to OAA/OGCA document No.100 for takeover procedures.
- .3 Consultant will allow a maximum of two final inspections for each discipline for rectifying all defects. Beyond this all additional visits will be charged to the General Contractor at a rate of \$1000.00 per visit/report per person.
- .4 During inspection by the Owner and Consultant, a list of deficiencies and defects will be tabulated. Correct within agreed time schedules.

14.5 **EQUIPMENT HANDOVER LIST**

- .1 The Contractor shall submit Equipment Handover List in accordance with Section 01 33 00, containing specific technical data for each equipment which has, or shall have, an Asset Tag number allocated. List shall include but not limited to the equipment name, quantity and equipment model.
 - .2 The template format will be provided by the Owner.
- End of Section

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City of Toronto

Method of Procedure (MOP) Template



Detailed Technical Method of Procedure
Isolation of Switchboard EB

Title: Isolation of Switchboard EB
Version: 2
Project:
Site Address:
Revision Date:

Activity Date:
Estimated Duration: 4:30
Start Time: 7:30
End Time: 11:30
Required Tech 1:
Required Tech 2:

Approved by:

Technical Details Approval by:	<input type="checkbox"/> -	<input type="checkbox"/> -	<input type="checkbox"/> COT - FM	<input type="checkbox"/> COT - Site Operations				
Impact/Schedule Approval by:	<input type="checkbox"/> T.P.S	<input type="checkbox"/> TPS - COMM	<input type="checkbox"/> PARAMEDICS	<input type="checkbox"/> COT - transportation	<input type="checkbox"/> COT - OEM	<input type="checkbox"/> COT – I & T	<input type="checkbox"/> COT – Security	<input type="checkbox"/> T.F.S

Overview:

MOP 60 pertains to the isolation of Switchboard EB and the downstream loads in order to remove panel CDP and connect new UPS-2 feeders.

Blackout:

In the event of an utility outage during the activity, the work shall continue as the building is being carried under the generator plant in a controlled condition.



Detailed Technical Method of Procedure
Isolation of Switchboard EB

Risk Assessment Summary				
Floor	Tenant	Building Level Impact	Risk Level	Duration (hrs)
Full Building	All	Isolation of Switchboard EB. The Blue Side loads will be carried by UPS-1 while UPS-2 is isolated. Momentary loss of emergency power identical to monthly generator testing.	High	4.5
Floor	Tenant	Floor Level Impact	Risk Level	Duration (hrs)
9th	T.P.S.	Loss of B feed at critical load TPS Radio Equipment Room.	High	4.5
8th	Paramedics	No stakeholder specific impacts.	N/A	0
	T.P.S. - COMM	No stakeholder specific impacts.	N/A	0
7th	T.P.S - I&T	Loss of B feed at critical load TPS TRIP Room.	High	4.5
	Paramedics			
	T.F.S - I&T			
6th	O.E.M.	No stakeholder specific impacts.	N/A	0
	T.F.S.	No stakeholder specific impacts.	N/A	0
5th	COT - Transportation	No stakeholder specific impacts.	N/A	0
4th	Paramedics	No stakeholder specific impacts.	N/A	0
3rd	COT - I&T	No stakeholder specific impacts.	N/A	0
2nd	COT - I&T	No stakeholder specific impacts.	N/A	0
1st	COT - I&T	No stakeholder specific impacts.	N/A	0
	COT - Security	No stakeholder specific impacts.	N/A	0
	Trans - RLC	No stakeholder specific impacts.	N/A	0
Basement	COT - I&T	No stakeholder specific impacts.	N/A	0
	COT - FM	No stakeholder specific impacts.	N/A	0

Low Risk - minimal to no impact to critical system redundancy
Medium Risk - work that has an impact to system redundancy (typical to normal maintenance)
High Risk - work that has an impact to system redundancy (above normal maintenance, e.g. loss of A or B feed at critical load, or limited cooling capacity)



Detailed Technical Method of Procedure
Isolation of Switchboard EB

Emergency Contacts				
Company	Title		Phone	Email
-	Construction Manager			
-	Project Manager			
-	Mechanical Foreman			
-	Project Foreman			
-	Mechanical Project Manager			
COT - FM	Project Manager			
COT - FM	Construction Coordinator			
COT - Site Operations	Operations Supervisor			
COT - Site Operations	Electrician			
-	Project Lead			
-	Electrical Enginner, E.I.T.			
-	Mechanical Lead			
-	Mechanical Engineer			
COT - FM				
COT - I&T				
COT - I&T				
COT - I&T				
COT - OEM				
COT - OEM				
COT - Transportations				
COT - Transportations				
COT - Security				
Paramedics				
T.F.S				
T.F.S				
T.P.S.				
T.P.S.				
T.P.S.				
T.P.S.				
T.P.S.				
Technician				
Technician				
Technician				
Technician				



Detailed Technical Method of Procedure
Isolation of Switchboard EB

Step	Description	Action By	Verified
0.0	Preliminary Steps		
0.01	At Switchboard 'EC' Blue Side, adjust the tie breaker settings and perform secondary injection.	FS	
0.02	At 'MTS A/C Riser 1', confirm the MTS is fed from DP-P-EB1.	Ops	
0.03	At 'MTS A/C Riser 2', confirm the MTS is fed from DP-P-EB1.	Ops	
0.04	At 'MTS-P-E1', confirm the MTS is fed from DP-P-EB1.	Ops	
0.05	At 'MCC-1EA', confirm the MCC is fed from Switchboard 'EA'.	Ops	
0.06	At 'MCC-2EA', confirm the MCC is fed from Switchboard 'EA'.	Ops	
0.07	At 'DP-P-EB5', confirm the panel is fed from Switchboard 'EA'.	Ops	
0.08	Confirm the building is being supported by Chiller 1 and Chiller 2.	Ops	
0.09	Confirm all UPSs are online with no alarms.	-	
0.10	Review generator fuel levels and confirm there are no alarms.	Ops	
0.11	Confirm PPE is prepared. Proper PPE must be worn for every switching steps and when confirming 0 voltage.	Ops	
0.12	Operations to notify security and the stakeholders that the work is about to begin.	Ops	

Step	Description	Duration	Start	End	Actual End	Action By	Verified
1.0	Start Generator Plant						
1.01	At Switchboard 'EA', turn the 'SELECT EMERGENCY AS PREFERRED SOURCE' switch.	1 min	7:00	7:01		-	-
1.02	At Switchboard 'EA', verify 'LOAD CONNECTED TO EMERGENCY' light is on.	1 min	7:01	7:02		-	-
1.03	At Switchboard 'EB', turn the 'SELECT EMERGENCY AS PREFERRED SOURCE' switch.	1 min	7:02	7:03		-	-
1.04	At Switchboard 'EB', verify 'LOAD CONNECTED TO EMERGENCY' light is on.	1 min	7:03	7:04		-	-
Step Sign Off (Initial):							-
Contingency Plan/Comments:							
2.0	Transfer Switchboard EC Blue side loads to Red side						
2.01	At UPS-1, confirm module is online with no alarms. Record load.	1 min	7:04	7:05		-	-
2.02	At UPS-2, confirm module is online with no alarms. Record load.	1 min	7:05	7:06		-	-
2.03	At UPS-1, turn the System Mode key to the 'BYPASS' position for three seconds.	1 min	7:06	7:07		-	-
2.04	At UPS-1, confirm the UPS is on Static Bypass.	1 min	7:07	7:08		-	-
2.05	At UPS-2, turn the System Mode key to the 'BYPASS' position for three seconds.	1 min	7:08	7:09		-	-
2.06	At UPS-2, confirm the UPS is on Static Bypass.	1 min	7:09	7:10		-	-
2.07	Obtain 2 Kirk Keys #17096 from key cabinet, insert into breakers 'EC-T1' and 'EC-T2' of Switchboard 'EC'.	1 min	7:10	7:11		-	-
2.08	At Switchboard 'EC', CLOSE breaker 'EC-T1'.	1 min	7:11	7:12		-	-
2.09	At Switchboard 'EC', remove the panel cover wearing proper PPE. At the tie breaker labelled 'EC-T2', test the following voltages: Phase A Line Terminal to Phase A Load Terminal (confirm voltage is less than +/-5V). Phase B Line Terminal to Phase B Load Terminal (confirm voltage is less than +/-5V). Phase C Line Terminal to Phase C Load Terminal (confirm voltage is less than +/-5V)	1 min	7:12	7:13		-	-
2.10	At Switchboard 'EC', CLOSE breaker 'EC-T2'.	1 min	7:13	7:14		-	-
2.11	At Switchboard 'EC', OPEN main breaker 'EC-A', remove Kirk Key and secure it.	1 min	7:14	7:15		-	-
2.12	At UPS-1, confirm the UPS is carrying all of the EC loads.	1 min	7:15	7:16		-	-
2.13	At UPS-1, turn the System Mode key to the 'NORMAL' position for three seconds.	1 min	7:16	7:17		-	-
2.14	At UPS-1, confirm module is online with no alarms. Record load.	1 min	7:17	7:18		-	-



	2.15	At UPS-2, shutdown the UPS.	1 min	7:18	7:19		-	-		-	
	2.16	At HMI, OPEN Switchboard 'EB' cell EB-4b breaker 'UPS-2 Input'.	1 min	7:19	7:20		-	-		-	
	2.17	At HMI, OPEN Switchboard 'EB' cell EB-2c breaker 'UPS-2 Bypass'.	1 min	7:20	7:21		-	-		-	
Step Sign Off (Initial):								-			
Contingency Plan/Comments:											
3.0 Isolation of UPS-P-4 Loads											
	3.01	At 'PP-9-UB1', OPEN all feeder breakers. (record the ones originally open)	1 min	7:21	7:22		-	-		-	
	3.02	At 'PP-7-UB1', OPEN all feeder breakers. (record the ones originally open)	1 min	7:22	7:23		-	-		-	
	3.03	Operations to return to 'PP-7-UB1' while all other loads are isolated and disconnect TP-UPS Panel 1 temporary feeders.	0 min	7:23	7:23		-	-		-	
	3.04	Verify with the associated stakeholders that all equipment are running satisfactorily.	1 min	7:23	7:24		-	-		-	
Step Sign Off (Initial):								-			
Contingency Plan/Comments:											
4.0 Isolation of UPS-P-4											
	4.01	At 'UPS-P-3', verify there is no alarm.	1 min	7:24	7:25		-	-		-	
	4.02	At 'UPS-P-4', verify there is no alarm and no load.	1 min	7:25	7:26		-	-		-	
	4.03	At 'UPS-P-4', shutdown UPS-P-4 module.	1 min	7:26	7:27		-	-		-	
Step Sign Off (Initial):								-			
Contingency Plan/Comments:											
5.0 Isolation of DP-P-EB4											
	5.01	At 'DP-P-EB4', OPEN breaker 'AC-PH-1'.	1 min	7:27	7:28		-	-		-	
	5.02	At 'DP-P-EB4', OPEN breaker 'UPS-P-4 Module'.	1 min	7:28	7:29		-	-		-	
	5.03	At 'DP-P-EB4', OPEN breaker 'UPS-P-4 Bypass'.	1 min	7:29	7:30		-	-		-	
	5.04	At BAS control system, acknowledge alarms and confirm system is running satisfactorily.	1 min	7:30	7:31		-	-		-	
Step Sign Off (Initial):								-			
Contingency Plan/Comments:											
6.0 Isolation of DP-P-EB2											
	6.01	At 'DP-P-EB2', OPEN breaker 'MTS-P-E1'.	1 min	7:31	7:32		-	-		-	
	6.02	At 'DP-P-EB2', OPEN breaker 'TX-P-B2'.	1 min	7:32	7:33		-	-		-	
	6.03	At 'DP-P-EB2', OPEN breaker 'MTS-A/C RISER 1'.	1 min	7:33	7:34		-	-		-	
	6.04	At 'DP-P-EB2', OPEN breaker 'MTS-A/C RISER 2'.	1 min	7:34	7:35		-	-		-	
	6.05	At 'DP-P-EB2', OPEN breaker 'DP-P-EM'.	1 min	7:35	7:36		-	-		-	
	6.06	At 'DP-P-EB2', confirm the 3 spare breakers are OPEN.	1 min	7:36	7:37		-	-		-	
	6.07	At HMI, OPEN Switchboard 'EB' cell EB-6c breaker 'DP-P-EB2'.	1 min	7:37	7:38		-	-		-	
Step Sign Off (Initial):								-			
Contingency Plan/Comments:											
7.0 Isolate Switchboard EB											
	7.01	At Switchboard 'EB', insert key and enable MAINTENANCE MODE.	1 min	7:38	7:39		-	-		-	
	7.02	At Switchboard 'C', OPEN, rack out and lock off breaker 'C-8 SWBD EB'.	1 min	7:39	7:40		-	-		-	
	7.03	At Switchboard 'EG-B', OPEN, rack out and lock off breaker 'EG-B-4b SWBD EB'.	1 min	7:40	7:41		-	-		-	
Step Sign Off (Initial):								-			
Contingency Plan/Comments:											
8.0 Disconnect Panel CDP and Connect New Feeders											
	8.01	At Switchboard 'EB', confirm 0 voltage.	1 min	7:41	7:42		-	-		-	
	8.02	At Switchboard 'EC', main breaker 'EC-A', adjust trip settings and perform secondary injection.	0 min	7:42	7:42		-	-		-	
	8.03	At Switchboard 'EB' cell EB-4c, disconnect existing panel CDP feeders.	45 min	7:42	8:27		-	-		-	
	8.04	At Switchboard 'EB' cell EB-4c, connect new UPS-2 Input Panel feeders.	120 min	8:27	10:27		-	-		-	
	8.05	At Switchboard 'EB' cell EB-4c, confirm torquing and meggering of new feeders	15 min	10:27	10:42		-	-		-	
Step Sign Off (Initial):								-			
Contingency Plan/Comments:											



9.0 Energize Switchboard EB											
	9.01	At Switchboard 'C', remove lock, rack in and CLOSE breaker 'C-8 SWBD EB'.	1 min	10:42	10:43		-	-		-	
	9.02	At Switchboard 'EG-B', remove lock, rack in and CLOSE breaker 'EG-B-4b SWBD EB'.	1 min	10:43	10:44		-	-		-	
	9.03	At Switchboard 'EB', insert key and enable AUTO MODE.	1 min	10:44	10:45		-	-		-	
Step Sign Off (Initial):								-			
Contingency Plan/Comments:											
10.0 Transfer Switchboard EC back to normal configuration											
	10.01	At HMI, CLOSE Switchboard 'EB' cell EB-4b breaker 'UPS-2 Input'.	1 min	10:45	10:46		-	-		-	
	10.02	At HMI, CLOSE Switchboard 'EB' cell EB-2c breaker 'UPS-2 Bypass'.	1 min	10:46	10:47		-	-		-	
	10.03	At UPS-2, startup the UPS.	1 min	10:47	10:48		-	-		-	
	10.04	At UPS-2, confirm module is online with no alarms.	1 min	10:48	10:49		-	-		-	
	10.05	At UPS-2, turn the System Mode key to the 'BYPASS' position for three seconds.	1 min	10:49	10:50		-	-		-	
	10.06	At UPS-2, confirm the UPS is on Static Bypass.	1 min	10:50	10:51		-	-		-	
	10.07	At UPS-1, turn the System Mode key to the 'BYPASS' position for three seconds.	1 min	10:51	10:52		-	-		-	
	10.08	At UPS-1, confirm the UPS is on Static Bypass.	1 min	10:52	10:53		-	-		-	
	10.09	At Switchboard 'EC', insert key and CLOSE main breaker 'EC-A'.	1 min	10:53	10:54		-	-		-	
	10.10	At Switchboard 'EC', OPEN breakers 'EC-T1' and 'EC-T2', remove Kirk Keys #17906.	1 min	10:54	10:55		-	-		-	
	10.11	Return 2 Kirk Keys #17096 to key cabinet.	1 min	10:55	10:56		-	-		-	
	10.12	At UPS-1, turn the System Mode key to the 'NORMAL' position for three seconds.	1 min	10:56	10:57		-	-		-	
	10.13	At UPS-1, confirm module is online with no alarms. Record load.	1 min	10:57	10:58		-	-		-	
	10.14	At UPS-2, turn the System Mode key to the 'NORMAL' position for three seconds.	1 min	10:58	10:59		-	-		-	
	10.15	At UPS-2, confirm module is online with no alarms. Record load.	1 min	10:59	11:00		-	-		-	
Step Sign Off (Initial):								-			
Contingency Plan/Comments:											
11.0 Energize DP-P-EB2											
	11.01	At HMI, CLOSE Switchboard 'EB' cell EB-6c breaker 'DP-P-EB2'.	1 min	11:00	11:01		-	-		-	
	11.02	At 'DP-P-EB2', CLOSE breaker 'MTS-A/C RISER 1'.	1 min	11:01	11:02		-	-		-	
	11.03	At 'DP-P-EB2', CLOSE breaker 'MTS-A/C RISER 2'.	1 min	11:02	11:03		-	-		-	
	11.04	At 'DP-P-EB2', CLOSE breaker 'DP-P-EM'.	1 min	11:03	11:04		-	-		-	
	11.05	At 'DP-P-EB2', CLOSE breaker 'MTS-P-E1'.	1 min	11:04	11:05		-	-		-	
	11.06	At 'DP-P-EB2', CLOSE breaker 'TX-P-B2'.	1 min	11:05	11:06		-	-		-	
	11.07	At 'DP-P-EB2', confirm the 3 spare breakers are left OPEN.	1 min	11:06	11:07		-	-		-	
Step Sign Off (Initial):								-			
Contingency Plan/Comments:											
12.0 Energize DP-P-EB4											
	12.01	At 'DP-P-EB4', CLOSE breaker 'AC-PH-1'.	1 min	11:07	11:08		-	-		-	
	12.02	At 'DP-P-EB4', CLOSE breaker 'UPS-P-4 Module'.	1 min	11:08	11:09		-	-		-	
	12.03	At 'DP-P-EB4', CLOSE breaker 'UPS-P-4 Bypass'.	1 min	11:09	11:10		-	-		-	
	12.04	At BAS control system, confirm system is running satisfactorily.	1 min	11:10	11:11		-	-		-	
Step Sign Off (Initial):								-			
Contingency Plan/Comments:											
13.0 Energize UPS-P-4											
	13.01	At 'UPS-P-4', startup UPS-P-4 module.	1 min	11:11	11:12		-	-		-	
	13.02	At 'UPS-P-3', verify there is no alarm.	1 min	11:12	11:13		-	-		-	
	13.03	At 'UPS-P-4', verify there is no alarm.	1 min	11:13	11:14		-	-		-	
Step Sign Off (Initial):								-			
Contingency Plan/Comments:											



14.0 Energize UPS-P-4 Loads											
	14.01	At 'PP-9-UB1', CLOSE all feeder breakers. (keep the ones originally open OPENED, see step 2)	1 min	11:14	11:15		-	-		-	
	14.02	At 'PP-7-UB1', CLOSE all feeder breakers. (keep the ones originally open OPENED, see step 2)	1 min	11:15	11:16		-	-		-	
	14.03	Verify with the associated stakeholders that all equipment are running satisfactorily.	1 min	11:16	11:17		-	-		-	
Step Sign Off (Initial):							-				
15.0 Shutdown Generator Plant											
	15.01	At Switchboard 'EA', turn the 'SELECT NORMAL AS PREFERRED SOURCE' switch.	1 min	11:17	11:18		-	-		-	
	15.02	At Switchboard 'EA', verify 'LOAD CONNECTED TO NORMAL' light is on.	1 min	11:18	11:19		-	-		-	
	15.03	At Switchboard 'EB', turn the 'SELECT NORMAL AS PREFERRED SOURCE' switch.	1 min	11:19	11:20		-	-		-	
	15.03	At Switchboard 'EB', turn the 'SELECT NORMAL AS PREFERRED SOURCE' switch.	1 min	11:19	11:20		-	-		-	
	15.04	At Switchboard 'EB', verify 'LOAD CONNECTED TO NORMAL' light is on.	1 min	11:20	11:21		-	-		-	
	15.05	Wait for generator cool down period.	5 min	11:21	11:26		-	-		-	
Step Sign Off (Initial):							-				
16.0 Closeout											
	16.01	Confirm building is back in normal conditions and no alarms.	3 min	11:26	11:29		-	-		-	
	16.02	Operations to notify security and the stakeholders that the work is completed.	1 min	11:29	11:30		-	-		-	
Step Sign Off (Initial):							-				
End of Technical Portion of the MOP											

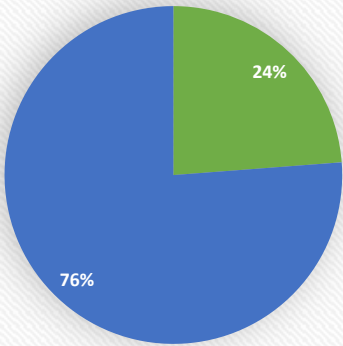
City of Toronto

Construction Dashboard Template

Schedule Tracking							
Phase	Address	Progress	Projected Start	Forecast / Actual Start	Projected Finish	Forecast / Actual Finish	Status
Pre-Construction	Address	50%	1900-01-00	1900-01-00	1900-01-00	1900-01-00	
	Address	50%	1900-01-00	1900-01-00	1900-01-00	1900-01-00	
Construction	Address	50%	1900-01-00	1900-01-00	1900-01-00	1900-01-00	1
	Address	50%	1900-01-00	1900-01-00	1900-01-00	1900-01-00	
Commissioning	Address	50%	1900-01-00	1900-01-00	1900-01-00	1900-01-00	
	Address	50%	1900-01-00	1900-01-00	1900-01-00	1900-01-00	2
Closeout	Address	50%	1900-01-00	1900-01-00	1900-01-00	1900-01-00	
	Address	50%	1900-01-00	1900-01-00	1900-01-00	1900-01-00	
Warranty	Address	50%	1900-01-00	1900-01-00	1900-01-00	1900-01-00	3
	Address	50%	1900-01-00	1900-01-00	1900-01-00	1900-01-00	

- Notes:
- 1. Explanation
 - 2. Explanation
 - 3. Explanation

Overall Construction Progress



Program Progress Pending

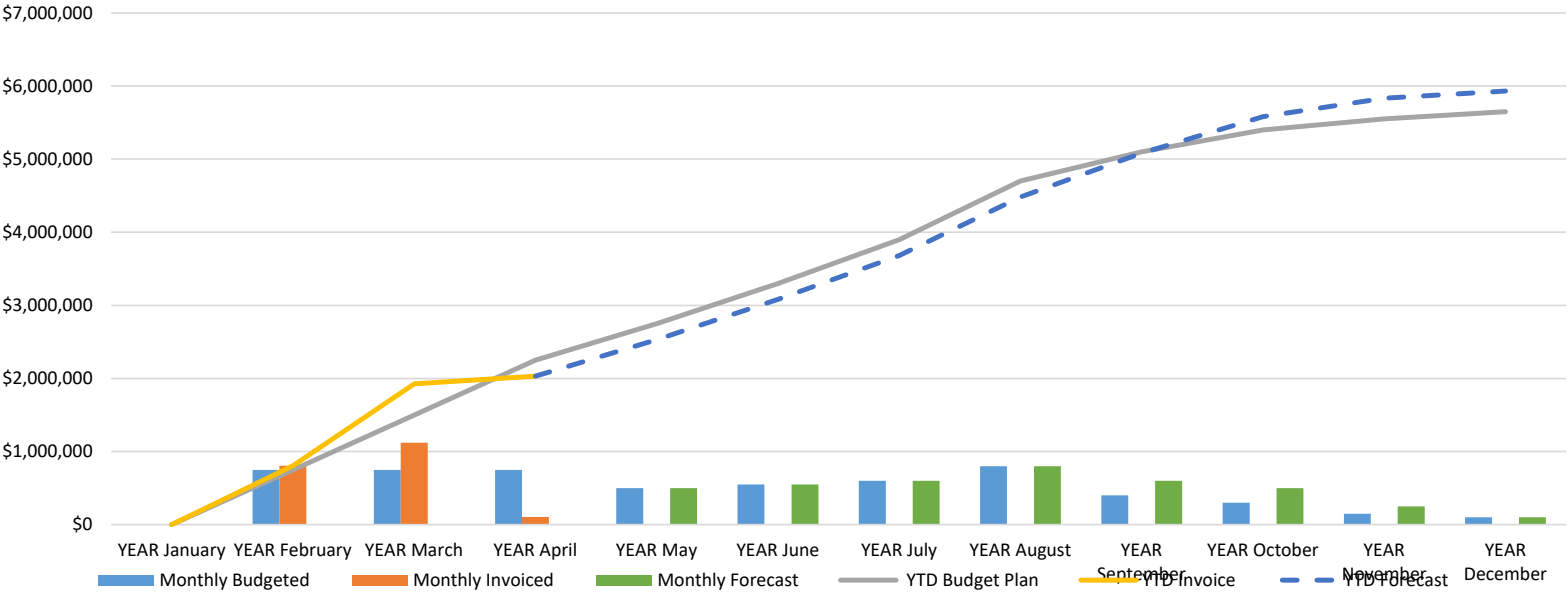
Risks		
Issue / Risk	Potential Impact	Mitigation Strategies
Risk #1	Impact	• Mitigation
Risk #2	Impact	• Mitigation
Risk #3	Impact	• Mitigation

Key Achievements	
1	Achievement 1
2	Achievement 2
3	Achievement 3
4	Achievement 4

Task / Schedule / Risk Legend

Not Started | On Track / Low Risk | Slight gap to schedule, budget / Medium Risk | Significantly gap to schedule, budget, / High Risk | Completed

Group XX - Forecast Invoice vs. Actual Invoice



- Notes:
- 1. Note
 - 2. Note
 - 3. Note

Address	Budgeted	Cash Allowance Used	Contingency Used	Invoiced	Remaining
Address #1	\$500,000.00	\$110,000.00	\$120,000.00	\$200,000.00	\$530,000.00
Address #2	\$400,000.00	\$30,000.00	\$25,000.00	\$150,000.00	\$250,000.00
Address #3	\$800,000.00	\$80,000.00	\$95,000.00	\$375,000.00	\$425,000.00
Address #4	\$1,200,000.00	\$30.00	\$0.00	\$550,000.00	\$650,000.00
Address #5	\$1,300,000.00	\$25,000.00	\$0.00	\$950,000.00	\$350,000.00
Address #6	\$350,000.00	\$0.00	\$0.00	\$0.00	\$350,000.00
Address #7	\$875,000.00	\$50,000.00	\$0.00	\$350,000.00	\$525,000.00
Address #8	\$900,000.00	\$0.00	\$0.00	\$0.00	\$900,000.00
Total	\$6,325,000.00	\$295,030.00	\$240,000.00	\$2,575,000.00	\$3,980,000.00

City of Toronto

New Asset & Equipment PM Details Form

Automatic from Column F

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Recommended PM TAG List Canada/U.S	
Equipment Code	Equipment Type
ACU	Air Conditioning Unit
AHU	Air Handling Unit
AMS	Alarm Monitoring System
ATS	Automatic Transfer Switch
BAS	Building Automation System
BAT	Batteries
BFP	Back Flow Preventor
BOI	Boiler
CDH	Cabinet Display Heated
CHLR	Chiller
CO/NO	CO/NO Detection Systems
CND	Condensing Unit
CT	Cooling Tower
DST	Diesel Storage Tank
ELEV	Elevator
EVP	Evaporator Unit
EXH	Exhaust Fans
EXTL	Exit Lighting
FAS	Fire Alarm System
FSS	Fire Suppression System
GEN	Emergency Generator
GHTR	Gas Heater
HP	Heat Pump
HCAB	Heated Cabinets/Warmers
HEX	Heat Exchangers
HWH	Hot Water Heater
REFRI	Refrigeration/Brine System
RHS	Ramp Heating System
RTU	Roof Top Unit
ROOF	Roofing System
SS	Split System
SUP	Sump Pump
SURPS	Suppression System
SWG	Switch Gear
UPS	Uninterruptible Power Supply
WTRT	Water Treatment System

1 **GENERAL**

- .1 This section is intended to provide basic identification of the Work, for the Contractor to determine upfront, the nature of the Work involved in this Contract. In no way shall this section be interpreted as being a full representation of the Work of this Contract.
- .2 It is the Contractor's sole responsibility to examine the Commercial Documents, Specifications and Drawings issued to establish/determine total scope of Work.

2 **PROJECT OVERVIEW**

- .1 Toronto City Council adopted the City of Toronto Corporate Accessibility Policy to ensure accessibility at all its facilities and public spaces. The Corporate Real Estate Management Division then initiated a capital Program to upgrade/renovate the facilities that fall under its capital maintenance program. This Program will support the City-wide mandate to remove physical barriers across all City facilities.
- .2 This Tender package represents the upgrade of a total of nine (9) buildings located at different addresses within a specific geographical area. The buildings addresses are as follows:

Building Address	Building Type
7 BRIMLEY ROAD SOUTH (23 BLUFFERS PARK)	POLICE MARINE SUB-STATION NO. 1 - BLUFFERS PARK
87 MAIN STREET	FIRE HALL NO. 226
116 DORSET ROAD	FIRE HALL NO. 223
313 PHARMACY AVENUE	WEST SCARBOROUGH COMMUNITY CENTER
351 BIRCHMOUNT ROAD	FIRE MUSEUM -FIRE PREVENTION OFFICE
1313 WOODBINE AVENUE	FIRE HALL NO.224
1859 KINGSTON ROAD	SCARBOROUGH ARTS COUNCIL
1904 QUEEN STREET EAST	FIRE HALL NO. 227
3600 DANFORTH AVE	FIRE HALL NO.225

- .3 The buildings included in this Tender are being renovated to meet the City of Toronto Accessibility Design Guideline (TADG 2016).

3 **PROJECT SCHEDULE**

- .1 An overall project construction schedule (attached to end of this section) has been developed based on the start and finish for each building in this Contract. These timelines have been discussed with the City and agreed to by the stakeholders and as such must be adhered to. These timelines must also take into account the phasing requirements for each building to minimize the interruption to the operation of each facility. The Contractor shall follow the attached schedule construction start and finish dates without exception and provide a detailed construction schedule as required in the specifications taking into

account the overall schedule timelines and phasing requirements shown on the Drawings. Construction schedule to be submitted to the Consultant for review prior to the commencement of the work.

4 PROJECT PHASING

- .1 All the buildings included in this Contract are occupied and will be operational during construction. As such, the Project shall be carried out in multiple phases to minimize interruption to the operation of the facility. The phasing to implement the work in each building is indicated on the architectural drawings for each building. The phasing plan for each building was discussed with the City and accepted by the stakeholders and therefore expected to be followed by the Contractor in performing the Work. Any deviation from this phasing plan must be approved by the City's Project Manager.
- .2 Discuss all storage, employee swing space, room and facility closures, equipment and furniture moves, and any other activities that may impact the operation of the facility with the Stakeholder of each building to ensure Stakeholder's acceptance of implementation and site conditions. Refer to Section 01 10 00 General Requirements.
- .3 Provide the City Project Manager with 30 Calendar Days notice prior to starting the Work in any phase.
- .4 The City, at their sole discretion, may choose to relocate staff and furniture at their own cost. The Contractor will be notified in this event and a credit for phasing and relocation costs on that particular building shall be provided by the Contractor to the City on the next monthly invoice.

5 WORKING HOURS

- .1 The buildings included in this Tender will be occupied and in operation Monday to Friday. Construction Work must occur 7 days a week 8:00 PM to 6:00 AM.
- .2 Extension or modification to the above specified hours of work must be submitted in writing to the City's Project Manager for approval.

6 POLICE BACKGROUND CHECKS AND SECURITY CLEARANCES

- .1 All Contractors and Subcontractors are subject to background checks, police clearances and vulnerable sector checks before being authorized to perform any Work.
- .2 Contractor to ensure all of its own staff and sub-contractors obtain clearances prior to bidding on Work. No Construction Schedule delays in the Commencement of Work are permitted as a result of not having the appropriate clearances.
- .3 The following is a list of non-mandatory Subcontractors that are already cleared to perform work on Toronto Police Service buildings:
 - .1 New Park Contracting – General Contractor
 - .2 Stevens & Black Electrical Contractors
 - .3 Active Mechanical
- .4 City of Toronto Contractor Cards
 - .1 Contractor to ensure all of its own staff and sub-contractors obtain contractor cards from the City of Toronto prior to commencing Work.

- .2 Forms to be completed and submitted with Contract execution documents.

7

SUBCONTRACTORS

.1 Abatement Subcontractor

- .1 The following are the City's abatement contractor requirements:

- .1 Licensed Unionized Abatement Contractor
- .2 Site Supervisor must hold the MOL's Supervisor 253S MTCU Accreditation
- .3 All other workers must hold the MOL's Asbestos Worker 253W MTCU Accreditation
- .4 Proof of all requirements listed above must be provided prior to award and is subject to review and acceptance by the City.

- .2 The following is a list of non-mandatory Subcontractors that already met the City of Toronto requirements for Designated Substance removal. These Subcontractors perform abatement work in City buildings on a frequent basis and are familiar with the City's strict abatement policies and procedures. These Subcontractors are already cleared to perform Work in Toronto Police Services buildings and other sensitive buildings.

- .1 Furcon Environmental Ltd
- .2 The BearStar Group Inc.
- .3 JMX Environmental

.2 Mandatory Toronto Police Service (TPS) Subcontractors

- .1 For all TPS buildings included in this Contract, The Contractor is required to use Johnson Controls as their subtrade. TPS has an existing contract with Johnson Controls. General Contractor to engage Johnson Controls to do the following Work in TPS buildings:

- .1 Johnson Controls will be responsible for security systems, all security controls, maglocks and card reader installations, maintenance and warranty.
- .2 Contractor shall be responsible for coordinating product lead time, Shop Drawings and provisions for all support structures, power and systems required for a complete installation.
- .3 No exceptions or other Subcontractors will be considered for the supply, install and delivery of security system equipment for TPS buildings.
- .4 The General Contractor is responsible for coordination between Johnson Controls and all other trades and Subcontractors.
- .5 Johnson Controls Contact:
Keith Porter
Security & Fire Account Executive, Building Efficiency
Email: keith.porter@jci.com

Main: (905) 731-2813
Cell: (647) 637-8010
Fax: (905) 747-3736

Address: 56 Leek Crescent, Richmond Hill Ontario L4B 1H1
Website: <http://www.johnsoncontrols.com>

- .2 Keying and Cylinder installation at the Toronto Police Services buildings (TPS):
 - .1 TPS will coordinate the keying and cylinder installation directly with their locksmith, Action Locksmiths.
 - .2 TPS will then issue an invoice to General Contractor to make the payment once the work is completed.
- .3 Automated Teller Machine (ATM)
 - .1 In some instances, TPS stations have an ATM machine placed by the entrance and may be in the way of the Work. In this case, the ATM will need to be relocated temporarily/permanently to allow for the Work to continue.
 - .1 Final Location of the ATM machine to be coordinated with the TPS Stakeholders during Construction.
 - .2 The General Contractor is responsible for contacting the ATM vendor to disconnect and move the ATM.
 - .3 Vendor:
 - .1 Cardtronics
- .3 Keying and Cylinder installation at all other buildings (non-TPS)
 - .1 Contractor is responsible for coordinating all key, cylinder and all other Lock related commissioning items and requirements
 - .2 The General Contractor shall engage one of the following Subcontractors as their locksmith subtrade for all buildings.
 - .3 Refer to Hardware Schedule.

Gunnebo Canada Ltd. 9 Van Der Graaf Ct, Brampton, ON L6T 5E5	Contact Name: Chris Nolan Telephone: 416-574-7381 E-mail: chris.nolan@gunnebo.com
Lock-Up Services Inc. 2977 Lake Shore Blvd W, Etobicoke, ON M8V 1J8	Contact Name: Rhonda Churly Telephone: 416-255-3500 E-mail: rhonda@lockupservices.ca
Reilly Lock and Security Systems Limited 54 Bartor Rd, North York, ON M9M 2G5	Contact Name: Greg Brazas Telephone: 416-256-7222 E-mail: gb@reillylock.com

.4 Preferred Corporate Security Subcontractors

- .1 The General Contractor shall engage one of the following Subcontractors as their security subtrade for all buildings. Refer to Section 28 01 00 City of Toronto Corporate Security Requirements for additional requirements and a comprehensive list of Subcontractors.
- .2 Johnson Controls to be used exclusively as security Subcontractor for all Toronto Police Services buildings as indicated. No other Subcontractors will be considered for this Work under this section.
- .1 Coordination with City of Toronto Corporate Security for all Security Work

COMPANY	CONTACT
AC Technical Systems Limited 2100 Forbes Street, Units 8 – 10 Whitby, ON L1N 9T3	Contact Name: Dominic Burns Telephone: (905) 666-8676 Fax: (905) 666-9795 E-mail: dburns@actechnical.com
Bond Securcom 41 Scarsdale Road, Unit 1 Toronto, ON M3B 2R2	Contact Name: Cesar Traverso Telephone: (416) 256-6666 Fax: (416) 249-8636 E-mail: CTraverso@bondsecur.com
Convergint Technologies 5716 Coopers Avenue Mississauga, ON L4Z 2E8	Contact Name: Eric Heagle Telephone: (905) 602-8622 Fax: (905) 602-8722 E-mail: eric.heagle@convergint.com
Delco Security	Contact Name: Mark Peterson Telephone: (416) 346-8628 E-mail: mpeterson@delcosecurity.com
Fitch Security Integration Inc. 14 Meteor Drive Toronto, ON M9W 1A4	Contact Name: Ed Fitchett Telephone: (416) 235-1818 Fax: (416) 235-1226 E-mail: efitchett@fitch.ca
Johnson Controls L.P. 56 Leek Crescent Richmond Hill, ON L4B 1H1	Contact Name: Danny Zavaglia Telephone: (905) 731-2813 Fax: (905) 629-3508 E-mail: danny.zavaglia@jci.com
Met-Scan Canada Ltd 30 Kern Road, Suite 104 Toronto, ON M3B 1T1	Contact Name: Rick Holder Telephone: (416) 391-2200 x111 Cell: (416) 709-3102 E-mail: rholder@met-scan.com
Paladin Technologies 2210 Markham Road, Unit 4 Toronto, ON M1B 5V6	Contact Name: Marc Kingsbury Telephone: (416) 916-6767 E-mail: mkingsbury@paladinsecurity.com

Profile Security 110 – 5525 Eglinton Ave W Toronto, ON M9C 5K5	Contact Name: Jason Caissie Telephone: (416) 695-1260 x 235 Fax: (416) 695-1958 E-mail: jasonc@profileinc.com
Quinn Digital Asset Protection 7065 Tranmere Drive, Unit 3 Mississauga, ON L5S 1M2	Contact Name: Rob Quinn Telephone: (416) 441-3770 x 223 Cell: (416) 303-6252 E-mail: rob.quinn@quinndigital.ca
Siemens Building Technologies, Ltd. 1577 North Service Road Oakville, ON L6H 0H6	Contact Name: Manny Lopes Telephone: (905) 799-9937 Fax: (905) 465-8167 E-mail: manuel.lopes@siemens.com
Securitas ES Canada 15 Marmac Drive, Suite 100 Toronto, ON M9W 1E7	Contact Name: Joel Finn Telephone: (647) 616-3183 E-mail: joel.finn@securitases.com
Stanley Convergent Security Solutions 2495 Meadowpine Blvd, Unit #1 Mississauga, ON L5N 6C3	Contact Name: Scott Jupp Telephone: (289) 290-7100 Fax: (905) 238-0750 E-mail: Scott.Jupp@sbdinc.com
Veridin Systems Canada Inc. 13 – 245 Matheson Blvd. East Mississauga, ON L4Z 3C9	Contact Name: Mike Finelli Telephone: (905) 568-9100 Fax: (905) 568-9957 E-mail: mfinelli@veridin.ca
Vipond Inc. 6380 Vipond Drive Mississauga, ON L5T 1A1	Contact Name: Mark Gill Telephone: (905) 564-7060 Ext 297 Cell: (647) 527-6339 E-mail: mark.gill@vipond.ca

- .3 Security Subcontractor shall include but not limited to the following:
- .1 Refer to Section 28 01 00 City of Toronto Corporate Security Requirements for additional requirements.
 - .2 Supply, installation, and delivery of security system equipment, all security controls, maglocks and card reader installations, maintenance, and warranty for all buildings.
 - .3 Proper decommissioning, removal and commissioning of all elements so as to prevent nuisance alarms and security vulnerabilities.
 - .4 Coordination with City of Toronto Corporate Security for all security Work. Contact information to be provide as needed.
 - .5 Provide police clearance, security clearance, and certificate from Software House to City of Toronto Corporate Security prior to starting any security Work.

- .6 Security Subcontractor shall obtain approval from Corporate Security before ordering and installing new security hardware and devices.
 - .1 Prior to commencement of Work, submit the following to Corporate Security for approval:
 - .1 Cut sheets and programming sheets for new security hardware and devices.
 - .2 Detailed schedule.
 - .2 Corporate Security will provide laptop for programming of devices. Security Subcontractor shall make arrangements to pick up laptop from the following location:

399 The West Mall
Toronto, ON M9C 2Y2
 - .3 Notify Corporate Security once installation of security hardware and device is completed.
 - .1 Prepare and submit testing and commission reports of the completed work.
 - .2 Conduct site walk through immediately following installation of the security system to verify functionality.
 - .4 Submit contract closeout document including as-built drawings, security specifications sheets, testing and commissioning reports, and warranty letters.
- .7 Security Subcontractor shall ensure all of their Work is functional, in proper working order, and commissioned by the Consultant prior to demobilizing from the site.
- .4 General Contractor shall include but not limited to the following:
 - .1 Refer to Section 28 01 00 City of Toronto Corporate Security Requirements for additional requirements.
 - .2 Coordinating product lead time, Shop Drawings and provisions for all support structures, power and systems required for a complete installation.
 - .3 Coordination between security Subcontractor and all other trades.

8 **DESCRIPTION OF CONTRACT (GENERAL CONTRACT)**

- .1 The Contract comprises the building modifications Work which consists of, but is not limited to, the following:
 - .1 Designated Substances
 - .1 Some of the building systems may contain designated substances. Prior to the Contractor starting any Work, the Contractor will be required to remove the designated substance from the building systems. Contractor shall coordinate timing and the extent of such removal with the City's

Project Manager. Refer to DSS reports, Abatement Summary, ACM and LCM Abatement Specification, City of Toronto Asbestos Management Policy, City of Toronto Management Plan and Design Drawings.

.2 Discovery of potential ACM and LCM Substances during the Work.

.1 During the execution of the Work, potential designated substances may be encountered. If this occurs, the Contractor is to inform the Consultant immediately with description of the affected Work area, photographs, and site location. The Consultants Environmental Sub-Consultant will attend site and sample the suspected material. Once there is confirmation that the material is or contains ACM or LCM, a report will be produced by the Consultants Environmental Sub-Consultant to determine the appropriate abatement method and issue to the Contractor. The Contractor's Work is to continue in parallel with this investigation to ensure adherence to the schedule.

.3 Monitoring and Testing of Abatement Work

.1 Monitoring

.1 The Contractors Abatement Subcontractor may be required to coordinate with an Environmental sub-consultant for monitoring during the Work.

.2 Testing

.1 The City's Environmental sub-consultant will continue testing the space after abatement is completed. Any remediation as a result of testing is the responsibility of the Contractor.

.2 Pre-Tendered Equipment

.1 New Elevators

.1 The City of Toronto prepared and issued a pre-tender package for various types of elevators for this Contract. As a result, an elevator supplier (Modern Elevator) has been selected to supply install and deliver the new elevators for the entire program as detailed in the appendices and the Drawings.

.2 The Contractor shall purchase the specified elevator in the Contract documents as per the appendices, directly from Modern Elevator, coordinate product lead time, Shop Drawings, and provisions for all support structures and systems required for a complete installation. The Contractor and Modern Elevator are responsible for reviewing the Contract Drawings to ensure that all site conditions are considered during the bid phase.

.3 The base bid price shall include the costs of the Technical Standards and Safety Authority (TSSA) yearly license fee for the first 2 years for new elevators.

.2 Automatic Door Openers (ADO)

- .1 The City of Toronto prepared and issued a pre-tender package for various types of ADO's for this Contract. As a result, an ADO supplier (Assa Abloy) has been selected to supply, install and deliver the ADO's for the entire program as detailed in the appendices and the Drawings. The Contractor shall purchase the specified ADO's in the Contract documents as per the appendices, directly from (Assa Abloy), coordinate product lead time, Shop Drawings, and provisions for all support structures, power and systems required for a complete installation.

.3 Commercial Plumbing Fixtures, Washroom Accessories and Drinking Fountains

- .1 The City of Toronto has an existing contract with the plumbing fixture supplier, NEXT Plumbing Supply (NEXT) and has negotiated bulk pricing for some commercial plumbing fixtures, washroom accessories and drinking fountains. The Contractor is to purchase selected equipment from NEXT. The Contractor is to reference both NEXT's contract number and RFQ number indicated on the Plumbing and Accessories Order Form when contacting NEXT.

.2 Ordering and Purchasing:

- .1 The Contractor is required to procure the selected plumbing and accessory equipment from NEXT. The Contractor is to provide the quantities per item to NEXT on the 'Plumbing and Accessories Order Form' and submit it to the Consultant and City of Toronto for review (Refer to the appendices for the Plumbing and Accessories Order Form). Once reviewed, the Contractor will then send the order to NEXT, NEXT will fill the order and provide a Lump Sum bill to the Contractor. The Contractor is responsible for the purchase, delivery and installation of these fixtures and accessories. Refer to Specification sections for a list of the selected plumbing fixtures and accessories and additional details. Refer to the appendices for the Plumbing and Accessories Order Form.

.3 Elevator Modernization or Replacement

- .1 Some of the buildings included in this Tender may require an elevator modernization or replacement. Refer to the Elevator Conditions Assessment Report and Design Drawings.
- .2 All Elevator shut down and maintenance is to be coordinated with the City of Toronto Vertical Transportation team
 - .1 Contact info to be provided as needed

.4 Network Data and Voice:

- .1 The City of Toronto has an existing contract with Bell Canada for Voice and Data cabling. Bell Canada is responsible for end to end (Lan room to endpoint) cabling which includes, installation, termination, and testing. The Contractor shall coordinate with Bell Canada for all new data and voice cabling, relocations, and removals of existing cabling. Pathways must be provided for voice and data cabling. Refer to the appendices for the City of Toronto Cabling Standards and Procedures. The Contractor shall contact Bell Canada for pricing during Tender.

Bell Canada Contact:
Roger D. Vachon
Project Manager - Structured Cabling Solutions | BBM
Phone: 905-540-7442
Email: roger.vachon@bell.ca

- .2 Prior to the start of Work, the Contractor shall coordinate all low voltage cabling infrastructure (Data & Voice) with City of Toronto IT-Network and Telecommunication Services. IT-Network Service is responsible for reviewing layouts, connecting cables to the network switch and if required interface with Bell to install new network equipment.
- .3 Once the Work is completed, the system shall be tested in the presence of the sub-contractor and IT-Network services to confirm connectivity.
- .4 The Contractor shall include network services as part of the construction schedule and when required IT-Network and Telecommunication Services shall be included in the construction meetings.

.5 IT, Desktop Services

- .1 As part of the Work, the Contractor is to coordinate with the City of Toronto Desktop Service team all removal, storage and replacement of desktop computers, office equipment and appurtenances
- .1 Contact info will be provided as needed

.6 Architectural scope; including but not limited to the following:

- .1 Demolition of
- .1 Existing drywall partitions
 - .2 Existing concrete block/concrete walls
 - .3 Wall openings
 - .4 Flooring tiles, flooring materials and bases
 - .5 Existing drywall ceilings and reflected ceilings and tiles
 - .6 Existing doors and frames
 - .7 Existing plumbing fixtures
 - .8 Existing millwork
-

-
- .9 Concrete stairs
 - .10 Curtain wall/glazing and exterior doors
 - .2 New Installations of
 - .1 Hoarding to match phasing requirements
 - .2 Site line painting to meet modified parking requirements
 - .3 Site signage
 - .4 Tactile indicators
 - .5 Stairs and nosing indicators
 - .6 Guardrails and handrails
 - .7 Millwork
 - .8 Concrete stairs
 - .9 Elevator, shaft, and all associated accessories
 - .10 Doors and hardware
 - .11 Door operators and controls
 - .12 Floor finishes including tiles, carpets, VCT, concrete sealant, etc.
 - .13 Floor transitions
 - .14 Wall finishes
 - .15 Signage
 - .16 Suspended ceiling and grid
 - .17 Gypsum board ceiling
 - .18 Drywall and concrete block partitions
 - .19 Patching and painting
 - .20 Roofing insulation and membrane
 - .21 Parapet
 - .7 Mechanical scope; including but not limited to the following:
 - .1 Demolition of
 - .1 Plumbing fixtures including sinks, toilets, urinals, and associated accessories
 - .2 Domestic cold/hot water piping
 - .3 Drainage piping
-

-
- .2 New installations of
 - .1 HVAC equipment and controls
 - .2 Plumbing fixtures
 - .3 Domestic cold/hot water piping
 - .4 Connection to existing piping
 - .5 Hose bibbs
 - .6 Piping insulations
 - .7 Piping accessories
 - .8 Drainage piping
 - .9 Hot water heaters
 - .10 Exhaust fans and associated ductwork controls
 - .11 Testing and balancing
 - .12 Elevator submersible pump complete with controls
 - .8 Electrical scope; including but not limited to the following:
 - .1 Removal of
 - .1 Existing outlets/switches/thermostats/access cards along the barrier-free path of travel
 - .2 Lighting fixtures and outlets
 - .3 Exit signs
 - .4 Relocation of existing electrical equipment to suit the installation of elevator and universal washroom
 - .2 New Installation of
 - .1 Outlets/switches/thermostats/access cards along the barrier-free path of travel
 - .2 Power supply to all mechanical and electrical equipment
 - .3 Lighting fixtures and controls
 - .4 Hand dryers
 - .5 Exit signs
 - .9 Structural scope; including but not limited to the following:
 - .1 Removal of
 - .1 Concrete stairs
 - .2 Roof openings
-

- .3 Wall openings
- .2 New Installation of
 - .1 Roof support for any new mechanical equipment
 - .2 Roof framing for new roof openings
 - .3 Foundations for a new elevator
 - .4 Concrete pit for new elevator
 - .5 Concrete pit waterproofing
 - .6 Elevator structures and tie in to the existing building
 - .7 Elevator shaft roofing structure
 - .8 Concrete stairs

End of Section

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ID	Group No.	Resource Names	Task Name	Duration	Start	Finish	Mar	2023 Qtr 2	Apr	May	Jun	2023 Qtr 3	Jul	Aug	Sep	2023 Qtr 4	Oct	Nov	Dec	2024 Qtr 1	Jan	Feb
1	G28	GC	Construction Works	185 days	Fri 23-04-14	Wed 24-01-17																
2	G28	GC	23 Bluffers Park (7 Brimley Rd S)	75 days	Fri 23-04-14	Mon 23-07-31																
3	G28	GC	87 Main St	105 days	Fri 23-04-14	Wed 23-09-13																
4	G28	GC	116 Dorset Rd	70 days	Fri 23-04-14	Mon 23-07-24																
5	G28	GC	313 Pharmacy Ave	185 days	Fri 23-04-14	Wed 24-01-17																
6	G28	GC	351 Birchmount Rd	70 days	Fri 23-04-14	Mon 23-07-24																
7	G28	GC	1313 Woodbine Ave	105 days	Fri 23-04-14	Wed 23-09-13																
8	G28	GC	1859 Kingston Rd	150 days	Fri 23-04-14	Thu 23-11-16																
9	G28	GC	1904 Queen St E	105 days	Fri 23-04-14	Wed 23-09-13																
10	G28	GC	3600 Danforth Ave	105 days	Fri 23-04-14	Wed 23-09-13																

1 General

1.1 **GENERAL**

.1 Provide Work of this section in accordance with the Contract Documents.

.1 This section applies on projects where commissioning is performed by the General Contractor.

1.2 **DESCRIPTION**

.1 The commissioning process provides the Owner of the facility with a high level of assurance that the systems to be commissioned, including but not limited to the mechanical and electrical systems, have been installed in accordance with the Contract Documents, and operate within the design intent.

.2 The process does not take away or reduce the responsibility of the Design Consultants or Installing Contractors to Provide a finished Product. Commissioning is intended to enhance the quality of the system start-up and aid in the orderly transfer of beneficial use and knowledge from the Design Consultant and the Installation Contractor to the Owner.

.3 The General Contractor has primary responsibilities for coordinating all commissioning activities with the Consultant, Subcontractors, manufacturers and equipment Suppliers.

.4 The Consultant will witness and confirm that all startup commissioning and training are in general conformance with the Contract Documents.

1.3 **COMMISSIONING PROGRAM**

.1 The commissioning program is divided into four parts:

.1 Part 1: Verification Testing

.2 Part 2: Performance Testing

.3 Part 3: Systems Operating Manuals

.4 Part 4: Operator Training

1.4 **SUBSTANTIAL COMPLETION**

.1 Substantial Completion of the trades Work requires the following parts of the commissioning program to be completed and accepted by the Owner:

.1 Part 1: Verification Testing

.2 Part 4: Operator Training

.2 Part 2: Performance testing may begin before Substantial Completion and extend upwards of nine months minimum after Substantial Completion, based on seasonal conditions required to obtain test load conditions.

1.5 **ROLES AND RESPONSIBILITIES**

.1 Owner

- .1 Assign maintenance and operations personnel and schedule them to participate in meetings, witnessing of demonstrations, and training.
 - .2 Designate a person(s) as an authorized acceptance authority, to sign-off and accept test reports.
 - .3 Authorize the use of Owner's utilities for the commissioning process.
 - .2 General Contractor
 - .1 Responsibility: primary point of responsibility to inform the Owner on the status, integration, and performance of the systems within the facility. Lead the coordination and scheduling of installation Work and commissioning Work. Ensure deficiencies are corrected.
 - .2 Scheduling: develop a coordinated commissioning schedule, including the scheduling requirements from the trade contractors conducting the commissioning. Coordinate Owner's commissioning personnel to be available at appropriate times for witnessing of tests.
 - .3 Information: collate and disseminate information to all construction team parties, including progress reports, meeting minutes, etc.
 - .4 Observation of tests: observe testing of installation and equipment and make recommendations for acceptance.
 - .5 Documentation of tests: document results of tests directly or ensure documentation is completed by trade contractors. Provide template format for tests to applicable trade contractors.
 - .6 Acceptance: determine and advise the Owner of the date of acceptance for each system and sub-system for start of the Warranty Period.
 - .7 Coordinate the Commissioning Plan with Consultant's Commissioning Agent.
 - .3 Acceptance Authority
 - .1 Witness demonstration tests of equipment and systems, and have the authority to sign-off on the test forms to accept the test results.
 - .2 Coordinate and schedule additional operations and maintenance personnel to witness the test if required.
 - .4 Consultant and Consultant's Commissioning Agent
 - .1 Conduct periodic construction site reviews to determine that the Work is in general conformance with the Contract Documents.
 - .2 Responsible for the system evaluation, adequacy of the system to meet design intent, capacity of the system, and review of Shop Drawings.
 - .3 Attend and participate in the systems training sessions. Provide hand-out literature to be reviewed by operations personnel as part of these sessions.
 - .4 Participate in operations staff orientation tours and final construction reviews.
 - .5 Attend initial meeting with TAB or similar testing contractor(s) to review testing methodology and acceptance criteria.
-

- .6 Review verification and performance testing sheets and procedures prepared by the Installation Contractors.
 - .7 Review testing documentation for system conformance to Contract Documents. Issue a report noting deficiencies requiring corrective Work.
 - .8 Review as-built records as required to the Contract Documents.
 - .9 Review and comment on the final commissioning report.
 - .5 Installation Contractor
 - .1 Include requirements for submittal data, start-up and testing, O&M data, and training in each Purchase Order or Subcontract written.
 - .2 Ensure cooperation and participation of Subcontractors.
 - .3 Ensure participation of major equipment manufacturers in appropriate training and testing activities. Provide and pay for power, fuel, oil and all other necessities to perform testing and commissioning. Provide qualified personnel for video recording and editing of training sessions.
 - .4 Attend construction/commissioning coordination meetings scheduled by the General Contractor.
 - .5 Prepare schedules for systems orientation and review, O&M Manual submission, training sessions, systems testing, flushing and cleaning, equipment start-up, specialty testing, and completion of deficiency Work. Prepare schedule in MS Project. Submit schedule on agreed revision cycle, for integration into the master commissioning schedule prepared by the General Contractor.
 - .6 Provide detailed schedule and notification to the General Contractor for upcoming tests, a minimum of two weeks before the anticipated test data.
 - .7 Conduct system orientation and inspection at the equipment placement completion stage. Do not make connections to equipment until acceptance has been given by the Owner.
 - .8 Participate in, and schedule Vendors and Subcontractors to participate in the training sessions.
 - .9 Gather O&M Manuals and data on all equipment, and assemble in binders as specified.
 - .10 Shop Drawings which are to be included in the O&M Manuals, which are marked as "Reviewed" (or similar) by the Consultant or Owner, are to be marked on the front page as "ISSUED FOR MANUALS".
 - .11 Shop Drawings which are to be included in the O&M Manuals, which are marked as "Reviewed as Noted" (or similar) by the Consultant or Owner, are to be revised by the manufacturer to incorporate comments and marked on the front page as "REVISED FOR MANUALS".
 - .12 Shop Drawings which are marked as "Revised and Resubmit" (or similar) shall not be included in the O&M Manuals.
 - .13 Provide a final commissioning report as described below.
-

- .6 Equipment Suppliers and Miscellaneous Contractors
 - .1 Provide submittals and appropriate O&M Manuals.
 - .2 Attend initial commissioning coordination meetings scheduled by the General Contractor.
 - .3 Participate in training sessions as scheduled by the Installation Contractor.
 - .4 Demonstrate performance of equipment as applicable. This includes in-season and out-of season testing depending on time of year of Substantial Completion.
 - .5 Provide written and signed start-up reports and submit to the Installation Contractor.
 - 2 Products
 - 2.1 **GENERAL**
 - .1 Refer to commissioning Specifications for affected division of the Work.
 - 3 Execution
 - 3.1 **COMMISSIONING PLAN AND SCHEDULE**
 - .1 The General Contractor shall coordinate, develop and submit an integrated construction and commissioning schedule. Commissioning schedule and commissioning activities are to be coordinated with the Consultant and the Consultant's Commissioning Agent. Any additional site visits required by the Consultant and/or Consultant's Commissioning Agent resulting from incomplete work or corrections regarding commissioning shall be paid for by the General Contractor.
 - .2 The Consultant and the Consultant's Commissioning Agent will provide a Commissioning Plan for the Contractor's use and coordination. Installation Contractors shall assist in the development and coordination of the overall commissioning schedule and plan.
 - .1 Commissioning Plan checklists and inputs for installers and sub-contractors may be hardcopy, software, app, or browser based.
 - .1 Log in information for General Contractor and sub-contractors will be provided as needed.
 - 3.2 **VERIFICATION AND PERFORMANCE TESTING**
 - .1 Personnel
 - .1 Develop and document each commissioning test and procedure using personnel experienced in this type of Work.
 - .2 Test Reports
 - .1 Provide a verification test report for each piece of equipment.
 - .2 Provide a verification test report for each system.
 - .3 Provide a performance test report for each system.
-

- .4 If template documents are used, modify document to suit the specific requirements of the system being tested.
- .5 Submit test reports for review to the Owner and Consultant. Each report is to be reviewed for technical depth, clarity of documentation and completeness.
- .3 Safety Interlocks
 - .1 Test safety or permissive interlocks in a real or closely simulated condition of failure.
 - .2 Provide details of proposed method of testing each device.
- .4 As a result of initial testing results, testing plans and procedures may need to be adjusted to suit

3.3 **OPERATING AND MAINTENANCE MANUALS/SYSTEMS OPERATING MANUALS**

- .1 Provide Operating and Maintenance Manuals (O&M) in accordance with the specific requirements of each division of the Work, Section 01 10 00 General Requirements, and the General Contract requirements.
- .2 Submit the O&M Manuals for review at least two months prior to the start of operator training.

3.4 **TRAINING**

- .1 Assist in scheduling and coordinating training sessions for the operations and maintenance staff for each system.
 - .1 The General Contractor shall coordinate with the Owner and the Installation Contractor to schedule each training session.
 - .2 The Installation Contractor shall schedule training sessions with their Sub-contractors and equipment manufacturer service representatives.
- .2 Training is to be conducted in a classroom setting with the appropriate system schematics, handouts, and any audio/visual training aids on-site with the equipment. Video record the training sessions in full and submit two DVD discs or two USB flash drives to the Design Consultant for turning over to the Owner.
- .3 The Consultant will assist the Installation Contractor with the development of training hand-outs, and in conducting training sessions with regards to system operation.
- .4 Equipment Vendors shall provide training on the specifics of each major equipment item including design intent, troubleshooting, and repair techniques.
- .5 Refer to the technical sections for specific commissioning requirements and Commissioning Plan for training details.

3.5 **RECORD DRAWINGS**

- .1 The Installation Contractor shall maintain and provide As-Built Drawings in accordance with the General Conditions of the Contract.
 - .2 The General Contractor and Design Consultant shall review As-Built Contract Documents to verify incorporation of both design changes and As-Built construction details.
-

3.6 ACCEPTANCE PROCEDURES

- .1 The final acceptance procedures will be determined by the Commissioning Authority and the Owner, and will include but not be limited to the following:
 - .1 Demonstration and acceptance of systems in full automatic control.
 - .2 All I/O points individually verified for proper function, calibration, and operation. The General Contractor will audit report results and witness sufficient field tests to confirm all I/O have been tested.
 - .3 All control sequence of operation strategies have been tested, including alarm generation, graphics, remote reporting functions, and part load operation.
 - .4 All graphic display devices are operating correctly.
 - .5 Mass storage of retrieved data is functioning correctly.
- .2 Witness Testing
 - .1 Request for witness testing only after already completing initial testing based on the accepted procedures and test sheet criteria. Where deficiencies are found by the Installation Contractor during these initial tests, these deficiencies will be corrected before scheduling a demonstration (witness) test.
 - .2 If during a witness test, a deficiency is discovered that in the opinion of the acceptance authority prevents the safe operation of the equipment or system, the test shall be abandoned. The Installation Contractor shall then correct the deficiency and reschedule the test(s).

3.7 DEFICIENCY REVIEW AND REMEDIATION

- .1 The Consultant will conduct a deficiency review only after the Contractor submits an application for Substantial Performance. As part of this application, the Contractor shall submit their own comprehensive deficiency list of incomplete or incorrect work. Failure by the Contractor to list any deficiency does not relieve the Contractor from correcting or completing the Work.
- .2 The Contractor shall correct, remedy, mitigate, or otherwise make good any and all deficient work immediately.

3.8 FINAL COMMISSIONING REPORT

- .1 Upon completion of all four phases of the commissioning program, provide a final commissioning report for each division of the Work describing the following:
 - .1 General summary: a listing of each system and date of acceptance.
 - .2 System summary: a general description of the state of operation of each system, including any noted operating problems which were discovered and corrected during the commissioning process, as well as those problems which were discovered but were not resolved.
 - .3 Documentation index – document type: a table index listing all commissioning documents, arranged alphabetically by type of document (Verification Test, Performance Test, O&M, SOM, Training).
-

- .4 Documentation index – alphabetic: a table index listing all commissioning documents, arranged alphabetically only by system name and/or equipment name.

3.9 **EXCLUSIONS**

.1 Responsibility for Construction Means and Methods

- .1 The Installation Contractor is responsible for the safe operation of the equipment and systems until such time as the equipment and systems have been accepted by the Owner. Once accepted by the Owner, the Owner may require the Installation Contractor to maintain and operate the system until such time as the Owner is prepared to operate the facility, and such Work will be paid for by the Owner as a separate Contract.

.2 Hands-On Work

- .1 The Installation Contractor shall provide all services requiring tools or the use of tools to start-up, test, adjust, or otherwise bring equipment and systems into a fully operational state.
- .2 The General Contractor shall coordinate and observe these procedures and may make minor adjustments as necessary.

End of Section

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- 1 General
- .1 Items to be submitted for review
- .1 Shop Drawings
- .2 Samples
- .3 Operating and Maintenance Manuals
- .4 "As-Built" Drawings
- .5 Certificates and transcripts
- .6 Progress photographs
- .2 Submit with reasonable promptness and in an orderly sequence so as not to cause delay in the Work. Failure to submit in adequate time is not considered sufficient reason for an extension of Contract Time and no claim for an extension by reason of such default will be allowed.
- .3 Work affected by the submittal shall not proceed until review is complete.
- .4 Submittals MUST be accompanied by "Standard Submittal Form" with all blank spaces filled in. A copy of the form is bound into the Specifications following this section.
- .5 Contractor shall retain one reviewed and stamped copy of each submission on Site. Only the stamped copies shall be used on the Work.
- 2 Shop Drawings
- 2.1 **GENERAL**
- .1 The term "Shop Drawing" means Drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by the Contractor to illustrate details of a portion of the Work.
- .2 The Contractor shall arrange for the preparation of clearly identified Shop Drawings as called for by the Contract Documents or as the Consultant may reasonably request.
- .3 Prior to submission to the Consultant, the Contractor shall review and stamp all Shop Drawings. By this review the Contractor represents that he has determined and verified all field measurements, field construction criteria, materials, catalogue numbers and similar data and that he has checked and coordinated each Shop Drawing with the requirements of the Work and of the Contract Documents. The Contractor's review of each Shop Drawing shall be indicated by stamp, date, and signature of a responsible person.
- .4 Submittals not stamped, signed, dated and identified as to the specific Contract requirements may be returned without being examined and shall be considered rejected.
- .5 The Contractor shall submit Shop Drawings to the Consultant for his review with reasonable promptness and in orderly sequence so as to cause no delay in the Work or in the work of other Contractors. If either the Contractor or the Consultant so requests they shall jointly prepare a schedule fixing the dates for submission and return of Shop Drawings. At the time of submission the Contractor shall notify the Consultant in writing of any deviations in the Shop Drawings from the requirements of the Contract Documents.
-

- .6 The Consultant will review and return Shop Drawings in accordance with schedule agreed upon, or otherwise with reasonable promptness so as to cause no delay. The Consultant's review will be for conformity to the design concept and for general arrangement only and such review shall not relieve the Contractor of responsibility for errors or omissions in the Shop Drawings or of responsibility for meeting all requirements of the Contract Documents unless a deviation on the Shop Drawings has been approved in writing by the Consultant.
- .7 The Contractor shall make any changes in Shop Drawings which the Consultant may require consistent with the Contract Documents and resubmit unless otherwise directed by the Consultant. When resubmitting, the Contractor shall notify the Consultant in writing of any revisions other than those requested by the Consultant.
- .8 The Contractor shall secure from all his Subcontractors and material Suppliers, uniform size Shop Drawings showing the construction materials, etc., or as required and upon which the respective Bids have been based.
- .9 Shop Drawings shall define the division of responsibility between the trades, and all items shown on the Shop Drawings shall be supplied as part of the Contract unless it is specifically noted that certain items are not part of the Contract.
- .10 Any work done before receiving the Consultant's final review of the Shop Drawings shall be at the Contractor's risk.

2.2 SHOP DRAWINGS IDENTIFICATION

- .1 An electronic stamp will be sized and placed to fit on each Shop Drawing:



The review of this Shop Drawing is for the sole purpose of ascertaining conformance with the general design concept and general arrangement only. This review does not constitute approval or verification of the design inherent in the Shop Drawings, and any omissions or errors therein remain the responsibility of the Contractor. The Contractor remains entirely responsible for complying with the Contract Documents, confirming all field dimensions and site conditions, for information that pertains to fabrication, techniques of construction and installation, and coordination of the Work.

Reviewed	Reviewed As Noted	Revise & Resubmit	Not Reviewed
Reviewed By:		Date:	

2.3 REPRODUCTION OF ENGINEERING DRAWINGS

- .1 Reproduction of the engineering Drawings, to serve as background or reference for Shop Drawings, will be permitted. Cost of reproduction shall be based on the number of electronic Drawing files as indicated below, and shall be paid for by the Contractor in accordance with rates indicated below. Rates are exclusive of HST. The Consultant will prepare the files by removing logos, seals and other identification or reference to the Owner or Consultant, checking all reference files and removing unnecessary external references, and packaging files for release. Any identification or reference to the Owner or Consultant is to be removed from all Drawings that are used by the Contractor for this

Contract. Costs incurred for the reproduction of engineering Drawings shall be paid by the Contractor directly to the Consultant.

- .1 One to ten files: \$1,000.00
 - .2 Eleven to twenty files: \$1,900.00
 - .3 Twenty-one to fifty files: \$4,500.00
 - .4 Fifty-one to one hundred files: \$8,000.00
 - .5 More than one hundred files: \$75 rate per file, plus \$500.00 administration fee
 - .6 The submission of a copy of the Consultant's Drawings as a Shop Drawing without additional detailed installation, fabrication or Product information added is not an acceptable form of submittal and is grounds for automatic rejection.
- .2 Prior to the release of digital or electronic files, the Consultant will issue to the Contractor the Digital Transfer Agreement form attached to the end of this section.
- .1 The Contractor shall review and return to the Consultant an electronic copy of the agreement with the Contractor's signature.
 - .2 By this review and signing of the agreement, the Contractor has acknowledged and agreed to the terms contained within the Digital Transfer Agreement.
 - .3 The Consultant will not release digital files to the Contractor until the agreement is signed and executed. The Consultant will retain an executed copy of the Digital Transfer Agreement.

2.4 SUBMITTAL SYSTEM - GENERAL

- .1 Submit Portable Data Files (PDF's) of fully detailed and dimensioned Shop Drawings of the Work.
- .2 Shop Drawings will be returned to the Contractor stamped and marked "REVIEWED", or "REVIEWED AS NOTED", or "REVISE & RESUBMIT" or " NOT REVIEWED". These stamps are defined as follows:

Stamp	Meaning
REVIEWED	Drawings reviewed without comments. Proceed with construction
REVIEWED AS NOTED	Incorporate corrections or comments and proceed with construction. No other alterations are to be made to the Drawings by the Contractor subsequent to receipt of Drawings stamped and marked as above. If further changes are made in addition to the Consultant's notations, then the Drawings must be resubmitted for further review.
REVISE & RESUBMIT	Revise Drawing in accordance with corrections or comments and re-submit to the Engineer for further review
NOT REVIEWED	Drawing does not require Engineer's review

- .3 Shop Drawing numbering shall be in numerical sequence beginning with the specification Section number followed by "001". If a revision is submitted it shall be followed up in sequence beginning with ".R1". See below table for example:

Section 02 41 19	Selective Structure Demolition
02 41 19.001	Demolition Plan
02 41 19.001.R1	Demolition Plan
02 41 19.002	Conflict with Buried Fiber Cable

- .4 Coordinate Shop Drawing file sizes with Consultant in advance of submittal. Generally, submit up to 10 megabytes file size only.
- .5 Drawings shall be blackline as much as possible to obtain good resolution when printed.
- .6 Consultant may mark up the Shop Drawings electronically or may print and mark up manually.
- .7 A copy of Shop Drawings with Consultant's comments in colour and shall be emailed back to the Contractor or posted on a File Transfer Protocol (ftp) site or project website, if such site exists. The Consultant will retain on its electronic folder, a PDF copy of Shop Drawings returned to the Contractor. Original marked up hardcopy if applicable will also be retained by the Consultant.

2.5 **SUBMITTAL SYSTEM**

- .1 Shop Drawings shall be submitted in electronic format for obtaining reviews from the Consultant.
- .2 Electronic submittals shall be uploaded by the Contractor in PDF format. Any other format will result in delays in the review of submittals.
- .3 Contractor shall electronically notify various people of each submittal according to a communications plan determined at the beginning of the Work.
- .4 Consultant will apply the review stamp to the submittals and upload a PDF version of the reviewed Drawings complete with comments. Consultant will return submittals and will be named to align as closely as possible.
- .5 Consultant will electronically notify the various parties of a reviewed submittal as determined at the beginning of the Work in the communications plan.
- .6 Contractor shall download "Reviewed" submittal and print out the files in order to obtain the Consultant's review comments.
- .7 Contractor is responsible for opening and checking all documents and shall confirm the following and if there are any discrepancies, the Contractor shall contact the Consultant immediately.
 - .1 That the files contained have been correctly transmitted.
 - .2 That the transmittal sheet accurately lists the files that were sent.
 - .3 That the files match-up with files previously submitted by the Contractor to the Consultant.

2.6 **SUBMITTAL SYSTEM – PART3**

- .1 The Consultant will be utilizing a web based construction contract administration control software such as Part3 to manage requests for information, submittal construction communications, and change management documents for the Project.
- .2 The Contractor and requested sub-contractors will be provided with access to this web-based software and project database following Contract award by the Owner.

2.7 **INFORMATION REQUIRED**

- .1 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information requested in the individual Specification sections or as necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of the section under which the adjacent items will be supplied and installed. Indicate cross references to design Drawings and Specifications.
- .2 Where a submittal relates to door schedule(s), submittal **MUST** be cross referenced to the door schedule(s) indicating door number and type. Non-compliance will result in the rejection of Shop Drawing.
- .3 All submittals shall be clearly drawn with CAD or typewritten to be legible.

2.8 **ENGINEER'S STAMP AND SIGNATURE**

- .1 Shop Drawings of components, apparatus and equipment which are designed by the Contractor shall bear the stamp and signature of an Engineer registered in the Province of Ontario in accordance with the Ontario Building Code and the Professional Engineer's Act.

2.9 **CHANGES**

- .1 Adjustments made on Shop Drawings by the Consultant are not intended to change the Contract Price. If adjustments affect the value of Work, state such in writing to the Consultant prior to proceeding with the Work.
- .2 Make changes in Shop Drawings as the Consultant may require and which are consistent with Contract Documents. When resubmitting, notify the Consultant in writing of any revisions other than those requested by the latter.

2.10 **UNITS OF MEASUREMENT**

- .1 Shop Drawings shall show weights and dimensions in either metric (S.I. units) or Imperial units, consistent with the Consultant's Drawings and Specifications.

2.11 **MISCELLANEOUS**

- .1 Fabrication shall not proceed until Drawings have been reviewed, unless other authorization is granted in writing by the Consultant.
 - .2 The Contractor and each Subcontractor is expected to operate as an expert in his respective field. The Contractor shall save Owner and Consultant harmless from any defect resulting from failure in this regard including cost of remedial action necessary before or after completion of the Work.
 - .3 Drawings shall be prepared specifically for the Work.
-

2.12 **RECORD SUBMISSIONS**

- .1 Record purpose submissions for:
 - .1 Piping specialties.
 - .2 Valves.
 - .3 Any inspection certificate/report submitted by authorities shall be stamped "FOR RECORD PURPOSES ONLY".
 - .4 For each size or model as applicable for equipment, submit two copies or one copy on USB flash drive or FTP site, scanned file copies in Adobe Acrobat Version 9 or later.

2.13 **SUBMISSIONS TO AUTHORITIES HAVING JURISDICTION**

- .1 Contact authorities having jurisdiction over the Place of Work for required list of submissions for their review.
- .2 All detailed design Drawings or other submittals required to be submitted to the authority for approval shall be prepared, submitted, and paid for by the Contractor.

2.14 **BROCHURES**

- .1 Submit two copies of Product data sheets or brochures, or one copy on USB flash drive, scanned file copies in Adobe Acrobat Version 9 or later. Data sheets or brochures are for requirements requested in Specification sections and as the Consultant may reasonably request where customized Shop Drawings will not be prepared due to standardized manufacture of Product.
- .2 Brochures or Drawings of standard production equipment shall be for one size or model and include all performance data and characteristic curves for such equipment.
- .3 Wiring diagrams and schematics shall accompany Shop Drawings for all equipment which have electrical controls furnished with the equipment.

3 Samples

3.1 **SAMPLES**

- .1 Submit for review all samples as requested in the respective Specification sections. Label samples as to origin and intended use in the Work.
 - .2 Deliver samples prepaid to Consultant's business address, unless otherwise approved by Consultant. Large, heavy items such as concrete block samples may be reviewed on site if arranged in advance with the Consultant.
 - .3 Notify the Consultant in writing at the time of submission, of deviations in samples from requirements of Contract Documents.
 - .4 Adjustments made on samples by the Consultant are not intended to change the Contract Price. If such adjustments affect the value of Work, state such in writing to the Consultant prior to proceeding with the Work.
 - .5 Make changes in samples which the Consultant may require consistent with the Contract Documents.
-

4 Building, Operating and Maintenance Manuals

4.1 **BINDERS**

- .1 Binders: Commercial quality, 260 mm x 295 mm; hard covered, jacketed, "D" ring style with 3 rings in size to suit binder thickness.
- .2 Covers: Identify each binder with typed or printed title "Building, Operating and Maintenance Manuals"; list title of Project, Owner, and date of manual submission.
- .3 Organize contents into applicable categories of Work, parallel to Specification sections. When only one volume is required, include a complete index. Where more than one volume is required, include a complete index of all volumes and each succeeding volume shall contain an index of its own contents.
 - .1 Provide tabbed fly leaf for each category of Work, with typed description of Product and major component parts of equipment.
 - .2 Include names, addresses, telephone number and general email address of Contractor with names of responsible parties; schedule of Products and systems, indexed to content of the volume.
 - .3 For each Product or system, list names, addresses, telephone numbers and general email address of Subcontractors and Suppliers who can effect repair or maintenance on equipment, including local source of supplies and replacement parts.
 - .4 Product data: organize to parallel Project Manual (Specifications) breakdown. Mark each sheet to clearly identify specific Products and component parts and data applicable to installation; delete inapplicable information. Supplement Product data to illustrate relationships of component parts of equipment and systems to show control and flow diagrams
 - .5 Typed text information: Provide as required to supplement Product data. Provide logical sequence of instructions for each procedure incorporating manufacturer's instructions.
 - .6 For test information, manufacturer's printed data or typewritten data is required.
 - .7 For Drawings, provide appropriate reinforced binder tabs and bind in with text; fold larger sheets.

4.2 **BUILDING MANUALS**

- .1 For building Products, applied materials and finishes include:
 - .1 Product data with catalogue number, size, composition and colour and texture designations.
 - .2 Maintenance instructions for finished surfaces and materials.
 - .3 Copy of finish hardware and paint schedules.
 - .4 Spare materials for maintenance purposes as listed in various technical sections.
 - .5 Provide information for reordering custom manufactured Products.
-

- .2 Include instructions for cleaning agents methods and recommended schedule for cleaning and maintenance, include precautionary information against detrimental agents and proper methods.

- .3 Additional requirements: Include as specified in individual Specification sections.

4.3 **OPERATING AND MAINTENANCE MANUALS**

- .1 One Operating and Maintenance Manual is to be submitted for each building and address included as part of the project.

- .2 Manuals are to contain operational information on equipment, cleaning and lubrication schedules e.g. filters, overhaul and adjustment schedules and similar maintenance information. Give equipment function, normal operation characteristics and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

- .3 Instructions shall be in such form and language so as to facilitate the Owner in the proper operation and maintenance of building systems.

- .4 In addition to information specified, include the following:

- .1 Final Shop Drawings and Product data of equipment.
 - .2 Record Drawings of mechanical and electrical installations.
 - .3 Full description of building systems and operations.
 - .4 Operating procedure: include start up, break-in, and routing normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter and any special operating instructions.
 - .5 Controls and operating sequences; wiring diagram of control panels.
 - .6 Schematic diagram of pneumatic, electrical, oil and/or gas systems.
 - .7 Non-dimensional layout showing locations of all electrical devices on mechanical equipment.
 - .8 Complete parts list of assemblies showing manufacturer's names, addresses, nearest replacement sources and telephone numbers.
 - .9 List of recommended spare parts and quantity of each item to be stocked.
 - .10 Maintenance requirements: include preventative requirements; routine procedures and guide for troubleshooting; disassembly, repair, and reassembly instructions and alignment, balancing and checking instructions.
 - .11 Manufacturer's warranties.
 - .12 Lubricating instructions, list of lubricants and recommended cycle of lubrication.
 - .13 Manufacturer's certified reports.
 - .14 Field testing and commissioning reports.
 - .15 Factory test reports.
-

- .16 Sequence of controls operation and control diagrams.
- .17 Contractor's coordination Drawings with installed colour coded piping diagrams.
- .18 Original manufacturer's parts list, illustrations, assembly Drawings and diagrams required for maintenance.
- .19 List of original manufacturer's spare parts, current prices and recommended quantities to be maintained in storage.
- .20 Additional requirements: Provide as specified in individual Specifications sections.
- .5 Requirements specified apply to component parts of equipment whether they are manufactured by Supplier of equipment or are supplied as a component part of an item of equipment.

4.4 **SUBMITTAL OF MANUALS**

- .1 Two weeks prior to anticipated date of Substantial Performance, submit to Consultant one hardcopy and one USB of completed manuals in final form.
 - .1 Copy will be returned with Consultant's comments.
 - .2 Revise contents of manuals as required prior to final submittal.
 - .3 Submit two copies of revised manuals in final form within 14 days before Substantial Performance.
 - .4 USB shall contain PDF file copies in Adobe Acrobat Version 9 or later, of all Building, Operating and Maintenance Manuals. Provide a file for each document, with bookmarking reference for each chapter or section in the document.

5 As-Builts

5.1 **AS-BUILT DRAWINGS AND CCTV**

- .1 Provide at own cost, additional sets of Drawing prints for use in maintaining "As-Built" information.
 - .2 Be responsible for creating "As-Builts" from field data collected during the course of the Project. Neatly record complete with legible dimensions and notes.
 - .3 "As-Built" Drawings are those prepared by the Contractor as it constructs the Project and upon which it documents the actual locations of the building components and changes to the original Contract Documents.
 - .4 Field data is defined as information that is not available from the Contract Documents, addenda, Change Orders, or Site instructions. It is of importance that the Contractor record on the "As-Builts" all field information relating to concealed conditions.
 - .5 "As-Built" information MUST have a high degree of accuracy in all respects.
 - .6 Recording must be done on the same day that deviation is made to ensure that important information is not missed from the "As-Builts".
 - .7 Hand-mark all recording using red ink. "Clouded" method is unacceptable and "As-Builts" showing such method will be returned to the Contractor.
-

- .8 Identify as "Project As-Built Copy". Maintain in good condition; clean, dry and legible, and make available for inspection on Site by Consultant at all times.
- .9 Upon completion of the Work and prior to final inspection, submit a clean and legible copy of "As-Built" Drawings to Consultant.
- .10 CCTV:
 - .1 Submit a CCTV recorded video file in .mpg or .mp4 format showing storm drainage and sewer systems free from construction debris.

5.2 **PROGRESS PHOTOGRAPHS**

- .1 On commencement of the Work and at every two-week interval thereafter, supply the Consultant with minimum twelve (others) digital colour photographs, taken from different views, indicating status and progress of the Work by each section of Work. Indicate date photograph was taken with appropriate description and email to the Consultant or upload to FTP site or project website, where the latter exists.
- .2 Maintain a binder on site with 4 x 6 photographs for easy reference.

5.3 **PROGRESS VIDEO**

- .1 Provide internet capable web-based camera and an active website that require software to be installed on a computer, allowing off-site viewing of the Place of the Work twenty-four hours a day, seven days a week. Submit website address and security access code to Consultant.
- .2 Submit colour files in digital format, weekly with progress statement.
- .3 Frequency: At completion of building as directed by Consultant.

End of Section

Digital Transfer Agreement

This Digital Transfer Agreement (the “**Agreement**”) is made as of **[Month, Day, Year]**, between **[Insert Client Name]** and **[Insert correct IBI Group entity legal name]** as provided below:

[Insert Recipient Name Office Address City, Province/State, Country Postal/ZIP Code]	and	[Insert correct IBI Group entity name and address.]
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the “**Recipient**”

“**IBI Group**”

IBI Group and the Recipient are providing services for the **[insert project name and brief description]** (the “**Project**”). The Recipient and IBI Group wish to enter into this Agreement whereby IBI Group will provide digital documents to the Recipient to assist the Recipient in carrying out its Project-related services.

NOW THEREFORE, in consideration for being given access to information that is confidential and proprietary, and for other good and valuable consideration the receipt and sufficiency of which are hereby acknowledged, the parties hereby agree and covenant as follows:

Section 1 – Transfer of Files

- 1.01 IBI Group will, following execution of this Agreement **[and payment to IBI Group by the Recipient of \$X]**, transfer to the Recipient the digital files listed at *Schedule 1 – Digital Files* (the “**Files**”). By separate amendment executed by both parties hereto, the parties may agree to transfer additional Files to be included in additional schedules in the form attached hereto at Schedule 2.
- 1.02 The Recipient acknowledges and agrees that it:
- (a) may use the Files, and any portion or component thereof, only for its own use in relation to the Project, and only for the following express purposes:
 - (i) **[background on which to prepare design, shop or other drawings and other submittals]**
 - (ii) **[3D coordination / clash detection / schedule simulation (4D)]**
 - (iii) **[take offs / quantity estimates of specific items (list)]**
 - (iv) **[fabrication / procurement of components]**
 - (v) **[integration with Geographic Information System (GIS) or Asset Management System]**
 - (vi) **[insert other]**
 - (b) may not transfer, forward, sell, trade, distribute, or permit access to, the Files, to any third party, including without limitation Project contractors, subcontractors, consultants and sub consultants, unless IBI Group has expressly agreed to such transfer in writing, it being understood that such agreement will not be forthcoming from IBI Group unless and until such proposed third party has executed a digital transfer agreement similar to the terms contained herein in favour of IBI Group; and

- (c) may not alter, modify, amend or change in any manner the contents of Files, or separate any content, schedules, materials, wall types or legends which are included as elements within the Files, or in any portion of the Files.

Section 2 – Liability of IBI Group and Recipient Indemnity

- 2.01 The parties agree that IBI Group is not responsible for, and does not warrant or guarantee the accuracy, correctness or completeness of, the Files or the data contained therein, including without limitation any reference notes to “as-built” or similar. IBI Group offers no assurances that the information in the Files is reflective of previous contract or as-built conditions, and disclaims all responsibility for the accuracy or use of the data contained within the Files.
- 2.02 The Recipient agrees to verify and check all information contained within the Files and acknowledges it is solely responsible for fully ascertaining all site conditions and measurements relevant to its Project deliverables.
- 2.03 The Recipient agrees to waive any and all actions, claims, demands, proceedings, charges, fines, sanctions, penalties, damages, losses, consequential losses, damages related to loss of use, loss of profit, loss of opportunity, loss income or diminution of property value and the like, and costs and expenses (including legal and other professional fees) of whatsoever nature or kind (together “**Claims and Damages**”), that the Recipient, the entity procuring the Project and any third party involved in the Project, and each of their respective employees and agents (together “**Project Parties**”) may suffer, on any theory of liability, whether in contract, strict liability, tort, negligence, or otherwise (as against IBI Group), which arise out of or result from the Recipient’s use of or reliance on the Files or use of or reliance of the Files by the Recipient’s third party recipient, whether or not authorized as permitted hereunder.
- 2.03 The Recipient agrees to indemnify, defend and hold harmless IBI Group, and each of its related and affiliated companies, their officers, directors, unit holders, partners, associates, and employees (together “**IBI Group Indemnified Parties**”) from and against any and all Claims and Damages suffered by any IBI Group Indemnified Party, arising out of, in connection with, or result from use of the Files by the Recipient or its representatives.

Section 3 – IBI Group Retention of Rights

- 3.01 IBI Group retains all common law, statutory law and other intellectual property rights relating to the Files and the data contained therein, including, but not limited to, title, copyright, industrial design rights and moral rights.
- 3.02 The Recipient hereby assigns to IBI Group all copyrights in all materials produced from the Files and except with IBI Group’s prior written consent, the Recipient shall not use the Files or any part thereof to produce any materials not expressly required for the Project, including without limitation views, graphics, renderings, physical models or marketing materials, nor may the Recipient use those materials for any purpose other than the Project. If, in its sole discretion, IBI Group does consent to any other use, such
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consent will be conditioned, at a minimum, to IBI Group receiving credit as the producer and (to the extent applicable) copyright holder.

Section 4 – Recipient Acknowledgments

- 4.01 While IBI Group has taken reasonable precaution to ensure that Files are “virus-free”, the Recipient takes full responsibility of assuring that this is the case, and that the Recipient shall have no entitlement to any Claims and Damages connected to damages to its computing systems and/or files in the transfer or use of the Files.
- 4.02 The Recipient acknowledges that:
- (a) the Files provide a representation of then dated design, are not construction documents, nor do the Files reflect construction or contract documents, and that there may be differences between the Files and any corresponding construction or contract documents, including but not limited to previously prepared construction or contract documents;
 - (b) the Files do not represent or confirm specific Project elements, including without limitation those relating to fire and life safety, assembly details, systems, building envelope assemblies or details and the like; and
 - (c) data contained in the Files may change subsequent to the issue of Files to the Recipient due to changes or additions, however IBI Group is under no requirement to advise the Recipient of any such changes or additions and no liability accrues to IBI Group for not advising the Recipient of any changes or additions.
- 4.03 The Recipient shall, at its sole expense, remove all references to the name and logo of IBI Group, the name and logo of any other consultant, and all professional seals, in the use of the Files. Furthermore, IBI Group reserves the right to remove all references to the name and logo of IBI Group, the name and logo of any other consultant, and all professional seals, in the Files provided to the Recipient.
- 4.04 If the Files are provided as linked components, the Recipient takes full responsibility for any ‘binding’ which may be required by the Recipient. The Recipient acknowledges that in some cases Files are linked because of size constraints, and agrees that file corruption which may be a consequence thereof is at the Recipient’s sole cost, risk and expense.

Section 5 – Term and Termination

- 5.01 Unless extended by mutual agreement of the Recipient and IBI Group, this Agreement will terminate on the earliest of: (a) **[DATE]**; and (b) the date of termination in accordance with this Section 5.
- 5.02 If the Recipient fails to comply with any of the terms or conditions of this Agreement, IBI Group may terminate this Agreement and all rights of the Recipient created herein.
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- 5.03 Upon completion of the Project, or upon termination of this Agreement for whatever cause, all rights and privileges granted to the Recipient hereunder will immediately terminate and the Recipient shall immediately return to IBI Group, or destroy, the Files and all related copies and materials. IBI Group reserves the right to require a certificate of a Director of the Recipient attesting to the return or destruction of the Files and all related copies and materials.

Section 6 – Confidentiality

- 6.01 Recipient shall not divulge any specific information identified as confidential, communicated to or acquired, or disclosed by IBI Group. No such information shall be used by Recipient on any other project without the written approval of IBI. These obligations of confidentiality shall not apply to information which is in the public domain; which is provided to Recipient by a third party without obligation of confidentiality; which is independently developed by Recipient without use of IBI Group's information; or which is required to be disclosed by law or by court order.

Section 7 – Miscellaneous

- 7.01 The express rights and remedies of the parties set out in this Agreement are in addition to and will not limit any other rights and remedies available to the Recipient or IBI Group at law or in equity. Any failure by either party to insist on strict performance and compliance by the other of any term, right or remedy under this Agreement will not be construed as a waiver by such party its right to require strict performance of any such term, right or remedy, and the duties of the party with respect to such contractual performance will continue in full force and effect.
- 7.02 Neither party will transfer, sublet or assign any rights or duties under, or interest in, this Agreement, without the prior written consent of the other party.
- 7.03 If any term, condition or obligation of this Agreement, or the application of any term, condition or obligation to the parties or to any other persons (including firms, partnerships, corporations or any combination), is to any extent held invalid or unenforceable under any applicable legislation or rule of law, such holding will be applied only to that provision(s), with the remainder of this Agreement remaining in full legal force and effect.
- 7.04 The parties agree that this Agreement and legal actions concerning its validity, interpretation and performance will be governed and interpreted in accordance with **[INSERT JURISDICTION OF IBI Group ENTITY]**; and it is further agreed by the parties that any legal action arising under this Agreement will be brought in a court of competent jurisdiction in that jurisdiction.
- 7.05 This Agreement constitutes the entire agreement between the Recipient and IBI Group regarding the transfer of Files and cancels and supersedes any prior understandings and agreements, whether written or oral in respect of the same. Except as expressly provided in this Agreement, no other terms, conditions or warranties, express or implied, form a part of this Agreement. Amendments to this Agreement must be in writing and signed by both parties.
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- 7.06 Notwithstanding any amendment, completion or termination of this Agreement, all indemnifications in favour of IBI Group will survive and will remain in full legal force and effect.
 - 7.07 The Recipient and IBI Group agree to be bound, as are their respective successors, executors, administrators and legal representatives, in respect of all terms, conditions and obligations pursuant to this Agreement.
 - 7.08 This Agreement may be signed in counterparts and each such counterpart will constitute an original document and such counterparts, taken together, will constitute one and the same instrument. This Agreement may be executed and delivered by electronic transmission and the Recipient and IBI Group may rely on such electronic signature as though such were an original signature.
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This Agreement is executed with effect as of the date set out on the first page of this Agreement.

RECIPIENT

	_____		_____
Name:	_____	Name:	_____
Title:	_____	Title:	_____

IBI GROUP

	_____		_____
Name:	_____	Name:	_____
Title:	_____	Title:	_____

Schedule 1 – DIGITAL FILES

INSERT DESCRIPTION OF DIGITAL FILES INCLUDING FORMAT

Schedule 2 – ADDITIONAL DIGITAL FILES

The defined terms used in Schedule 2 have the meaning ascribed to them in the Agreement.

For and in consideration of good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the parties hereto agree that except for the addition of Files as described below, the provisions of Agreement shall remain in full force and effect and the Files described below shall be subject to the terms and conditions of the Agreement in full.

IBI Group will, following execution of this Agreement **[and payment to IBI Group by recipient of \$X]**, transfer to the Recipient the digital files listed at *Schedule 2 – Additional Digital Files* (the “Files”). By separate amendment executed by both parties hereto, the parties may agree to transfer additional Files to be included in additional schedules in the form attached hereto at Schedule 2.

RECIPIENT

Name:	_____	Name:	_____
Title:	_____	Title:	_____

IBI GROUP

Name:	_____	Name:	_____
Title:	_____	Title:	_____

End of Form

**Attachment "A" to Specification Section 01 33 00
Standard Submittal Form**

Page 1

1. Submittal Title:												
2. To:		3. From:		4. Project Title & Location:			5. Submittal Date			6. New Resubmittal		
ATTN:		ATTN:		8. Specification Section No:			7. Submittal No.			10. Resubmittal No.		
							9. Partial Submittal No.					
11. Contract				12. Project No:					IBI/Owner Use Contract No:			
13. Page No.	14. Mfr/Contractor		15. Item I.D. Description		16. Electronic Copy (Yes) (No)		17. No. of Hard Copies				Date Received:	
							Print	Cat.	Samp	Other	Action Code # Dept. File	
18. Contractor's Remarks:					<p>The undersigned certifies that the above submitted items have been reviewed in detail and are correct and in strict conformance with all requirements of the Contract Documents, except as otherwise noted. Note: Approval of items submitted does not relieve Contractor from complying with all requirements of the Contract Documents.</p> <p>Name of Contractor _____</p> <p>Signature _____</p>					Action Codes: Refer to Section 01 33 00 for full text of codes below		
										1. Revise & Resubmit Revise and resubmit to the Consultant for further review 2. Reviewed as Noted Incorporate corrections or comments and proceed with construction		
Consultant Comment:			Route	Dept.	Ck'd by	Date	Action	Received				
				Civil								
				Arch.								
				Struc.								
				Mech.								
				Elect.								
				I & C								
				Process								
				PM								
Copies to:			Primary Dept. Checker				Review completed on				By Date	
			Control Administrator				Returned to Contractor on					
											IBI Group	

Attachment "A" to Specification Section 01 33 00
Standard Submittal Form

Page 2

Instructions for Use of Standard Submittal Form

1. Use an individual copy of this form for each and every required Project submittal.
2. Contractor shall fill in all blank spaces above the "Owner Comment" box and to the left of the "Action Codes", including the following:
 - Box 1 - Indicate generically what is being submitted i.e. "structural steel", "overhead doors", "plumbing fixtures", "wiring diagrams", etc.
 - Box 3 - Contractor's return address
 - Box 5 - Submittal date
 - Box 6 - Indicate "New" or "Resubmittal"
 - Box 7 - Submittal number
 - Box 8 - Specification section number submittal is in response to
 - Box 9 - Indicate if this is a partial submittal by using root number with part number (A5-00-01 – Part A, A5-00-01 – Part B, etc.)
 - Box 10 - Indicate if this is a resubmittal by using original root number with revision number
 - Box 11 - Indicate appropriate Contract name
 - Box 13 - Indicate Specification page number
 - Box 14 - Identify the manufacturer/Vendor/Subcontractor
 - Box 15 - Describe the submitted item
 - Box 16 - Indicate if electronic submittal
 - Box 17 - Indicate the quantity of submittal copies
 - Box 18 - Include appropriate remarks as required and sign the certification
3. The remainder of the submittal form will be completed by the Consultant, and returned to the Contractor with the submittal.

End of Attachment

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|----|--|
| 1 | Description |
| .1 | This section covers Work for protection of environment as applicable to this Project. |
| .2 | Provisions of this section supplement requirements of Contract Documents. |
| 2 | Environmental Practices |
| .1 | Implement environmentally sound practices in this Project by incorporating Products that lessen burden on environment in production, use and final disposition. Support implementation of reduction, reuse and recycling strategies and use of environmentally sound Products. Promote use of environmentally responsible packaging practices by reducing and/or eliminating Products with excessive packaging in this Project where these practices do not negatively affect the proper protection of materials from inclement weather, especially water damage. |
| .2 | Employ environmentally sound Products which are made, used and disposed of in a manner that significantly reduces harm to environment. |
| 3 | Surface Drainage and Watercourses |
| .1 | Maintain ditches and watercourses for surface water drainage of Site and external properties during construction. Be responsible for damage due to negligence. |
| .2 | Incorporate appropriate retention, detention and settling ponds, or similar methods, reviewed by Consultant, to control surface water run-off to adjacent ditches or other watercourses and to prevent oil, sediment or de-icing materials being carried into such ditches and/or watercourses. Tested quality of water discharged to ditches and/or watercourses shall not be of worse quality than that present in ditches and/or watercourses prior to any discharge of Site surface water. Monitor and test discharge water at least weekly and provide copies of test result to Consultant. |
| .3 | Locate and protect stockpiles of semi-permanent nature to satisfaction of authorities having jurisdiction to ensure minimum environmental interference. |
| 4 | Noise Control |
| .1 | Adhere to local noise bylaws. |
| .2 | Equip vehicles and equipment with efficient noise attenuation devices (mufflers) to minimize noise levels in vicinity of Site. |
| .3 | Where necessary place noise attenuation devices (barriers) around stationery pumps and compressors. |
| 5 | Dust Control |
| .1 | Undertake control measures to prevent nuisances due to dust in any phase of construction. |
| .2 | Application of calcium chloride shall be kept to a minimum and shall be restricted to vehicle right-of-way. In close proximity to watercourses, frequent application of water is preferred method. Obtain Consultant's approval before chemicals for dust control are used. |
| .3 | Transport dusty materials in covered haulage vehicles. |
| .4 | Transport wet materials in suitable watertight haulage vehicles. |
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- 6 Waste Management Practices
- .1 Refer to Section 01 74 19.
- 7 Equipment Fuelling, Maintenance and Storage
- .1 Obtain Consultant's acceptance of refueling areas.
- .2 Procedures for interception and rapid clean-up and disposal of fuel spillages shall be submitted to Consultant for review prior to starting Work.
- .3 Ensure that materials required for clean-up of fuel spillages are readily accessible on Site at all times.
- .4 Carry out refueling of equipment at acceptable refueling areas.
- .5 Ensure that water used for cleaning of equipment does not drain into streams, lakes or watercourses. Do not empty fuel, lubricants and/or pesticides into any watercourse, or on ground.
- .6 Clean Construction Equipment prior to entering public roadways to prevent littering. Debris from cleaning equipment shall not be permitted into storm sewers or watercourses.
- .7 Store equipment and materials in orderly manner and in location acceptable to Consultant.
- 8 Spills Reporting
- .1 In event of spill or other emission of pollutant into natural environment, notify:
- .1 Local office of the Ministry of Environment and MOE Spill Action Centre (SAC).
- .2 Municipality or regional municipality within boundaries of which spill occurred.
- .3 Person having control of pollutant, if known, of spill, of circumstances surrounding the spill and of any action taken or intended to be taken.
- 9 Contingency Plan for Control and Clean-Up of Spill
- .1 Prior to commencing construction, prepare contingency plan for control and clean-up of spills. Contingency plan to include:
- .1 Names and telephone numbers of persons in local municipalities and MOE to be notified forthwith of spill.
- .2 Names and telephone numbers of representatives of fire, police and health departments of local municipalities who are responsible for responding to emergency situation.
- .3 Names and telephone numbers of companies experienced in control and clean-up of hazardous materials that would be called upon in emergency involving spill.
- .4 Contingency plan shall include provisions for spills of hazardous or unknown materials (i.e. puncturing on unmarked drain during excavation).
- .5 Proposal for immediate containment and control of spill, clean up procedures to be initiated immediately and any other action to be taken to mitigate potential environmental damage while awaiting additional assistance.
-

- .6 Be responsible for preparing, implementing, directing and supervision of contingency plan.
- .2 Ensure immediate availability of Products with which to effect temporary repair to broken pipelines and other services so spill or other emission of pollutant is immediately controlled and stopped and to mitigate damages.
- .3 Submit for Consultant's review copy of contingency plan and make appropriate changes as requested.

End Of Section

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- 1 All equipment shall be guarded and safeguarded in compliance with the Industrial Regulations O.Reg. 851 and shall meet the latest revision of the applicable standard listed in tables 3 and 4 of the Guidelines for Pre-Start Health and Safety Reviews: How to Apply Section 7 of the Regulation for Industrial Establishments (available on the Government of Ontario website).
- 2 For all equipment that triggers a Pre-Start Health and Safety Review (PSR) as outlined in the Guidelines for Pre-Start Health and Safety Reviews: How to Apply Section 7 of the Regulation for Industrial Establishments and as specified in Section 7 of the Industrial Regulations O.Reg. 851, the Contractor shall provide a PSR report. Alternatively, the Contractor shall provide a Letter of Exemption complete with supporting documentation as outlined in the Guidelines and as specified in Section 7 of the Industrial Regulations O.Reg. 851.

End of Section

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1 PROPOSED EQUIVALENT PRODUCTS

- .1 Whenever a material or article is specified or described by using the name of a proprietary Product or the name of a particular manufacturer or Vendor, the specific item mentioned shall be understood as establishing type, function, dimension, appearance, and quality of Product desired.
- .2 The words "or accepted equal", "or accepted equivalent" and "or accepted alternative" as used in the Specifications are to be regarded as synonymous in meaning, and are applicable to all Specifications unless specifically stated otherwise. Any material, Product, or equipment which will fully perform or meet the service or function and/or aesthetics represented by a specified Product will be considered for acceptance as a "substitution", provided the Contractor submits proof that such material, Product or equipment is of acceptable equivalent substance and function and is accepted by the Owner. The burden of proof of acceptability rests with the Contractor.

2 PROPOSED SUBSTITUTIONS

- .1 Requests for substitutions must be submitted in writing using Section 01 62 01 Substitution Request Form.
- .2 The net cost of proposed substitution, weighed versus the cost of review, will be a factor in the Owner's final decision.
- .3 Contractor is responsible to determine suitability of accepted substitute Products for general construction purposes and scheduling requirements.
- .4 Acceptability of proposed substitutions is at the sole discretion of the Owner. The Owner however, is under no obligation to consider any or all proposed substitutions. Acceptance of substitutions shall in no way be interpreted as a waiver from full compliance with other Specification requirements.
- .5 Contractor shall declare that such substitution will fit within all constraints of the intended location and operating system in the Work without modification, or clearly described and defined modification, to allied specified systems, materials or assemblies.
- .6 Contractor shall save harmless the Owner, Consultant and their Subconsultants from any costs or third party action as a consequence of accepted substitution. Failure to comply with these requirements will result in rejection of the request.

3 NOTIFICATION OF ACCEPTANCE

- .1 Materials and equipment accepted as substitutions will be formally notified to the Contractor by a Change Order, Supplementary Instruction (SI) or Shop Drawings, as the case may be.

End of Section

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Substitution Request Form (SRF) No.: _____ Date: _____

Project: _____

General Contractor: _____ Subcontractor _____

Owner's Authorization: _____ Proceed (per _____)

1

General

- .1 This section applies to proposed substitutions submitted after Contract award.
- .2 Within two (2) weeks of Contract award, the Consultant will receive requests for substitutions from General Contractor for consideration. Proposed substitutions received after the expiration of the specified period will be marked "substitution review expired" and returned to Contractor.
- .3 Copy Owner on all substitution requests. The Owner will forward authorized substitution requests to Consultant by email. Consultant will not proceed with review without Owner's authorization.
- .4 For the Consultant's services in reviewing submittal, pay a fee of \$180.00/hour plus HST, minimum three hours or \$540.00, per proposed substitution.
- .5 Upon receipt of request, the Consultant will assess time required to review. If up to three hours is required, the Consultant will email Contractor and the Contractor will acknowledge by return email, authorizing the Consultant to proceed.
- .6 If the Consultant requires additional time above the three hours, Consultant will email Contractor with proposed additional hours with a proper breakdown for Contractor's consideration. Contractor shall send an email response accepting the proposed budget to authorize Consultant to do the review.
- .7 The Consultant will complete its review and submit a response back to Contractor in a timely manner.
 - .1 If accepted, a Change Order or Supplementary Instruction is issued.
- .8 Whether rejected or accepted, the Consultant will invoice Contractor for the cost of the review, with a copy of the Contractor's email confirmation attached to the invoice.
- .9 The Owner is under no obligation to consider any or all proposed substitutions.
- .10 For substitutions where cost savings are proposed the cost saving amount proposed by the Contractor will be reduced by the cost for the review.
- .11 Contractor shall declare that such substitution will fit within all constraints of the intended location and operating system in the Work without modification, or clearly described and defined modification, to allied specified systems, materials or assemblies. The proposed substitute shall be equal to or superior to the specified item as determined by Consultant.
- .12 Save harmless the Owner, Consultant and their Subconsultants from any costs or third party action as a consequence of accepted substitution. Failure to comply with these requirements will result in rejection of the request.

- .13 Any system, Product or material utilized without acceptance from the Consultant shall be removed from the Work, and replaced with complete installation of those specified without adjustment of Contract Price or Contract Time.

2 Details of Substitution Request

.1 Specified Product

- .1 Section Number: _____
- .2 Section Title: _____
- .3 Paragraph Number: _____

.2 Proposed Substitution

- .1 Manufacturer: _____
- .2 Trade Name or Model Number: _____
- .3 Manufacturer's Address: _____
- .4 Contact Person: _____
- .5 Phone No.: _____ Email: _____

.3 Product History

- .1 ☐ New ☐ 2 to 5 yrs old ☐ 5 to 10 yrs old ☐ more than 10 yrs old
- .2 Similar Installations:
- .3 Project Name: _____
- .4 Address: _____
- .5 Consultant: _____
- .6 Owner: _____
- .7 General Contractor: _____

.4 Proposed Product Affects Other Parts of Work?

- .1 ☐ No ☐ Yes
- .2 If "Yes", explain:

.5 Differences between proposed substitution and specified Product:

.6 Reason for not providing specified Product (substitution requests are considered under any of the following conditions only. Indicate conditions with a check (✓) mark):

- .1 ☐ Product(s) selected from those specified is/are unavailable.
- .2 ☐ Method(s) specified is/are too intricate.
- .3 ☐ Delivery date of Product(s), selected from those specified would unduly delay completion of Contract.
- .4 ☐ Method(s) specified would unduly delay completion of Contract.
- .5 ☐ Proposed substitute Product(s) or system(s) will result in a meaningful credit to the Contract Price.

.7 Change to Contract Price

.1 Add/Deduct \$ _____ (_____)

.8 Change to Contract Time

.1 Add/Deduct _____ days

.9 Contractor's Declaration:

- .1 Proposed substitution has been fully investigated and determined to be equivalent or superior in all respects to specified Product, and complies with requirements of authorities having jurisdiction.
- .2 Same warranty will be furnished for proposed substitution as for specified Product.
- .3 Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- .4 Proposed substitution does not affect dimensions and functional clearances.
- .5 Proposed substitution is compatible with adjacent materials and assemblies.
- .6 Coordination, installation, and changes in the Work as necessary for accepted substitution will be the responsibility of the Contractor.

Signed By Contractor: _____

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Reports ☐ Other

3 Consultant's Review

- .1 Substitution Accepted - Provide submittals per Specification requirements.
 - .2 Substitution Not Accepted.
-

.1 Reason: _____

Signed By Consultant: _____ Date _____

End of Form

1 General

1.1 **REQUIREMENTS INCLUDED**

- .1 Product quality, availability, storage, handling, protection, handling on Site.
- .2 Manufacturer's instructions.
- .3 Workmanship, coordination, cutting, fastenings.
- .4 Existing facilities.

2 Products

2.1 **QUALITY**

- .1 Products, material, equipment and articles (referred to as Products throughout the Specifications) incorporated in the Work shall be new, not damaged or defective, and of the best quality, compatible with Specifications for the purpose intended.
 - .1 If requested, furnish evidence as to type, source and quality of Products provided.
- .2 Defective Products, whenever identified prior to the completion of Work will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is a precaution against oversight or error. Remove and replace defective Products at own expense and be responsible for delays and expense caused by rejection.
- .3 Should any dispute arise as to the quality or fitness of Products, the decision rests strictly with the Consultant based upon the requirements of the Contract Documents.
- .4 Unless otherwise indicated in the Specifications, maintain uniformity of manufacture for any particular or like item throughout the building.
- .5 Permanent labels, trademarks and nameplates on Products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms as approved by the Consultant.

2.2 **AVAILABILITY**

- .1 Immediately after award of Contract, review Product delivery requirements and anticipate foreseeable supply delays for any item. If delays in supply of Products are foreseeable, notify the Consultant of such, in order that substitutions or other remedial action may be authorized in sufficient time to prevent delay in performance of Work.
- .2 In the event of failure to notify the Consultant at commencement of Work and should it subsequently appear that Work may be delayed for such reason, the Consultant reserves the right to substitute more readily available Products of similar character at no increase in Contract Price.
- .3 Utilize Canadian materials and Products if available and equivalent in price and quality.

2.3 **STORAGE, HANDLING AND PROTECTION**

- .1 Handle and store Products in a manner to prevent damage, deterioration and soiling and in accordance with manufacturer's instructions where applicable.
-

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

2.4 **RECEIVING MATERIAL FURNISHED BY OWNER**

- .1 Owner furnished material or equipment are listed in the Specifications.
 - .1 Contractor shall be responsible for unloading and handling material or equipment furnished by Owner to the Site.
- .2 Contractor receiving such items shall give receipts for the item delivered and thereafter will be held responsible for the care and storage of such items and shall pay for the cost of replacing or repairing any items damaged, misplaced or found to be missing while in Contractor's care and custody.

2.5 **TRANSPORTATION**

- .1 Pay costs of transportation of Products required in the performance of Work.
- .2 Transportation cost of Products supplied by the Owner and delivered to Site will be paid for by the Owner.
 - .1 Contractor shall unload, handle and store such Products.

2.6 **MANUFACTURER'S INSTRUCTIONS**

- .1 Unless otherwise indicated in the Specifications, install or erect Products in accordance with manufacturer's instructions. Do not rely solely on labels or enclosures provided with Products.
- .2 Obtain written instructions directly from manufacturers.

2.7 **ALTERNATIVE MATERIALS**

- .1 Purchased items or materials must meet the requirements of the Specifications. Be responsible for all costs for any modifications required for use of such items.
 - .2 To receive approval of substitution, the proposed substitute shall be equal to or superior to the specified item. Requests for substitution shall be accompanied by documentary proof of equality and difference in price and delivery.
-

- .3 Submit request to the Consultant in writing and provide all technical data, samples and other information requested. No substitution shall be made without the written authority of the Consultant whose decision shall be final.
- .4 Products shall be applied, installed, connected, erected, cleaned and conditioned in accordance with the manufacturer's instructions or directions, unless specified to the contrary elsewhere in the Contract Documents.
- .5 Assume responsibility for any additional material or installation costs resulting from the approved use of equivalent materials or equipment.

2.8 **EXPEDITING**

- .1 The Contractor shall submit, when requested by Consultant, an updated material procurement/expediting record indicating clearly the status of material delivery and fabrication. Particulars to be covered by this record shall include the item identification, sub-vendor, order date, order number, Shop Drawing submission date(s) and review date(s), required delivery date, promised delivery date, date received, date checked and general remarks.
- .2 The Contractor shall accumulate and submit similar records from (assigned) Subcontractors and shall ensure that Subcontractors are properly and frequently expediting all equipment and material to meet delivery deadlines to suit installation schedule.
- .3 The Contractor shall allow the Owner, Consultant, or their representative free access to the Contractor's plant and to Subcontractor's plants for visual inspection of allotted material and/or progress of the Work.

3 Workmanship

3.1 **GENERAL**

- .1 Workmanship shall be of the best quality, executed by workers experienced and skilled in the respective duties for which they are employed. Immediately notify the Consultant if required Work is such as to make it impractical to produce required results.
- .2 Do not employ any unfit person or anyone unskilled in their required duties. The Consultant reserves the right to require the dismissal from the Site of workers deemed incompetent, careless, insubordinate or otherwise objectionable.
- .3 Decision as to the quality or fitness of workmanship in cases of dispute rests solely with the Consultant whose decision shall be final.
- .4 Whenever possible, give preference to the use of local labour. Establish rates of wages, and hours of work in accordance with provincial regulations and as generally recognized and accepted in the locality.

3.2 **CO-ORDINATION**

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

3.3 CONCEALMENT

- .1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.
- .2 Before installation, inform Consultant if there is an existing contradictory situation. Install as directed by Consultant.

3.4 CUTTING AND REMEDIAL WORK

- .1 Perform cutting and remedial Work required to make the parts of the Work come together.
 - .1 Coordinate the Work to ensure this requirement is maintained.
- .2 Should Work performed outside this Contract necessitate cutting and/or remedial Work to be performed, the cost of such Work will be valued by the Consultant.
- .3 Perform cutting and remedial Work by specialists familiar with the materials affected. Perform in a manner to neither damage nor endanger any portion of Work.

3.5 FASTENINGS

- .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent material unless indicated otherwise.
- .2 Prevent electrolytic action between dissimilar metals and materials.
- .3 Use non-corrosive hot dipped galvanized steel fasteners and anchors for securing exterior Work, unless stainless steel or other material is specifically requested in the affected Specification section.
- .4 Space anchors within their load limit or shear capacity and ensure that they provide positive permanent anchorage. Wood or any other organic material plugs are not acceptable.
- .5 Keep exposed fastenings to a minimum, space evenly and install neatly.
- .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

3.6 PROTECTION OF WORK IN PROGRESS

- .1 Adequately protect Work completed or in progress. Work damaged or defaced due to failure in providing such protection is to be removed and replaced, or repaired, as directed by the Consultant, at no increase in Contract Price.
- .2 Prevent overloading of any part of the Work or building. Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated without written approval of the Consultant.

3.7 EXISTING UTILITIES

- .1 Connect to existing services or utilities at times directed by Owner or local governing authorities, with a minimum of disturbance to Work, building occupants, pedestrian and vehicular traffic.
-

- .2 Protect and maintain existing active services. When inactive services are encountered cap off in a manner approved by authority having jurisdiction and stake or otherwise record location of capped service.

End of Section

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1 General

1.1 **DESCRIPTION**

.1 This section includes administrative and procedural requirements for construction waste management activities including the following:

- .1 Salvaging nonhazardous construction waste.
- .2 Recycling nonhazardous construction waste.
- .3 Disposing of nonhazardous construction waste.

1.2 **DEFINITIONS**

- .1 CDL: Construction, Demolition and Land clearing.
- .2 Construction Waste: Building and Site improvement materials and other solid waste resulting from construction operations. Construction waste includes packaging.
- .3 Disposal: Removal off-site of construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- .4 Recycling: The process of sorting, cleaning, treating, and reconstituting materials for the purpose of using the material in the manufacture of a new Product.

1.3 **SUBMITTALS**

- .1 Recycling and processing facility records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- .2 Landfill and incinerator disposal records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

1.4 **QUALITY ASSURANCE**

- .1 Regulatory requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- .2 Surplus materials, removals, grindings and other debris shall be disposed of offsite. No separate payment shall be made for the costs associated with this Work. The Owner will not make arrangements for the disposal of surplus materials or supply bills of lading. Stockpiling of excavated material is not permitted and shall immediately be disposed of upon removal.

2 Products

Not Used

3 Execution

3.1 **GENERAL**

- .1 Site access and temporary controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
-

- .1 Designate and label specific areas on Project site necessary for separating materials that are to be recycled.
- .2 Comply with Project requirements for controlling dust and dirt, environmental protection, and noise control.

3.2 **RECYCLING AND CONSTRUCTION WASTE, GENERAL**

- .1 Provide containers for CDL waste that is to be recycled clearly labeled as such with a list of acceptable and unacceptable materials. The list of acceptable materials must be the same as the materials recycled at the receiving material recovery facility or recycling processor.
- .2 Provide containers for CDL waste that is disposed in a landfill clearly labeled as such.
- .3 Use detailed material estimated to reduce risk of unplanned and potentially wasteful cuts.
- .4 Include in material purchasing agreements, a waste reduction provision requesting that materials and equipment be delivered in packaging made of recyclable material, that they reduce the amount of packaging, the packaging be taken back for reuse or recycling, and to take back all unused product. Ensure that Subcontractors require the same provisions in their purchase agreements.
- .5 Conduct regular visual inspections of dumpsters and recycling bins to remove contaminants.
- .6 Recycle paper and beverage containers used by on-site workers.
- .7 Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.
 - .1 Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin. Inspect containers and bins for contamination and remove contaminated materials if found.
 - .2 Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - .3 Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 - .4 Store components off the ground and protect from the weather.
 - .5 Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.3 **RECYCLING CONSTRUCTION WASTE**

- .1 Packaging
 - .1 Cardboard and boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 - .2 Polystyrene packaging: Separate and bag materials.
-

- .3 Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
- .4 Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- .2 Wood Materials
 - .1 Clean cut-offs of lumber: Grind or chip into small pieces.
 - .2 Clean sawdust: Bag sawdust that does not contain painted or treated wood.
- .3 Gypsum board: Stack large clean pieces on wood pallets and store in a dry location.
 - .1 Clean gypsum board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.
- 3.4 **SOURCE SEPARATION WASTE**
 - .1 General: Separate recyclable materials by type from CDL waste.
 - .2 Provide containers, clearly labeled, by type of separated materials or provide other storage method for managing recyclable materials until they are removed from Project site.
 - .3 Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - .4 Stockpile materials away from demolition area. Do not store within drip line of remaining trees.
 - .5 Store components off the ground and protect from weather.
- 3.5 **CO-MINGLED RECYCLING**
 - .1 General: Do not put CDL waste that will be disposed in a landfill into a co-mingled CDL waste recycling container.
- 3.6 **DISPOSAL OF WASTE**
 - .1 General: Except for items or materials to be recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 - .1 Except as otherwise specified, do not allow waste materials that are to be disposed of to accumulate on-site.
 - .2 Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - .2 Burning: Do not burn waste materials.
 - .3 Disposal: Transport waste materials off Owner's property and legally dispose of them.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

.1 Labour, Products, equipment and services necessary to complete the Work of this section.

.2 Restore damaged or disturbed Work.

.3 Be responsible for providing and performing items required and necessary other than specified, in order to complete the Work.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

.1 AODA - Accessibility for Ontarians with Disabilities Act

1.3 **SUBMITTALS**

.1 Shop Drawings:

.1 Submit Shop drawings indicating proposed location and construction of hoarding, fencing, barriers, and dust-tight partitions, including plan for maintaining access during each stage of the Work.

.2 Submit a demolition plan for Consultant's review. Demolition plan shall be prepared by a qualified Professional Engineer licensed in the Province of Ontario.

.3 Submit copies of certified weigh bills receipts from authorized disposal sites and reuse and recycling facilities for all material removed from Site upon request of Consultant. Written authorization from the Consultant is required to deviate from the haulers facilities receiving organizations listed in waste reduction workplan.

1.4 **MAINTAINING ACCESS**

.1 Maintain and preserve Owner's access requirements to and from existing buildings in areas where demolition and removal Work is carried out and throughout the existing structures.

.2 Do not close, obstruct, place or store material in Owner's driveways and passageways. Conduct operations with minimum interference to roads, streets, driveways and passageways.

.3 Provide and erect barriers, maintain lights, and traffic control as required by the Owner, municipal traffic regulations or building by-laws.

.4 Maintain access to fire exits.

1.5 **HAULING OPERATIONS**

.1 Haul and move machines, vehicles and equipment over designated route and within Work areas as designated by Consultant.

.2 Maintain roadways and paving in the hauling areas clean on a daily basis and as required by municipal authorities.

- .3 Location of chutes, rubbish containers, hoisting equipment and the like shall be subject to approval by Owner and such that they will not unduly impede pedestrian or vehicular traffic and will not obstruct entrances and exits.

1.6 **INTERRUPTIONS TO OWNER'S OPERATIONS**

- .1 There will be absolutely no interruptions to Owner's operations permitted. Execute machine and equipment movements, deliveries and removals at time or times that will permit uninterrupted Owner's operations in and around buildings, including parking, deliveries and Site access and egress.
- .2 Carry out Work in such a manner to cause a minimum of noise or interference to adjoining operations and approval of Owner obtained before proceeding with any Work which may cause interference.
- .3 Service lines to be modified, if any, must be kept in service throughout the construction period except for brief change-over periods.
- .4 Maintain such services. Prepare sketches and detailed schedule of Work, and submit to Consultant for review.

1.7 **PROJECT/SITE CONDITIONS**

- .1 Existing Conditions
 - .1 The Demolition Drawings indicate the physical dimensions, existing levels and similar items being indicated where known and shall be read in conjunction with the new Drawings. Not all demolition Work may be shown in its entirety; the Contractor shall include for any demolition required to complete the new Work specified and on the Drawings.
 - .2 All information relative to existing conditions is offered to assist the Contractor in evaluation of the Work, but with no specific representation, either expressed or implied, as to completeness or accuracy. Be responsible for any deductions or conclusions made on the basis of this information and that of any additional Site inspections, if made.
 - .2 Prior to beginning field construction Work, survey and record the condition of existing conditions to remain in place that might be affected by the demolition operations. After demolition operations are completed, survey the conditions again and restore existing facilities to their pre-demolition condition.
 - .3 Protection
 - .1 Protect Work to remain against damage. Repair or replace damaged Work.
 - .2 Maintain in service and protect from damage, the existing utilities that are to remain.
 - .3 Conduct demolition operations to ensure safety of all persons and to prevent damage to existing structures and utilities, construction in progress, and other property.
 - .4 Conduct demolition operations and remove debris to disposal areas in a manner to ensure maximum safety and minimum interference with other operations.
 - .5 Protect building floor and roof against damage from operations under this section, including lifting, moving, rolling, etc., of materials. Use 13 mm thick
-

plywood covers with ends mechanically joined, over floor for any such handling. Over roof, provide 19 mm thick plywood underlaid with 25 mm thick polystyrene insulation board adhered to same. Provide same when working from, or over roof surfaces. Be responsible for repairs of any damage caused.

- .6 Provide temporary sheeting, shoring, bracing, underpinning and other protective measures, as required to prevent movement, collapse of, or damage to unsupported walls and other facilities as a result of demolition operations.
- .7 Support affected structures and, if safety of structure being demolished or adjacent structures or services appears to be endangered, take preventative measures and then cease operations and notify Consultant.
- .8 Remove and dispose of all temporary Work when no longer required.
- .9 Should material resembling spray or trowel applied asbestos or any other designated substance listed be encountered in the course of demolition, stop Work, take preventative measures, and notify Consultant immediately. Do not proceed until written instructions have been received.
- .10 Prevent extraneous materials from contaminating air beyond application area, by Providing temporary enclosures during demolition Work.
- .11 Cover or wet down dry materials and waste to prevent blowing dust and debris. Control dust on temporary roads.
- .12 Provide temporary means of exit as required for affected exits or entrances.
- .13 Protect existing air intakes for existing building ventilation system. Carry out all operations so as to prevent dust entering these intakes, using dampening abatement measures and protection.
- .14 Pay particular attention to prevention of fire and elimination of fire hazards which would endanger the Work or adjacent buildings and premises.
- .15 Keep and maintain fire extinguishers throughout the Work at all times to the approval of the fire marshal, and located at convenient and accessible points.

1.8 **UNEXPECTED CONDITIONS**

- .1 If existing active services are unexpectedly encountered, are not indicated on Drawings, or otherwise made known and interfere with permanent facilities under construction, notify Consultant and Owner in writing, requesting instructions on their disposition. Take immediate steps to ensure that services provided are not interrupted, and do not proceed with the Work until written instructions are received from the Consultant and Owner.

1.9 **COORDINATION**

- .1 Mechanical
 - .1 This clause is supplementary and complementary to demolition requirements specified in the mechanical divisions. Where there is conflict between this section and the mechanical divisions, the requirements of the mechanical divisions shall govern.
 - .2 Coordinate the Work to facilitate removal of walls and cutting of new openings. Disconnect, remove, cap off and relocate existing lines interfering with such Work. Remove and/or relocate equipment as required.

- .3 Carry out alterations to existing mechanical systems as shown on Drawings and as required to interconnect new and existing systems.
 - .4 Do all cutting, patching and making good of existing structure required to complete mechanical Work.
 - .5 Refer to mechanical division for specific requirements.
 - .2 Electrical
 - .1 This clause is supplementary and complementary to demolition requirements specified in the electrical divisions. Where there is conflict between this section and the electrical divisions, the requirements of the electrical divisions shall govern.
 - .2 Coordinate to facilitate demolition, removals, cutting of new openings and alteration in existing building, disconnecting, removing and/or relocating existing wiring, fixtures and devices interfering with such Work.
 - .3 Carry out all alterations to existing electrical, signal, and fire alarm systems as shown on Drawings and as required to interconnect new and existing systems.
 - .4 Remove or relocate existing equipment and services unexpectedly encountered, are not indicated on Drawings, or otherwise made known and interfere with such Work.
 - .5 Do all cutting, patching, and making good of existing structure and finishes as required to complete electrical Work. Remove and replace existing acoustic tile ceilings where required. Be responsible for replacement of any tile soiled or marred as a result.
 - 2 Products
 - 2.1 **MATERIALS**
 - .1 Temporary wood studs: Construction grade spruce.
 - .2 Polyethylene sheet: 0.152 mm, thick, clear, stapled in place.
 - .3 Plywood: Douglas fir plywood.
 - 3 Execution
 - 3.1 **TEMPORARY PARTITIONS OR DUST PROOF SCREENS**
 - .1 Dust proof partitions or screens: Before any Work proceeds in any particular area in the existing building, temporarily enclose the area and access thereto, with light stud and plywood, clean polyethylene sheet material or, clean polyethylene sheet screen overlapped 100 mm and taped at floor, ceiling and doors, walls or intersecting members, in a manner to prevent dust and dirt infiltration into the adjoining areas.
 - .2 Where access is required through partition, provide a solid core wood door or hollow steel door, in steel frame, equipped with self-closing and latching hardware.
 - .3 Where an exit is closed off due to construction activities, provide alternate exit acceptable to both the Owner and to Authorities Having Jurisdiction. Temporary exits shall be clearly identified with appropriate signage.
-

- .4 Take every possible precaution to prevent dust and dirt resulting from the Contract operations from entering Owner's operational areas. Adjust and relocate such partitions or screens as required for the various operations under the Contract.
- .5 As Work progresses, Contractor shall remove and relocate, reconfigure or adjust the dust proof partitions and/or construction hoarding as required to accommodate the construction progress and to ensure that the construction areas remain secure at all times.
- .6 Weather Protection
 - .1 Provide weather protection screens similar to above in areas where existing building interior is exposed to the elements.
 - .2 Provide protection in the form of tarpaulins, plywood or polyethylene for temporary roof and wall openings and other exposed areas, before final construction is in place.
 - .3 Provide weather protection screens similar to above in areas where existing plant interior is exposed to the elements.
 - .4 Provide protection in the form of tarpaulins, plywood or polyethylene for temporary roof and wall openings and other exposed areas such as during removal of windows, doors or parapets, equipment to be relocated, etc., before final construction is in place.

3.2 **DEMOLITION AND REMOVALS**

- .1 Carry out demolition Work, removal of existing materials and equipment, and disposal of resultant debris. Proceed with demolition of or alteration to any portion of existing building ONLY after thorough protection of existing building has been achieved.
- .2 During demolition operations, keep Work wetted down with fog sprays to prevent dust and dirt rising. Provide temporary water for this purpose. Use covered chutes, watered down.
- .3 During demolition operations, keep Work wetted down with fog sprays to prevent dust and dirt rising. Provide heavy duty water hose for this purpose; connect to Owner's existing water source where directed by Consultant.
- .4 Where Work includes cutting of roof openings, provide a plywood catchboard immediately under the areas to be cut so as to protect the building interior from falling debris. Provide catchboard in combination with weather screens previously specified.
- .5 Confine operations and workmen to those parts of the building which are defined on Drawings, and exercise great care not to damage existing construction beyond that necessary for carrying out new Work and make good any such damage in every respect.
- .6 At end of each day's Work:
 - .1 Leave Work in safe and stable condition. Protect interiors of parts not to be demolished from exterior elements at all times.
 - .2 Leave Work in safe condition so that no part is in danger of toppling or falling.
 - .3 Prevent debris from blocking surface drainage system, elevators, mechanical and electrical systems which must remain in operation.

- .4 Ensure that demolition Work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.
- .5 Do not dispose of waste or volatile materials such as: mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers. Ensure proper disposal procedures are maintained throughout Project.
- .7 Materials to be reused: Where designated on Drawings to be removed and stored for future use, remove, handle and transport such items to point of storage. Perform such Work carefully and with diligence to prevent any damage to the items during removal and in storage.
- .8 Cutting
 - .1 Use power operated cutting devices. Chipping will not be allowed. Commence breaking out operations only after sawcutting of the cut-off points has been performed in order to prevent damage to remainder of structure and to obtain straight and clean junctions of new and existing works.
 - .2 Use a saw blade which will achieve superior sawing performance. Spalling of remaining concrete at sawcut points will be judged as defective and shall be rectified at no increase in Contract Price. Do not overcut corners (i.e. avoid "intersecting" sawcuts).
 - .3 Demolish masonry and concrete in small sections.
 - .4 Coordinate with mechanical trade and sawcut and breakout existing floor or wall to accommodate new mechanical piping. Have mechanical trade lay out and supervise Work.

3.3 **DISPOSAL OF MATERIALS, RUBBLE AND DEBRIS**

- .1 Surplus materials: Take ownership of surplus materials and remove from Site daily, unless such materials are designated to be reused or turned over to Owner.
- .2 Rubble and debris: Clean up rubble and debris as they are generated. Dispose of same at end of each day's Work or place in waste disposal bins and empty on a regular basis.
- .3 Stockpiling of surplus materials, rubble and debris on Site will not be permitted.
- .4 Do not burn material on Site.

3.4 **CLEAN-UP**

- .1 Vacuum clean and wet mop floors and wipe clean wall surfaces free of dust on completion of Work.

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

- .1 MTRCA - Metro Toronto Region Conservation Authority
.2 AODA - Accessibility for Ontarians with Disabilities Act, latest edition

1.3 **GEOTECHNICAL INVESTIGATION**

- .1 Refer to the geotechnical documents which accompany the Specifications. The contaminated soil is described therein.

2 Products

Not applicable.

3 Execution

3.1 **DISPOSAL OF UNCONTAMINATED MATERIAL**

- .1 This clause applies to the disposal of "Reusable Fill".
.2 "Reusable Fill" is defined as soil which meets the guidelines for commercial/industrial land use, as specified in the latest edition "Guidelines for the Decommissioning and Clean-Up of Sites in Ontario" published by the Ministry of the Environment and Energy, Ontario.
.3 Select appropriate disposal or reuse sites, and all surplus soils and other materials at such sites. The Contractor may elect to use the Keele Valley landfill site located at Maple, Ontario.
.4 Submit to the Consultant for approval, details of all locations where surplus soils and other materials are to be disposed of or reused. Include for each disposal/reuse site and type of surplus soil or other material the following information:
.1 Location of the disposal/reuse site
.2 The operator's name and business address
.3 Type of license under which the site operates
.4 Criteria used by the site to assess the suitability of the surplus material for disposal
.5 If Contractor proposes to dispose of reusable fill as cover material to the Keele Valley or Brock West landfill sites, the Contractor shall be responsible for confirming with the landfill operators the quantity of reusable fill that the latter will accept, and the rate at which fill will be accepted.

- .6 Within forty-eight hours of a load of surplus soil or other material leaving the Site, submit to Consultant waybills or other documentation recording the time and place of disposal/reuse of that load of surplus soil or other material.
- .7 The results of the soil testing carried out prior to the award of Contract are provided in the geotechnical documents. Carry out any further testing required, as a condition of disposal/reuse, by the operators of the disposal/reuse sites.
- .8 Where soil contains construction rubble, roots or organic materials, separate the soil from the rubble by sieving or other approved means.
- .9 If the Contractor proposes to dispose of reusable fill as lakefill, the Contractor shall be responsible for obtaining bills of lading from the lakefill site operator. All of the tested soil showing exceedance for one or more parameters of the MTRCA lakefill criteria, and no reusable fill shall be disposed of as lakefill unless the MTRCA accepts the reusable fill as suitable for lakefill.
- .10 Reusable fill may be rejected as lakefill because of excessive water content (based on the slump test). Such a rejection shall not be considered a basis for changing the designation of the material as reusable fill.

3.2 **DISPOSAL OF CONTAMINATED WASTE MATERIAL**

- .1 This clause applies to excavated "Waste".
- .2 "Waste" is defined as that material which does not meet the criterion for reusable fill given above, and which would not be classified as construction rubble or topsoil. Waste material is subdivided into three classifications depending on the results of acid leach tests carried out in accordance with the Ontario Environmental Protection Act, Regulation 347 Leachate Quality Criteria, Ontario Ministry of the Environment and Energy, 1993. Two waste classifications are given below.
 - .1 "Non-hazardous, Non-registerable Waste": Material where the leachate concentrations are less than ten times the values given in Schedule 4 of Regulation 347.
 - .2 "Non-hazardous, Registerable Waste": Material where the leachate concentrations are between ten and one hundred times the values given in Schedule 4 of Regulation 347.
- .3 If there is any visual or other indication that a waste is encountered, immediately inform the Consultant. Stockpile material suspected of being a waste on Site to allow further testing by the Consultant. Chemical test results obtained by the Consultant will be forwarded to the Contractor.
- .4 Remove waste from the Site in accordance with provincial regulations.
- .5 The application of the "Guidelines for Decommissioning and Clean-Up Sites in Ontario" is subject to interpretation of the following parameters. Soil which is reused as a lakefill, backfill, or as landfill cover shall not be considered as waste and shall only be disposed of as waste if it is not acceptable to reuse it.

End of Section

Group 28

Abatement Summary

Group 28 Abatement Summary

Assumptions:

For every single doorway to be widened - less than 1 sq. m. of the adjacent wall will be removed, less than 1 sq. m. of the adjacent flooring will be removed and the ceiling tile within the area will not be disturbed.

Address	Site Visit Date	Initial Drawings Provided	Latest Drawings Provided	ACM on site?	ACM Abatement Required? *	Lead Abatement Required? **	Abatement Type (based on assumptions)	Area to be removed	No. of areas	Spec.	Any other ACM near work area?
1859 Kingston Road	November 8, 2021	October 27		Yes	Yes	Yes	Dark Brown Caulking	10 lin. m	1	2.1	mastic under VFT2 in washroom
							Vinyl Sheet Flooring 2	3 SM	1	2.2	at the Main Entrance Door
							Brown Caulking	12 lin. m	1	2.1	at the Main Entrance Door
							Tan Caulking	3 lin. m	1	2.1	at the Main Entrance Door
							Lead-containing door paint	Unknown	1		
							Lead-containing wall paint	Unknown	8		
87 Main Street	November 9, 2021	October 27		Yes	No	Yes	Lead-containing wall paint	Unknown	1		VFT2 in second floor corridor
3600 Danforth Avenue	November 9, 2021	October 27		No	No	No					
313 Pharmacy Ave	November 10, 2021	October 27		Yes	Yes	No	Texture Coat on ceilings	Unknown	10	2.2 or 2.3	
							Lead-containing door paint	Unknown	6		
351 Birchmount Road	November 10, 2021	October 27		Yes	No	Yes	Lead-containing wall paint	Unknown	10		VFT5 in first floor office
1313 Woodbine Avenue	November 18, 2021	October 27		Yes	No	No					Pipe insulation assumed to be ACM
1904 Queen St. East	November 18, 2021	October 27		No	No	No					

No. of areas = No. of abatement containments required (areas are indicated on the drawings included in the DSS report)

* All painted surfaces should be treated as lead containing, unless sampled. Based on the proposed scope of work, it is our understanding that Type 2 or similar lead abatement procedure would be sufficient. Disposal of any waste generated from the above mentioned work, would be determined by the receiving site.

* If destructive work is being conducted within an occupied building, including cleaning staff and/or security, containment areas to contain dust are required. If the full work area is under full care and control **by the CONTRACTOR, under guidance from the CONSULTANT IBI**, containment may not be required, please confirm conditions with the owner: City of Toronto.

* Fire doors may contain asbestos-containing thermal insulation inside the door panel (Type 1) follow Spec 2.1.

** Lead abatement indicated only if paint samples have been collected and results are found to be above the City of Toronto action limit.

**The values and figures in the table are estimates, actual abatement to be verified by the contractor on site after the work is awarded.
The contractor is to perform the minimum amount of asbestos and lead abatement as possible.**

1 General

1.1 **GENERAL CONDITIONS AND RELATED WORK**

- .1 This section forms a part of the Contract Document and should be read in conjunction with Section 02 82 00.01 City of Toronto Asbestos Management Policy, Section 02 82 00.02 City of Toronto Asbestos Management Plan and all other Divisions in order to comply with the requirements of the General Conditions of the Contract. Sections 02 82 00.01 and 02 82 00.02 take precedence where there is a conflict in this section.
- .2 It is the intent that work performed as outlined in this specification will result in the removal and disposal of asbestos-containing materials (ACM), lead-containing materials (LCM) and materials that become contaminated by asbestos or lead, as a result of the required work activities.
- .3 Dispose of all waste as specified in applicable sections of the specifications document.
- .4 The Environmental Consultant may perform area air monitoring to verify the effectiveness of dust suppression methods used by the Contractor. Contractor's personnel shall co-operate with the Environmental Consultant in collecting the required air samples.
- .5 This project and all work associated with it is regulated by The Occupational Health and Safety Act, the Regulation Respecting Asbestos on Construction Projects and in Buildings and Repair Operations, Ontario Regulation 278/05; the Designated Substances Regulation, Ontario Regulation 490/09; the Regulation for Construction Projects-Ontario Regulation 213/91; and other applicable regulations, manuals, and guidelines.
- .6 Provide all equipment, material, services, supervision and labour required or specified to complete the scope of work of this project as described in the Contract and Specifications Documents.
- .7 In cases of conflict between procedures outlined in this document, the more stringent requirement will apply.

1.2 **DESCRIPTION OF WORK**

- .1 **Before submitting a bid, confirm the scope of work of the project by visiting the site and reading the entire specification documents and associated drawings. The estimated quantity and other information presented in supporting documents should not be used as the only basis for submitting a bid. It is the abatement contractor's responsibility to confirm all quantities and measurements during the mandatory site meeting.**
 - .2 **Each Work Area:** dependant of type of ACM and/or LCM in this Work Area will determine the abatement method best suited for the scope of work. Refer to Table 1 (attached) for a list of the suitable methods based on the abatement scope of work. The following preparations applies to all methods.
 - .1 Pre-clean and remove all moveable objects and items present in the work area.
 - .2 Remove all non-asbestos containing building materials that may be impeding reasonable access to the ACM to be abated, prior to preparations of any abatement work.
 - .3 Pre-clean and remove all debris on the floor prior to preparations of the abatement work.
 - .4 The abatement Contractor shall install scaffolding, if it is required, to access the materials to be cleaned, as required.
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- .5 The abatement Contractor shall be responsible for providing their own temporary lighting, if it is required.
- .6 The abatement Contractor shall be responsible for abatement enclosures that are set up in occupied area(s) to be supervised 100% of the time or a secondary lockable barrier (hoarding) needs to be installed.
- .7 Protect the floor in the immediate vicinity of the Work Area using rip-proof poly drop-sheets.
- .8 Maintain the fire alarm and other life/safety systems in operation. Immediately advise the Project Manager in case the systems are damaged during the execution of the work.
- .9 All the asbestos waste generated in the Work Area shall be double bagged using asbestos labelled yellow bags and disposed as asbestos waste.

The abatement Contractor shall be responsible for the disposal of all waste generated as part of the subject project. This includes the costs related to the procurement of waste bins and the associated handling, transportation and disposal fees. The disposal of waste includes, but is not limited to ACM or LCM, as well as general waste and debris. The abatement Contractor shall ensure that the disposal and recycling of wastes is accounted for in their bid submitted for the project.

1.3 DEFINITIONS

- .1 Abatement: Procedures to control fibre release from asbestos containing building materials. Includes encapsulation, enclosure, and removal.
- .2 Amended Water: Water containing a wetting agent or surfactant that is added for the purpose of reducing water surface tension to allow proper wetting of asbestos material.
- .3 Asbestos: The term includes chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite, and any of these that have been chemically treated and/or altered.
- .4 Airlock: A system for ingress or egress without permitting air movement between a contaminated area and an uncontaminated area, consisting of two curtained doorways at least 6 feet apart.
- .5 Area Monitoring: Sampling of asbestos fibre concentrations within the asbestos control area and outside the asbestos control area which is representative of the airborne concentrations of asbestos fibers which may reach the breathing zone.
- .6 Asbestos Work/Control Area: An area where asbestos removal operations are performed which is isolated by physical boundaries to prevent the spread of asbestos dust, fibers, or debris.
- .7 Air Monitoring: The process of measuring the asbestos fibre content of a specific volume of air in a stated period of time.
- .8 Asbestos Containing Material (ACM): Any material analyzed and found to contain 0.5 percent more asbestos either alone or mixed with other fibrous or nonfibrous materials.
- .9 Asbestos Fibers: For this specification, asbestos fibers are those fibers 5 microns or longer having an aspect ratio of at least 3:1.
- .10 Authorized Visitor: The building Owner or his representative, persons of any regulatory or other agency having jurisdiction over the project and the asbestos abatement Consultant or his representative.
- .11 Barrier: Any surface that closes up the work area to prevent the movement of fibres.

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- .12 Curtained Doorway: A device to allow ingress or egress from one room to another while permitting minimal air movement between the rooms, constructed by placing two overlapping sheets of rip-proof plastic over an existing or temporarily framed doorway, securing each along the top of the doorway, securing the vertical edge of one along one vertical side of the doorway, and securing the vertical edge of the other sheet along the opposite vertical side of the doorway. The free bottom edge of the plastic sheets shall be weighted to ensure proper closure. The plastic sheets shall overlap by no less than 1.5 meters.
 - .13 Critical Barrier: One or more layers of plastic sealed over all openings into a regulated area or any other similarly placed physical barrier sufficient to prevent airborne asbestos in a regulated area from migrating to an adjacent area.
 - .14 Chemical Stripping Agent Neutralizer: Chemical stripping agent neutralizers may be used on exterior surfaces only. Neutralizers shall be compatible with and not harmful to the substrate that they are applied to and the stripping agent that has been applied to the surface substrate.
 - .15 Chemical Stripping Removers: Chemical removers shall contain no methylene chloride products and shall be compatible with and not harmful to the substrate that they are applied to.
 - .16 Clean Room: An area or room which is part of the worker decontamination enclosure system used for changing into uncontaminated protective clothing, putting on respiratory equipment, storing clean clothing and, after showering, for dressing in street clothes. No asbestos-contaminated items are allowed in this room.
 - .17 Contractor/Supervisor: An individual who supervises asbestos abatement work and has the proper qualifications and training as specified in this document.
 - .18 Control Area: An area which is considered uncontaminated and is suitable for regular occupancy.
 - .19 Disposal: Procedures necessary to transport and deposit the asbestos contaminated material stripped and removed from the building, piping, and equipment in an approved waste disposal site in compliance with the applicable environmental regulations.
 - .20 Demolition: The razing, removing or wrecking of any building component, assembly or system together with any associated handling operations.
 - .21 Decontamination Area: An enclosed area adjacent and connected to the regulated area and consisting of an equipment room, shower area, and clean room, which is used for the decontamination of workers, materials, and equipment that are contaminated with asbestos.
 - .22 Diocetylphthalate (DOP) Test: A test method that uses Diocetylphthalate aerosol to challenge a HEPA filter-equipped negative pressure unit to determine its integrity and effectiveness to filter out asbestos fibres.
 - .23 Dirty Room: A contaminated area or room which is part of the worker decontamination enclosure system, with storage for contaminated clothing and equipment.
 - .24 Emery 3004 – a compound (a poly-alpha olefin) that may be substituted for DOP in HEPA filter testing.
 - .25 Encapsulant: A liquid material which can be applied to ACM and which controls the possible release of asbestos fibers from the material either by creating a membrane over the surface (bridging encapsulant) or by penetrating into the material and binding its components together (penetrating encapsulant). A third type of encapsulant (removal encapsulant) is a penetrating encapsulant and is designed to be applied during the removal of asbestos-containing materials to minimize the release of fibres.
 - .26 Disposal Bag: A 0.15 mm 6 mil thick, leak-tight plastic bag, pre-labeled as containing asbestos waste and used for transporting asbestos waste from containment to disposal site.
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- .27 Disturbance: Activities that disrupt the matrix of ACM, crumble or pulverize ACM, or generate visible debris from ACM.
 - .28 Encapsulation: Procedures necessary to coat all asbestos-containing materials with an encapsulant to control the possible release of asbestos fibers into the ambient air.
 - .29 Enclosure: All herein specified procedures necessary to complete enclosure of all hazardous materials behind airtight, impermeable, permanent barriers.
 - .30 Equipment Room: A contaminated area or room which is part of the worker decontamination enclosure system, with storage for contaminated clothing and equipment.
 - .31 Friable Asbestos Material: Material that when dry can be crumbled, pulverized or powdered by hand pressure and includes material that is crumbled, pulverized or powdered.
 - .32 Filtration System for Water: A multistage system for filtering water from the decontamination shower and wastewater. The system is usually manufactured with two filters: a primary filter and a secondary filter. The primary filter collects and retains particles that are 20 microns or larger and the secondary filter removes particles that are 5 microns or larger.
 - .33 Glove Bag System: A portable asbestos abatement system designed for the isolation of an object from which materials containing asbestos are to be removed.
 - .34 HEPA Filter Equipment: High efficiency particulate air filtered vacuuming equipment with a filter system capable of collecting and retaining asbestos fibers. Filters shall be capable of trapping and retaining at least 99.97 percent of 0.3 micrometer diameter particles.
 - .35 Lead: The term includes elemental lead, and/or inorganic and organic lead compounds derived from chemically treated and/or altered elements (i.e. paints, plastics, pigments, glasses, and rubber compounds).
 - .36 Lead Cleaning Agent: A cleaning agent suitable for lead dust. Acceptable detergents include products with a high phosphate content (containing at least 5% trisodium phosphate) and/or phosphate-free lead dissolving agents such as Ledisolv™ or similar product.
 - .37 Lead Leachate Material: Any material analyzed and found to have a concentration equal to or greater than 5.0 milligrams per litre (mg/l) or 100 milligrams per kilogram (mg/kg)/ micrograms per gram (µg/g) as per the Regulation Respecting Hazardous Materials (R.S.Q., c.Q-2, r.32).
 - .38 Lead Surface Contamination: Any surfaces analyzed and found to have a concentration equal to or greater than 40 micrograms per square feet (µg/ft²) or 4 micrograms per 100 square centimetres (µg/cm²) for floors, 250 µg/ft² (25 µg/cm²) for window sills, and 400 µg/ft² (40 µg/cm²) for window troughs as per the U.S. Environmental Protection Agency (EPA) Lead, Identification of Dangerous Levels of Lead, Final Rule, January 2001 (40 CFR Part 74).
 - .39 Lead Waste Container: An impermeable container acceptable to a disposal site and Ministry of Sustainable Development, Environment, and Parks. It shall be labelled as required by the Ministry of Sustainable Development, Environment, and Parks and Transport Canada.
 - .40 Lead Work Area: An area where lead removal operations are performed which is isolated by physical boundaries to prevent the spread of lead dust or debris.
 - .41 Negative Pressure Fan System: An air purifying fan system located within or outside the isolated work area, which draws air out of the work area through a HEPA filter and discharges this air directly to the exterior of the building, thus keeping the static air pressure in the work area lower than in adjacent areas and preventing infiltration of contaminated air from work area to adjacent areas. This system shall be equipped with an alarm to warn of system breakdown, shall maintain a minimum pressure differential of 0.02" water gauge relative to adjacent areas outside of work areas and shall be equipped with an instrument to continuously monitor and automatically record pressure differences.
 - .42 Non-friable Asbestos Material: Material that contains asbestos in which the fibers have been locked in by a bonding agent, coating, binder, or other material so that the asbestos is well
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bound and will not release fibers during any appropriate use, handling, demolition, storage, transportation, processing, or disposal.

- .43 Negative Pressure Respirator: A respirator in which the air inside the respiratory inlet covering is negative during inhalation in relation to the air pressure of the outside atmosphere and positive during exhalation in relation to the air pressure of the outside atmosphere.
- .44 Powered Air Purifying Respirator (PAPR): A full-face mask into which filtered air is pumped at approximately 100 – 150 litres per minute (4 – 6 cubic feet per minute). The PAPR consists of a full-face mask, a battery pack, an air pump, high efficiency filter and hoses.
- .45 Personal Monitoring: Sampling of asbestos fibre concentrations within the breathing zone (within 12 inches of the mouth) of an employee.
- .46 Personnel: Supervisors, Contractor employees, subcontractor employees.
- .47 Positive Pressure Respirator: A respirator that maintains a positive pressure inside the facepiece during inhalation and exhalation in relation to the atmospheric pressure.
- .48 Shower Room: A room between the clean room and the equipment room in the worker decontamination enclosure system, with hot and cold or warm running water and arranged for complete showering during decontamination. The shower room comprises an airlock between contaminated and clean areas.
- .49 Supplied-air respirator – an accepted respirator and air-supply hose with a hood/helmet, a tight fitting facepiece that is supplied with compressed breathing air from a compressed breathing air system.
- .50 Surfactant: A chemical wetting agent added to water to improve penetration, thus reducing the quantity of water required for a given operation or area.
- .51 Tape-Sealed Polyethylene Sheets: Rip-proof polyethylene sheets or polyethylene sheets of type and thickness as specified, sealed with tape along the edges, around objects, over cuts and in other locations as required to provide a continuous polyethylene membrane to protect underlying surfaces from water damage and damage by sealant and to prevent the escape of asbestos fibres through the sheeting into a clean area.
- .52 Wet Cleaning: The process of eliminating asbestos from building surfaces and objects by using cloths, mops, or other cleaning tools dampened with water.
- .53 Work Decontamination Enclosure System: A decontamination system for workers, consisting of a clean room, a shower room, and an equipment room. One entrance to the clean room shall be outside of the contaminated area. One entrance to the equipment room shall be connected directly to the contaminated area.
- .54 Work: Includes all labour, supervision, materials and equipment required for the complete execution of the project as specified in the contract.

1.4 **WORK SCHEDULE**

- .1 It is the responsibility of the contractor to provide the necessary manpower and work shifts to meet the schedule.
 - .1 The start date for the project is to be determined by the Owner (IBI Group)
- .2 The Contractor shall, at no extra cost to the Owner, be responsible for the completion of work required or scheduled to be performed on weekends, holidays and after regular hours and shall be carried out as required to meet the schedule specified.

1.5 **SUBMITTALS**

- .1 All submittals must be received by the Consultant or his representative before the work is allowed to commence.

- .2 The Contractor shall submit the following:
- .1 Proof that the Contractor has made arrangement for the transport and disposal of asbestos waste. The proof shall be satisfactory to the Consultant.
 - .2 Proof satisfactory to the Consultant that each Supervisor scheduled to work on the project has successfully completed an approved asbestos abatement course and can provide an up to date training certificate issued by a competent entity.
 - .3 One supervisor shall remain on site while asbestos removal or cleanup is being carried out.
 - .4 Copies of Insurance certificates and Workplace Safety and Insurance Board status.
 - .5 D.O.P test results and performance data for negative air unit systems.
 - .6 Proposed work schedule.
 - .7 Work force expected to be present on site daily or according to the schedule.
 - .8 Proposed number of shifts.
 - .9 Layouts of proposed platforms and hoardings for the Consultant's review and approval.
 - .10 Layout of proposed waste and worker decontamination facilities and asbestos work area enclosures.
 - .11 Proof that all workers have successfully completed an approved asbestos abatement course and can provide an up to date training certificate issued by a competent entity.
 - .12 Proof that all workers have received Workplace Hazardous Material Information System (WHMIS) training.
 - .13 A WHMIS information package containing documentation addressing test results, flammability and fire data and Safety Data Sheets (SDSs) for products, chemicals and materials used on site during the course of the asbestos abatement project.
 - .14 Proof satisfactory to the Consultant that each worker scheduled to work on the project has been fit tested for the appropriate respirator to be used.
 - .15 Code of practice for respiratory protection.
 - .16 Pressure differential monitoring data – to be submitted on a daily basis.

1.6 **QUALITY ASSURANCE**

- .1 Ensure that work progresses according to schedule.
 - .2 Ensure that work complies with all the requirements of the applicable regulations, guidelines and manuals.
 - .3 Ensure that no water runoff or airborne asbestos material contaminates areas outside the asbestos removal work area enclosures. The Consultant has been given authorization by the Owner to stop any work where contamination of areas outside enclosures is suspected. The Contractor shall be responsible for all costs to rectify the problem.
 - .4 Use only skilled and qualified workers for all trades required to work on this project.
 - .5 Only the asbestos abatement Contractor, and never the Consultant, is responsible for the following:
 - .1 Safety programs and precautions required by applicable regulations for the work being performed.
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- .2 Control over the acts and omissions of the Contractor's workers, agents, subcontractors and other employees of the Contractor required to perform work on the project.

- .3 Control over construction techniques, methods, means or procedures.

1.7 **SUPERVISION**

- .1 The Contractor shall provide a trained and qualified shift supervisor for each and every shift during which asbestos removal is being carried out. The Owner reserves the right to stop all work if this requirement is not complied with, at no additional charge to the Owner.

- .2 The shift supervisor shall have the authority to make decisions and take actions with respect to production, manpower and equipment.

1.8 **REGULATIONS**

- .1 The Contractor shall comply with all local, provincial and federal requirements relating to asbestos and lead,

- .2 In case of conflict among the above mentioned requirements or with these specifications, the more stringent requirements shall apply.

- .3 Perform work following the requirements of the various regulations in effect at the time the work is being carried out.

- .4 The regulations shall include, but are not limited to:

- .1 Ontario Occupational Health and Safety Act.

- .2 Ontario Regulation 278/05, Regulation Respecting Asbestos on Construction Projects and in Building and Repair Operations.

- .3 The Designated Substances Regulation, Ontario Regulation 490/09.

- .4 Ontario Ministry of Environment Regulation 347 (as amended) for the disposal of asbestos waste made under the Environmental Protection Act.

- .5 Health and Safety Guideline: Lead on Construction Projects, Published by the Ministry of Labour.

- .6 Health and Safety Guideline: Silica on Construction Projects, Published by the Ministry of Labour.

- .7 Standard Construction Document, Canadian Construction Association, CCA 82 - 2004.

- .8 Regulations respecting the Handling, Offering for Transport and Transportation of Dangerous Goods.

- .9 WHMIS Regulations.

1.9 **NOTIFICATIONS**

- .1 The Contractor shall be responsible for notifying the appropriate regulatory bodies before any work on this project commences:

- .2 The Contractor shall notify an approved industrial land fill site equipped to accept hazardous waste and one which has agreed to accept the waste:

- .3 The Fire Marshall, in cases where the execution of the work will result in blocking building exists or when turning off, removing or temporarily altering fire alarms.

- .4 Prior to conducting any planned abatement work, the Contractor shall notify human resources' occupational health and safety team and the joint health and safety committee of the proposed work schedule.

1.10 **PROSCRIPTIONS**

- .1 The use of compressed air for removal or clean up of asbestos dust and debris from any surface is not allowed.
- .2 Smoking, eating, drinking or chewing is not allowed in the work area.
- .3 Unauthorized persons or persons not using proper personal protective equipment shall not be allowed to enter the work area.
- .4 No entry into the work area shall be permitted to any person who has facial hair growth that prevents the establishment of a proper seal between the respirator and the skin.
- .5 The use of torches, propane-fired heaters and other open flames shall not be permitted in the abatement work area.

1.11 **WORKER AND VISITOR PROTECTION**

- .1 Instruct all personnel (workers and visitors) in all aspects of work procedures and protective equipment before allowing entry into the asbestos and lead abatement work areas.
 - .2 A competent person (as defined by the Occupational Health and Safety Act) shall provide all the training and instructions.
 - .3 Instructions and training shall include, but shall not be limited to, the following:
 - .4 Entry and exit from asbestos abatement work areas.
 - .5 Work practices and personal hygiene.
 - .6 The use, cleaning and care of respirators and protective clothing.
 - .7 Protective measures and work procedures.
 - .8 Asbestos work area entry and exit procedures shall be posted in the clean room of the decontamination unit.
 - .9 Respiratory Protection:
 - .10 All personnel required to wear respirators shall be fit tested either by a qualitative or quantitative fit testing method.
 - .11 Each worker or visitor required to enter an asbestos abatement work area shall be provided with a personally issued respirator that is:
 - .12 Appropriate for the work that is being carried out.
 - .13 Acceptable to the Ministry of Labour, Occupational Health and Safety Division.
 - .14 The worker shall be responsible for wearing a respirator that is issued by the Contractor.
 - .15 The following criteria, as outlined in Table 2 of O. Reg. 275/05, shall be followed when selecting an appropriate respirator.
 - .16 Respirator shall be stored in a clean location such as the clean room of the decontamination unit. This room can also be used for charging PAPR batteries.
 - .17 The procedures specified by the equipment manufacturer shall be followed while using and maintaining the respirators.
 - .18 Respirators shall be cleaned and inspected at the end of each shift. All damaged and deteriorated parts found during the inspection shall be replaced before the respirator is used again.
 - .19 Appropriate combination cartridges shall be used if substances other than asbestos are to be handled inside the asbestos removal work area.
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- .20 Used filters shall be tested and replaced as specified by the manufacturer or as specified below. The more stringent testing and replacement protocol shall be followed.
- .21 Cartridges for negative pressure respirators should be replaced every 16 hours of actual usage.
- .22 Cartridges for PAPRs should be replaced every 8 hours.
- .23 Cartridges shall be treated as asbestos waste and shall be disposed of accordingly after usage inside an asbestos removal work area.
- .24 Protective Clothing:
- .25 The Contractor shall provide every worker and authorized visitor with full body disposable coveralls.
- .26 All personnel shall wear the protective coveralls before they are allowed to enter into the asbestos removal work area.
- .27 Coveralls shall be equipped with head covering (hood), foot covering and tight fitting cuffs at the neck, ankles and wrists.
- .28 The disposable coveralls shall be made up of materials that do not readily permit the penetration of asbestos fibers.
- .29 Disposable coveralls shall be immediately repaired (using duct tape) or replaced once torn.
- .30 Coveralls shall be disposed of as asbestos waste once they are worn inside an asbestos abatement area.
- .31 Workers are allowed to wear reusable protective clothing provided that the clothing is left in the equipment room until the end of the asbestos abatement project. The clothing shall then be disposed of as asbestos waste.
- .32 Safety shoes, hard hats and additional body protection equipment shall be used as necessary to meet the requirements of applicable safety regulations.

1.12

INSPECTIONS

- .1 The Environmental Consultant will be present on site to carry out quality control inspections for the entire duration of the project. The inspections will be performed during the preparation phase, removal phase and a final inspection upon completion of the abatement work. The inspection will be carried out inside and outside the work areas.
- .2 The purpose of the inspections is to ensure that the work is being carried out following the requirements and procedures outlined in the specification documents and applicable regulations.
- .3 The Environmental Consultant will issue written or verbal instructions to the asbestos abatement Contractor throughout the duration of the project. The instructions will authorize the Contractor to proceed to next phase of work. The general phases of work will consist of the following: Pre-cleaning, set-up and preparation of the work area, removal of specified materials, clean-up of work area and tear down of containment.
- .4 The Contractor shall not proceed to the next phase of work without obtaining authorization from the Environmental Consultant.
- .5 The Environmental Consultant has been given authorization by the Owner to order a shutdown of work in case contamination of areas adjacent to controlled work areas has occurred.
- .6 In all non-controlled areas where it is determined by the Environmental Consultant (through visual inspection or air monitoring) that contamination has leaked, the Contractor shall be

responsible to the complete isolation and cleaning of such areas under the direction of the Environmental Consultant and at no extra charge to the Owner.

- .7 The Environmental Consultant has been given authorization by the Owner to ensure that the Contractor adheres to specified procedures and materials and to inspect for completion and final cleanliness. Any additional work (including labour and material charges) specified by the Environmental Consultant to achieve completion of work to the level specified shall be carried out by the Contractor at no additional charge to the Owner.
- .8 The Contractor shall ensure that all equipment and materials to be used on the project are acceptable to the Environmental Consultant. Unacceptable materials and equipment shall be replaced by the Contractor at no additional charge to the Owner.
- .9 The Contractor shall be responsible for all additional inspection charges which are carried out as a result of a failure by the Contractor to meet set criteria relating to schedule, health and safety and quality.

1.13 **AIR MONITORING**

- .1 Air samples will be collected by the Environmental Consultant (on behalf of the owner) from the start of work until the completion of the tear down operations, both inside and/or outside the controlled work areas.
- .2 The objective of air monitoring is to detect defects in the containment of controlled areas and to ensure that any contamination of building spaces beyond the controlled areas is discovered and rectified immediately.
- .3 Any contamination of areas outside the limits of the controlled work areas (as determined by air monitoring) shall be contained and shall be thoroughly cleaned to the Consultant's satisfaction.
- .4 Air monitoring will be carried out following procedures specified in the latest edition of the National Institute for Occupational Safety and Health (NIOSH) method 7400A. The samples will be analyzed by the Phase Contrast Microscopy (PCM) technique as specified in NIOSH method 7400A.
- .5 Air monitoring may also be carried out according to either, or both NIOSH methods described below:
- .6 The latest edition of the National Institute for Occupational Safety and Health (NIOSH) Method 7082. The samples will be analyzed by the Flame Atomic Absorption Spectrophotometer technique as specified in the above noted NIOSH method.
- .7 The Contractor shall cooperate with the Environmental Consultant during air monitoring and shall:
- .8 Ensure that the workers exercise care and avoid damaging the Consultant's equipment.
- .9 Ensure that the samples and equipment are not tampered with.
- .10 Air samples will be analyzed by the PCM method. The area will be considered clean and clear for public occupancy only if the fibre levels are less than 0.01 fibres/cc.
- .11 In case the fibre levels are equal to or greater than 0.01 fibres/cc, the Contractor shall be responsible for re-cleaning the asbestos work area and re-applying the lock-down agent. This process will have to be repeated until the fibre levels are below the specified limit.
- .12 Re-occupancy air samples may be collected and analyzed by NIOSH method 7082 or 77032. The area will be considered clean and clear for public occupancy only if the airborne concentrations levels are less than 0.005 mg/m³ (5 µg/m³).
- .13 In case the concentration levels are equal to or greater than 0.005 mg/m³ (5 µg/m³), the Contractor shall be responsible for re-cleaning the lead work area. This process will have to be repeated until the concentration levels are below the specified limit.

1.14 **WASTE TRANSPORT AND DISPOSAL**

- .1 All hazardous materials, including but not limited to, asbestos or lead containing materials, and equipment and systems containing mercury, existing asbestos or lead contaminated materials and materials that become contaminated by asbestos or lead, as a result of the work, shall be disposed of as prescribed by Ontario Regulation 347, Waste Management Regulation, made under the Environmental Protection Act and the provincial and federal regulations for the Transportation of Dangerous Goods.
- .2 All wash water generated from decontamination activities shall be treated as asbestos waste and shall be disposed of accordingly.
- .3 All non-asbestos containing waste generated during demolition activities inside an asbestos work area shall be treated as asbestos waste.
- .4 Non-porous materials that can be washed and properly cleaned can be disposed of as clean waste.
- .5 All sharp asbestos-contaminated materials (such as hangers, T-bars, wood, etc) that could rip or damage a 6mil polyethylene waste disposal bag shall be disposed of in a sealed solid asbestos waste container.
- .6 The waste must be stored and transported in an enclosed, lockable waste bin.
- .7 Every vehicle used for the transportation of asbestos waste shall display a Class 9 Label.
- .8 Both sides of the vehicle used for the transportation of asbestos waste and every waste bag and container shall display the word CAUTION in letters not less than 10 cm in height and the words:

CONTAINS ASBESTOS FIBRES

Avoid Creating Dust

Asbestos May Be Harmful to Your Health

Wear Approved Protective Equipment

- .9 The transport vehicle must be properly equipped to deal with asbestos waste spills. Equipment shall include, but not limited to, respiratory protective equipment, disposable protective clothing, 6 mil polyethylene bags, shovel and broom and wetting agent.
- .10 For asbestos waste of unknown material or an asbestos type other than Chrysotile, the words Asbestos, Blue, Product Identification Number must be displayed on every waste container.
- .11 For Chrysotile asbestos, the words Asbestos, White, Product Identification Number must be displayed on every waste container.

1.15 **WIPE SAMPLING (WHEN REQUIRED)**

- .1 Wipe samples may be collected by the Environmental Consultant (on behalf of the Owner) following a 2 hour settling period as part of the clearance inspection once the final cleaning procedures have been completed inside the work area(s).
 - .2 The objective of wipe sampling is to verify the effectiveness of the cleaning procedures and to ensure that any contamination on surfaces inside the lead work area(s) is discovered and rectified immediately.
 - .3 Wipe sampling will be carried out following procedures specified in the latest edition of the National Institute for Occupational Safety and Health (NIOSH) Method 9100 or the American Society for Testing of Materials (ASTM) Standard E1728-99. The samples will be analyzed by either the Flame Atomic Absorption Spectrophotometer technique as specified in NIOSH
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method 7082 or Graphite Furnace Atomic Absorption Spectrophotometer technique, NIOSH method 7105.

- .4 The clearance standards for settled lead dust inside a lead work area is 40 µg/ft² (4 µg/100cm²) for floors, 250 µg/ft² (25 µg/100cm²) for interior window sills, and 400 µg/ft² (40 µg/100cm²) for window troughs.
- .5 In case the dust levels are equal to or greater than the specified clearance standards, the Contractor shall be responsible for re-cleaning the lead work area. This process will have to be repeated until the concentration levels are below the specified limit.

2 Execution

ASBESTOS

2.1 TYPE 1 REMOVAL OPERATION

- .1 Initial Preparation and Isolation of Work Areas: Unless otherwise specified, work carried out as part of this phase shall proceed as follows:

- .1 Carry out a survey of the work areas to compile an inventory of existing damages and provide a copy to the Consultant.
- .2 The Contractor is responsible for moving materials and objects which are present in the work areas.
- .3 Prevent the spread of dust from the work area using measures appropriate to the work to be done.
 - .1 Shut off, lock out and seal all ventilation duct vents with the application of one layer of 6 mil (0.15mm) thick clear polyethylene sheet sealed with tape.
 - .2 Use FR polyethylene drop sheets over all flooring in work areas where dust and contamination cannot otherwise be thoroughly cleaned. This does not apply if work involves the removal of asbestos-containing floor tiles.
 - .3 Use one layer of 6 mil (0.15 mm) thick clear polyethylene sheets to cover walls.
 - .4 Separate parts of the building required to remain in use from the work area by polyethylene drop sheets at the perimeter of the work area.
 - .5 Separate the work area with clearly visible warning signs advising of the hazards of asbestos dust and that entry is restricted to authorized trained personnel wearing personal protective equipment.
 - .6 Erect scaffolding or platforms where necessary to perform the removal work. All platforms that exceed 25 feet in height will require the submission of a shop drawing stamped by a professional engineer for approval by the inspector within a minimum of 5 days prior to commencing the work. Guard rails shall be provided around all platforms or scaffolding where practicable. Cover the floor area of the scaffold or platform with one layer of FR polyethylene. Extend the floor of scaffolding or platform under an item being removed to act as a receptacle. Polyethylene sheeting shall be suitably braced and/or restrained so that billowing or failure of the polyethylene sheeting or taped joints does not occur.

- .2 Entry and Exit Procedures from Asbestos Removal Work Areas: the following general procedures shall be adhered to when entering into and exiting from asbestos abatement work areas:

- .1 Work Area Entry Procedures:

- .1 Every worker and visitor planning to enter the work area should remove all street clothing and should store them in a designated clean change room.
 - .2 The person shall then put on disposal coverall with head covering, respirators with clean filters and foot covering and shall proceed to the work area.
 - .2 Work Area Exit Procedures:
 - .1 Each worker shall decontaminate their protective clothing, boots and respirator by first HEPA vacuuming and then by damp wiping using soap and water.
 - .2 The removed disposable coveralls shall be disposed of as asbestos waste in a 0.15 mm (6 mil) labelled waste bag. Respirator filter inlets shall be sealed in tape or disposed of as asbestos waste.
 - .3 Asbestos Removal Procedures
 - .1 Asbestos Removal shall not commence until:
 - .1 The work area is effectively separated from clean areas of the building.
 - .2 Warning signs are posted outside the removal work areas.
 - .3 All surfaces which are not possible to clean are sealed with polyethylene sheeting and tape.
 - .4 Arrangements have been made for waste disposal, landfill site operator has been contacted and storage bin is on site.
 - .5 Tools equipment and materials are on hand and in the work area.
 - .6 Facilities for the washing of hands and face are available for workers leaving the work area.
 - .2 Before beginning work remove visible dust from surfaces in the work area where dust is likely to be disturbed during the course of the work. Use HEPA vacuum, or damp cloths where damp cleaning does not create a hazard and is otherwise appropriate. Do not use compressed air to clean up or remove dust from any surface.
 - .3 Wet materials containing asbestos to be cut, ground, abraded, drilled, or otherwise disturbed with amended water. Use garden type low velocity fine mist sprayer. Perform work in a manner to reduce dust creation to lowest levels practicable. Spray asbestos material repeatedly during the work process to minimize asbestos fibre release.
 - .4 Additional cement board removal procedures.
 - .1 Cement board shall be removed intact where possible.
 - .2 When not possible to remove intact, the board shall be cut with hand saws where necessary and dust shall be collected with a HEPA vacuum cleaner nozzle held under the cut area.
 - .3 Drop sheets shall be used no more than 0.5 metres below the cutting location and shall be constructed in such a manner that any dust not removed by the HEPA vacuum is collected.
 - .5 Remove material in sections as intact as possible.
 - .6 Frequently during the work and immediately after completion of the work, clean up dust and waste containing asbestos using a HEPA vacuum or by damp wiping.
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.4 Final Clean

- .1 When removal is complete, clean the entire work area by HEPA vacuuming and wet wiping.
- .2 The work area shall be deemed clean by the Inspector when there is no visible residue, dirt, film, stain, or discolouration resulting from either asbestos removal or cleaning activities.
- .3 After completion of the initial cleaning and after the Inspector has passed the visual inspection, spray sealant on all surfaces in the work area, including, but not limited to:
 - .1 Where asbestos material has been removed.
 - .2 Polyethylene sheeting used on walls, floors and ceilings.
- .4 Sealant should be sprayed using a garden reservoir type low velocity fine mist sprayer. The sprayer cannot be used if the nozzle is partially obstructed, or if a uniform fine mist spray cannot be obtained.
- .5 After the area is declared clean and written approval to proceed has been received from the Inspector:
 - .1 Dismantle boundaries and isolating barriers as asbestos waste. Drop sheets shall be wetted and folded to contain dust and then placed in waste bags.
 - .2 Immediately before their removal from the work area, and disposal, clean each filled labelled waste bag using damp cloths or HEPA vacuum and place in second clean clear polyethylene waste bag.
 - .3 Dispose of waste as per procedures specified in subsection 1.14 Waste Transport and Disposal.
- .6 Repair or replace objects damaged in the course of the work. Re-establish objects moved to temporary locations in the course of the work, in their proper positions. Re-secure mounted objects removed in the course of the work in their former positions.

2.2

TYPE 2 REMOVAL OPERATION: FOR WORK IN ENCLOSURES

- .1 Initial Preparation and Isolation of Work Areas: Unless otherwise specified, work carried out as part of this phase shall proceed as follows:
 - .1 Carry out a survey of the work areas to compile an inventory of existing damages and provide a copy to the Consultant.
 - .2 The Contractor is responsible for moving materials which are present in the work.
 - .3 Prevent the spread of dust from the work area using measures appropriate to the work to be done.
 - .1 Shut off, lock out and seal all ventilation duct vents with the application of one layer of 6 mil (0.15 mm) thick clear polyethylene sheet sealed with tape.
 - .2 Clean all moveable objects within proposed work area using a HEPA vacuum.
 - .3 Clean fixed casework, plant, and equipment within proposed work area, using a HEPA vacuum and cover with polyethylene sheeting sealed with tape.
 - .4 Clean proposed work areas using, where practicable, HEPA vacuum cleaning equipment. Do not use methods that raise dust, such as dry sweeping, or vacuuming using other than HEPA filter-equipped vacuums.

- .5 Cover and seal airtight light fixtures, duct openings and other suspended ceiling objects using clear 6 mil polyethylene sheeting and tape.
 - .6 Erect scaffolding or platforms necessary to perform the removal work. All platforms that exceed 25 feet in height will require the submission of a shop drawing stamped by a professional engineer for approval by the inspector within a minimum of 5 days prior to commencing the work. Guard rails shall be provided around all platforms or scaffolding where practicable.
 - .7 Cover floor area of scaffold or platform with one layer of FR polyethylene.
 - .8 Extend scaffolding or platform under the item being removed to prevent material from falling.
 - .9 Separate parts of the building required to remain in use from the work area by polyethylene drop sheets at the perimeter of the work area.
 - .10 Set up an airtight enclosure around the work area where the work on friable asbestos- containing material is to be carried out. Enclosure should be set up using 1 layer of FR polyethylene sheeting to cover the floors, and 1 layer of 6 mil (0.15 mm) thick clear polyethylene sheeting to cover the walls. Two layers of FR polyethylene sheeting should be used to cover carpeted floors. Polyethylene on the walls should be made to overlap with the polyethylene on the floor a minimum of 300 mm.
 - .11 Polyethylene sheeting shall be suitably braced and/or restrained so that excessive billowing or failure of the polyethylene sheeting or taped joints does not occur as a result of the negative pressure differential created by the vacuums.
 - .12 Erect a temporary structure made of wooden studs to support polyethylene sheeting where necessary.
 - .13 Insert a hose of a HEPA filter equipped vacuum into the enclosure to provide negative air pressure inside the enclosure.
 - .14 Entrance to the enclosure should be covered with two pieces of overlapping polyethylene sheeting.
 - .15 Separate the work area with clearly visible warning signs advising of the hazards of asbestos dust and that entry is restricted to authorized trained personnel wearing personal protective equipment.
- .2 Entry and Exit Procedures from Asbestos Removal Work Areas: the following general procedures shall be adhered to when entering into and exiting from asbestos abatement work areas:
- .1 Work Area Entry Procedures:
 - .1 Every worker and visitor planning to enter the work area should remove all street clothing and should store them in a designated clean change room.
 - .2 The person shall then put on disposal coverall with head covering, respirators with clean filters and foot covering and shall proceed to the work area through the flaps covering the entrance to the enclosure.
 - .2 Work Area Exit Procedures:
 - .1 Each worker shall decontaminate their protective clothing, boots and respirator by first HEPA vacuuming and then by damp wiping using soap and water.
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- .2 The removed disposable coveralls shall be disposed of as asbestos waste in a 0.15 mm (6 mil) labelled waste bag. Respirator filter inlets shall be sealed in tape or disposed of as asbestos waste.

.3 Asbestos Removal Procedures

- .1 Asbestos Removal shall not commence until:
 - .1 The work area is effectively separated from clean areas of the building.
 - .2 Warning signs are posted outside the removal work areas.
 - .3 All surfaces which are not possible to clean are sealed with polyethylene sheeting and tape.
 - .4 Arrangements have been made for waste disposal, landfill site operator has been contacted and storage bin is on site.
 - .5 Tools equipment and materials are on hand and in the work area.
 - .6 Facilities for the washing of hands and face are available for workers leaving the work area.
- .2 Before beginning the work remove visible dust from surfaces in the work area. Use HEPA vacuum, or damp cloths where damp cleaning is considered more appropriate. Do not use compressed air to clean up or remove dust from any surface.
- .3 Wet materials containing asbestos to be removed, disturbed, or sealed with amended water. Garden reservoir type low velocity fine mist sprayer may be used. Perform work in a manner to reduce dust creation to lowest levels practicable. Spray asbestos material repeatedly during the work process to minimize asbestos fibre dispersion.
- .4 Removed material has to be placed directly in waste bags. Wherever possible, asbestos- containing material should be removed in sections as intact as possible.
- .5 Areas that used to be covered with the asbestos-containing material should be cleaned after the material is removed, using brushes, steel wool, or any other tools suitable.
- .6 Frequently during the work and immediately after completion of the work, clean up dust and waste containing asbestos using a HEPA vacuum or by damp wiping.
- .7 All labelled waste bags should be placed in clean clear 6 mil poly bags before they are taken out of the enclosure.

.4 Final Clean

- .1 When removal is complete, clean the entire work area by HEPA vacuuming and wet wiping.
- .2 All tools and equipment used in the removal process such as hook knives, extension cords, scrapers, wire brushes, garden sprayers etc, should be washed and cleaned and placed in 6 mil polyethylene bags.
- .3 The work area shall be deemed clean by the Inspector when there is no visible residue, dirt, film, stain, or discolouration resulting from either asbestos removal or cleaning activities.
- .4 After completion of the initial cleaning and after the Inspector has passed the visual inspection, spray sealant on all surfaces in the work area, including, but not limited to:
 - .1 Where asbestos material has been removed.
 - .2 Polyethylene sheeting used on walls, floors and ceilings.

- .5 Sealant should be sprayed using a garden reservoir type low velocity fine mist sprayer. The sprayer cannot be used if the nozzle is partially obstructed, or if a uniform fine mist spray cannot be obtained.
- .6 Enclosure should be left standing until all the sealant has dried or, if required, until an air sample is taken inside the enclosure, and the fibre concentration level is below 0.05f/cc.
- .7 After the area is declared clean and written approval to proceed has been received from the Inspector:
 - .1 Dismantle boundaries and isolating barriers and treat as asbestos waste. Drop sheets shall be wetted and folded to contain dust and then placed in waste bags.
 - .2 Immediately before their removal from the work area, and disposal, clean each filled labelled waste bag using damp cloths or HEPA vacuum and place in second clean clear polyethylene waste bag.
 - .3 Dispose of waste as per procedures specified in subsection 1.14 Waste Transport and Disposal.
- .8 Repair or replace objects damaged in the course of the work. Re-establish objects moved to temporary locations in the course of the work, in their proper positions. Re-secure mounted objects removed in the course of the work in their former positions.

2.3 TYPE 2 REMOVAL OPERATION: FOR WORK USING GLOVE BAGS

- .1 Initial Preparation and Isolation of Work Areas: Unless otherwise specified, work carried out as part of this phase shall proceed as follows:
 - .1 Carry out a survey of the work areas to compile an inventory of existing damages and provide a copy to the Consultant.
 - .2 Prevent the spread of dust from the work area using measures appropriate to the work to be done.
 - .1 Shut off, lock out and seal all ventilation duct vents with the application of one layer of 6 mil (0.15 mm) thick clear polyethylene sheet sealed with tape.
 - .2 Use FR polyethylene drop sheets over flooring such as carpeting that absorbs dust and over all flooring in work area where dust and contamination cannot otherwise be safely contained.
 - .3 Separate parts of the building required to remain in use from the work area by polyethylene drop sheets around the perimeter of the work area.
 - .4 Separate the work area with clearly visible warning signs advising of the hazards of asbestos dust and that entry is restricted to authorized trained personnel wearing personal protective equipment.
- .2 Worker Protection Procedures
 - .1 Before proceeding to the work area:
 - .1 Each worker shall don respirator and disposable coveralls, including head covering and suitable foot wear. Removal of street clothes in a designated clean room before wearing the disposable coveralls is recommended.
 - .2 Before leaving the work area:
 - .1 Each worker shall decontaminate their protective clothing, boots and respirator by first HEPA vacuuming and then by damp wiping using soap and water.

- .2 The removed disposable coveralls shall be disposed of as asbestos waste in a 6 mil (0.15 mm) labelled waste bag.
 - .3 The worker shall proceed to clean their hands and arms. The waste water should be collected and filtered using a filter that passes particles 5 microns in size and smaller, before it is discharged into the municipal sewer system.
- .3 Asbestos Removal Procedures
- .1 Asbestos Removal shall not commence until:
 - .1 The work area is effectively separated from clean areas of the building by polyethylene drop sheets and the placing of rope barriers at the boundary of the designated work area. The boundaries of the work area shall be a minimum of 10 feet from the location of the insulation being removed.
 - .2 Warning signs are posted outside the removal work areas.
 - .3 All surfaces which are not possible to clean are sealed with polyethylene sheeting and tape.
 - .4 Arrangements have been made for waste disposal, landfill site has been contacted and storage bin is on site.
 - .5 Tools equipment and materials are on hand and in the work area.
 - .6 Facilities for the washing of hands and face are available for workers leaving the work area.
 - .2 Before beginning work remove visible dust from surfaces in the work area where dust is likely to be disturbed during the course of the work. Use HEPA vacuum, or damp cloths where damp cleaning does not create a hazard and is otherwise appropriate. Do not use compressed air to clean up or remove dust from any surface.
 - .3 Remove all obstructions from around pipe. Where access is required above plaster ceilings, provide sufficient openings to gain access.
 - .4 Friable material containing asbestos to be removed or disturbed shall be thoroughly surface wetted before and during work unless wetting creates a hazard or causes damage. Use garden type low velocity fine mist sprayer. Sprayers that are partially clogged, or that does not produce uniformly fine mist will not be accepted. Perform work in a manner to reduce dust creation to lowest levels practicable.
 - .5 Inspect all glove bags for defects before using. A defective bag shall not be used.
 - .6 Ensure that the following tools are used:
 - .1 Knife shall have a retractable blade.
 - .2 Saw shall be a flexible wire type.
 - .3 Brushes shall not have metal bristles.
 - .7 After written authorization has been received from the Inspector to proceed perform the removal using the following procedures.
 - .1 Place tools necessary to remove insulation, in tool pouch. Wrap the bag around pipe and close zippers. Seal bag to pipe with restraining nylon straps. Welds and folds of glove bag are to remain intact without modification to manufacturers design.
 - .2 Place hands in gloves and use necessary tools to remove insulation. Cut or remove exterior insulation covering where applicable to expose asbestos pipe covering. Wet exposed pipe or duct covering with sufficient mixture to suppress any dust. Arrange insulation in bag to obtain full capacity of bag.
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- .3 Insert nozzle of spray pump prefilled and primed with water and surfactant into bag through valve and wash down pipe and interior of bag thoroughly, use cloth or sponge to aid in washing process. Wet surface of insulation in lower section of bag.
 - .4 Waste material in bags intended for use at more than one location and which are equipped with internal zippers to seal off waste, shall have the upper section of bag thoroughly cleaned then shall be sealed off in lower sections of bag before bag is removed from pipe. Reinstall bag in new location before opening zip lock.
 - .5 If bag **(Only if bag is a Safe-T-Strip)** is to be moved along pipe, loosen straps, move bag, re seal to pipe using double pull zipper to pass hangers. Repeat stripping operation.
 - .6 To remove bag after completion of stripping wash top section and tools thoroughly. Seal off waste in lower section of bag using zipper. Pull polyethylene waste container over glove bag before removing from pipe. Release one strap and remove freshly washed tools. Place tools in water. Remove second strap and zipper. Fold over into appropriately labelled waste disposal bags and seal.
 - .7 Prior to removal of bag ensure that pipe is free of all residue. Remove all residue using wet cloths as necessary. Ensure that surfaces are free of sludge which after drying could release asbestos dust into atmosphere. Seal exposed surfaces of pipe and ends of insulation with slow drying sealer to seal in any residual fibres.
 - .8 Upon completion of work, cover exposed ends of remaining pipe insulation with polyethylene tape.
 - .9 If the glove bag is ripped, cut or opened in any way, work that may disturb friable material shall cease immediately. If the rip, cut or opening is small and easy to repair then the glove bag shall be repaired forthwith with tape. Work may continue once the repairs are complete. If the rip, cut or opening is not small and cannot be easily repaired, place the glove bag forthwith in a suitable asbestos waste container. Any spilled material containing asbestos shall be cleaned up and removed by using a vacuum equipped with a HEPA filter.
 - .8 All work will be subject to visual inspection and air monitoring. Any contamination of surrounding areas indicated by visual inspection or air monitoring will require the complete enclosure and clean up of affected areas.
- .4 Cleanup:
- .1 Frequently during the work and immediately after completion of the work clean up dust and waste containing asbestos using a HEPA vacuum or by damp mopping.
 - .2 Place dust and waste containing asbestos in sealed dust tight waste bags. Drop sheets and disposable protective clothing shall be treated as asbestos waste and shall be wetted and folded inward to contain dust and then placed in waste bags.
 - .3 Glove bags, disposal bags, drop sheets, cloth rags and any porous materials are to be considered as asbestos waste and handled according to disposal subsection.
 - .4 Immediately before their removal from the work area, and disposal, clean each filled waste bag using damp cloths or HEPA vacuum and place in second clean waste bag.
 - .5 Seal and remove double bagged waste from site. Dispose of in accordance with procedures specified in subsection 1.14 Waste Transport and Disposal.
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- .6 Perform final thorough cleanup of work areas and adjacent areas affected by the work using HEPA vacuums.

2.4 TYPE 3 REMOVAL OPERATION

- .1 Initial Preparation and Isolation of Work Areas: Unless otherwise specified, work carried out as part of this phase shall proceed as follows:
 - .1 Carry out a survey of the work areas to compile an inventory of existing damages and provide a copy to the Consultant.
 - .2 The Contractor is responsible for moving materials and objects which are present in the work areas.
 - .3 Separate the asbestos removal work areas from other areas in the mechanical room required to remain in use as follows by erecting rip-proof polyethylene sheeting and plywood sheeting. The polyethylene sheeting should extend from floor to ceiling and the plywood hoarding should extend 8ft from the floor on the separation side of the enclosure. Use one layer of rip proof poly on the exterior side of the wood stud framing under the plywood sheets. Use two layers of poly on the interior side of the wood frame. The inner layer shall be made up of clear 6 mil poly sheets. The outer layers shall be made up of rip proof poly.
 - .4 All surfaces, equipment and objects located in the work areas and not scheduled for removal shall be pre-cleaned by HEPA vacuuming or wet wiping and shall be protected by one layer of rip proof poly sheeting unless otherwise specified. Dry sweeping or vacuuming with units not equipped with HEPA filters shall not be allowed.
 - .5 All equipment, objects and articles scheduled for removal shall be taken out of the work area only if its removal will not disturb any asbestos-containing materials.
 - .6 Ensure that smoke detectors, fire alarms, heat detectors and other life safety equipment remain active and operating as installed.
 - .7 All specified clean demolition work can be carried out before the Type 3 enclosure is set up on condition that the demolition work does not disturb any asbestos-containing materials.
 - .8 Construct the decontamination enclosure systems for workers and for equipment and materials as specified.
 - .9 Independently seal off all openings leading to the work area using polyethylene sheeting and duct tape. Such openings include, but are not limited to, windows, doorways, corridors, skylights, diffusers, grills and air ducts. Also seal all floor openings independently before covering the entire floor with polyethylene sheeting. Ensure that the individual seals are air tight and water tight.
 - .10 Cover floors with two independently sealed layers of polyethylene sheeting and seal with duct tape. Poly on the floor shall extend a minimum of 30 cm up all vertical surfaces located in the work area.
 - .11 Cover walls with one layer of 6 mil rip-proof polyethylene sheeting (unless specified otherwise). Overlap floor poly with wall poly by a minimum of 30 cm at each layer. The layers of wall poly shall always overlap the layers of the floor poly.
 - .12 Ensure that adjoining sheets of poly used on walls and floors overlap by at least 30 cm.
 - .13 Ensure that poly sheets are properly supported to avoid excessive billowing and failure of the enclosure as a result of applying negative pressure differential. Brace the poly in case of excessive billowing using 1"x2" straps.

- .14 Use flame resistant polyethylene sheeting near heat sources.
 - .15 Create negative pressure in the work area using HEPA-filtered negative air unit distributed evenly (horizontally and vertically) within the work area. Supply any necessary platforms as required to elevate the negative air unit.
 - .16 Provide enough negative air units to be able to exchange the air volume of the work area at least once every 20 minutes (three air changes per hour) and to maintain a minimum of 0.02" water gauge differential.
 - .17 The pressure differential shall be continuously monitored using an automatic recorder as specified. Place the monitor outside the contaminated work area. A backup negative air unit shall be set up and ready for operation in case one of the original units fail.
 - .18 Operate the negative air units from the start of the preparation and isolation phase until completion of the final clean up work and air testing.
 - .19 Ensure that the necessary make up air is supplied to the work area through flaps installed in the perimeter seal.
 - .20 Replace pre-filters and HEPA filters as necessary to maintain the proper flow rate and to ensure that the unit continues to function properly.
 - .21 Contaminated air from the work area shall be exhausted directly to the outside through sealed ducts. Where necessary, remove existing windows and replace with a plywood panel. Secure panel in place and make weather tight using caulking. Install appropriately sized openings for exhaust (typically 12"). Replace windows upon completion of work.
 - .22 All negative air units which are set up to discharge inside the building shall be leak tested in place using the DOP method.
 - .23 The Contractor is allowed to connect to the Owner's existing water supply for use in the asbestos work areas and in the temporary shower and decontamination facilities. The Contractor shall be responsible for making all the connections using vacuum breakers and other backflow preventers.
 - .24 The Contractor shall use copper pipes and fittings and high pressure hoses when making connections to the main water supply. The Contractor shall also install a main shut-off valve on the clean side of the decontamination enclosure. All connections shall be made down stream from the main shut-off valve. Ensure that the pressure in the temporary water distribution system is relieved if the system is to be left unattended. Ensure that no leaks are present around hose pipe connections. Minimize the possibility of water damage through spills or leaks by providing drip pans of suitable size and by ensuring that the drip pans are drained regularly.
 - .25 Ensure that all water from the drainage facilities installed on the shower and other decontamination enclosures is passed through filtration systems as specified.
 - .26 Test all temporary piping installed during this project and ensure that they are watertight. All temporary pipe installation shall remain water tight for the duration of the project. Pipes shall be installed parallel to walls and shall be temporarily secured to existing structures. Ensure that all piping is removed upon completion of work. Avoid damaging or altering the owner's existing water equipment and piping.
 - .27 All electrical work shall be performed by a licensed electrician in compliance with all applicable regulations. Isolate, disconnect and lockout all power supplying or passing through the work area. Ensure that power supply to the remaining areas of the building is not disrupted during work in asbestos contaminated areas.
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- .28 Unless specified, the use of the existing power and lighting circuits shall not be allowed. Use temporary electrical panels to provide power and lighting to the decontamination facilities and the work area. One electrical panel shall be provided for every 5000 square feet of contained asbestos work areas. Electrical panels shall be equipped and sized to handle all electrical equipment required for the completion of the project. The Contractor shall also be required to provide other additional electrical equipment such as temporary lighting, circuit breakers, panels, transformers and switch gears.
- .29 The contractor shall be responsible for establishing and maintaining fire and emergency exits from the work area that are acceptable to the Provincial Fire Marshall and other authorities having jurisdiction. The emergency exits shall be sealed in a manner that will not hinder the use of the doors during an evacuation and shall be clearly marked by using proper exit signs.
- .30 Battery powered emergency lighting shall be installed by the Contractor to provide general lighting throughout the work area in case of loss of power supply to the ground fault panel and to ensure that the emergency exits and the exit routes remain lit during the power failure.
- .31 Ensure that fire extinguishers are installed throughout the asbestos work area at each of the emergency exits and on both sides of the decontamination facilities. All fire extinguishers installed inside the work area shall be protected by clear polyethylene sheets and shall be easily accessible in case of an emergency.
- .32 The Contractor shall place warning signs at all access points leading to the contained work area. The signs shall be posted at the curtained door ways and shall read:

CAUTION
ASBESTOS HAZARD AREA
NO UNAUTHORIZED ENTRY
WEAR ASSIGNED PROTECTIVE EQUIPMENT
BREATHING ASBESTOS DUST MAY CAUSE SERIOUS BODILY HARM

- .33 Once the initial clean preparation and isolation of the work area is completed, the Contractor shall request an inspection from the Consultant before proceeding to next phase. Notify the Consultant 24 hours before the inspection is needed.
- .34 Once authorization is obtained from the Consultant, proceed to setting up critical seals that might become accessible once removal operations commence.
- .35 Shut off and lock out the HVAC system serving the subject work area. Ensure that all work requiring the complete shut down of the HVAC system is carried out during the time when the building is not occupied.
- .36 Unless otherwise specified, all electrical systems scheduled to remain inside the work area during asbestos removal activities shall be sealed using duct tape and poly sheets. Examples of such systems include speakers, wiring, smoke and heat detectors, alarm equipment, communication systems, PA systems, junction boxes, etc.
- .37 Once all the preparation work is complete, the contractor shall ensure that the work area is maintained neat and organized. All the enclosures shall be inspected by the supervisor before and after the completion of each work shift to ensure that the hoarding walls, polyethylene barriers and enclosures are intact. Any damaged discovered during the inspection shall be repaired immediately. Maintain an inspection log book on site to document when (date and time) the inspection was carried out and by whom (name and signature of the person). Summarize any problems encountered during the inspection.

- .38 Ensure that the negative air units and the associated ducting and exhaust openings are regularly inspected during the work shift. The pressure differential monitoring unit shall be also inspected regularly during the work shift to ensure that the specified negative pressure inside the work area is maintained.
 - .2 Entry and Exit Procedures from Asbestos Removal Work Areas: the following general procedures shall be adhered to when entering into and exiting from asbestos abatement work areas:
 - .1 Work Area Entry Procedures:
 - .1 Every worker and visitor planning to enter the work area shall remove all street clothing including undergarments and shall store them in the clean change room.
 - .2 All uncontaminated articles such as clothing, footwear, towels, personal effects, etc. shall be store in the clean room of the decontamination facility.
 - .3 The person shall then put on disposal coverall with head covering, respirators with clean filters and foot covering and shall proceed to the work areas through the shower and then the equipment and access room.
 - .2 Work Area Exit Procedures:
 - .1 Using HEPA vacuuming or wet wiping, remove all gross contamination from personal protective equipment (disposable coveralls, boots, hard hats, safety glasses, exterior of respirator, etc.) in the work area and then proceed to the equipment and access room.
 - .2 In the equipment and access room, remove all protective clothing except the respirator and proceed to the shower. All disposal contaminated clothing shall be placed in asbestos disposal bags. Reusable items shall be stored neatly in the equipment and access room for use during the next shift.
 - .3 Proceed naked to the shower while still wearing the respirator. While showering, clean the outside of the respirator with soap and water. Seal the openings in the filter as per the manufacturer's instruction or using duct tape. Alternatively, the filters can be disposed of as asbestos waste. Continue showering by thoroughly wetting and washing the body and the head. Wet and clean the inside of the respirator. Filters shall not be allowed in the clean room if not properly sealed.
 - .4 Upon completion of showering and drying off, proceed to the clean room and dress in street clothing.
 - .3 Asbestos Removal Procedures
 - .1 Asbestos removal work shall not commence until the following requirements have been met:
 - .2 All work areas have been and contained as specified, decontamination enclosure systems have been set up and occupied areas of the building have been properly isolated.
 - .1 All required notifications have been made and a notice of project has been posted in a visible area.
 - .2 Warnings signs have been displayed at all potential access points into the work area.
 - .3 All arrangements have been made with the waste disposal facility.
 - .4 All equipment, materials and tools needed inside the work area are available and in working condition.
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- .5 Appropriate negative pressure differential have been established inside the work area with proper allowance for make up air.
 - .6 All building security arrangements have been made.
 - .7 Written authorization has been obtained from the Consultant to commence asbestos removal work.
 - .3 Using an airless sprayer, spray the asbestos-containing material with water mixed with a wetting agent. Apply enough amended water to ensure that the material is wet all way through to the substrate. Avoid dripping. Etch the surface of the material being wetted in cases where the water does not penetrate the outer layer of the material.
 - .4 Remove the wet asbestos-containing materials in layers and/or small sections while maintaining exposed surfaces of insulation in a wet condition. Spray the material regularly throughout the removal work to maintain saturation and to minimize the generation and dispersion of dust. Ensure that the wet material does not dry out.
 - .5 Ensure that the removed material and other waste generated during the removal process is collected and bagged immediately. Place the material in yellow labelled bags. Ensure that the waste water is also collected regularly. Avoid pooling of water. Dispose of the waste water in labelled 6 mil polyethylene bags (or other suitable rigid containers) or pump it straight into the sanitary sewer after passing it through the specified two stage filters.
 - .6 Dispose of waste in accordance with procedures specified in subsection 1.14 Waste Transport and Disposal
 - .7 Mist the air during the removal process using an airless sprayer capable of producing a fine mist and amended water to keep the airborne fibres levels as low as possible. Monitor the air inside the work area during removal. Airborne fibre levels in excess of 2.5 fibres/cc require the utilization of more airless sprayers.
 - .8 Remove deck mounted objects and other obstructions as necessary to facilitate the removal of the asbestos-containing materials. Ensure that the removal work includes all asbestos-contaminated materials specified for removal.
 - .9 After completion of gross asbestos removal work, perform a more thorough cleaning of all surfaces that used to be covered by asbestos to remove all visible residue and fibrous materials. Cleaning shall be carried out using wire brushing (stiff bristle brushes such as nylon or fibre bristles not metal), wet sponging and vacuuming. Ensure that the surfaces remain wet during the performance of this work.
 - .10 Notify the Consultant in cases where asbestos-containing materials is encountered which cannot be properly removed without demolishing building structural members or removing major service elements. The Consultant will advise the Contractor in writing regarding the next course of action. If sealing the material in place is the recommended course of action, apply a penetrating sealer onto the material and ensure that it penetrates all the way to the substrate.
 - .11 Continue with the wet thorough cleaning activities and include other surfaces in the work area including, but not limited to, decontamination facilities, polyethylene sheeting, walls and floor surfaces, equipment, containers, piping, ducts, conduits and poly surfaces used in the equipment and access room and the equipment decontamination facilities. Pre- filters used on the negative air units shall be removed and shall be disposed of as asbestos waste.
 - .12 Request a visual clearance inspection by the Consultant once all the cleaning activities are completed. The level of cleanliness shall be acceptable to the Consultant before a written authorization is issued to apply the lock-down material.
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.4 Procedures for Handling of Materials and Waste

- .1 Seal all filled asbestos waste containers and clean the exterior of the containers and other items by wet sponging. Move the containers from the filling area to a temporary storage area located within the enclosure and close to the equipment waste decontamination facility.
- .2 Move the item to the container cleaning room, clean by wet sponges and pass it through the curtained doorway to a second worker stationed in the holding room. The second worker shall be fully protected (similar to the removal workers) and can only leave by going through the work area and exiting through the worker decontamination facility (after taking a shower). The second worker shall then clean or double bag and seal the item and shall pass it through the curtained doorway to a third worker stationed in the transfer room. The third worker enters the transfer room from the clean side and does not need to use personal protective equipment. The third worker is then responsible for transferring the item to the disposal bin or to the Contractor's temporary storage room or truck.
- .3 All waste generated within the asbestos work area shall be treated as asbestos-contaminated waste and shall be disposed of accordingly. Non-porous materials which can be properly washed and cleaned can be disposed of as normal waste after cleaning.
- .4 The contractor shall use a combination of a rigid container with 6 mil poly bag to transport and dispose of waste containing sharp materials which could rip two 6 mil poly bag.
- .5 Transportation of waste and materials through occupied areas of the building shall be limited to a time when the building is not occupied. The Contractor shall use covered carts to transport the waste inside the building. Predetermined transport routes shall be approved by the Owner or his representative.
- .6 Workers transporting the waste shall be equipped with spill kits and full personal protective equipment and shall be trained to contain and clean any spilled asbestos-containing materials resulting from a failure in the waste containers.
- .7 Ensure that waste transport routes, loading areas and garbage bin storage areas are kept clean at all times. Garbage bins shall be of the fully enclosed type and shall be locked at all times when not in use. Garbage bins shall be placed only in locations specified and approved by the Owner or his representative.
- .8 Schedule garbage bin pick up and drop off times in consultation with the Consultant and ensure that the scheduled times do not interfere with the operations of the building Owner or his tenants.
- .9 Transport and dispose of asbestos waste as procedures specified in subsection 1.14 Waste Transport and Disposal.

.5 Procedures for Locking-Down of Work Area

- .1 Upon completion of clean up operations and after receiving written authorization from the Consultant to proceed, apply a lock-down agent acceptable to the Consultant on all surfaces in the work area such as areas where asbestos materials has been removed, pipes, ducts and other exposed objects present in the work area, polyethylene sheeting and other exposed walls, ceilings and floors, etc. Ensure that the sprayed material covers all surfaces. Apply twice as much lock-agent on areas that used to be covered by asbestos-containing materials.
 - .2 Ensure that proper respiratory protective equipment is used during the application of the lock-down agent since, depending on the nature of the sealer used, potentially hazardous materials could be generated during the application process.
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- .3 Restrict access to the work area for a period of 24 hours after completion of the lock-down application to allow for the dust to settle and for the lock-down agent to dry off. Clearance air samples will then be collected inside the work area.
 - .4 The work area shall be considered acceptable for public occupancy only if the airborne fibre levels inside the work area are less than 0.01 fibres/cc. Levels above 0.01 fibres/cc requires that the entire area be re-cleaned and another coat of lock-down agent be applied by the Contractor on all surfaces in the work area. Re-sampling will be carried out and the entire process shall be repeated until the fibres levels are less than 0.01 fibres/cc.
 - .5 The Contractor shall be responsible for all charges associated with re-cleaning work and other associated requirements as specified.
 - .6 Procedures for Work Area Teardown and Dismantling
 - .1 Proceed with the teardown of the work area only after obtaining written authorization from the Consultant. Ensure that Type 3 procedures remain in effect during this phase of work. The worker and equipment and material decontamination units shall remain fully operational. The negative air units shall continue to operate throughout the duration of the teardown work.
 - .2 Start by removing polyethylene sheeting by carefully folding it away from the walls to the centre of the work area making sure that any loose debris is trapped within the poly. Also remove all enclosures, duct tape, caulking, polyurethane foam and other materials used in setting up the enclosure. Ensure that one layer of polyethylene sheeting is kept in place in situations where re-application of fireproofing is required. Polyethylene and other materials used in setting up enclosures shall be disposed of as asbestos-contaminated waste.
 - .3 Clean all vacuum units, fittings, hoses and other small tools used during the removal work inside the work area, seal in 6 mil poly bags and remove from the work area through the equipment and materials decontamination unit. Wash down and clean other equipment used during the work and remove from the work area.
 - .4 Clean up the asbestos work area including all surfaces and all decontamination enclosures. Remove negative air units pre-filters and dispose of as asbestos waste. Seal the exterior of the unit on all sides with poly and remove from the work area.
 - .5 Remove all waste bags containing polyethylene sheets and other materials used to set up the enclosures and dispose of as specified.
 - .6 Remove all hoarding walls separating the work area from occupied areas except in locations where the walls are set up adjacent to other areas that still contain asbestos. Obtain approval of Consultant before dismantling hoarding walls.
 - .7 Dismantle the remainder of the enclosure including scaffolding, platforms, decontamination facilities, tunnels, etc. Final clean the work area using HEPA vacuuming and wet wiping. Clean and remove all ground fault panels and temporary lighting.
 - .7 Procedures for Re-Establishment of Objects and Systems
 - .1 Re-establish mechanical and HVAC systems and install new clean air filters where previously removed. Re-establish all electrical system and return to as found condition unless otherwise specified.
 - .2 Repair, replace and make good on all damages not identified during the per-removal survey.
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- .3 Unless otherwise specified, all items and objects removed during the initial preparation phase of the work shall be returned to their original position and shall be properly mounted and secured.

TABLE 1

Asbestos Containing Building Material	ACM Abatement Scope of Work	Required Abatement Method	Specification Section
Sprayed Fireproofing	< 1m ²	Type 2	2.2
Thermal Insulation / Vermiculite	> 1m ²	Type 3	2.4
Plaster	< 1m ²	Type 2	2.2
Texture Finish	> 1m ²	Type 3	2.4
Drywall Joint Compound	< 1m ²	Type 1	2.1
	> 1m ²	Type 2	2.2
Pipe Insulation – Aircell	< 1m ² or can be contained in a glove bag for removal	Type 2 or Type 2 Glove Bag	2.2 or 2.3
	> 1m ²	Type 3	2.4
Pipe Insulation – Parging Cement	< 1m ² or can be contained in a glove bag for removal	Type 2 or Type 2 Glove Bag	2.2 or 2.3
	> 1m ²	Type 3	2.4
Duct Insulation	< 1m ² or can be contained in a glove bag for removal	Type 2 or Type 2 Glove Bag	2.2 or 2.3
	> 1m ²	Type 3	2.4
Acoustic Ceiling Tile	< 7.5 m ²	Type 1	2.1
	> 7.5 m ²	Type 2	2.2
Cement Products like	Hand Tools	Type 1	2.1
Transite pipe/board	Power Tools	Type 3	2.4
Vinyl Floor Tile	Hand Tools	Type 1	2.1
Vinyl Sheet Flooring	Power Tools	Type 3	2.4
Door/Window Caulking		Type 1	2.1
Putty		Type 1	2.1
Gaskets		Type 1	2.1
Fire Doors		Type 1	2.1
Asphalt		Type 1	2.1

End of Section

City of Toronto

Asbestos Management Policy

Purpose

It is the policy of the City of Toronto to:

- eliminate, or minimize to the extent possible, the potential for worker and tenant exposure to airborne asbestos fibres, thereby protecting their health, and
- maintain compliance with legislative requirements by appropriately managing asbestos in buildings on an ongoing basis as well as during any construction and renovation work that may potentially disturb any asbestos-containing material.

Application

This policy applies at all City-owned or leased facilities at which asbestos-containing materials are, or may be, present.

Specifically, it outlines owner responsibilities for implementing and maintaining asbestos management programs in every building with material which may contain asbestos. During construction projects, it outlines responsibilities of the constructor, every employer and workers engaged in or on the project, as well as responsibilities of the owner of the project. During repair, alteration, maintenance or demolition of a building, it outlines responsibilities of all workers and employers involved, as well as, responsibilities of the owner.

Definitions

Asbestos	Any of the following fibrous silicates: actinolite, amosite, anthophyllite, chrysotile, crocidolite or tremolite. Asbestos is most commonly found in sprayed-on insulation or fireproofing, fibrous or corrugated paper pipe insulation, cement pipe, drywall and drywall joint compound, floor and ceiling tiles.
Asbestos-containing material	Material that contains 0.5% or more asbestos by dry weight.
Building	Means any structure, vault, chamber or tunnel including, without limitation, the electrical, plumbing, heating and air handling equipment (including rigid duct work) of the structure, vault, chamber or tunnel.
Building asbestos record	A document that details the current location (by room, hallway, stairwell, etc.), type, condition and whether material is friable or non-friable of asbestos-containing material(s) in a facility, as well as associated inspection and repair records.
Building asbestos assessment and report	A document (showing material likely to be handled, disturbed or removed during demolition, alteration or repair work, whether or not material is asbestos-containing material, its condition, whether friable or non-friable and drawings, plans and specifications showing location of material in question) that is prepared in addition to the building asbestos record and provided to prospective contractors prior to

asking for tenders.

Friable material	Material that when dry can be crumbled, pulverized, or powdered by hand pressure and any material which is crumbled, pulverized or powdered. It is important to recognize that damage or deterioration may cause non-friable material to become friable.
Competent person	An individual meeting the definition of “competent person” under the Occupational Health and Safety Act. It means a worker who, (a) is qualified because of knowledge, training and experience to perform the work, (b) is familiar with the Act and with the provisions of the regulations that apply to the work, and (c) has knowledge of all potential or actual danger to health or safety in the work.
HEPA filter	A high efficiency particulate aerosol filter that is at least 99.97% efficient in collecting a 0.3 aerosol.
Homogenous material	Material that is uniform in colour and texture.
Owner	Includes a trustee, receiver, mortgagee in possession, tenant, lessee, or occupier of any lands or premises used or to be used as a workplace, and a person who acts for or on behalf of an owner as an agent or delegate.
Type 1 operations	Installing or removing ceiling tiles that are asbestos-containing if the tiles cover an area less than 7.5 square metres and are installed or removed without being broken, cut, drilled, abraded, ground, sanded or vibrated. Installing or removing non-friable asbestos-containing material, other than ceiling tiles, if the material is installed or removed without being broken, cut, drilled, abraded, ground, sanded or vibrated. Breaking, cutting, drilling, abrading, grinding, sanding or vibrating non-friable asbestos-containing material if the material is wetted to control the spread of dust or fibres and the work is done only by means of non-powered hand-held tools. Removing less than one square metre of drywall in which joint filling compounds that are asbestos-containing material have been used.
Type 2 operations	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.
Type 2 operations (ctd)	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. Enclosing friable asbestos-containing material. Applying tape or a sealant or other covering to pipe or boiler insulation that is asbestos-containing material.

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.

Breaking, cutting, drilling, abrading, grinding, sanding or vibrating non-friable asbestos-containing material, if the material is not wetted to control the spread of dust or fibres and the work is done only by means of non-powered hand-held tools.

Removing one square metre or more of drywall in which joint filling compounds that are asbestos-containing material have been used.

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.

Removing insulation that is asbestos-containing material from a pipe, duct or similar structure using a glove bag.

Cleaning or removing filters used in air handling equipment in a building that has sprayed fireproofing that is asbestos-containing material.

An operation that is not mentioned previously and may expose a worker to asbestos and is not classified as a Type 1 or Type 3 operation.

Type 3 operations

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.

The spray application of a sealant to friable asbestos-containing material.

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.

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.

Type 3 operations (ctd)

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.

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, 1998.

Conditions

Because of its fire-resistant properties, asbestos was extensively used in buildings as insulation around pipes and boilers, in sprayed-on fireproofing, in thermal/acoustic insulating boards, in ceiling and floor tiles, and in cement pipes.

The Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations (Ontario Regulation 278/05), made under the Occupational Health and Safety Act, outlines requirements for the management of asbestos (friable and non-friable) in buildings and safe work measures and procedures during construction and renovation. The requirement to incorporate non-friable asbestos-containing materials in building management programs comes into effect as of November 1, 2007.

Where the City of Toronto is the facility owner, all requirements of the regulation apply and must be complied with. Any City of Toronto division responsible for acquiring and maintaining City facilities [e.g. divisions who maintain their own facilities (e.g. Toronto Water, Parks, Forestry and Recreation); Facilities and Real Estate who acquire and maintain a number of City-owned facilities] in which asbestos-containing material is present must assume asbestos-related “owner” obligations under the Occupational Health and Safety Act and the Regulation respecting Asbestos on Construction Projects and Repair Operations.

When a City division is the tenant only, divisional management continues to assume the employer responsibility for protecting the health of employees. However, responsibilities are more limited as building management (whether external or another City division) assumes owner responsibilities.

On projects that are carried out on City-owned facilities, even where the City has not been deemed to be the constructor, the City maintains owner responsibilities and employer responsibilities for protecting the health of any employees located on-site.

Responsibilities

Division heads responsible for maintaining City-owned facilities will ensure that:

- responsibilities for asbestos management are clearly established and communicated for all plants/facilities/complexes/buildings, including multi-tenanted locations.

Management of divisions which acquire and maintain City-owned facilities will establish a system to ensure the following steps are taken:

- A list of buildings, indicating whether asbestos is present, is prepared and maintained.
- Funds are budgeted for preparing a building record (where previously none was required) or for updating an existing building record (to ensure compliance with current legislative requirements).
- Funds are budgeted for updating asbestos records at least annually.
- Funds are budgeted for asbestos remediation projects, as deemed necessary during asbestos inspections. If maintaining a facility where abatement is required for another City division, that division’s senior manager is advised of the need to budget for abatement.

In addition to the above, management of divisions which acquire and maintain City-owned facilities will also ensure the following actions are taken:

Building Acquisition or Lease

- When purchasing, leasing or otherwise acquiring facilities, every reasonable effort is made to ensure that acquired buildings are asbestos-free. In circumstances where this is not feasible or achievable, building asbestos records are obtained, wherever possible. At a minimum, if building asbestos records are not obtained during the acquisition process, asbestos inspections are performed by competent persons and building asbestos records are prepared prior to building occupancy.

Asbestos Record

- Evaluate the need for a building record according to new legislative requirements (whether friable or non-friable material containing 0.5% asbestos or greater is present). Should a record now be required, ensure building record is prepared by November 1, 2007.

- Review existing building record and revise as required to include non-friable in addition to friable asbestos-containing material by November 1, 2007.
- Review existing building records to ensure minimum number of bulk samples as defined by legislation have been collected by a competent person from an area of homogenous material and analyzed using specified method.
- Retain the master copy of each building asbestos record.
- Provide a copy of each building asbestos record to the corporate Occupational Health, Safety and Workers' Compensation Unit.
- Provide a copy of each building asbestos record to the senior manager(s) responsible for the work location and updates, as necessary. These senior managers are to ensure that a copy of the building asbestos record is available and maintained on site and that business unit health and safety staff are advised of the location of these records.

Asbestos Management Program

- Periodic routine inspections of asbestos-containing materials are performed by competent persons in facilities in which asbestos is present to determine its condition and results of these inspections are incorporated into building asbestos records. Reports are made accessible to the joint health and safety committee/health and safety representative for that location.
- Asbestos records are updated at least annually and if new information is available.
- Any incidents of accidental disturbance of asbestos-containing material are promptly abated.
- Repair orders, generated as a response to recommendations of joint health and safety committees/health and safety representatives, building users, health and safety staff and/or those employees who conduct periodic routine inspections, are promptly addressed.
- Employees, who work in the vicinity of asbestos-containing material, including employees of contractors, are advised of its presence.
- If friable material has fallen and is being disturbed such that exposure is likely, no further work is done until it is determined whether it is asbestos-containing material. The fallen material is cleaned up, removed and appropriately disposed of. If it is likely that the material will continue to fall, then it is repaired, sealed, removed or permanently enclosed.

Before Requesting Tenders or Arranging Work

- A detailed building asbestos assessment and report is provided to prospective contractors prior to asking for tenders, this is in addition to the building asbestos record.
- If the work of service providers may result in disturbance of asbestos-containing materials, they are advised of the existence of such materials, as well as required work protocols and procedures.
- Employees who perform work, which may disturb asbestos-containing material, are advised of the need to consult building asbestos records for work locations prior to beginning work.
- Arrangements for removal of asbestos-containing material as part of major renovations are made, whenever possible. At a minimum, all damaged or deteriorating material is removed during renovations.
- In the case of demolition work, remove to the extent practicable any asbestos-containing material that may be disturbed during the work.

Asbestos Work

- Written notification is provided to senior on-site managers prior to initiation of scheduled asbestos-abatement work. When work is of an emergency nature, E-mail or fax notification is provided.
- Asbestos remediation work is classified as Type 1, 2 or 3 as specified in Regulation 278/05 and appropriate work procedures are developed and implemented.
- The Ministry of Labour (MOL) is notified in advance by telephone and in writing of all Type 3 work and all glove bag work exceeding 1 square meter.
- Outside contractors retained for asbestos abatement work and their staff are competent and possess all

necessary registrations and permits before undertaking any work. As of November 1, 2007 all workers and supervisors involved in Type 3 work must have successfully completed an Asbestos Abatement Worker training program and Asbestos Abatement Supervisor training program, respectively, approved by the Ministry of Training, Colleges and Universities.

- Project managers who oversee the work of asbestos abatement contractors are appropriately trained and competent.
- Project managers are to review and revise, as appropriate, contract language to ensure that contractors hired by the City to conduct asbestos abatement are competent. Project managers are to seek confirmation (e.g. written documentation), as appropriate, that contractors hired by the City to conduct asbestos abatement are in compliance with legislative requirements (e.g. staff have successfully completed approved asbestos training programs as of November 1, 2007, staff wear appropriate respiratory protection and have been successfully fit-tested, specified work procedures are followed, required clearance air monitoring is conducted etc.). Project managers are to take immediate corrective action, either directly or indirectly, depending on constructor status, if any violations of safe working procedures are noted.
- Asbestos waste is transported and disposed of in accordance with regulatory requirements.
- If, in the course of work, material is discovered which was not identified in the asbestos assessment and report but which may be asbestos-containing material, work is stopped and the material is analyzed for asbestos content. The MOL and joint health and safety committee or health and safety representative are immediately advised by telephone and in writing.
- Written notice is provided in advance to the joint health and safety committee or health and safety representative if varying a measure or procedure from legislation. Varied measures or procedures must afford at least equal protection to workers.

Additional Requirements if Asbestos Work Conducted by City Staff

- All employees likely to be engaged in asbestos-related work are trained in (i) asbestos hazards, (ii) personal hygiene and appropriate work practices and (iii) use, care and disposal of respirators and protective equipment, including limitations, inspection and maintenance, proper fitting, respirator cleaning and disinfection. Training records are maintained. Retraining is completed on a routine and as-needed basis.
- Advise joint health and safety committee/health and safety representative of time and place that the above worker training is to be carried out.
- As of November 1, 2007, all workers and supervisors engaged in Type 3 work must have completed training programs approved by the Ministry of Training, Colleges and Universities.
- Asbestos work reports are completed for any workers engaged in Type 2 or Type 3 operations at least once every 12 months and immediately on termination of employment, or, for any employees who experience accidental exposure to asbestos. Reports are submitted to Employee Health staff with responsibility for the asbestos biomedical surveillance program.
- All workers engaged in cleaning and/or removing filters used in air handling equipment in a building with asbestos-containing sprayed fireproofing must have been trained in and follow Type 2 procedures.
- Ensure workers follow legislatively required procedures.
- Ensure workers are provided with appropriate personal protective equipment. For respiratory protective equipment, ensure these are provided within the context of a written respiratory protection program (which includes respirator fit testing).
- For type 3 work, ensure that a copy of clearance air test results are posted in the workplace and in a common area (if the building contains other workplaces) and a copy is provided to the joint health and safety committee/health and safety representative within 24 hours after the test results are received. The owner shall keep a copy of the clearance air test results for at least one year.

Management of all divisions that occupy buildings where asbestos is present will:

- Obtain and maintain the building asbestos record in an accessible location on-site.
- Supply a copy of the building asbestos record to the joint health and safety committee/health and safety representative responsible for the location and notify workers potentially exposed.
- Develop, in consultation with health and safety staff, job-specific safe working procedures for asbestos-related work.
- Schedule with health and safety staff asbestos training of (i) workers who may work in close proximity to asbestos-containing material and who may disturb this material and (ii) joint health and safety committee members/health and safety representatives who visually inspect accessible asbestos materials of which they are aware.
- Notify building management when they suspect damaged asbestos-containing material, requesting investigative and/or corrective action.
- Report and seek immediate corrective action if any violations of safe working procedures are noted.
- Advise employees and tenants of any scheduled or emergency asbestos-related work.

The Occupational Health, Safety and Workers' Compensation Unit's occupational hygiene staff will:

- Lead in the development of procedures, guidelines and training programs to facilitate compliance with this policy.
- Retain copies of building asbestos records, as provided by divisions, and maintain database of locations.
- Provide, or assist in provision of, asbestos training for those employees potentially exposed to asbestos.
- Assist in addressing employee asbestos-related concerns.
- Assist divisions in asbestos-related communications with the Ministry of Labour.

Health and Safety Consultants will:

- Monitor frequency of management's inspections.
- Based on joint health and safety committee/health and safety representative inspection reports and/or occupational health and safety staff inspections, recommend appropriate remedial actions or seek an occupational hygiene assessment.
- Assist in the provision of training and development of safe work procedures.

Employee health staff in Human Resources' Employee Health, Rehabilitation and Employee Assistance Unit will:

- Develop and assist City divisions in implementing an asbestos biomedical surveillance program.
- Co-ordinate asbestos-related health assessments with appropriate health care practitioners, in response to needs identified by departments.
- Review and communicate results of these assessments to employees and, to the extent legislatively required, with departments.
- Submit asbestos work report forms to the Ministry of Labour at the frequency required by legislation.

Joint health and safety committees/health and safety representatives representing employees at locations with identified asbestos-containing materials will:

- Inspect readily visible asbestos-containing material as part of their routine workplace inspections
- Bring deficiencies, if any, to the attention of area supervisors and occupational health and safety staff.

Workers will:

- Follow asbestos safe work procedures applicable to the work they perform.
- Advise their supervisors of any asbestos-related occupational health and safety issues or concerns.

- For workers engaged in Type 2 or 3 work, voluntarily participate in biomedical surveillance program.

The Occupational Health and Safety Co-ordinating Committee will:

- Monitor the implementation and effectiveness of this policy

Authority

The Regulation Respecting Asbestos on Construction Projects and in Buildings and Repair Operations
(O. Reg. 278/05)

Hazardous Waste Regulation (O. Reg. 347 as amended)

Corporate Asbestos Management Program

**ENDORSED BY: Occupational Health & Safety Co-ordinating Committee, (OHSCC),
June 6, 2007**

**APPROVED BY: City Manager
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City of Toronto

Asbestos Management Plan

ASBESTOS MANAGEMENT PLAN



Prepared by:
City of Toronto

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GLOSSARY OF TERMS

Amended Water	Water with wetting agent added for purpose of reducing surface tension to allow thorough wetting of ACM.
Asbestos-Containing Material(s) (ACM)	A material that contains 0.5% or more asbestos as measured by U.S. Environmental Protection Agency Test Method EPA/600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials, June, 1993.
Asbestos	Any of the following fibrous silicates: Actinolite; Amosite; Anthophyllite; Chrysotile; Crocidolite; Tremolite.
Asbestos Plan Manger	Also known as the District Manager of Operations, or Director of Operations or designated City of Toronto employee.
Asbestos Work Area	Area where work is being performed which will or may disturb ACM including overspray and fallen material or settled dust that may contain asbestos.
Building	means any structure, vault, chamber or tunnel including, without limitation, the electrical, plumbing, heating and air handling equipment (including rigid duct work) of the structure, vault, chamber or tunnel.
City	City of Toronto
Competent Worker	<p>In relation to specific work, means a worker who,</p> <ul style="list-style-type: none">• is qualified because of knowledge, training and experience to perform the work• is familiar with the Occupational Health & Safety Act and with the provisions of the regulations that apply to the work, and• has knowledge of all potential or actual danger to health or safety in the work.
Encapsulation	The application of a liquid sealant to asbestos-containing materials; the sealant may penetrate and harden the material (penetrants) or cover the surface with a protective coating (bridging sealants). Also called encasement. This is generally not advisable.

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Enclosure	<p>Enclosure of ACM means the construction of solid enclosure (walls, ceiling, bulkhead etc.) around ACM, or</p> <p>An Enclosure means the site isolation including hoarding walls, polyethylene sheeting and seals that isolates an Asbestos Work Area.</p>
Facility Manager	Also known as the Property or Building Manager. May be a City of Toronto employee or an employee of City of Toronto's Facility Management Service Provider.
Friable Material	<p>Material that:</p> <ul style="list-style-type: none">• when dry, can be crumbled, pulverized or powdered by hand pressure or• is crumbled, pulverized or powdered.
Glove Bag Removal	A method of removing friable insulation from a piping system using a prefabricated bag which isolates the section of insulation being removed. This is a Type 2 Procedure.
HEPA Filter	High Efficiency Particulate Aerosol filter that is at least 99.97 percent efficient in collecting a 0.3 micrometre aerosol.
HEPA Filtered Negative Pressure Unit:	Portable air handling unit which extracts air directly from the Asbestos Work Area and discharges the air to the exterior of the building after passing through a HEPA filter.
JHSC	<p>Joint Health and Safety Committee.</p> <ul style="list-style-type: none">▪ a joint health and safety committee established under section 9 of the Act,▪ a similar committee described in subsection 9 (4) of the Act, or▪ the workers or their representatives who participate in an arrangement, program or system described in subsection 9 (4) of the Act;
MOE	Ontario Ministry of the Environment.
MOL	Ontario Ministry of Labour.

GLOSSARY OF TERMS

Phase Contrast Microscopy (PCM)	A method which uses an optical microscope to determine airborne fibres, normally in an occupational setting. Particles are observed for shape and size. Results are presented as a number of fibres per cubic centimetre or millilitre of air (f/mL). The method of analysis in Ontario is based on the US National Institute for Occupational Safety and Health (NIOSH) Manual of Analytical Methods, Method 7400, issue 2, Asbestos and Other Fibres by PCM (August 15, 1994).
Transmission Electron Microscopy (TEM)	A method which uses an electron microscope to determine airborne asbestos fibres. Results are presented in fibres per cubic centimetre of air (f/cc). The method of analysis in Ontario is The U.S. National Institute of Occupational Safety and Health (NIOSH) Manual of Analytical Methods, Method 7402, Issue 2: Asbestos by TEM (Aug 15, 1994).
Type 1, 2 and 3 Procedures	Procedures defined under Ontario Ministry of Labour Regulation 278/05. The specific operations and their classification into these procedures are described under the Classification of Work Section.
US EPA	United States Environmental Protection Agency.

SECTION 1.0

1.0 INTRODUCTION

Asbestos is a designated substance in Ontario, governed by legislation under the Occupational Health and Safety Act, Regulation 278/05, *Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations*. This Asbestos Management Plan (AMP) has been prepared to ensure that asbestos containing materials (ACM) found in the building are not disturbed without taking appropriate precautions to protect the health and safety of City of Toronto staff, tenants and the general public. The AMP identified in this document will formally outline the current administration of the program, training requirements, detail safe guards and work procedures for asbestos in any of the buildings associated with City of Toronto. This AMP in present or revised form must remain in effect until all ACM have been removed from the building.

The substance “Asbestos” is one component of a group of dangerous chemical substances and biological agents that are customarily addressed in an overall Health and Safety program. The presence of asbestos in a building does not mean that the health of building occupants is necessarily endangered. As long as ACM remains in good condition and is not disturbed, exposure is unlikely. Where the material is handled or removed in an appropriate manner with safe guards to contain airborne fibre and protect the work force, exposure to the work force and to building occupants is also minimal.

It should be understood that the following are fundamental in the management of asbestos in buildings:

- Although asbestos fibres are hazardous, the risk of asbestos-related disease depends upon inhalation exposure to airborne asbestos fibres.
- Based upon available data the average airborne asbestos levels in buildings seem to be very low where ACM are not being actively disturbed. Accordingly, the health risk to most building occupants also appears to be very low. However it should be noted that personnel engaged in asbestos related work or those nearby suffer the greatest risk to exposure.
- Removal is often not a building owner's best course of action to reduce asbestos exposure. In fact an improper removal can create a dangerous situation where none previously existed. Full scale asbestos removal is only required in order to prevent significant public exposure to airborne asbestos fibres during building demolition or renovation activities.

Refer to Appendix A for further information regarding asbestos.

1.1 PURPOSE AND SCOPE

The AMP provides information and procedures for Asbestos Management in various City owned buildings. It applies to all categories of property with the exception of vacant lands. The AMP applies to all City of Toronto staff as well as all service providers and contractors performing work in City of Toronto facilities.

The AMP outlines the responsibilities of City staff in their roles as the Owner of buildings containing Asbestos-Containing Material (ACM), as tenants of a building with ACM and outlines requirements

for City personnel involved in acquisition of property which may contain ACM.

The AMP is a management system to control disturbance of asbestos-containing materials during demolition, renovation, alteration, maintenance, repair or other activities.

The AMP incorporates the following elements:

- Asbestos Assessments and Reassessments. These documents are part of the AMP and can be found at each facility and in Facility Manager's Office.
- Regulatory Requirements and the City of Toronto Policies.
- Roles and Responsibilities.
- Notifications.
- Training Requirements.
- Emergency Reaction and Procedures.
- Work Practices (Type 1, 2 and Glove Bag work).
- Record Keeping.
- Contractor Requirements.

1.2 PROGRAM STATEMENT

The City of Toronto's first concern is the health and safety of all tenants, employees and everyone who enters a City of Toronto property. City of Toronto is also committed to operate in compliance with the Ontario Ministry of Labour Regulation 278/05, *Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations* made under the Occupational Health and Safety Act and all other applicable regulations.

The City has established certain policies which exceed the minimum requirements of O. Reg. 278/05 as follows:

- Due to future management issues and additional costs incurred over the life of the material, if practical, the City will not utilize any ACM in new construction or installations.
- When remedial action is undertaken on friable sprayed ACM, the City will generally opt for removal of the ACM. Encapsulation or encasement will not be undertaken unless removal is not practicable in specific locations.
- When remedial action is undertaken on friable mechanical insulation both removal and repair (re-jacketing or encapsulation of mechanical insulation) will be considered depending on the extent of work required.

- Prior to leasing properties, (if practical) the City will have asbestos assessments performed in buildings constructed prior to 1986.
- Prior to leasing properties, if practical, the City requires that the Landlord remove all friable ACM at the Landlords sole expense.
- At existing properties when ACM is discovered during any improvement, addition, renovation, demolition, maintenance, repair of any kind, or at any other time, the City shall promptly remove the ACM from the Premises or the Building.
- No City staff shall undertake any asbestos operations as defined as Type 3 in O. Reg. 278/05 other than as required by an emergency situation.
- All Type 3 asbestos operations shall be undertaken by an Asbestos Abatement Contractor.
- Type 1 and Type 2 work may be undertaken by either City staff (if they have employees with appropriate training, as per the City of Toronto's asbestos management policy dated July 2007, on site) or an Asbestos Abatement Contractor.

1.3 PROGRAM ELEMENTS

1.3.1 Asbestos Inventory

A record of the locations of friable and non-friable ACM has been established for the building in a Hazardous Materials Survey. This document is to be made available to all persons that enter the building and are likely to work in close proximity, disturb or handle ACM.

The Asbestos Survey will be available in the building with the Building Manager or Maintenance office. Additionally, the document will be maintained by the Asbestos Plan Manager in the main offices of City of Toronto.

A description of ACM in this facility is included in Designated Substance Survey that is available in the Facility Manager's Office. If assessments have not been performed for a building (and hence is not in compliance with Regulation 278/05), use the information in this section as a minimum for an asbestos assessment.

All City Facilities shall have an asbestos assessment report that includes friable and non-friable ACM. The survey shall be conducted on a room by room basis and shall indicate the location, condition, friability, accessibility and type of asbestos present in the Facility as outlined below.

As the survey will be typically performed for maintenance purposes it will not usually include destructive sampling that may destroy the material or damage the building. Typical materials that will not be part of the assessment include: roofing felts, drywall, window caulking and mechanical gaskets.

The survey must include the information gathered on a room-by-room basis together with recommendations for asbestos management, control or removal for each material detected in each location. The location of materials suspected to contain asbestos but shown by analysis to be non-

asbestos shall be reported. The original laboratory report of all analyses shall be provided as part of the report. Samples are to be collected at a rate that is in compliance with the requirements of O.Reg. 278/05, which states a minimum number of samples are to be collected and analyzed from each area of homogeneous material for the material to be considered non-asbestos. This frequency is indicated in the table below. A homogeneous sampling area is defined by the US EPA as containing material that is uniform in texture and appearance, was installed at one time and is unlikely to consist of more than one type or formulation of material.

Type of Material	Size of Homogeneous Material	Minimum Number of Bulk Samples
Surfacing material, including without limitation material that is applied to surfaces by spraying, by troweling or otherwise, such as acoustical plaster on ceilings, fireproofing materials on structural members and plaster	Less than 90 square metres	3
	90 or more square metres, but less than 450 square metres	5
	450 or more square metres	7
Thermal insulation, except as described below	Any size	3
Thermal insulation patch	Less than 2 linear metres or 0.5 square metres	1
Other materials	Any size	3

1.3.2 Administration

The administration of the AMP is provided in Section 2.0 of this document and includes various flow charts.

1.3.3 Operations and Maintenance

This segment of the AMP deals with the day-to-day operations where the ACM will remain in the building. An Operations and Maintenance Program will remain in effect until all ACM are removed from the building.

Elements of the Operation and Maintenance Program, found in Section 3.0 of this document, includes:

- a) Periodic Building Inspection and Annual Assessment of ACM,
- b) Notification of Tenants,
- c) Training,
- d) Employee Protection,
- e) Medical Surveillance,
- f) Work Authorization,
- g) Waste Disposal
- h) Air Monitoring,
- i) Equipment.

It is City of Toronto's intent at this time that no employees will be required to handle or remove any Type 3 Abatement of ACM. Those employees who may be required to work in close proximity to ACM will undergo awareness-training sessions. The Asbestos Plan Manager, Building Manager and Maintenance Supervisors may be required to have additional training as detailed in Section 3.9.

An Asbestos Training Manual has been developed to reflect the content of the training sessions. In addition the Occupational Health and Safety division will maintain a list of personnel having received in-house training.

1.3.4 Work Procedures

Prescribed procedures for the handling and removal of ACM are provided in Section 4.0 of the AMP. Appendix G addresses major and minor removal projects undertaken by an abatement contractor. .

1.4 REGULATORY REQUIREMENTS

At present three regulations govern the control, handling, transport and disposal of asbestos in Ontario.

Refer to Appendix B for further reference materials regarding regulatory requirements.

TABLE 1.1 – Summary of Legislation

STATUTE AND REGULATION	REGULATION REFERENCE	REGULATION AMENDMENTS
Occupational Health and Safety Act - R.S.O. 1990, c.O.1 <ul style="list-style-type: none"> <i>Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations</i> http://www.elaws.gov.on.ca/DBLaws/Regs/English/050278_e.htm 	R.O. 278/05	No amendments.
Environmental Protection Act - R.S.O. 1990, c.E.19 <ul style="list-style-type: none"> <i>General – Waste Management</i> http://www.elaws.gov.on.ca/DBLaws/Regs/English/900347_e.htm 	R.R.O. 347	Regulation of Ontario 183/92, 240/92, 501/92, 555/92, 457/93, 507/93, 105/94, 190/94, 298/94, 299/94, 512/95, 128/98, 157/98, 191/98, 460/99, 558/00, 501/01, 323/02, 326/03, 461/05.
Dangerous Goods Transportation Act - R.S.O. 1990, c.D.1 <ul style="list-style-type: none"> <i>General</i> http://www.tc.gc.ca/acts-regulations/GENERAL/T/tdg/regulations/tdg001/part_1.htm 	R.R.O. 261	Regulation of Ontario 269/92, 190/95, 252/02.

1.4.1 *Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations*

The AMP outlines procedures to maintain compliance with Ontario Regulation 278/05, *Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations*, made under the Occupational Health and Safety Act. Ontario Regulation 278/05 applies to maintenance, renovation or demolition work where ACM is or may be disturbed.

The major requirements to building owners under this regulation include:

1. Provision of establishing an asbestos survey report outlining the locations, quantity, condition and content of asbestos in material in the building to all prospective

contractors who are likely to handle or disturb the material.

2. The asbestos survey report shall contain the following information,
 - The location of material,
 - Whether the material is friable or non-friable,
 - In the case of friable sprayed-on material, for each location, i) if the material is known to be ACM, the type of asbestos, if known, or ii) in any other case a statement that the material will be treated as though it contained a type of asbestos other than chrysotile.
3. Advising workers of the building owner who may work in close proximity to ACM and who may disturb the material.
4. Periodic inspection of the material to determine its condition, including an annual update of the asbestos survey report.
5. Implementation of appropriate control measures, where required, following the precautions and procedures prescribed by the Regulation (Type 1, Type 2 or Type 3 operations). The classification of the work depends on the type of material, procedures used and the quantity of material to be disturbed. Refer to Table 1.2 Classification of Asbestos Work for further information.
6. Establishment of a training program for employees of the owner who are likely to handle ACM.
7. Annual submission of an asbestos work report form for each employee working in a Type 2 or Type 3 operation.
8. Removal of ACM, to the extent practicable, prior to demolition of a building, or part thereof.

There are more than 3,000 uses of asbestos reported in the literature; most of these are hard or non-friable materials. Ontario Regulation 278/05, effective November 1, 2007, does require that the location of non-friable materials be included in the report. Work on non-friable materials including installation, removal, breaking, cutting, drilling, abrading, grinding, sanding and vibrating is covered in the Regulation and procedures for such work are specified. Before any major renovation work or demolition is performed, non-friable materials suspected of containing asbestos (roofing materials, floor tile, ceiling tile, etc. which have not previously been identified) which could be disturbed should be analysed for asbestos content.

The assessments did not include a number of non-friable materials that may contain asbestos (vinyl floor tiles, plaster surfaces, roofing felts, window caulking, elevator brakes, etc.) nor did it include demolition of walls, ceilings etc. to check on concealed conditions. The City of Toronto requires that all non-friable materials are to be assumed to contain asbestos unless sampling indicates otherwise. The City of Toronto recommends that prior to renovations, maintenance work or building demolition, materials that

may potentially contain asbestos, which have been sampled for the purpose of the survey report, must be sampled and analyzed to determine the asbestos content.

1.4.2 Environmental Protection Act, General - Waste Management

Ontario Regulation 347, as amended, under the *Environmental Protection Act, General - Waste Management*, regulates asbestos waste from the location of generation, transportation to and acceptance at an approved land fill site.

The major requirements to the building owner are as follows:

- To ensure that all asbestos waste is packaged and labelled as prescribed;
- That the transport vehicle is placarded as prescribed; and
- That the asbestos waste arrives at the landfill site on the same day as received by the waste transporters and by the most direct route.

1.4.3 Dangerous Goods Transportation Act

The Dangerous Goods Transportation Act, R.S.O. 1990, Chapter D.1, governs the packaging mode of transport labelling, placarding and documentation of the asbestos waste while in transport. These requirements are in addition to Ontario Regulation 347.

The building owner is also responsible for the waste while in transport.

SECTION 2.0

Administration

2.0 USE OF THIS MANUAL

This manual contains the information and procedures required for administering, implementing and maintaining an effective AMP for any building.

Procedures for the safe handling, repair, and removal of ACM are detailed for staff, outside contractual forces and service personnel. All parties involved in the program should review those sections of the document appropriate to their level of work and thoroughly understand their requirements and responsibilities. Additional procedures for employee protection and waste disposal are provided and referenced in numerous locations in the repair/removal procedures. When this information is referenced, it should be reviewed before proceeding with the work so that the correct safety procedures are followed.

The detailed Asbestos Survey document must be referred to prior to doing any work, if there is any doubt concerning the location of ACM. Sections of the manual may be issued as instructions to service or maintenance personnel or asbestos abatement contractors to ensure compliance with City of Toronto procedures. The program itself is dynamic in that the manual can be modified and altered to reflect changes in regulatory requirements, administration or work procedures.

2.1 ADMINISTRATION OF THE ASBESTOS MANAGEMENT PLAN

An effective management system is essential to ensure that all planned and unplanned disturbances of ACM are handled according to established procedures. This AMP consists of three distinct facets as follows:

- Asbestos location documentation delineating where asbestos is found within the building;
- An Operation and Maintenance Program to deal with the ACM that are left in place until removal is contemplated; and
- Procedures for major abatement projects where the ACM are removed from all or major segments of the building due to deterioration, for renovation or for other reasons.

The AMP for City of Toronto will be administered by an assigned site representative who will be responsible for the co-ordination and effectiveness of the Program. The co-ordinator for the Program will be referred to as the “Asbestos Plan Manager” in this document.

The following City personnel have responsibilities for establishing and maintaining the AMP.

2.1.1 Personnel Involved in Acquisition or Leasing to the City of Toronto

Personnel involved in Acquisition or Leasing to the City shall:

- 3 Prior to leasing or acquiring properties, City staff will have asbestos assessments performed in buildings.
- 4 Prior to leasing properties, if practical, City staff requires that the Landlord remove all friable ACM at the Landlords sole expense.
- 5 Prior to occupying acquired properties, City selected Abatement Contractor will remove ACM in any spaces renovated by City, or will negotiate to have vendor remove ACM prior to purchase. Preference is that asbestos abatement work be done under City supervision to ensure thoroughness.

2.1.2 Personnel Leasing To City Of Toronto Tenants:

Personnel involved in Leasing to City Tenants shall:

1. Ensure all leases signed by tenants of City include reference to this AMP and that tenants are to follow the requirements of the AMP.
2. City will remove accessible ACM that may be disturbed, from spaces to be leased, prior to tenant occupying space and performing renovations.

2.1.3 Facility Manager

The Facility Manager shall:

1. Ensure that an asbestos assessment has been performed for all facilities constructed or occupied prior to 1986. Where such a survey has not been performed in pre-1986 facilities, arrange for a room-by-room survey of the facility. For facilities constructed after 1986, asbestos assessment will be performed for all non-friable materials that may be present (i.e. transite rain water leaders and sheets, gaskets and roofing materials). Notify the JHSC representatives and employer in the building to ensure that all aspects of committee involvement are complied with.
2. Ensure the asbestos assessment report is available on site.
3. Notify in writing all existing and new Tenants of City (Management Representatives) at the location of asbestos, of the information in this record (modify and issue Tenant Notification Letter as appropriate – Appendix C).
4. Notify staff and outside contractors or service providers who may work with or may disturb the material in the record of its presence and location (issue Contractor Notification Letter as appropriate – Appendix D).
5. Measures are implemented to prevent accidental disturbance or further damage to ACM;

6. Arrange for the reassessment of asbestos-containing materials at regular intervals and ensure the asbestos assessment report is updated at least annually, or when new information is obtained as ACM is removed or it's condition changes.
7. He or she is informed of all upcoming work;
8. Arrange for the abatement of deteriorated ACM reported in the asbestos assessment report or in reassessment reports using the appropriate procedures (Type 1, Type 2 or Type 3 procedures).
9. The work is properly arranged for and scheduled;
10. Ensure all Project Managers, Architects, Engineers and others arranging for or planning work in the Facility are provided with necessary information on ACM and a copy of the Asbestos Survey or record. Ensure that an intrusive pre-construction assessment for friable and non-friable ACM is performed prior to any renovation, alteration or demolition. Ensure this information is provided to Constructor in plans, drawings or specifications. Such assessments shall include destructive investigation where necessary.
11. The person(s) scheduled to perform the work are trained (as per approved training developed by the Ministry of Training, Colleges and Universities or equivalent in the case of Type 3 work), and in the case of a Contractor, that the firm is qualified;
12. The person(s) responsible for overseeing the work has/have been advised;
13. Ensure that Tenant Management Representatives, JHSC and/or building occupants are informed in advance of projects which will require asbestos abatements.
14. Arrange for training for City staff (refer to Training Section 3.9).
15. Proper procedures are being followed for the handling, storage and disposal of ACM waste;
16. Arrange for awareness training on asbestos for building occupants as required to respond to concerns over the presence of asbestos or planned asbestos work when required.
17. Ensure that procedures are in place in the Facility to respond to emergencies involving asbestos by using City Personnel or an Asbestos Abatement Contractor.
18. Maintain all documentation required by this program, including but not limited to: Asbestos Management Program, Asbestos Assessment Reports and Reassessments, Tenant Notification Letters, Contractor Notification Forms, Asbestos Project Work Records, Training Certificates and Respiratory Protection Programme – i.e. records of fit testing.
19. Upon unexpected discovery of suspect ACM, or upon an uncontrolled asbestos spill or disturbance, follow the emergency procedures of Appendix E. Ensure all City personnel

that may report an emergency are aware of contact names and numbers.

20. Arrange for the inspection and air monitoring of asbestos work in the facility as required by O. Reg. 278/05 and this AMP, when contracted by Facility Manager.
21. At the completion of the work, to allow updating of the asbestos assessment report to reflect altered location and condition of ACM, complete the Asbestos Project Work Record in Appendix F for each project during which asbestos is removed that is managed by the Facility Manager.
22. Inform JHSC committee of any sampling or testing as they have a right to be present during testing if desired.
23. When major renovations or demolitions are undertaken, the procedures outlined in Figure 2.4 should be followed. Asbestos documentation may include but not be limited to the following:
 - Periodic Inspection Reports,
 - Damage Reports,
 - Emergency Response Reports,
 - Record of Asbestos Repair or Removal,
 - Asbestos Bulk Sample Reports,
 - Air Monitoring Reports,
 - Ministry Correspondence,
 - Contractor Correspondence,
 - Requests for Information,
 - Asbestos Contracts and Specifications,
 - Training Courses,
 - Joint Health and Safety Committee Reports.

2.1.4 *Project Manager*

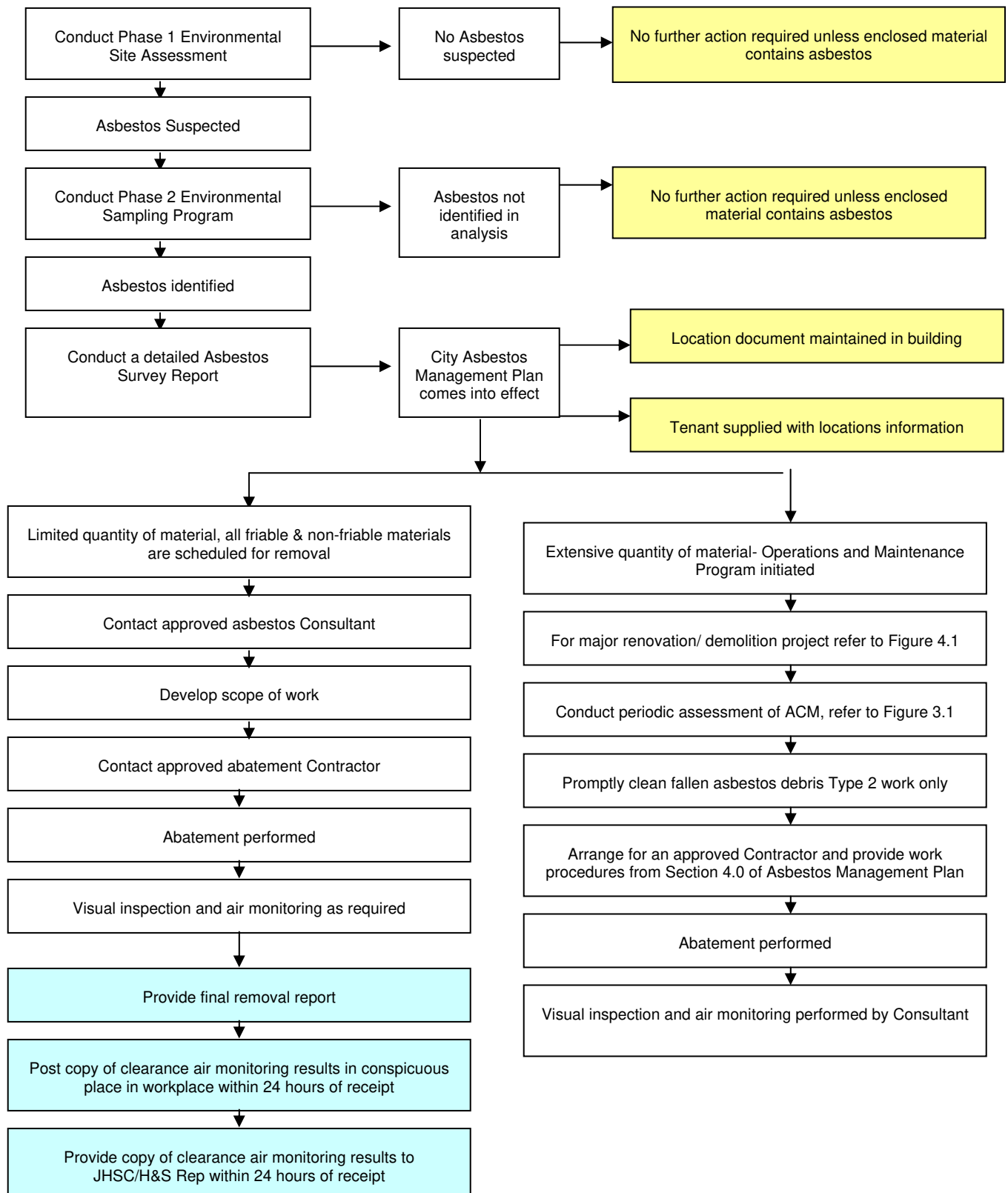
Project Managers (may also include Building Maintenance Managers) who plan, arrange for or oversee work in the facility shall:

1. Ensure that an intrusive pre-construction assessment for friable and non-friable ACM is performed prior to any renovation, alteration or demolition. Ensure this information is provided to Constructor in plans, drawings or specifications. Such assessments shall include destructive investigation where necessary.
2. Based on the results of the pre-construction assessment report, provide or arrange for the provision of appropriate specifications (Type 1, 2 or 3 operations) to Constructor to remove ACM from the work area.
3. Ensure all asbestos work in the facility is performed by Consultants and Asbestos Abatement Contractors who specialize in asbestos work and who have appropriate experience, equipment and insurance.
4. Arrange for the inspection and air monitoring of asbestos work in the facility as required by O. Reg. 278/05 and this AMP, when contracted by Project Manager.
5. Notify the Facility Manager of work requiring asbestos abatement precautions sufficiently in advance of work to allow Tenant notification.
6. Ensure all necessary notification of the Ministry of Labour for Type 2 and 3 Projects have been performed by the contractor prior to start of work and that all necessary forms are posted on site.
7. At the completion of the work provide information to Facility Manager to allow updating of the asbestos assessment report to reflect altered location and condition of ACM. Complete Asbestos Project Work Record in Appendix F for each project during which asbestos is removed or disturbed and submit to Facility Manager. The local JHSC must also be notified.

2.1.5 Facility Occupants And Tenant Representatives

All persons in the Facility who may arrange for maintenance or alteration of the Facility are to be made aware of the presence of ACM and shall:

1. Ensure all personnel who may work near the location of ACM are aware of its presence and follow the procedures outlined in this AMP.
2. Avoid unnecessary contact with or disturbance of ACM.
3. Report any disturbance, damage or deterioration of ACM to the Facility Manager.

FIGURE 2.1 – OVERVIEW OF ASBESTOS MANAGEMENT PLAN

2.2 RECORD KEEPING AND DOCUMENTATION OF AMP

The following records are to be kept by the Facility Manager for all sites with ACM:

- Asbestos Assessment Reports.
- Reassessment Reports.
- Tenant Notification Letters.
- Contractor Notification and Acknowledgement Forms.
- Asbestos Project Work Records.
- Inspection reports during abatement from Hazardous Materials Consultants.
- Bulk sample analytical results from any sampling.
- Abatement or emergency response project records.
- Air monitoring reports. Note clearance air monitoring reports must be retained for a minimum of one year.

This AMP is to be re-evaluated each time there is a substantial change to the Asbestos Regulation (O.Reg. 278/05).

2.3 CONTRACTOR REQUIREMENTS

Contractors hired by City are to meet the following minimum requirements:

- Must maintain a Comprehensive General Liability Policy, provided on an “occurrence” basis, for a minimum of \$5,000,000 in coverage.
- Must maintain an Asbestos Liability or Pollution Liability Policy, provided on an “occurrence” basis, for a minimum of \$5,000,000 in coverage.
- Must maintain an Automobile or Fleet Policy, and Non-owned Automobile Policy for a minimum of \$2,000,000 in coverage.
- Maintain a valid Workplace Safety and Insurance Board Clearance Certificate.
- All supervisors and workers performing Type 3 work are to have attended an approved Ministry of Training, Colleges and Universities, or equivalent, course regarding asbestos, as of November 1, 2007.

- All workers are to be fit tested for respirators and trained in respirator care.
- If City is signatory to any of the Labourers Union, Insulators Union or Painters and Allied Trades Unions, union labour must be provided by the contractor.
- For large projects, the Project Manager may wish to ask for references for 5 previous projects of similar scope and cost.

2.4 CUSTODIAL WORK

Where exposed asbestos-containing sprayed fireproofing is present, or exposed and badly damaged asbestos-containing materials are present, Custodial Staff are not to clean the area by dry sweeping. Instead, Custodial Staff are to call Facility Manager and arrange to have the Asbestos Abatement Contractor use a HEPA vacuum to clean floors. This is not an asbestos procedure, but a precautionary procedure to fully protect Custodial Staff from unexpected disturbance in the event that debris is present and unseen. Mopping is acceptable.

2.5 LOCATION OF ACM DOCUMENTATION

2.5.1 Introduction

City of Toronto will maintain up to date asbestos survey documents of their facility. Initial and subsequent surveys of the building will be performed using safe procedures that will not unnecessarily disturb existing ACM. The survey documents for the building will be maintained on site together with the AMP. Survey documents will be updated at least annually or more frequently where the condition or extent of ACM has changed and will continue to remain in effect until all ACM are removed from the building.

It is required that each property managed by City of Toronto be surveyed for the presence of friable and non-friable ACM. The findings of the survey shall be maintained in the form of a report, which will be kept on the premises and at the City of Toronto main offices.

The document will be provided in various forms to serve the various needs of the building or specific targeted group's special needs. The various document forms may include any of the following:

1. A master copy which details all known ACM in the building;
2. An overall floor plan, which indicates those locations in the building that have some kind of ACM; and
3. A summary of each individual Commercial or Residential Rental Unit for submission to the tenant or lessee whose premises will not be managed and maintained by City of Toronto.

The Asbestos Plan Manager shall administer the inventory of ACM in the building. The Program Manager shall be responsible for maintaining the inventory of the location of all ACM contained in the building. They will also schedule, co-ordinate, and authorize action necessary to complete initial and interval inspections of all buildings.

The reports will be modified and updated to reflect changes in the presence of ACM in the building as a result of removal, repair, damage, maintenance, construction, demolition, etc. The inventory shall be made available for inspection to Ontario Ministry of Labour Inspectors and to any building occupants as required by legislation.

The Asbestos Plan Manager may appoint the services of a Consultant specialized in the inspection of buildings for ACM as the need arises to provide building audits or to update existing surveys.

2.6 ASBESTOS SURVEYS

Regulation 278/05, *Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations*", made under the *Occupational Health and Safety Act*, requires building Owners to identify materials which may contain asbestos by either analysis or manufacture's documentation. The analysis is required only where work will be performed on building materials or where material is deteriorating and falling. Where asbestos is identified in building materials the building owner is required to implement a program to manage the ACM. Part of this program includes asbestos sampling to identify ACM and implementation of procedures for the periodic assessment, control, handling and disposal of the ACM. Asbestos identification in building materials is also a component of a designated substance list that must be issued to Contractors or service personnel prior to performing work.

2.7 BULK SAMPLE COLLECTION PROCEDURES

Bulk samples collected during the initial survey and all samples collected for future testing shall be collected following the procedures provided in Ontario Regulation 278/05. Following these procedures, samples can be collected by City staff, or by an Asbestos Consultant, under the direction of the Facility Manager or Project Manager.

2.8 BULK ANALYSIS

Bulk samples will be analysed for asbestos in accordance with O. Reg. 278/05 section 3(1)1. All analyses shall be performed by laboratories accredited in the US National Voluntary Laboratory Accreditation Program (NVLAP) or the American Industrial Hygiene Association (AIHA) asbestos in bulk sample programs.

2.9 OVERALL SITE FLOOR PLAN

Purpose

The purpose of the individual floor plan is to allow the Asbestos Plan Manager and the Maintenance Staff immediate recognition if a particular location in the building has ACM. For the type of material, location and asbestos content the information will have to be referenced in the “Asbestos Survey Report”.

Document Format

Individual floor plans will be provided for each floor of the building in standard building plan size. All areas where ACM are found will be shaded to clearly show where the asbestos is present in a room or area. The location of the ACM will be approximated as close to the location where it is found in the building as is reasonably permitted by visual observation. Legends will be developed depending on need and materials present.

Document Location

Copies of the floor plan will be maintained in the City of Toronto offices, with the Asbestos Plan Manager and with each Property Manager and with each building manager. Additional copies will be distributed on an as required basis.

Alternate Documentation

In the absence of a floor plan drawing, the Asbestos Survey Report will document the location of ACM in a clear and descriptive manner.

2.10 TENANT SUMMARY DOCUMENTATION

Purpose

The tenant summary document for individual commercial retail units or residential tenants will provide notification to all small commercial or residential tenants that will be managed and maintained by the tenant. This information is required under the Regulations so that the tenant can readily recognize the location of ACM and safeguard their staff against possible exposure to asbestos fibres. The tenants in turn must establish their own AMP for the leased space. For those units that City of Toronto maintain, the tenants are expected to operate under the City of Toronto AMP. Additionally this will permit City of Toronto staff to provide service personnel, maintenance personnel and contractors with detailed information as to the location of ACM in each rental unit.

Document Format

The information for each tenant unit shall consist of a single page entry on the floor plan including adjacent properties marked with coloured overlays showing the location of each of the ACM present. Key wording will describe the particular location of the material (i.e., a particular material may be found in the room space or concealed above solid plaster ceiling, etc.). Summary information in tabular form will compliment the drawing.

Document Location

Copies of this document shall be provided to each tenant and a master set maintained with the Asbestos Plan Manager. Additional copies may be distributed as required.

2.11 MASTER LOCATIONS DOCUMENT***Purpose***

The purpose of the master document is to consolidate all information on ACM for each individual building. This document will be available to the Asbestos Plan Manager, each Property Manager and Maintenance staff of the building.

Document Format

The document shall be arranged in two distinct sections, one to address the locations of ACM and the second to provide an assessment of the condition of the material with recommendations for appropriate corrective measures where required. The use of layout floor plans shall form an integral part of the report

Location Information Portion of Document

The document will include the following for the locations of ACM section of the document:

1. A survey methodology indicating limitations of the survey and whether destructive investigation was performed;
2. Bulk sampling and analysis methodologies used;
3. A site description with drawings showing the location and building additions; and
4. A summary of the location results, which shall include the following:
 - a) A room-by-room summary of ACM in the building. If applicable, the summary is also to be divided based upon building additions.
 - b) Separate floor plans showing the location of each ACM differentiating between friable and non-friable materials.

- c) A summary of analysis of bulk samples collected specifying the analytical method used and including floor plans showing the location where the bulk samples were collected.
- d) The type of asbestos and concentration within the material.

Once ACM has been removed, the Asbestos Plan Manager will update the locations document with the changes.

Assessment Information Portion of Document

The document will include the following for the assessment of the condition of the ACM section of the document:

1. A description of the assessment of ACM methodology.
2. A rationale for corrective action with a description of the options including:
 - Cleaning,
 - Repairing or sealing,
 - Enclosing, and
 - Removal.
3. A summary of assessment with recommendations for corrective action where required.
4. Individual recommendations for repair and any restrictions until repairs are completed will be listed with floor plans showing the location of each item.

Document Location

The master document for each facility shall remain with the Asbestos Plan Manager in the Administration office for City of Toronto and a site-specific document with each Property Manager or in the Maintenance Department office of each facility.

2.12 DISTRIBUTION OF ASSESSMENT RECORD AND REASSESSMENT

The Facility Manager is responsible for maintaining a copy of records, assessment reports and reassessment reports on site. In addition, the Facility Manager will ensure the following are provided with access (not additional copies) to these reports:

- JHSC representative.
- Tenant (in premises with ACM).
- Project Managers or Managers planning or performing work in a City Building.

SECTION 3.0
OPERATIONS AND MAINTENANCE
PROGRAM

3.0 OPERATIONS AND MAINTENANCE PROGRAM

3.1 INTRODUCTION

The identification, documentation and confirmatory analysis of ACM within a facility, is the first step in controlling building occupant exposure to asbestos fibres. Information generated from the building survey is then used by the Asbestos Plan Manager to control work that will be performed on or may likely disturb ACM. The purposefully managed and controlled work on ACM in buildings is known as the Operations and Maintenance Program.

The Operations and Maintenance Program is a set of specific procedures and practices applied to building cleaning, maintenance, renovation and general operation to reduce exposure to asbestos fibres to ambient levels (i.e. the outdoor environment). The Operations and Maintenance Program is initiated after the building survey is completed and draws heavily on information generated during that survey and any ongoing evaluations of the ACM. The Operations and Maintenance Program shall remain in effect until all ACM are removed from the facility.

The principal objective of an Operations and Maintenance Program is to minimize exposure to all building occupants from asbestos fibres. To accomplish this objective an Operation and Maintenance Program includes work practices to:

1. Maintain ACM in good condition,
2. Monitor the condition of ACM for deterioration,
3. Ensure a proper cleanup of asbestos fibres previously released, and
4. Prevent further uncontrolled releases of asbestos fibres.

The Operations and Maintenance Program is not a permanent abatement option. It should be implemented as part of an overall AMP that has a goal of eventual elimination of ACM within a building. The intent of the Operations and Maintenance Program is to manage the ACM on a daily basis including any repairs or minor removals. Large removal projects that require extensive planning and technical expertise are beyond the scope of the Operations and Maintenance Program.

The Operations and Maintenance Program includes the following elements:

1. The administration of the program, as discussed in Section 2.0, including assessing the impact of maintenance or renovation work on ACM and ensuring appropriate protective measures are implemented;
2. Conducting building inspections for renovations or demolition, periodic assessments (commonly referred to as Surveillance Programs) to evaluate the condition of the ACM to document any changes in the materials (i.e., deterioration) and to assess any spill episodes;
3. Providing building occupants (tenants and staff) with notification advising them on the locations of ACM in the building, as well as how and why uncontrolled disturbance of the material should be avoided;

4. Implementing control measures and procedures to limit building occupant exposure. Specialized work practices intended to avoid or minimize fibre release will include the following:
 - Cleaning procedures,
 - Work practices for maintenance activities,
 - Work practices for renovation, and
 - Emergency response procedures.
5. Record keeping documenting any operations and maintenance activities;
6. Training for the Asbestos Plan Manager, appointed designates, building managers, supervisory staff, custodial staff and maintenance personnel; and
7. Providing worker protection where staff is required to handle ACM and include:
 - A respiratory protection program, and
 - A medical surveillance program.

Additional work procedures may be included in the Program as determined by future needs. This will result in additions to the documented program.

3.2 PERIODIC BUILDING INSPECTION AND ASSESSMENT OF ACM

Periodic review of the Operations and Maintenance Program is essential to ensure that the program objectives are being met. A key feature of the review is re-inspection of all ACM in the building. Combined with ongoing reports of changes in the condition of the ACM made by service workers, the re-inspection will ensure that any damage or deterioration of the ACM will be detected and corrective action taken.

Inspection of the condition of the friable ACM will occur at three levels as required by legislation:

3.2.1 Routine Inspection

To be performed by maintenance staff and/or other qualified personnel, during their normal course of work. This is a casual inspection where deterioration or damage to an application or material shall be recorded and reported to the Building Manager who in turn will report the damage to the Asbestos Plan Manager. Necessary arrangements will then be made for remedial action where it is confirmed through documentation or additional bulk sampling and analysis that the material in question contains asbestos.

Upon discovery of damage the Damage Report (Figure 3.2) shall be filled in and arrangements can be made by the Asbestos Plan Manager, or designate, for repair if limited to a small disturbance. An outside firm specializing in asbestos inspection and abatement shall provide assistance where the disturbance is significant. All damage reports should be retained with the location report to assist in the formal inspection as described in the following.

3.2.2 Formal Inspection

An annual inspection (at least once in each 12-month period) will be made of the condition of all ACM in the building for all locations identified in the Asbestos Survey. The frequency of the inspection may be increased if the previous assessment indicates rapid deterioration or uncontrolled damage due to vandalism.

Formal inspections should be undertaken by a consulting firm, specialized in asbestos inspection and abatement. The auditor performing the inspection shall be qualified with a minimum of 5 years experience performing such inspections on projects of similar size and complexity.

Various assessment factors must be taken into account to evaluate each type of material. The assessment factors are:

- ACM condition (deterioration, physical damage, and water damage),
- Potential for disturbance (accessibility of the ACM, sources of vibration near the ACM, and potential for air and/or water erosion), and
- Location of the ACM in or near air plenums, airshafts, or elevator shafts.

For each time the formal inspection is performed the following should be recorded:

- Inspector's name,
- Date of inspection, and
- Notation of change (or lack of) in the condition of the ACM.

When an inspection reveals that remedial action is necessary due to deterioration, or that a situation exists that could result in deterioration, or that there is a risk of exposure to asbestos fibres, the Asbestos Plan Manager is to be informed. The need for corrective action is to be recorded in a similar format as per the initial assessment of the Building.

3.2.3 Pre-Renovation or Construction Inspection

An inspection of a building or section of a building is required prior to conducting any building renovation or construction to evaluate whether any ACM will be impacted. The inspection shall require intrusive methods to determine if concealed ACM is present. Additional sampling and analysis may also be required on any concealed materials or other materials not previously sampled. Confirmation of asbestos content can be determined by analytical results from visually similar material sampled in other locations.

3.3 REASSESSMENT OF ACM AND UPDATE OF SURVEY RECORD

The Facility Manager will arrange for a regular reassessment of all accessible areas identified by the survey to contain ACM. The reassessment will be performed at least annually if ACM is present. If a specific area is subject to any change of use, frequent maintenance which may disturb the material, or if any report of damaged or deteriorated ACM is brought to the attention of the Facility Manager, the reassessment of materials in the specific area shall be performed on a more frequent basis. Reassessment shall always be performed of specific materials when damage or deterioration is reported. The JHSC shall be notified of the reassessment and be invited to attend.

The reassessment of ACM will be documented in writing using the forms provided in Appendix H. The survey record should be updated based on these forms.

In Facilities which are entirely leased and in which neither City nor Facility Management Service Provider are responsible for maintenance, renovation or alteration of the initial survey and the reassessment are the responsibility of the landlord. Copies of the initial survey and reassessments shall be provided by the landlord to the Facility Manager and maintained on site.

3.4 DISTRIBUTION OF ASSESSMENT RECORD AND REASSESSMENT

The Facility Manager is responsible for maintaining a copy of records, assessment reports and Reassessment reports on site. In addition, the Facility Manager will ensure the following are provided with access (not additional copies) to these reports:

- JHSC representative.
- Tenant (in premises with ACM).
- Project Managers or Managers planning or performing work in a City Building.

3.5 PRE-CONSTRUCTION ASBESTOS SURVEY (SECTION 10 OF O. REG. 278/05)

Prior to the commencement of any renovation, construction or demolition project (including buildings built up to 1986/the present time), the building or specific areas of the building which are to be affected by the work, shall be assessed for friable and non-friable ACM. However, if the owner already knows that the materials within the building or specific areas which are to be affected by the work is not ACM, or if the owner already knows that the materials are ACM and knows the type of asbestos, or the building or specific areas have already been assessed, an asbestos survey is not required prior to the commencement of the renovation, construction or demolition. The survey must be performed by a specialized asbestos consultant and include destructive or intrusive testing of enclosed areas which will be affected by the work.

Upon completion of the pre-construction survey, if asbestos is present in the area, specifications for removal shall be prepared (Type 1, 2 or 3 as appropriate) and provided to the Constructor in the work specifications.

FIGURE 3.1 - PERIODIC INSPECTION OF ASBESTOS-CONTAINING MATERIALS

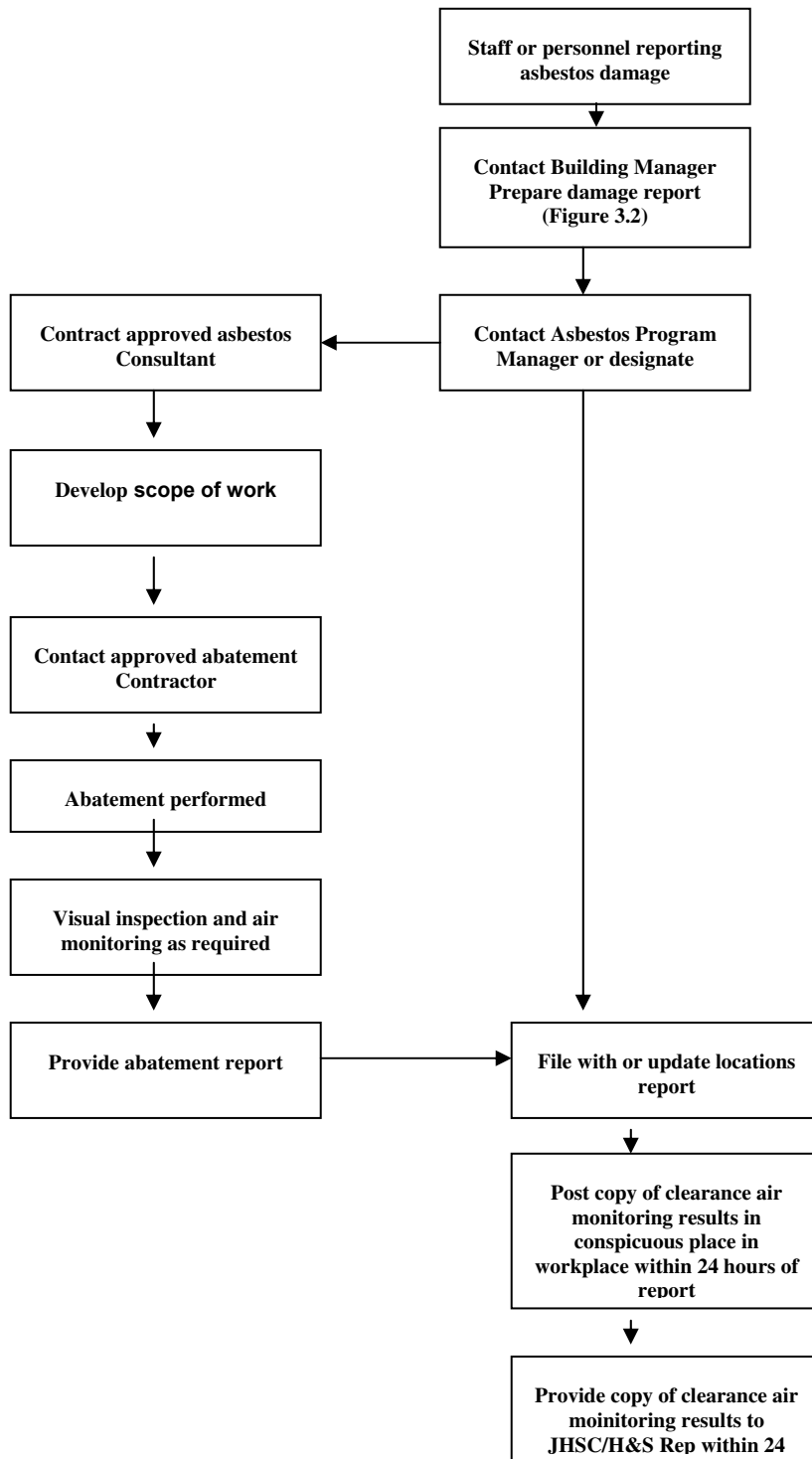


FIGURE 3.2 - ASBESTOS CONTROL PROGRAM DAMAGE REPORT

Reported By: _____ Date: _____

LOCATION DETAILS:

Building Name: _____

Building Section: _____

Room Name: _____ Room Number: _____

DAMAGE DETAILS:

Description of Damage:

Cause of Damage (If known):

Immediate Action Required:

YES _____ NO _____

Area Isolation Required:

YES _____ NO _____

SUBMISSION TO ASBESTOS PLAN MANAGER:

Name: _____ Position: _____ Date: _____

FOLLOW UP ACTION:

Asbestos Plan Manager: _____ Date: _____

Copies to: _____

This level of inspection is to be performed by a firm specializing in asbestos inspection and abatement. The auditor performing the inspection shall be qualified with a minimum of 5 years experience performing such inspections on projects of similar size and complexity. The locations document shall be updated following performance of the project.

Upon completion of the inspection, a report shall be generated and submitted to the Asbestos Plan Manager for submission to Contractors outlining the extent of asbestos that will be disturbed. The report shall use drawings to clearly delineate the extent of asbestos present in the construction/renovation area and the material requiring removal prior to conducting any other construction. NOTE: As per legislation, all ACM must be removed before renovations or construction can occur.

3.6 NOTIFICATION

Once the presence of ACM has been established in a building, a notification program is required by legislation. The purpose of the notification and warning program is to inform employees, tenants, service personnel, maintenance personnel, or others *with the potential* to come in contact with ACM, that ACM material is present.

The notification and warning program serves two purposes:

1. It alerts affected parties to a potential hazard in the building; and
2. It generates a broad involvement in the Operations and Maintenance Program.

Building occupants who are aware of the presence of ACM are less likely to disturb the material and cause fibre release. The notification to building occupants (i.e. staff and tenants) may include:

- Distribution of notices outlining the locations of ACM accompanied with a fact sheet on asbestos (Appendix A); and
- By holding awareness or informational seminars as outlined in the awareness training section of this manual.

All concerns relating to the condition of asbestos applications, reports or questions regarding the AMP are to be directed to the Asbestos Plan Manager. Notification will be initiated by the Asbestos Plan Manager and distributed in the following manner to targeted parties:

3.6.1 *City of Toronto Staff*

Individuals who have a potential to come into direct contact with ACM will receive formal training dealing with general asbestos awareness and recognition of potentially or hazardous situations and have full access to the master locations document for the building(s) under their responsibilities.

3.6.2 *Notification To Tenants*

Upon completion of the asbestos assessment, the Facility Manager will inform all Tenant Representatives of the presence of asbestos within their leased space and provide them with access to portions of the record regarding their premises and common areas. The letter of notification to Tenants regarding asbestos (Appendix C) shall be used for this purpose. This notice will be provided to all existing and new tenants as required.

3.6.3 *Service Personnel and Maintenance Personnel or Contractors*

All contractors and City employees who perform work at facilities where ACM is present must be notified of the presence of the ACM if their work may bring them into contact or close proximity to the ACM and they may disturb it. This notification may include janitorial, security, telephone, computer cabling suppliers, mechanical maintenance contractors, etc. This notification shall be performed by the Facility Manager or Project Manager.

All contractors and City employees who perform work at City facilities, where asbestos-containing sprayed fireproofing is present above ceilings, including telephone, computer cabling suppliers, electrical and mechanical contractors, etc., are to be notified that Type 2 Procedures are required for any entry to, or work within the ceiling space (visual inspection excepted, Type 1 Work). This notification shall be performed by the Facility Manager or Project Manager.

Upon completion of the asbestos assessment, the Facility Manager will inform Maintenance Personnel (including Physical Plant Personnel) of the presence of asbestos within the building and ensure they have access to the asbestos assessment report.

3.7 NOTIFICATION OF ASBESTOS ABATEMENT

Contractors are to:

- Notify orally and in writing, an inspector at the office of the Ontario Ministry of Labour nearest the project site (Notice of Project), as per Regulation 278/05, prior to commencing Type 3 abatement, Glove Bag abatement or any abatement project that exceeds \$50,000.00 in cost.
- Notify Sanitary Landfill site as per Ontario MOE Regulation 347 as amended.
- Inform all sub trades of the presence of ACM identified in the contract documents.
- Notify the Project Manager if suspect ACM not identified in the contract documents are discovered during the course of the work. The contractor is to notify the MOL and the JHSC if the friable material is asbestos containing, as required by Regulation 278/05.
- The Project Manager is to notify the JHSC of any testing or sampling that is

proceeding.

- The Project manager is to notify the Facility Manager, which in turn, is to notify tenants of any abatement work within their space or that will impact their operations. This is a procedural requirement, not a regulated requirement.

3.8 EMERGENCY PROCEDURES AND CONTACTS

3.8.1 *Fallen Debris Or Damaged Material*

City staff may encounter fallen material that is suspected to contain asbestos. This may occur in locations where asbestos has been documented or in areas not included in the Assessment due to limited accessibility, etc.

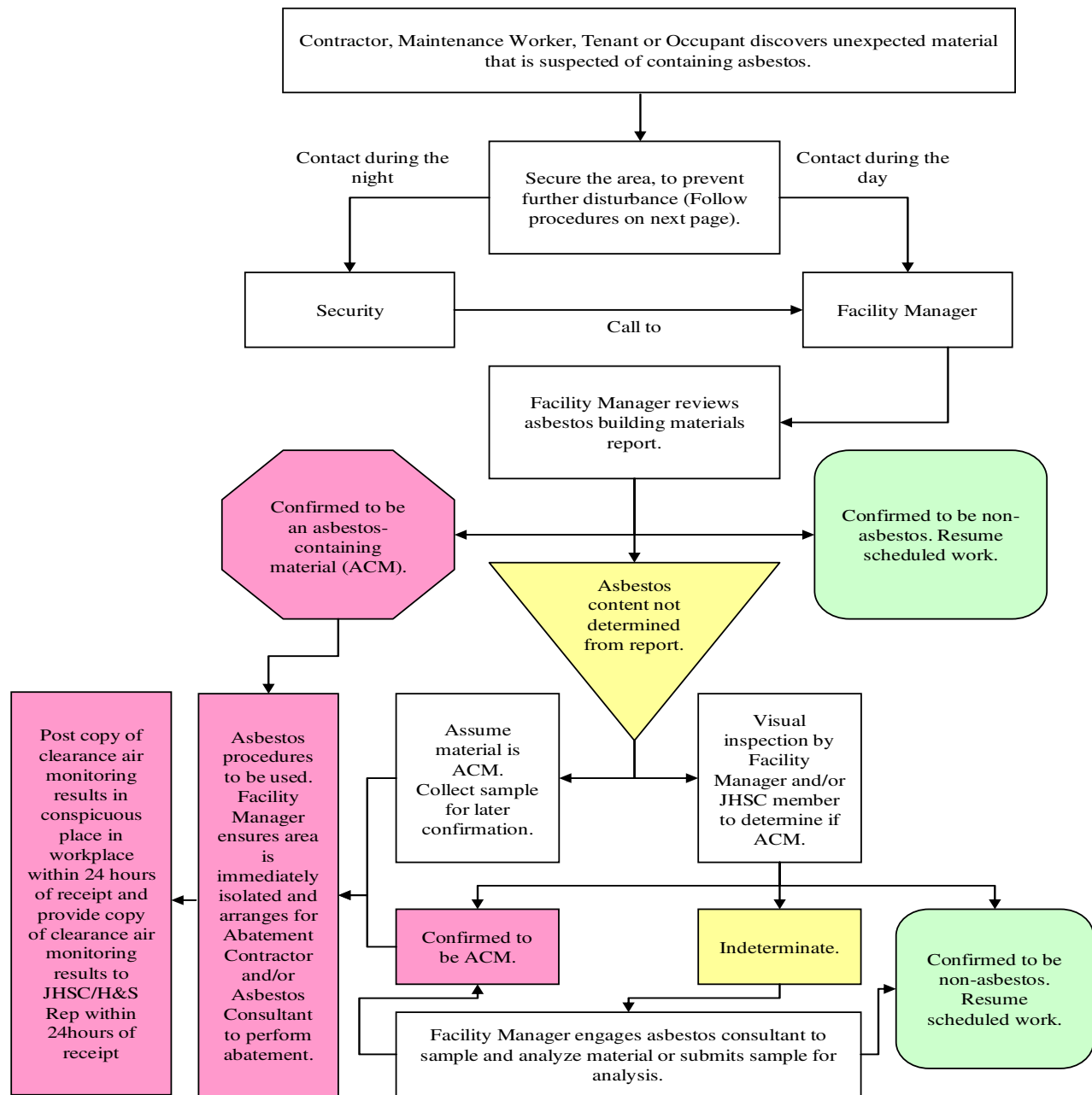
Facility Management shall follow the protocol “Emergency Reaction in the Event of a Suspected Asbestos Spill” (Appendix E).

In the event that Emergency Work must be undertaken, follow the procedures outlined in Appendix E – Work Practices for Emergency Work. All emergency situations shall be reported to the Facility Manager as soon as possible.

Emergency Contacts:

- Security: Emergency: 416 392 6666
- Security: Non- Emergency: 416 397 0000
- FRED: 416 338 3733
- Help Desk: 416 392 7995
- District Operations Manager: contact manager within the district
- Abatement Consultant:
 - ECOH Management: 905 195 2800
 - Fisher Environmental: 905 475 7755
- Abatement Contractor:
 - Furcon Environmental: 905 672 8314

FIGURE 3.3 - ASBESTOS EMERGENCY OR DAMAGE REPORTING



3.9 DISTURBANCE OF PREVIOUSLY UNIDENTIFIED FRIABLE MATERIAL

Previously unidentified friable materials may also be uncovered during demolition of finishes, walls etc. during construction. The Project Manager shall follow the protocol “Emergency Reaction in the Event of a Suspected Asbestos Spill” (Appendix E).

If the material contains asbestos, the Project Manager is to notify the local Ministry of Labour Office of the discovery. This is a regulated requirement.

3.9.1 Module 1: General Awareness Training

The "awareness seminar" is intended for all building occupants and other affected parties. It serves the purpose of occupant notification described in the previous notification section. The objective of the training is to provide a general awareness of the hazards of ACM. This module would also be suitable for building occupants other than employees who are concerned about the presence of asbestos in the building.

Session Content – Estimated duration of 2 hours

1. Health Effects of Asbestos Exposure;
 - Types and properties of asbestos,
 - Routes of entry,
 - Asbestosis, cancer, other health effects,
 - Effects of concentration and exposure duration.
2. Uses of Asbestos;
 - Products made from asbestos,
 - Risks of different types of materials (friable/non-friable),
 - Recognition of asbestos-containing building materials,
 - How asbestos in buildings can be a hazard.
3. Overview of Regulatory requirements;
 - Application to buildings,
 - AMP.
4. The AMP;

- Purpose of management program,
 - Elements of management program,
 - Person responsible for the program in a building.
5. Questions to Demonstrate Understanding.

3.9.2 *Module 2: Type 1 Work Training*

This session is designed for workers who are expected to be involved in Type 1 asbestos work only. The objective of the training is to enable the workers to identify work that requires Type 1 work procedures, understand the asbestos exposure hazard associated with the work, and to be able to carry out the work accordingly.

Session Content - Estimated duration of 7 hours

1. All of Module 1.
2. Overview of Regulatory requirements;
 - Requirements for testing insulation,
 - Classification of work,
 - Work procedures based on classification,
 - Medical surveillance.
3. Principles of Remedial Measures;
 - Enclosure, encapsulation, and removal,
 - Limitations of remedial measures.
4. Use and Interpretation of the Asbestos Record;
 - Should allow individual workers to identify where they may come into contact with friable asbestos material.
5. Limitations of Training;
 - Type of work that training allows worker to perform,
 - Who to contact in event of emergency.
6. Classification of Work;

- As prescribed by the regulation (Type 1 work procedures),
 - Work that employee may be required to perform.
7. Respirator Training;
- Theory of respirators,
 - Limitations of equipment,
 - Inspection, maintenance, and storage of equipment,
 - Selection, fitting and use of respirators,
 - Positive and negative pressure fit check,
 - Respirator cleaning and disinfection,
 - Record of worker training and fit testing,
8. Use, Care and Disposal of Protective Clothing,
9. Questions to Demonstrate Understanding.

3.9.3 *Module 3: Type 2 Work Training*

This session is designed for workers who are expected to be involved in both Type 1 and 2 asbestos work. The objective of the training is to enable these workers to distinguish between each work type. To understand the asbestos exposure hazards associated with the work, and to apply the appropriate procedures as prescribed by the Regulation.

Session Content – Estimated duration of 8 hours

Training should be related to actual jobs that each worker would be expected to perform. It is recommended that training for this module include hands-on experience in the use of respirators, protective clothing, portable enclosures, HEPA filter vacuums, etc.

1. Modules 1 and 2.
2. Asbestos Work Reports.
3. Type 2 Work Procedures;
 - As prescribed by the regulation,
 - Work that employee will be required to perform.
4. Biomedical Surveillance Program

5. Questions to Demonstrate Understanding.

3.9.4 *Module 4: Evaluating the Impact of Asbestos in a Facility*

This session is designed for building workers who are expected to inspect buildings for friable ACM or to evaluate whether the work will impact on ACM. The objective of the training is to enable these workers to survey buildings for and to assess the exposure potential of such materials.

Session Content – Estimated duration of 21 hours

1. Inspecting Buildings for Asbestos;
 - Reviewing building records,
 - Surveying building for ACM,
 - Where to look,
 - When to sample,
 - Precautions to be taken,
 - Sampling materials for analysis,
 - Preparing record of location of ACM.
2. Addressing the Risk of Asbestos Exposure;
 - Significance of the type of insulating material,
 - Significance of percentage of asbestos friability,
 - Effect of age and deterioration,
 - Evidence of physical or water damage,
 - Location and accessibility: potential for future disturbance,
 - Control options.
3. Workers carrying out inspections must also complete Module 3 training.
4. Questions to Demonstrate Understanding.

3.9.5 *Module 5: Outside In-depth Training*

Additional training may be required, on an as needed basis, for work beyond those described in the training packages presented in the AMP. The training may include attendance by City of Toronto personnel at seminars and courses presented by others pertaining to asbestos management or abatement. Course content may include detailed training for asbestos abatement or general information seminars. The Asbestos Plan Manager must authorize attendance in these programs. Asbestos workers must meet the requirements for Type 3 training as established by the Ministry of Training, Colleges and Universities and must also achieve a passing grade.

3.10 TRAINING

City employees will not undertake asbestos work other than for Type 1 and Type 2 work or in emergency situations in Type 3 projects. Therefore training shall be limited to the following:

Maintenance personnel and supervisors shall receive training in asbestos including identification of ACM, uses and hazards of asbestos, regulations applying to asbestos work and Type 1 and Type 2 work practices and safety procedures.

Facility and Project Managers shall receive training in asbestos management and removal and the AMP of sufficient content to allow them to implement the policies outlined in the AMP and to enable City to remain in compliance with O. Reg. 278/05.

Tenant Representatives and Building Occupants shall receive (upon request only) Asbestos Awareness Training. Such training may be provided in advance of a project incorporating Type 2 or 3 operations or if concern over asbestos is expressed by employees.

City requires all service providers, contractors, etc. to provide appropriate training to all workers who perform Type 1, 2 or 3 work in City Facilities.

In accordance with the Regulations, every employee working with ACM, or working in close proximity to ACM, and in a manner that may disturb the ACM, must partake in an information and training program. The program must be designed to instruct each employee in work procedures necessary to prevent exposure to asbestos fibres. Asbestos training is a continuous process with updates and reviews. The program will allow for re-training of current employees as well as ensuring that new hires are also given the proper training. Workers and supervisors conducting/overseeing Type 3 work must have proof of having attended training approved by the Ministry of Training, Colleges and Universities.

Training of building occupants and other affected parties is an integral aspect of an effective Operations and Maintenance Program. Training serves to establish the basis for proper awareness and work practices that will result in the effective implementation of the Operations and Maintenance Program. Training must be adequately developed and offered, on several levels, depending on the audience's particular participation in the program. Therefore, it is usually preferable to develop several training programs tailored to individual needs.

Asbestos training will be offered and provided on the needs of specific buildings as authorized by the Asbestos Plan Manager. At this time, City of Toronto staff are not permitted to conduct any Type 3 asbestos related work, and as such, a specialist Abatement Contractor will complete this work. The following training modules have been prepared as an outline to assist building owners in establishing

training requirements that will comply with the Regulations. The appropriate level of training will be selected based upon a person's role, function or responsibilities within the AMP. The Joint Health and Safety Committee/Health and Safety Representative must be advised of the time and place of any training provided.

3.11 PERSONAL PROTECTIVE EQUIPMENT PROGRAM

Any employee or building occupant with a significant potential for exposure to airborne asbestos should be involved in a personal protective equipment program. This is particularly relevant for custodial and maintenance workers who encounter ACM during the course of their duties. Additionally, outside maintenance personnel, service personnel and Contractors will be required to show proof of employee training in asbestos control procedures including a respiratory protection program.

City of Toronto have decided at this time that an experienced and qualified Abatement Contractor pre-selected by the Asbestos Plan Manager will perform all Type 3 work involving ACM for City of Toronto. No City of Toronto employee will be assigned Type 3 friable asbestos related work.

The information in this section is provided for reference only and not applicable at this time. Should this position change and selected employees will be required to conduct any type of work as specified in the Regulation 278/05, *Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations*, then training will be provided by a qualified Occupational Health and Safety Consultant. No work will be performed until specific training has been provided and the employee comprehension of the work has been evaluated by the Asbestos Plan Manager, and accepted as adequate. When initiating the Personal Protective Equipment Program, employee training shall include training with respirators and other personal protective equipment.

3.11.1 Respiratory Equipment

Respiratory requirements for work with asbestos are covered by Regulation 278/05, *Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations*. The requirements for use, selection, fit testing and storage of respirators are outlined in the following sections.

3.11.2 Requirement

1. Type 1 Operation - Respirator use is optional. If an employee requests a respirator while performing a Type 1 operation, the employee must wear the respirator. The specified respirator must be a half face or full face (for falling debris), air-purifying respirator with replaceable high-efficiency particulate filters.
2. Type 2 Operations - Respirator use is mandatory. This applies to all operations specified in this category. Depending on the nature of the work being performed, the following types of respirators may be required.

- Air purifying half-mask respirator with N-100, R-100 or P-100 particulate filter,
 - Air purifying full-face piece respirator with N-100, R-100 or P-100 particulate filter,
 - Or one of the following;
 - Powered air purifying respirator equipped with a tight-fitting face piece (half or full-face piece) and a high efficiency filter or N-100, P-100 or R-100 particulate filter,
 - Negative pressure (demand) supplied air respirator equipped with a full-face piece, or
 - Continuous flow supplied air respirator equipped with a tight fitting face piece (half or full-face piece).
 - NOTE: An Occupational Health & Safety Consultant must verify respirator requirements for specific asbestos removal work.
3. Type 3 Operations – Respirator use is mandatory. Different respirators are required depending on type of Asbestos and whether the ACM are removed wet or dry. Depending on the nature of the work being performed, the following types of respirators may be required.
- Pressure demand supplied air respirator equipped with a half mask.
 - Pressure demand supplied air respirator equipped with a full face piece.
 - Or one of the following;
 - Air purifying full-face piece respirator with N-100, R-100 or P-100 particulate filter,
 - Powered air purifying respirator equipped with a tight-fitting face piece (half or full-face piece) and a high efficiency filter or N-100, P-100 or R-100 particulate filter,
 - Negative pressure (demand) supplied air respirator equipped with a full-face piece, or
 - Continuous flow supplied air respirator equipped with a tight fitting face piece (half or full-face piece).
 - NOTE: An Occupational Health & Safety Consultant must verify respirator requirements for specific asbestos removal work.

In all cases the respirators provided must be approved by the US National Institute for Occupational Safety and Health (NIOSH).

Note: NIOSH publishes a certified equipment list. The approval number on the respirator and filter cartridge should be checked against the list to ensure that they are certified for use with asbestos. All respirators must properly fit the employee to afford adequate protection. The NIOSH certified equipment list link is <http://www.cdc.gov/niosh/94-104.html>.

3.11.3 *Fit-Testing*

The respirator must be fit-tested to ensure an effective seal on the face. The procedures, as outlined below, are to be followed when fit-testing a respirator.

1. Qualitative or Quantitative Fit Testing. Qualitative Fit Testing involves use of a challenge agent (either sweet or bitter).

This test is applicable to all respirator types and is performed at the following intervals:

- When a respirator is initially issued,
- Upon changing style, model or size of respirator, and
- Following any significant changes to the facial structure.
- Retraining is conducted at least every 2 years with a review conducted annually to confirm whether the respirator user remains qualified.

After the initial fit testing, the following are User Checks to be conducted by the respirator user before each use of the respirator:

1. Negative Pressure Test: This test is performed before each use of the respirator and is applicable to the negative pressure respirators only. Covering one or two filter inlets depending on type of respirator configuration with the palms of the hands and inhaling performs the negative pressure test. The face piece should collapse on the face with no air leakage around the mask.
2. Positive Pressure Test: This test is performed in conjunction with the negative pressure test before each use of the respirator and is applicable to the negative pressure respirators only. The positive test is conducted by covering the exhalation valve, usually located at the bottom centre of the respirator body, with the palm of the hand and exhaling gently. The face piece should puff slightly away from the face without allowing air to escape.

3.11.4 Maintenance

It is important to take proper care of a respirator in order to provide maximum protection. This requires regular maintenance and cleaning of the respirator and associated parts. Under no circumstances should a respirator with defective parts be used. Proper maintenance must include a visual inspection of the items listed in the following respirator checklist:

1. Examine the face piece for:
 - Excessive dirt,
 - Cracks, tears or holes,
 - Distortion and inflexibility, and
 - Cracks or breaks in filter holders, worn threads and missing gaskets.
2. Examine the head straps for:
 - Breaks or tears,
 - Broken or malfunctioning buckles and attachments, and
 - Excessively worn serrated edges on head harness, which might permit slippage (full-face pieces only).
3. Examine valves for:
 - Dust or other material on valves or valve seats,
 - Cracks, tears or distortion in the valve material, and
 - Missing or defective valve covers.
4. Examine filter cartridge for:
 - Proper filter for protection against asbestos (HEPA),
 - Incorrect installation, loose connections, missing or worn gaskets or cross threading, and
 - Cracks or dents in filter housing.

3.11.5 Cleaning

Respirators must be cleaned and disinfected after each use. Respirators shall be assigned to a person for their exclusive use, if practicable. The procedure listed below is to be followed when cleaning reusable full or half-face piece respirators:

- When removing mask from contaminated area of work, external surfaces must be cleaned by

damp wiping or with a High-efficiency filtered vacuum. Filter inlets should be sealed with either a protective cap, duct tape or disposed of,

- Remove the filter cartridges and damp wipe again placing them separately from the respirator body,
- Separate the parts of the respirator under water,
- Wash the face piece and components in warm water using a mild detergent,
- Rinse the face piece and components thoroughly in warm water,
- Place the respirator on a paper towel in a clean area to dry,
- Where disinfecting is required, for use by more than one person, a solution of 2 millilitres of laundry bleach to 1 litre of water will suffice or use manufacturers prepared disinfecting soap, and
- The respirator should then be place in a sealed container after it is dry.

3.11.6 *Storage*

Following cleaning of the respirator, it must be stored in a proper manner to ensure that it is kept clean and free of exposure to contamination from dirt, moisture and chemicals. After cleaning:

- Place the face piece and cartridges in a sealable plastic bag or container,
- Seal device, and
- Store the bag in a clean environment, away from any source of contamination, excessive heat or humidity and in an area where the respirator will not be crushed by any article or thing.

3.11.7 *Training*

Employees required to wear respirators during work involving asbestos will receive training in the use of respirators, covering:

- Theory of respirators,
- Limitations of equipment,
- Inspection, maintenance, and storage of equipment,
- Selection, fitting and use of respirators,

- Positive and negative pressure fit check,
- Respirator cleaning and disinfection, and
- Record of worker training and fit testing.

3.11.8 Protective Clothing

Each employee must be provided with and wear protective clothing when carrying out work involving ACM. This clothing shall consist of:

- Full body coveralls, and
- Suitable footwear.

The coveralls shall:

- Be made of a material which does not readily retain nor permit the penetration of asbestos fibres,
- Consist of a head covering and full body covering that fits snugly at the ankles, wrists and neck, in order to prevent asbestos fibres from reaching the garments and skin under the protective clothing, and
- Be repaired or replaced if torn.

The protective clothing must be put on in a suitable area away from the asbestos work area prior to beginning the work for Type 1 or 2 operations or in an attached change room adjacent to Type 3 work areas. The clothing is also to be decontaminated at the completion of the work prior to leaving the work area then disposed. Decontamination of clothing can be accomplished by either damp wiping or using a HEPA vacuum prior to removal.

3.12 MEDICAL SURVEILLANCE PROGRAM

The purpose of the medical surveillance program for Type 2 and 3 works is to establish an employee's fitness for duty (to wear a respirator, etc), and to detect any changes in the gastrointestinal and cardiopulmonary systems. Such changes may indicate the presence of an asbestos related disease.

City of Toronto has decided at this time that an experienced and qualified Abatement Contractor pre-selected by the Asbestos Plan Manager will perform all Type 3 work, with the exception of emergency Type 3 work, involving asbestos-containing building materials for City of Toronto. No City of Toronto employee will be assigned Type 3 friable asbestos related work, with the exception of emergency Type 3 work.

The information in this section is provided for reference only and is not applicable at this time. Should this position change and selected employees be required to conduct any type of work as specified in the

Regulation 278/05, *Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations*, then training will be provided by a qualified Occupational Health and Safety Consultant. No work will be performed until specific training has been provided and the employee comprehension of the work has been evaluated and accepted, by the Asbestos Plan Manager, as adequate. When authorized to proceed the employee and supervisory staff will comply with the requirements of this section of the Operations and Maintenance Program.

The main requirements of the medical surveillance program include:

- A physical examination, with emphasis on the cardiovascular and gastrointestinal systems, and
- A pulmonary function test, which includes the forced vital capacity (FVC) and the forced expiratory volume in one second (FEV).
- Chest X-ray

On the recommendation of the Ministry of Labour, Provincial Physician, a worker may volunteer to undergo the above tests initially and subsequently as recommended by his/her physician at least 2 years after the most recent exam. However, it is recommended that an initial chest x-ray be used in order to establish baseline conditions for the employee.

3.12.1 Employee Exposure Records

Regulation 278/05, *Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations* requires that an Asbestos Work Report form (see Figure 4.2) be maintained for each employee working on a Type 2 or Type 3 operation.

These work reports are to be submitted to the Provincial Physician; Ministry of Labour annually and when the employment of an employee is terminated. A copy of the form must also be given to the employees.

The procedure outlined below for recording the information and submission of reports is to be followed:

1. Employees;
 - Report the number of hours per day of working with ACM, as required, to his/her immediate supervisor.
2. Maintenance and Trades Supervisor;
 - Maintain a monthly log, as illustrated in Figure 4.3 for each employee involved in asbestos operations and include the following,
 - Number of hours daily,
 - Type of work performed (according to the classifications listed in the Asbestos Work Report),

- Employee information including Name, Address (home), Date of Birth and Social Insurance Number, and
 - Forward a copy of the individual employee log on a monthly basis to the Asbestos Plan Manager.
3. Asbestos Plan Manager;
- Maintain a file for each employee, containing the information forwarded by the employees supervisor,
 - Complete an Asbestos Work Report, containing all of the appropriate information for each employee and forward to the City's Employee Health and Rehabilitation section who will then forward to the Chief Physician, Occupational Health Branch, Ministry of Labour, on an annual basis. Medical surveillance would be coordinated through the City's EH&R section and
 - Forward a copy of the work report to each respective employee annually and on termination of employment.

FIGURE 3.4 – ASBESTOS WORK REPORT
Occupational Health and Safety Act/Loi sur la
santé et la sécurité au travail

For the Period/Pour la période
From/du **To/au**

This form is required under Section 21 of the Regulation for Asbestos on Construction Projects and in Buildings & Repair Operations.

Ce formulaire est requis en vertu de l'article 21 du règlement sur le travail avec l'amiante dans les projets de construction et de réparations d'édifices.

Asbestos Work Report/Rapport sur le travail avec l'amiante

Name of Employer/Nom de L'employeur			Employer's Address/Adresse de L'employeur	
Employee's Surname/Nom de l'employé	Given Name/Prénom	Init/Init.	Employee's Address/Adresse (Street No., Street, City, Postal Code/N° de rue, Rue, Ville, Code postal)	
S.I.N. /N° d'ass. Sociale	Date of Birth/Date de naiss. Y/A M/M D/J		Family Physician's Name and Address/Nom et adresse du médecin de famille	
Hours of Work/Heures de travail	Type 2		Type 3	
Return to: Provincial Physician Occupational Health & Safety Branch Ministry of Labour 655 Bay St 14 th Floor Toronto, ON M7A 1T7		Renvoyer au: Médecin provincial Direction de la sante et de la securite au Travail Ministère du Travail 655, rue Bay 14 th étage Toronto (ON) M7A 1T7		Signature of Employer/Signature de l'employeur
				Date
Distribution Part 1 Provincial Physician Part 2 Worker Part 3 Employer		Distribution Partie 1 médecin provincial Partie 2 travailleur Partie 3 Employeur		

FIGURE 3.5 - EMPLOYEE EXPOSURE RECORD

Employee: _____ Clock #: _____

Building & Department: _____

Period Starting: _____ Period Ending: _____

Employee Identification

Surname: _____

Given Names: _____

Address: _____

Date of Birth: _____

Social Insurance
Number: _____**Exposure Information**

Date of Exposure	Type of Work	Number of Hours
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3.13 WORK AUTHORIZATION

This section of the Operations and Maintenance Program deals with the authorization and issuing of work for the daily activities and occurrence in any specific building. All asbestos related work shall be authorized by the Asbestos Plan Manager in accordance with the following sections.

3.13.1 Maintenance/Renovation Permit System

An informal permit system will be initiated through the Asbestos Plan Manager or his designate for any maintenance or renovation work. All work that may potentially disturb ACM shall be funnelled through the Asbestos Plan Manager.

In the permit system, all requests for maintenance/renovation activities are given to the Asbestos Plan Manager prior to permitting the work to proceed. The Manager will check the building's asbestos records (files, computerized database, etc.) for information about the presence of ACM where work is to be performed. Additional testing for concealed or non-friable ACM in the actual area of work may also be necessary.

1. Where no asbestos is present, the work order is issued and the planned actions can proceed.
2. If ACM are present but will not be affected the work may proceed.
3. Where asbestos is present and the amount of material that will be disturbed is minimal, procedures appropriate to the work will be issued from Section 4 of this Manual, as applicable to the work, for service personnel, maintenance personnel or Contractor if adequately trained.
4. Where asbestos is present and impact will be extensive, an outside Consultant will be retained to prepare work procedures. In worst-case situations (e.g. large amounts of asbestos containing material, non-critical maintenance/renovation) work would be deferred until the ACM in the area can be dealt with in the proper manner.

3.13.2 Work Practices For Renovation and Remodelling

3.13.2.1 Renovation

Building renovation or building system replacement can cause major disturbance of ACM. Moving walls, adding wings, and replacing heating or air conditioning systems involve breaking, cutting, or otherwise disturbing ACM that may be present. Prior to renovation the removal of ACM is required. It is required by the Regulations to differentiate between Type 2 and 3 procedures for the quantity of material that will be disturbed. The following criteria should be used to guide the classification between the two work types. Type 2 work is the removal or disturbance of one square meter or less of friable ACM during the repair, alteration, maintenance or demolition of all or part of machinery or equipment or a building. Greater quantities than these values require the work to be considered a major removal

project and not part of the Operations and Maintenance Program.

3.13.2.2 Remodelling

Remodelling or redecorating implies less dramatic structural alteration. However, disturbance of ACM or materials contaminated with asbestos fibres is still possible. Where the remodelling involves direct contact with ACM all of the procedures and precautions specified would apply.

3.13.2.3 Specialized Cleaning Procedures

Four work criteria exist where specialized cleaning may be required. They consist of sections:

Appendix G – G-7: Cleaning, Stripping Wax from and Waxing Asbestos-Containing Floor Tiles - Type 1 Work in particular for tenants who may have extensive sections of vinyl tile;

Appendix G – G-8: Cleaning of Asbestos-Containing Debris – Type 2 Work;

Appendix G – G-9: Access and Cleaning above Suspended Ceilings – Type 2 Work where ACM may be found in a damaged condition; and

Appendix G – G-10: Cleaning Out Of HEPA Filtered Vacuum Cleaners, Asbestos Waste Storage and Disposal - Type 2 Work.

Studies have shown that cleaning, stripping or minor movement adjacent to ACM can, under some situations, release fibres and become hazardous. The following procedures are outlined to inhibit fibre release.

3.13.2.4 Special Work Practices for Maintenance Activities

Normal maintenance activities can disturb ACM and raise levels of airborne asbestos. Maintenance workers should be cautioned against conducting any maintenance work in a manner that may disturb ACM. Four work criteria are specified for handling various situations:

Appendix G – G-11: Work with Non-friable Materials and Manufactured Products – Type 1 Work generally involving removal of vinyl floor tile or removal of pipe gasket;

Appendix G – G-12: Repairing Thermal Insulation with non-powered tools – Type 2 Work where damaged thermal insulation applications are noted;

Appendix G – G-13: Asbestos Removal Using Glove Bags – Type 2 Work; and

Appendix G – G-14: Minor Asbestos Removal – Type 2 Work when the ACM must be removed.

3.13.2.5 Emergency Response Procedures

As long as ACM remains in the building, a fibre release episode could occur. Custodial and maintenance workers should report to the Building Manager, who in turn will report to the Asbestos Plan Manager, the presence of debris on the floor, water or physical damage to the ACM, or any other evidence of possible fibre release. Fibre release episodes can also occur during maintenance or renovation projects. The Asbestos Plan Manager should call an abatement contractor to clean up debris

and make repairs as soon as possible. If an outside contractor is to be used, the company should be retained for quick response action.

One procedure is provided for handling these episodes as follows:

Appendix G – G-15: Emergency Spill or Repair Response – Type 2 Work.

3.13.2.6 Minor Episodes

Minor episodes, such as a small section of insulation (less than 1 linear meter) falling from a pipe or a careless worker bumping into a beam and dislodging a small amount of fireproofing ACM (less than 1 square meter), can be treated with standard wet cleaning and HEPA-vacuum techniques.

3.13.2.7 Major Episodes

Major fibre release episodes are serious events. Large amounts of ACM falling from heights of several feet may contaminate an entire building with asbestos fibres. If 1 square meter or more of surfacing ACM or 1 linear meter or more of thermal system insulation delaminates or is dislodged from its substrate, the episode should be considered major. A large breach in a containment barrier for a maintenance or abatement project should also be considered a major episode.

3.14 WASTE DISPOSAL

City of Toronto has decided at this time that an experienced and qualified Abatement Contractor pre-selected by the Asbestos Plan Manager will perform all Type 3 work, with the exception of emergency work, involving asbestos-containing building materials for City of Toronto. No City of Toronto employee will be assigned Type 3 friable asbestos related work, with the exception of emergency Type 3 work.

The information in this section is provided for reference only and is not applicable at this time. Should this position change and selected employees be required to conduct any type of work as specified in the Regulation 278/05, *Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations*, then training will be provided by a qualified Occupational Health and Safety Consultant. Asbestos waste will not be stored in any building at this time except as part of a project.

Waste disposal requirements for work with asbestos are covered by the Revised Regulation of Ontario 1990, Regulation 347, as amended, under the *Environmental Protection Act General Waste Management*.

The abatement contractor will initiate shipment of the waste and will forward all records to the Asbestos Plan Manager. The Asbestos Plan Manager maintains all completed records of all shipments, as illustrated in Figure 3.6, of asbestos-containing waste and attachments. This record includes information on:

- date of shipment,
- number of drums / bags (estimated when in large quantities),
- destination,

- shipper, and
- shipment manifest/waybill number (include copy of the shipping manifest).

Reference must be made to the actual regulation in order to ensure that all of the requirements are being met.

FIGURE 3.6 - RECORD OF WASTE DISPOSAL

Building Name: _____

Address: _____

Date of Shipment: _____ Time of Departure: _____

Type of Waste: _____ Type of Container: _____

Number of Containers Shipped: _____

Waste Haulage Company: _____

Address: _____

Provisional Certificate of Authorization or
Certificate of Authorization Number of Hauler: _____

Waste Disposal Site: _____

Address: _____

Provisional Certificate of Authorization or Certificate
of Authorization Number of Disposal Site: _____

Date of Receipt: _____ Arrival Time: _____

Number of Containers Received: _____

Condition of Containers: _____

Copy of Shipping Documents and Bill of Lading on File: Yes _____ No _____

Signatures:

City of Toronto

Shipper: _____ Date: _____

Building Manager: _____ Date: _____

Asbestos Plan Manager: _____ Date: _____

3.15 AIR MONITORING

When a building is known to contain friable ACM, air monitoring may be carried out at the discretion of the Asbestos Plan Manager in order to reassure concerned staff or occupants, that the concentration of airborne-asbestos fibres does not exceed acceptable levels. In addition, air monitoring may also be performed during and at conclusion of abatement activities to verify that the work was performed in accordance with project specifications. Clearance air monitoring is required at the end of Type 3 abatement work.

In Canada, all existing legislation and environmental guidelines concerning permissible airborne asbestos fibre concentration are expressed in terms of fibres having lengths exceeding 5 micrometers. Table 3.1 lists the general permissible airborne asbestos fibre concentration criteria.

Table 3.1 – Asbestos Air Quality Criteria in Ontario

DESCRIPTION		FIBRE CONCENTRATION (fibres/cubic centimetre of air)
Time weighted average exposure of worker to airborne asbestos for an 8 hour day:		
All forms of airborne asbestos fibres ⁽¹⁾		0.1
Ambient Air Quality Criterion Over 24 Hours (average) ⁽²⁾		0.04
Clearance Value on Type 3 Work		0.01
Notes:	<p>(1) Ontario Regulation 278/05, as amended, – Designated Substance – Asbestos, made under the <i>Occupational Health and Safety Act</i>.</p> <p>(2) <i>Summary of Point of Impingement Standards, Point of Impingement Guidelines and Ambient Air Quality Criteria</i> (AAQCs), Standards Development Branch, Ontario Ministry of the Environment, December, 2005.</p>	

Air samples can be analysed by three methods: Phase Contrast Microscopy or Transmission Electron Microscopy by a laboratory specialized in the identification of asbestos in air samples following recognised methodologies. Although there are two methods, for Type 3 clearance testing, only the first two are outlined as methods to be used in the Regulation. Clearance air sampling at the completion of Type 3 abatement shall be conducted in compliance with Regulation 278/05 including the required number of samples and using forced air as per EPA Method 560/5-85-024. Clearance air sampling results must be posted in a conspicuous workplace location within 24 hours of receipt and a copy also provided to the JHSC/H&S Rep within 24 hours of receipt.

Acceptable Phase Contrast Light Microscope methodologies is:

1. Asbestos Fibres, NIOSH Method 7400 – Asbestos fibre counting rules (Latest Edition).

Acceptable Transmission Electron Microscope methodologies is:

1. Asbestos Fibres, NIOSH Method 7402 (Latest Edition)

3.15.1 *Air Sampling Program*

Air Monitoring will be performed by an outside Occupational Health & Safety Consulting firm specializing in this type of work with appropriate equipment and qualified personnel. Air monitoring requirements are broken down into two levels:

3.15.1.1 *Occupied Building*

Air quality checks in an occupied building where there may have been an asbestos disturbance or a need to establish fibre levels as established by the Asbestos Plan Manager.

Whenever feasible, City of Toronto will use the PCM method of air monitoring unless special circumstances indicate another method is preferable as determined by the Asbestos Plan Manager.

3.15.1.2 *Abatement Projects*

Abatement projects may require air sampling (is required in the case of Type 3 work), which will be authorized by the Asbestos Plan Manager.

3.16 EQUIPMENT

City of Toronto has determined that a qualified, experienced contractor will perform all asbestos abatement work and that no employee will be assigned Type 3 asbestos related work (see previous comment).

The information in this section is provided for reference only and is not applicable at this time.

3.16.1 *Asbestos Equipment Room*

The Asbestos Equipment Room is a room in the Maintenance Department of one or more buildings set-aside for the storage of the equipment and supplies required to perform any repair and/or minor removal of ACM. A copy of the Operations and Maintenance Program is also kept in the room for reference purposes.

In addition to equipment storage, the room may also be used for the temporary storage of sealed asbestos waste and emptying of the HEPA vacuum. Refer to the correct procedures listed in Section 3.16.5 for the emptying of the vacuum cleaner.

At the end of asbestos-related work all supplies are to be returned to the room and material used up during the work recorded on the equipment usage list. The Asbestos Plan Manager or designate will be responsible for maintaining adequate supplies of the equipment in the room.

3.16.2 List of Equipment

The supplies and protective equipment, presented in the list below, are required to perform the work outlined in Section 4.0, if and when, procedures are established. All required equipment shall be stored in the Asbestos Equipment Room.

A) PROTECTIVE EQUIPMENT:

1) Respirators;

- Half-face air purifying respirators (minimum for Type 1 and limited Type 2 work),
- HEPA Cartridge Filters,
- Qualitative or Quantitative Fit Testing Equipment
- Disinfectant.

2) Clothing;

- Disposable Coveralls with integral hood, boot covers and elasticized cuffs (Tyvek or equivalent).

B) REPAIR/REMOVAL EQUIPMENT:

1) Cleaning Equipment;

- HEPA Vacuum,
- Buckets and Sponges,
- Scrub Brush (Non-metal Bristles), and
- Mop (Long-Handled).

2) Asbestos Repair/Removal:

- Glove bags in the following configurations manufactured by Safe-T- Strip or equivalent;
 - 6",10" straight,
 - 6",10" vertical, and
 - 6",10" valve,
- Flexible Saw,
- Retractable Knife,

- Wire Cutters,
- Garden-style Airless Sprayer For Amended Water,
- Water containing one ounce/gallon of a 50/50 mixture of polyoxyethylene ester and polyoxyethylene ether (i.e. Aqua-Gro),
- Separate Garden-style Airless Sprayer For Encapsulant,
- Encapsulant (Approved) Ocean 666, or Decadex Fire Check,
- Lagging Adhesive (Approved) Bakelite 120-19 or 120-20,
- 6-ounce canvas cloth,
- Paint Brushes - 4",
- Warning Signs (Displaying Information Below),

CAUTION-ASBESTOS HAZARD

Breathing Asbestos Dust May Be

Hazardous to Your Health

ACCESS RESTRICTED TO PERSONS WEARING

PROTECTIVE CLOTHING AND EQUIPMENT

- Rope for Barricades,
- Duct Tape,
- Polyethylene Sheeting - 6 mil, Clear, and
- Polyethylene Sheeting - 6 mil, Dark.

3) Waste Disposal;

- Waste Disposal Bags - Yellow, Pre-labelled,
- Bag Ties, and
- Fibre Drums with sealable lids.

3.16.3 Special Equipment - HEPA Vacuum Cleaners

Vacuums equipped with a High-Efficiency Particulate Aerosol (HEPA) filters find wide use in asbestos-related work. A HEPA filter must be 99.97% efficient in collecting a 0.3 micrometer aerosol. Each filter is individually tested and certified. Important points to be considered in the

selection, use and care of HEPA vacuums include:

- HEPA vacuums are available in different sizes; some run on different voltages. Selection of the appropriate unit must be made after assessing all of the relevant factors.
- Manufacturers' instructions regarding filter life, use and care of the vacuum etc., should be followed. Because the HEPA filter is expensive to replace, every effort should be made to extend its service life by maintaining and replacing the less expensive and less sophisticated earlier stages of filtration (pre-filters).
- The changing of filters and emptying of waste from the vacuum require care and diligence to ensure that potential airborne fibre contamination is confined (refer to procedures, Appendix G).
- The outsides of HEPA vacuum cleaners must also be kept clean and free of dust and debris. Vacuum hoses are to be inspected regularly to ensure their cleanliness.

3.16.4 Requirement for Use

The Regulation respecting Asbestos requires that cleaning is performed in various stages of the operations involving asbestos. This cleaning must be performed either by:

- 1) Damp mopping / wiping; or
- 2) Vacuuming using a HEPA vacuum cleaner

3.16.5 Handling and Cleaning HEPA Vacuums

The changing of filters and emptying of waste is to be performed in the specially designated area (Asbestos Control Room) which is isolated from other occupied areas. The following procedure is to be used:

Work Procedure:

- 1) Identify the room with the proper warning signs and restrict access to those employees performing the work.
- 2) Wear a non-powered air-purifying respirator approved for use with asbestos and suitable protective clothing. Only persons wearing protective clothing and equipment shall be allowed to enter the work area.
- 3) Disable the ventilation system servicing the room if possible; seal ventilation ducts to and from the room.
- 4) Cover the floor with a large sheet of 8 mil. rip-proof polyethylene sheeting.
- 5) Place the HEPA vacuum in the centre of the polyethylene sheeting and slowly

remove the top lid.

- 6) Seal the waste bag in the vacuum cleaner and transfer to the waste disposal bag.
- 7) Seal the waste disposal bag and replace the lid on the vacuum cleaner.
- 8) Damp wipe the HEPA vacuum and the waste disposal bag.
- 9) HEPA vacuum the polyethylene sheeting on the floor and dispose of as asbestos waste. Clean the floor using the HEPA vacuum or by damp wiping.
- 10) Before leaving the work area, decontaminate protective clothing (including boots) and dispose of as asbestos waste; damp wipe the respirator and store in a proper place.
- 11) Wash hands and face at the completion of the job.
- 12) Ensure that the daily asbestos work report has been completed.

SECTION 4.0
ASBESTOS WORK PROCEDURES

4.0 ASBESTOS WORK PROCEDURES

The following sections briefly describe the standard operating procedures adopted for asbestos-related work. These meet or exceed the requirements of O. Reg. 278/05 and other regulatory requirements in effect on November 1, 2005.

These procedures are provided as a minimum standard for all asbestos work in City Facilities. No scheduled (non-emergency) Type 3 asbestos work will be undertaken by City employees.

4.1 CLASSIFICATION OF SCHEDULED WORK

The Ministry of Labour Regulation classifies asbestos work into Types 1, 2, and 3 procedures, depending on the type of disturbance, the material being disturbed, and the extent of work. The Ministry of Labour also allows the use of Glove Bags for removal of asbestos-containing pipe insulation as a Type 2 operation.

The following is the classification of work for materials known to exist in City Facilities.

Note: Refer to Appendix G for further details

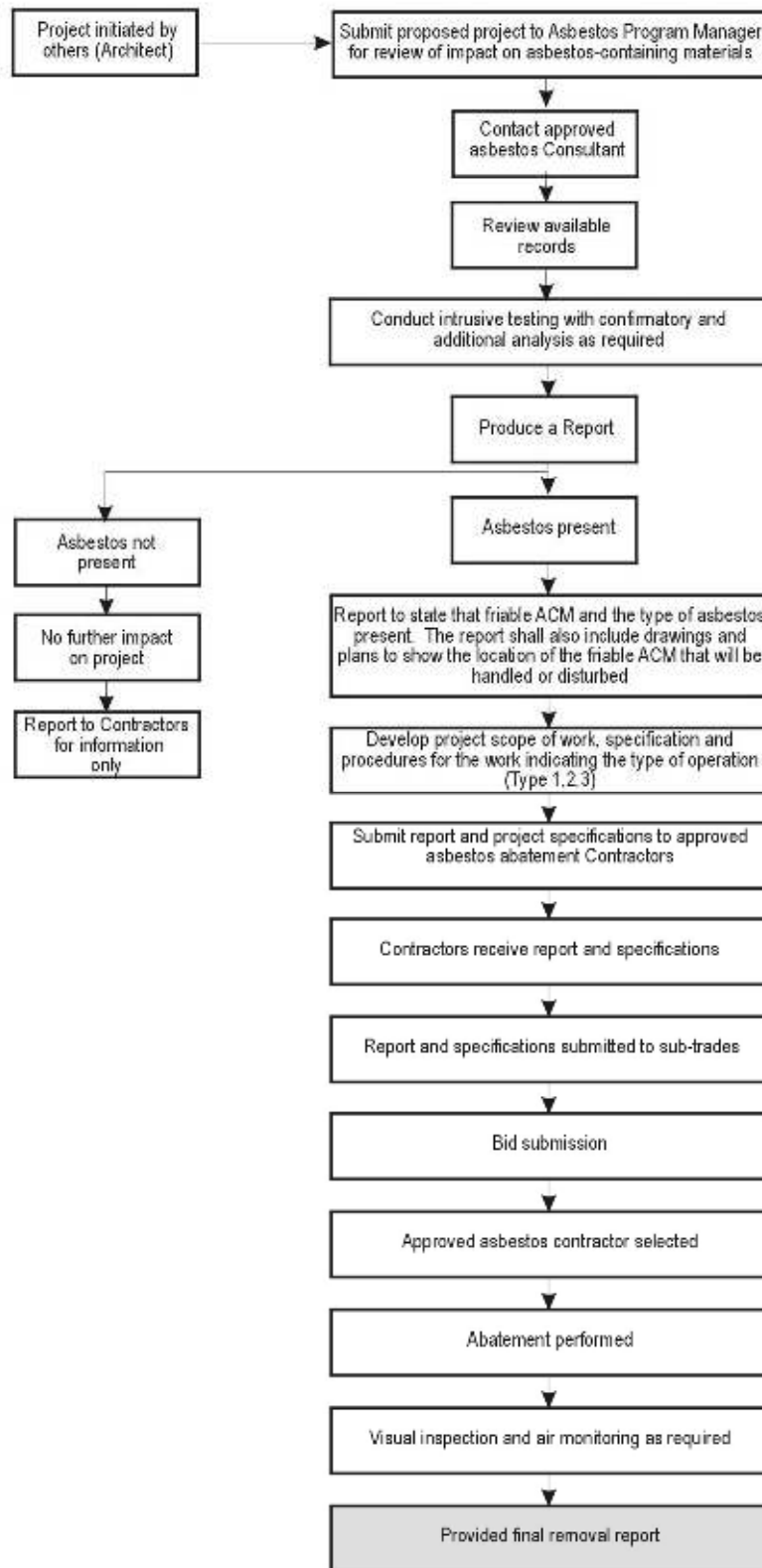
TABLE 4.1 – Classification of Asbestos Work Types

CLASSIFICATION	DESCRIPTION OF WORK
TYPE 1 OPERATIONS	Installing or removing ceiling tiles that are asbestos-containing material, if the tiles cover an area less than 7.5 square metres and are installed or removed without being broken, cut, drilled, abraded, ground, sanded or vibrated.
	Installing or removing non-friable asbestos-containing material, other than ceiling tiles, if the material is installed or removed without being broken, cut, drilled, abraded, ground, sanded or vibrated.
	Breaking, cutting, drilling, abrading, grinding, sanding or vibrating non-friable asbestos-containing material if, <ul style="list-style-type: none"> i. the material is wetted to control the spread of dust or fibres, and ii. the work is done only by means of non-powered hand-held tools.
	Removing less than one square metre of drywall in which joint-filling compounds that are asbestos-containing material have been used.
TYPE 2 OPERATIONS	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.
	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.
	Enclosing friable asbestos-containing material.
	Applying tape or a sealant or other covering to pipe or boiler insulation that is asbestos-containing material.

CLASSIFICATION	DESCRIPTION OF WORK
	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.
	Breaking, cutting, drilling, abrading, grinding, sanding or vibrating non-friable asbestos-containing material if, <ul style="list-style-type: none"> i. the material is not wetted to control the spread of dust or fibres, and ii. the work is done only by means of non-powered hand-held tools.
	Removing one square metre or more of drywall in which joint filling compounds that are asbestos-containing material have been used.
	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.
	Removing insulation that is asbestos-containing material from a pipe, duct or similar structure using a glove bag.
	Cleaning or removing filters used in air handling equipment in a building that has sprayed fireproofing that is asbestos-containing material.
	An operation that, <ul style="list-style-type: none"> i. is not mentioned in any of paragraphs 1 to 10, ii. may expose a worker to asbestos, and iii. is not classified as a Type 1 or Type 3 operation.
GLOVE BAG WORK	The use of glove bags to remove insulation from a pipe duct or similar structure is classed as Type 2 work but it requires notification of the MOL if more than 1 square metre of ACM is removed.
TYPE 3 OPERATIONS	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.
	The spray application of a sealant to friable asbestos-containing material.
	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.
	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.
	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.
	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.

CLASSIFICATION	DESCRIPTION OF WORK
NOTES TO CLASSIFICATION	Work on ceiling tiles, drywall or friable asbestos-containing material is classified according to the total area on which work is done consecutively in a room or enclosed area, even if the work is divided into smaller jobs.
	The following provisions apply if a dispute arises as to the classification of an operation under this section:
	<ol style="list-style-type: none">1. A party to the dispute may notify an inspector at the office of the Ministry of Labour nearest the workplace of the dispute.2. The party who notifies the inspector shall promptly inform the other parties that the inspector has been notified.3. Work on the operation shall cease until the inspector has given a decision under paragraph 4.4. The inspector shall, as soon as possible, investigate the matter and give the parties a decision in writing.
	Nothing in subsection (6) affects an inspector's power to issue an order for a contravention of this Regulation.

FIGURE 4.1 - MAJOR PROJECT PROTOCOLS FOR RENOVATION OR DEMOLITION

**Notes:**

1. All general contractors performing asbestos related work should be chosen from the Asbestos Plan Manager's approved list.
2. Where the general contractor for the work subcontracts part of the work, they shall supply a list of subcontractors who must be approved by the Asbestos Plan Manager.
3. If a major project results in the removal of all known ACM in the building, the AMP can be terminated.

NOTE: The term "Friable asbestos" must be interpreted to include non-friable materials.

Post copy of clearance air monitoring results in conspicuous place in workplace within 24 hours of receipt

Provide copy of clearance air monitoring results to JHSC/H&S Rep within 24hours of receipt

APPENDIX A
ASBESTOS FACT SHEET

ASBESTOS FACT SHEET

What Is Asbestos?

"Asbestos" is the name given to a group of naturally occurring minerals composed of tiny fibres, which become easily airborne. There are five major mineral forms in the asbestos group, only two of which, chrysotile and amosite, have been commonly used in Canada. These tiny fibres are flexible, fire-resistant and almost indestructible- qualities which have made asbestos very useful commercially.

Where Is It?

There have been more than 3,000 asbestos-containing products, some of which are currently in use. These are mostly in the form of hard materials. Soft materials of particular interest include thermal and acoustic insulation and fireproofing. Some of the more common products that may contain asbestos include:

Pipe insulation	Duct insulation
Cement products	Fireproofing
Plasters	Vinyl floor tiles
Floor felts in sheet floors	Floor mastics
Roofing shingles	Roofing tars
Roofing felts	Ceiling panels

In most commercial products, asbestos is combined with a binding material, so that it does not become readily released into the air. However, if the asbestos should become airborne, and if it is inhaled, it can remain in the lungs for a long period of time, possibly causing severe health problems that do not appear for many years.

Commencing in the mid-1970's, many ACM were banned from use, especially in the construction industry. Those products already in use were made subject to regulations governing their handling and disposal.

What Are The Problems?

Asbestos is rarely used alone, and it is generally safe when it is combined with other materials with strong bonding properties. Occasionally, asbestos fibres become loose and airborne, this is referred to as a "fibre-release." This happens most often when they are contained in soft, easily crumbled (friable) materials, such as sprayed-on fireproofing. Even in well-bonded materials such as floor tiles and painted surfaces, asbestos can become airborne when materials are cut, drilled, scraped, filed, sanded or otherwise abraded.

What Are The Health Effects?

If asbestos fibres are inhaled or swallowed, they can have serious effects on your health. These effects may not appear for 15 to 30 years after exposure. Asbestos can cause asbestosis, also known as "white lung", a scarring of the lungs that leads to severe breathing problems and heart failure. This disease is usually seen in workers who manufacture or use asbestos products, and is associated with high exposure levels.

Asbestos can also cause cancer of the lungs, as well as a very rare cancer of the chest and abdominal linings known as mesothelioma. It may also be linked with some cancers of the stomach, intestines,

kidneys and rectum.

There is much controversy in the scientific community over what constitutes a safe exposure level to asbestos fibres, and many factors determine whether an individual will develop an asbestos related disease. It is known that smokers exposed to asbestos are at a greater risk of developing lung cancer. Individual susceptibility is another factor. Also, different asbestos minerals have a different effect on the body, the fibres most often associated with mesothelioma are very rarely used.

Children and young adults are a special concern for asbestos exposure, since they carry asbestos fibres in their lungs for many years. It is for this reason that proper asbestos management is so important, particularly in schools.

Determining If There Is A Problem

To determine whether or not an asbestos problem exists, it must first be established if the material in question contains asbestos fibres. The only sure way to determine the presence of asbestos is to have a sample of the material analyzed at a testing laboratory using high-resolution microscopy techniques. A reputable company must always do the analysis.

What Are The Government Regulations?

There are three regulations that govern the control of asbestos and ACM in buildings in Ontario as follows:

Under the Occupational Health and Safety Act, Regulation 278/05, *Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations*.

Under the *Environmental Protection Act: General - Waste Management Regulation*: R.R.O. 1990, Regulation 347, as amended.

Under the *Dangerous Goods Transportation Act*: R.S.O. 1990. c.D.1

Under the *Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations* under the *Occupational Health and Safety Act*, the major requirements to building owners under this regulation include:

1. Provision of establishing an asbestos survey report outlining the locations, quantity, condition and content of asbestos in material in the building to all prospective contractors who are likely to handle or disturb the material.
2. The asbestos survey report shall contain the following information.
 - The location of material,
 - Where the material is friable or non-friable,
 - In the case of friable sprayed-on material, for each location, i) if the material is known to be ACM, the type of asbestos, if known, or ii) in any other case a statement that the material will be treated as though it contained a type of asbestos other than chrysotile.
3. Advising workers of the building owner who may work in close proximity to ACM and who may disturb

the material.

4. Periodic inspection of the material to determine its condition, including an annual update of the asbestos survey report.
5. Implementation of appropriate control measures, where required, following the precautions and procedures prescribed by the Regulation (Type 1, Type 2 or Type 3 operations). The classification of the work depends on the type of material, procedures used and the quantity of material to be disturbed. Refer to Table 4.1 Classification of Asbestos Work for further information.
6. Establishment of a training program for employees of the owner who are likely to handle ACM.
7. Annual submission of an asbestos work report form for each employee working in a Type 2 or Type 3 operation.
8. Removal of ACM, to the extent practicable, prior to demolition of a building, or part thereof.

What Is The City of Toronto Doing To Meet These Regulations?

1. Worker Training

The City of Toronto has a policy that no employees will actually be performing Type 3 asbestos related work but will receive asbestos awareness training courses for those who have the potential to come in contact with ACM during the performance of their duties so that they can recognize potential problems. All training meets the legislative requirements established by the Ontario Ministry of Labour. In addition managers of tenants whose rental units are tended to by City of Toronto will also be invited to the information sessions. The JHSC/H&S Rep will be advised of the time and place of the sessions.

2. Comprehensive Building Survey

The City of Toronto enlisted the services of a consulting firm specializing in asbestos surveys. The firm conducted a comprehensive inventory of the ACM present in the building, assessed the condition of these materials, and established the risk they pose to building occupants. The firm also recommended any required asbestos control measures.

3. AMP

The City of Toronto has in place a long-term plan to manage our ACM. It includes work procedures for trained service personnel, maintenance personnel and contractors who may be required to work in the facility so that their work actions will not increase the risk potential of asbestos exposure to building occupants.

4. Operations and Maintenance Program

The City of Toronto has implemented a program of procedures for the proper handling and maintenance of our ACM. It includes preventative measures to reduce the probability of damage to ACM as well as procedures for routine maintenance, cleaning, emergency responses to fibre releases, renovation and periodic re-inspection (surveillance) of these materials.

APPENDIX B
REFERENCE MATERIALS

1. Ontario Regulation 278/05: Designated Substance — Asbestos on Construction Projects and in Buildings and Repair Operations, made under the Occupational Health and Safety Act.

http://www.e-laws.gov.on.ca/DBLaws/Regs/English/050278_e.htm

2. Revised Regulations of Ontario 1990, Regulation 347, as amended: General — Waste Management, made under the Environmental Protection Act.

http://www.e-laws.gov.on.ca/DBLaws/Regs/English/900347_e.htm

3. Revised Statutes of Ontario 1990, Chapter D1: Dangerous Goods Transportation Act.

http://www.e-laws.gov.on.ca/DBLaws/Statutes/English/90d01_e.htm

4. Asbestos Information Sources and Governmental Sources (Canadian and US)

<http://www.chrysotile.com/>

<http://www.ccohs.ca/>

<http://www.cdc.gov/search.do?action=search&queryText=asbestos>

<http://www.ashrae.org/template/AdvancedSearchResult.jsessionid=aaa-u1J4MK-DY>

<http://www.labour.gov.on.ca/moved/index.html>

http://www.hc-sc.gc.ca/iyh-vsv/enviro/asbestos-amiante_e.html

<http://www.osha.gov/SLTC/asbestos/index.html>

APPENDIX C

LETTER OF NOTIFICATION TO TENANTS REGARDING ASBESTOS IN PREMISES

LETTER OF NOTIFICATION TO TENANTS REGARDING ASBESTOS IN PREMISES

To Tenant Management Representative

This letter is being provided as notification of the presence of asbestos within the building at [address], Ontario. City has recently had an asbestos survey performed of the entire building and have established a program to manage all asbestos in a safe and prudent fashion. O.Reg. 278/05 requires notification of the building's tenants of the location of such material, as well as notification of workers who may work in close proximity to the material and who may disturb it.

Our consultant inspected all areas of the building and made recommendations, where necessary, for removal or repair of asbestos. All such work [has been completed/will be completed shortly] with appropriate inspection and supervision. All asbestos remaining is subject to the Asbestos Management Program as required by our own due diligence. A copy of the survey and Asbestos Management Program are available locally on site, or at Metro Hall, 55 John Street, Toronto, Ontario for review.

The continuing presence of the remaining asbestos does not pose a risk of exposure to your employees as long as it remains under this management program. Staff that may disturb these materials has been given appropriate training and are aware of its presence. If you are planning maintenance or renovation work please notify the Facility Manager who will determine if the planned work will affect the asbestos in any way and provide information regarding necessary work practices and obligations to maintain a safe and healthy environment for your staff and contractors.

Please ensure that your staff and sub-contractors are aware of the above information. If you have any concerns please contact the facility management office at _____.

APPENDIX D

**CONTRACTOR NOTIFICATION AND
ACKNOWLEDGEMENT FORM**

CONTRACTOR NOTIFICATION AND ACKNOWLEDGEMENT FORM

City has identified the presence of various friable and non-friable asbestos-containing materials in the Building. An asbestos inventory report showing the locations and amounts of these materials is available for viewing from the Facility Manager.

Ontario Regulation 278/05 (*Designated Substance - Asbestos on Construction Projects and in Buildings and Repair Operations*) applies to workers that may disturb asbestos materials. The disturbance of asbestos building materials are only to be undertaken by Asbestos Abatement Contractors that maintain the appropriate insurance coverage and meet the requirements set out in the AMP. The following activities may disturb asbestos materials. The Facility Manager must be notified prior to performing the following:

- Removal or repair of asbestos mechanical insulation or sprayed asbestos.
- Ceiling entry which may disturb sprayed fireproofing or pipe insulation.
- Any other operation which may generate airborne asbestos from friable asbestos.
- Any removal, cutting or other disturbance of non-friable asbestos material.
- Disturbance of any material excluded from the survey.

Declaration by Contractor

The Contractor and their sub-contractors shall follow the work procedures as specified by City's Asbestos Management Program (AMP) and shall not disturb ACM without using proper procedures in accordance with Regulation 278/05 and this AMP..

We agree that our staff will not disturb asbestos-containing materials without prior notification to the Facility Manager. This firm and our staff will follow all procedures specified by the City Asbestos Management Program and/or O. Reg. 278/05. All asbestos waste will be packaged and disposed of in accordance with Ministry of the Environment requirements.

Notification of Asbestos Abatement

All contractors and City employees who perform work at facilities where ACM is present should be notified of the presence of the ACM if their work may bring them into contact or close proximity to the ACM and they may disturb it. This notification may include janitorial, security, telephone, computer cabling suppliers, mechanical maintenance contractors, etc. This notification shall be performed by the Facility Manager or Project Manager.

All contractors and City employees who perform work at City facilities, where asbestos-containing sprayed fireproofing is present above ceilings, including telephone, computer cabling suppliers, electrical and mechanical contractors, etc., are to be notified that Type

2 Procedures are required for any entry to, or work within the ceiling space (visual inspection excepted, Type 1 Work). This notification shall be performed by the Facility Manager or Project Manager.

Contractors are to:

- Notify orally and in writing, an inspector at the office of the Ontario Ministry of Labour nearest the project site (Notice of Project), as per Regulation 278/05, prior to commencing Type 3 abatement, Glove Bag abatement or any abatement project that exceeds \$50,000.00 in cost.
- Notify Sanitary Landfill site as per Ontario MOE Regulation 347 as amended.
- Inform all sub trades of the presence of ACM identified in the contract documents.
- Immediately notify the Project Manager and stop work if friable materials not identified in the contract documents are discovered during the course of the work. Ensure that the MOL and the Joint Health and Safety Committee are immediately notified if the friable material is asbestos containing, as required by Regulation 278/05.

Building (Address): _____

Project: _____

Contractor: _____

Name and Title: _____

Signature: _____

Date: _____

APPENDIX E

WORK PRACTICES – EMERGENCY WORK

WORK PRACTICES – TYPE 2 EMERGENCY CLEAN UP

Emergency asbestos procedures shall be implemented, when required, in order to protect those undertaking the work, as well as to protect all others from, or limit exposure to, airborne asbestos. Procedures indicated shall be followed as closely as possible, in the event of an emergency situation.

Procedures for asbestos work, required as an immediate response to floods through asbestos fireproofing, accidental disturbance of ACM, ceiling collapses of asbestos-containing ceiling tiles, or other emergencies that affect asbestos materials, are as follows:

- Clear area of all occupants. In critical situations clear area of only non-essential personnel, and provide essential personnel with proper respiratory protection.
- Shut down ventilation systems serving area including supply, return and exhaust.
- Isolate the area by locking doors, if this can be done without blocking emergency or fire routes.
- If it is not possible to safely isolate the area, the Facility Manager will notify personnel not to enter the area. If possible, post security to prevent unnecessary access.
- Close access doors to area or construct enclosure around area if time permits. Do not obstruct emergency exits under any circumstances.
- Only trained workers or Abatement Contractors will perform the emergency clean up.
- Entrance to the area will now be limited to those wearing applicable respiratory protection, safety glasses with side shields, disposable Tyvek coveralls, and impermeable gloves. Half face NIOSH approved respirators with P100 (HEPA) filters are adequate.
- No eating, smoking or chewing in the Asbestos Work Area.
- Remove all debris within the area of the accidental disturbance of ACM using HEPA vacuums.
- Place polyethylene drop sheets under area of repair.
- Repair ACM pipe insulation, replace ceiling tiles or stabilize ACM as required with minimum disturbance to ACM. Prior to repair work, area must be wetted to control the spread of dust and fibres.
- Remove dust using HEPA vacuums or wet wiping from all surfaces within area of disturbance.
- Dispose of items that cannot be cleaned as asbestos waste.

- Clean all non-disposable tools and items (before leaving work area).
- Dispose of all cleaning supplies and drop sheets as asbestos waste.
- Remove coveralls and dispose of as asbestos waste.
- Proceed to washroom and wash face and hands.
- At their option, the Facility Manager may decide to employ an Asbestos Consultant to perform air monitoring and consulting, after clean-up to ensure airborne fibre levels are within acceptable limits to re-occupy the space.
- The Facility Manager must notify the Joint Health and Safety Committee of the results of air monitoring or testing.

APPENDIX F

ASBESTOS PROJECT WORK RECORD

ASBESTOS PROJECT WORK RECORD

Building: _____
(Building Address or Name)

Date: _____
(Today's Date)

Project Number: _____
(City Project Number or Purchase Order Number)

Project Type: ☐ Emergency ☐ Type 1 ☐ Type 2
 ☐ Planned Project ☐ Glove Bag ☐ Type 3

Area of Work: _____
(Room Name, Number, Floor etc.)

Description: _____
(Brief description of abatement, material, system, etc)

Tenant: _____
(Tenant name if any, department or group)

Project Start Date: _____
(Mobilization date)

Project End Date: _____
(After dismantling/clean-up)

Contractor: _____
(Contracting firm or employee)

Telephone: _____
(Contractor or employee telephone)

Consultant: _____
(Name of consulting firm/contact if any)

Telephone: _____
(Consultant telephone)

Pre-Construction Survey for ACM performed and report provided to Contractor?

☐ Yes ☐ No (Explain) _____

Air Sampling during abatement?

☐ Yes ☐ No

Clearance Air Monitoring performed (Regulated requirement after Type 3 abatement)?

☐ Yes ☐ No

Air Monitoring results to Joint Health and Safety Committee?

☐ Yes ☐ No

Asbestos Survey Updated to Reflect Changes in ACM Inventory?

☐ Yes ☐ No. No changes to ACM inventory resulted.

☐ No. Forward copies to Consultant prior to next re-assessment.

Asbestos waste removed from site and disposed of?

☐ Yes. Dump tickets attached. ☐ No. ACM waste not generated.

☐ No. ACM waste remains on site for later disposal.

Append the following information relating to asbestos abatement to this work record, if applicable, and file Asbestos Work Record and attachments with AMP. Check where attached.

Submittals including Insurance ☐ Yes ☐ No

Dump tickets, waybills, etc for waste. ☐ Yes ☐ No

Specifications, Change Orders, Drawings. ☐ Yes ☐ No

Consultant Inspection Reports. ☐ Yes ☐ No

Air Monitoring Results. ☐ Yes ☐ No

Analytical Certificates. ☐ Yes ☐ No

Correspondence as required. ☐ Yes ☐ No

APPENDIX G
ASBESTOS WORK PROCEDURES

G-1 ASBESTOS WORK PROCEDURES

City of Toronto has decided that all asbestos abatement work will be performed by qualified, experienced outside service personnel, maintenance personnel or authorized asbestos abatement contractor and that no City of Toronto employee will be assigned any Type 3 asbestos related work.

The information provided in this section is intended to give background to the Asbestos Plan Manager so that they may select an appropriately qualified abatement contractor.

Various sections of this manual will be made available to Service/Maintenance personnel or a Contractor describing the work required to be performed and authorization to proceed will be based on receipt of proof that the individual is qualified to perform the work and demonstrates so.

G-2 MAJOR ASBESTOS ABATEMENT WORK

Any work of this type is to be performed by firms specializing in asbestos abatement under contract to the building. A qualified consultant will inspect all removal work. The consultant will be required to provide an on site inspector with experience working on projects of similar size and complexity.

Where additional work is required in separate locations, appropriate procedures can be incorporated with the main work. Type 3 work involves the handling or removal of significant amounts of ACM. This type of work is only performed within a polyethylene enclosure for indoor operations by qualified abatement contractors. The checklist presented below is intended to provide guidance in the administration of work performed by qualified outside consultants and contractors.

1. Arrange to have Specifications prepared for the project.
2. Schedule work with input from all affected parties including but not limited to:
 - Affected City Division/Tenant,
 - Facilities Management,
 - Project Architect,
 - City of Toronto Administration,
 - City of Toronto H&S Consultant
 - JHSC/H&S Rep

3. Arrange for inspection and air monitoring services.
4. Prepare Tender Documents.
5. Pre-qualify contractors.
6. Hold a pre-bid meeting with contractors to explain the scope of work.
7. Notify staff who work in the immediate area of the asbestos removal work.
8. Notify JHSC/H&S Rep for the building.
9. Conduct a walk-through inspection of the work area with the contractor prior to starting the work to identify and document the condition of the area and any existing damage.

In addition to the above, the following items should be considered for implementation into the removal project specifications, supplementary to the regulatory requirements:

1. Inspection
 - Provides on-site monitoring of the removal work to ensure that proper work practices, waste disposal and cleanup procedures are being followed.
2. Waste and equipment decontamination enclosure system
 - Minimizes the potential for contamination due to improperly cleaned waste containers and removal equipment, especially in occupied areas.
3. Application of sealant to work area surfaces
 - Prevents any residual fibres from becoming airborne and contaminating the work area after final cleanup.
4. Settling period
 - Allows airborne fibres to settle to the ground and be removed during the final cleanup process.

These items should be considered in addition to the regulatory requirements to ensure that contamination of the area adjacent to the asbestos removal does not occur, especially in occupied areas.

G-3 EMPLOYEE TYPE 1 WORK PROCEDURES

City of Toronto has decided at this time that an experienced and qualified Abatement Contractor pre-selected by the Asbestos Plan Manager will perform all work involving ACM.

This section has been intentionally left blank, until such time that employees will be required to

conduct this level of work as specified in Regulation 278/05, *Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations*. When it is decided that this type of work will be performed in-house, a qualified Occupational Health and Safety Consultant will provide training. No work will be performed until specific training has been provided and the employee's comprehension of the work has been evaluated and accepted as adequate.

G-4 EMPLOYEE TYPE 2 WORK PROCEDURES

City of Toronto has decided at this time that an experienced and qualified Abatement Contractor pre-selected by the Asbestos Plan Manager will perform all work involving ACM.

This section has been intentionally left blank, until such time that employees will be required to conduct this level of work as specified in Regulation 278/05, *Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations*. When it is decided that this type of work will be performed in house, a qualified Occupational Health and Safety Consultant will provide training. No work will be performed until specific training has been provided and the employee's comprehension of the work has been evaluated and accepted as adequate.

G-5 EMPLOYEE TYPE 3 WORK PROCEDURES

City of Toronto has decided at this time that an experienced and qualified Abatement Contractor pre-selected by the Asbestos Plan Manager will perform all work involving ACM.

This section has been intentionally left blank, until such time that employees will be required to conduct this level of work as specified in the Regulation 278/05, *Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations*. When it is decided that this type of work will be performed, a qualified Occupational Health and Safety Consultant will provide training and the training will be equivalent to training approved by the Ministry of Training, Colleges and Universities. No work will be performed until specific training has been provided and the employee's comprehension of the work has been evaluated and accepted as adequate.

G-6 CONTRACTOR WORK PROCEDURES – MINIMAL ASBESTOS DISTURBANCES

As indicated in the following Sections, the following work procedures are provided as background to the Asbestos Plan Manager, to allow for the selection of a qualified asbestos abatement contractor. Procedures for the following work are provided:

Procedures

- | | |
|-----|--|
| G7 | Cleaning, Stripping Wax From and Waxing Asbestos-containing Floor Tiles – Type 1 Work |
| G8 | Cleaning of Asbestos-containing Debris – Type 2 Work |
| G9 | Access and Cleaning above Suspended Ceilings – Type 2 Work |
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- G11 Work with Non-friable Materials and Manufactured Products – Type 1 Work
- G12 Repairing Thermal Insulation – Type 2 Work
- G13 Asbestos Removal Using Glove Bags – Type 2 Work
- G14 Minor Asbestos Removal – Type 2 Work
- G15 Emergency Spill or Repair Response – Type 2 Work

G-7 *Cleaning, Stripping Wax From and Waxing Asbestos-Containing Floor Tiles - Type 1 Work*

Many of the floor tile (vinyl asbestos tile - VAT) applications contain asbestos fibre. The asbestos is held in place within the vinyl binding-matrix and no fibres are released during regular traffic conditions. Studies have shown that dry stripping of these applications can under some situations release fibres and become a hazard.

Work Procedure:

- 1) Avoid Frequent Stripping of Wax from Floors. Stripping of floors should be done as infrequently as possible -- no more than once a year, if at all.
- 2) Strip Wax from Floors or Clean while Wet. The floors are to be kept wet with detergent or water during the stripping operation. **DO NOT PERFORM DRY STRIPPING.** Prior to machine operation, an emulsion of chemical stripper and water is to be applied to the floor with a mop, which strips the wax and also controls fibre release during the work. The floor should be thoroughly cleaned while wet after stripping and before application of new wax.
- 3) Run Machine at Low Speed. If a variable speed control is present, the machine is to run at the lowest setting.
- 4) Select the Least Abrasive Pad. White and red colour buffing pads should be used in preference to the green coloured type. Black coloured pads should not be used under any circumstances.
- 5) Do Not Over Buff Floor. Stop stripping when the old surface coat is removed. Over stripping can damage the floor and may cause release of asbestos fibres. Do not operate a floor machine with an abrasive pad on unfinished floors.

G-8 *Cleaning Of Asbestos-Containing Debris - Type 2 Work*

Use provisions of this section when cleaning is to be performed in areas where ACM has been previously disturbed and there is visible evidence of dust and debris. This situation differs from an emergency spill, as this disturbance has occurred in an area that can be isolated.

Work Procedure:

- 1) Prior to commencing the work, notify all affected staff of the asbestos work that will

be taking place.

- 2) Perform this work during off-hours if at all possible.
- 3) Assemble all supplies and equipment necessary for performing the work.
- 4) Wear a non-powered air-purifying respirator approved for use with asbestos.
- 5) Wear disposable full body type coveralls that will not permit penetration by asbestos fibres equipped with tight fitting cuffs including head hood and rubber boots or disposable shoe covers.
- 6) Do not use compressed air.
- 7) Do not eat, drink, chew or smoke in the work area.
- 8) Disable the mechanical ventilation system servicing the work area and seal with polyethylene sheeting sealed with tape.
- 9) Separate the work area from the rest of the workplace using rope barriers. The extent of the work area will depend on the amount of work to be performed, potential for fibre release and the height of the work above floor level.
- 10) Identify the work area with clearly visible warning signs
- 11) Spray any visible pieces of ACM with a mist of amended water using a garden-type sprayer.
- 12) Place any large pieces of ACM directly into waste disposal bags.
- 13) Use a squeegee or wetted broom to gather waste debris together into a dustpan and place directly into waste disposal bag.
- 14) Clean with HEPA filtered vacuum, remaining debris and then wet clean the immediate area of the "spilled material".
- 15) Where practical (in pipe chases or porous surfaces), HEPA vacuum and wet clean the entire designated work area and spray a coat of encapsulant on surfaces in the work area.
- 16) Before leaving the work area, decontaminate protective clothing, including boots, and equipment using a HEPA vacuum or by damp wiping.
- 17) Clean all non-disposable tools and items (before leaving the work area).
- 18) Wash hands and face at the completion of the work (before leaving the work area). Damp wipe the respirator and store in a proper place.
- 19) Dispose of protective clothing and spent respirator filter cartridges as asbestos waste.

- 20) Shower at the completion of the work if contamination is suspected, before leaving work.

G-9 Access And Cleaning Above Suspended Ceilings -Type 2 Work

This section applies to work above suspended ceilings in buildings where there is likely to be a significant quantity of friable material (fireproofing or thermal pipe and duct insulation) lying on the upper surface of the ceiling tile. Significant is any visible amount of material found on the ceiling tile that can be identified as originating from the overlying or adjacent parent material.

This procedure is to be used to access ceiling spaces where fireproofing or thermal insulation has been noted to be present or where in performing routine work material is discovered on the tiles.

Work Procedure:

- 1) Perform this work during off-hours if at all possible.
- 2) Clear the immediate area of all personnel not assigned to the work.
- 3) Collect all supplies and equipment necessary for performing the work.
- 4) Wear a non-powered air-purifying respirator approved for use with asbestos.
- 5) Wear disposable full body type coveralls that will not permit penetration by asbestos fibres equipped with tight fitting cuffs including head hood and rubber boots or disposable shoe covers, safety glasses with side shields and impermeable gloves.
- 6) Do not use compressed air.
- 7) Do not eat, drink, chew or smoke in the work area.
- 8) Separate the work area from the rest of the workplace using rope barriers. The extent of the work area will depend on the amount of work to be performed, potential for fibre release and the height of the work above floor level.
- 9) Disable the mechanical ventilation system that services the work area and seal with polyethylene sheeting and tape.
- 10) Relocate moveable objects (chairs, tables, desks, coat racks, etc.) out of the work area if practical.
- 11) Cover the floor and remaining furniture and equipment in the work area with dark 8-mil rip-proof polyethylene sheeting.
- 12) Construct an enclosure with polyethylene sheeting, duct tape and/or clips from ceiling to floor to contain any disturbed materials. Work area shall be large enough to cover 1 to 3 ceiling tiles with polyethylene sheeting sealed with tape at floor and at suspended ceiling tile metal frame. Allow an adequate lap (1 metre) in the polyethylene sheeting to provide an entrance yet maintain the isolation.

- 13) For operations involving the removal of false ceilings where ACM debris is likely above or when removing 1 square meter, or less, of friable ACM, the enclosure shall include one or more transparent windows areas to allow observation of the entire work area from outside the enclosures, if the work area is not enclosed by walls.
- 14) Identify the work area with clearly visible warning signs.
- 15) Work shall proceed in a careful manner to ensure thoroughness and to minimize potential airborne contamination.
- 16) Carefully remove the minimum number of tiles required to provide employee access (usually one tile is sufficient), lift the tile straight up and slide across onto the surface of the adjacent ceiling tiles. Note that there may be interference from overhead piping, conduits, duct work, hanger wires or construction debris.
- 17) Large bulk material shall be wetted and bagged if it cannot be handled with the HEPA vacuum. Then use a HEPA vacuum to clean any remaining fallen debris or loose material on the tiles in the immediate vicinity of the opening.
- 18) After immediate tiles have been cleaned, remove carefully, one at a time, to provide access to the next row.
- 19) Clean, with HEPA vacuum or by damp wiping, ceiling tile track system and all other above-ceiling components that may retain or hold asbestos debris.
- 20) Proceed with cleaning in this manner until a sufficient number of ceiling tiles have been cleaned to allow for the work to be performed in the ceiling space.
- 21) At the completion of the cleaning work, replace the tiles, clean the area under the suspended ceiling, including polyethylene drop sheets and equipment used in the cleaning operation (ladders, scaffolding, HEPA vacuum, etc.) by HEPA vacuuming or damp wiping.
- 22) After wetting the polyethylene sheeting, dismantle the enclosure, dispose of all polyethylene sheeting and tape as asbestos waste, vacuum surfaces in the immediate area including the floor.
- 23) Before leaving the work area, decontaminate protective clothing (including boots) and equipment, etc., using a HEPA vacuum or by damp wiping.
- 24) Clean all non-disposable tools and items (before leaving the work area).
- 25) Wash hands and face at the completion of the work (before leaving the work area). Damp wipe the respirator and store in a proper place.
- 26) Dispose of protective clothing and spent respirator filter cartridges as asbestos waste.
- 27) Shower at the completion of the work if contamination is suspected, before leaving work.

G-10 Cleaning Out Of HEPA Filtered Vacuum Cleaners, Asbestos Waste Storage and Disposal - Type 2 Work

This section applies to any work force on the property.

Work Procedure:

- 1) Cleaning or emptying of contents of HEPA filtered vacuums is not permitted for minor work anywhere on the property including within vehicles parked on the premises. The contents of the vacuum shall be cleaned or emptied at the Contractor's, Maintenance Personnel's or Service Personnel's facility.
- 2) Asbestos waste may only be stored on site during the performance of the work. The waste shall be removed at the end of the job or operation.
- 3) Waste shall be placed in 6-mil polyethylene bags and sealed.
- 4) Waste bags shall be pre-labelled advising of the contents.
- 5) While handling sealed waste bags, wear a non-powered air-purifying respirator approved for use with asbestos.
- 6) While handling sealed waste bags, wear disposable full body type coveralls that will not permit penetration by asbestos fibres and is equipped with tight fitting cuffs including head hood and rubber boots or disposable shoe covers.
- 7) Transport waste to an approved and authorized land fill-site.

G-11 Work With Non-Friable Materials and Manufactured Products - Type 1 Work

This work category covers the installation, removal, breaking, cutting, drilling, abrading, grinding, sanding or vibrating of non-friable asbestos-containing building materials, other than ceiling tiles, or manufactured products containing asbestos. Typical examples of these types of materials include vinyl floor tiles, gaskets, seals, packing, friction products or cement products.

Note: Power tools, including those equipped with dust collecting devices connected to a HEPA filtration system, are not permitted in this type of work.

Work Procedure:

- 1) Collect all supplies and equipment necessary for performing the work.
- 2) Wear a non-powered air-purifying respirator approved for use with asbestos.
- 3) Wear disposable full body type coveralls that will not permit penetration by asbestos fibres equipped with tight fitting cuffs including head hood and rubber boots or disposable shoe covers, safety glasses with side shields and impermeable gloves.
- 4) Do not use compressed air.

- 5) Do not eat, drink, chew or smoke in the work area.
- 6) Before beginning work, clean visible dust from all surfaces in the work area using a damp cloth or HEPA vacuum cleaner.
- 7) Where applicable, place a drop sheet of rip-proof polyethylene sheeting on the floor of the work area to catch any dust created by the work.
- 8) Spray the material being worked on continuously with a mist of amended water to reduce dust (unless wetting creates an electrical hazard), using a garden type sprayer.
- 9) Clean dust and debris during, and at the end of the work, using a HEPA vacuum or by damp wiping.
- 10) Clean polyethylene drop sheets using a HEPA vacuum or by damp wiping. Drop sheets shall not be reused. At completion of work, drop sheets are to be wetted and disposed of as asbestos waste.
- 11) Clean all non-disposable tools and items.
- 12) Ensure that hands and face are washed at the completion of the job.
- 13) Clean the respirator by damp wiping and store in a proper manner.

G-12 Repairing Thermal Insulation - Type 2 Work

This category of work covers the repair of damaged asbestos-containing thermal insulation on ducts and piping systems only using lagging (canvas cloth) and mastic (paint adhesive i.e. glue). This does not include any removal whatsoever. Repair of thermal insulation is usually selected as the control option where damage is limited and of a minor nature (such that repair activities are not likely to cause significant disturbance to the underlying friable material) and is not likely to re-occur due to its accessibility or for other reasons.

Work Procedure:

- 1) Perform this work during off-hours if at all possible.
- 2) Clear the immediate area of all personnel not assigned to the work.
- 3) Collect all supplies and equipment necessary for performing the work.
- 4) Wear a non-powered air-purifying respirator approved for use with asbestos.
- 5) Wear disposable full body type coveralls that will not permit penetration by asbestos fibres and is equipped with tight fitting cuffs including head hood and rubber boots or disposable shoe covers, safety glasses with side shields and impermeable gloves.
- 6) Do not use compressed air.
- 7) Do not eat, drink, chew or smoke in the work area.

- 8) Separate the work area from the rest of the workplace using rope barriers. The extent of the work area will depend on the amount of work to be performed, potential for fibre release and the height of the work above floor level.
- 9) Identify the work area with clearly visible warning signs.
- 10) Disable the mechanical ventilation system that services the work area and seal with polyethylene sheeting and tape.
- 11) Relocate moveable objects (chairs, tables, desks, coat racks, etc.) out of the work area if practical.
- 12) Place a drop sheet of rip-proof polyethylene sheeting on the floor of the work area to catch any dust or debris created by the work.
- 13) Pre-clean insulation to be repaired and any dust or debris in the immediate area using a HEPA vacuum.
- 14) Spray a fine mist of amended water (using a garden-type sprayer) on the damaged area of insulation.
- 15) Do not remove any existing jacket material.
- 16) Apply approved encapsulant to one side of a piece of 6-ounce canvas.
- 17) Apply the piece of canvas to the damaged area. Paint the outside area of the canvas with encapsulant. Ensure that the area of repair and six inches on all sides are coated with encapsulant.
- 18) Following completion of repair work, clean polyethylene drop-sheets and surrounding area, by damp wiping or HEPA vacuuming.
- 19) After wetting the polyethylene drop sheets, repeatedly fold on to itself, whereby trapping any debris that may be present in the folds. Dispose of all polyethylene sheeting and tape as asbestos waste. Using a HEPA vacuum, clean surfaces in the immediate area including the floor.
- 20) Before leaving the work area, decontaminate protective clothing (including boots) and equipment, etc., using a HEPA vacuum or by damp wiping.
- 21) Clean all non-disposable tools and items (before leaving the work area).
- 22) Wash hands and face at the completion of the work (before leaving the work area). Damp wipe the respirator and store in a proper place.
- 23) Dispose of protective clothing and spent respirator filter cartridges as asbestos waste.
- 24) Shower at the completion of the work if contamination is suspected, before leaving work.

G-13 Asbestos Removal Using Glove Bags - Type 2 Work

Glove Bag use is appropriate for asbestos removal in easily accessible areas when the full enclosure method is not justified and the Glove Bags can be used in accordance to the procedures specified.

Work Procedure:

- 1) Glove bag Removal Method on work where one square metre or more of friable asbestos-containing material will be removed, requires a Notice of Project (NOP) signed by the Ontario Ministry of Labour. A copy of the signed NOP must be available on site prior to beginning the work. All materials and work are to conform to requirements as detailed on the NOP.
- 2) Perform this work during off-hours if at all possible.
- 3) Clear the immediate area of all personnel not assigned to the work.
- 4) Collect all supplies and equipment necessary for performing the work.
- 5) Wear a non-powered air-purifying respirator approved for use with asbestos.
- 6) Wear disposable full body type coveralls that will not permit penetration by asbestos fibres and is equipped with tight fitting cuffs including head hood and rubber boots or disposable shoe covers, safety glasses with side shields and impermeable gloves.
- 7) Do not use compressed air.
- 8) Do not eat, drink, chew or smoke in the work area.
- 9) Separate the work area from the rest of the workplace using rope barriers. The extent of the work area will depend on the amount of work to be performed, potential for fibre release and the height of the work above floor level.
- 10) Identify the work area with clearly visible warning signs.
- 11) Relocate moveable objects (chairs, tables, desks, coat racks, etc.) out of the work area if practical.
- 12) Disable the mechanical ventilation system that services the work area and seal with polyethylene sheeting and tape.
- 13) Shut off all sources of heat for pipe systems.
- 14) Only new Glove Bags without modification or defects may be used.
- 15) The glove bag shall be made of material that is impervious to asbestos and sufficiently strong to support the weight of material the bag will hold.
- 16) Glove bag shall be equipped with:

- Sleeves and gloves that are permanently sealed to the body of the bag to allow the worker to access and deal with the insulation and maintain a sealed enclosure throughout the work period,
 - Valves or openings to allow insertion of a vacuum hose and the nozzle of a water sprayer while maintaining the seal to the pipe, duct or similar structure,
 - A tool pouch with a drain,
 - A seamless bottom and a means of sealing off the lower portion of the bag, and
 - A high strength double throw zipper and removable straps, if the bag is to be moved during the removal operation.
- 17) A glove bag shall not be used to remove insulation from a pipe, duct or similar structure if,
- It may not be possible to maintain a proper seal for any reason including, without limitation,
 - The condition of the insulation, or
 - The temperature of the pipe, duct or similar structure, or
 - The bag could become damaged for any reason including without limitation,
 - The type of jacketing, or
 - The temperature of the pipe, duct or similar structure.
- 18) Immediately before the glove bag is attached, the insulation jacketing or coating shall be inspected for damage or defects, and if any damage or defect is present, it shall be repaired.
- 19) The glove bag shall be inspected for damage or defects,
- Immediately before it is attached to the pipe, duct or other similar structure, and
 - At regular intervals during its use.
- 20) If damage or defects are observed when the glove bag is inspected, the glove bag shall be disposed of.
- 21) If damage or defects are observed when the glove bag is inspected, prior to beginning removal work, or at any other time,
- The use of the glove bag shall be discontinued,
 - The inner surface of the glove bag and the contents, if any, shall be thoroughly

wetted,

- The glove bag and the contents, if any, shall be removed and placed in the asbestos waste container, and
 - The work area shall be cleaned by vacuuming with a vacuum equipped with a HEPA filter before removal work is resumed.
- 22) Glove Bags cannot be used to remove pipe insulation that has a jacketing made of aluminium with a thickness exceeding 0.51 mm (24 gauge) or a jacketing made of steel.
 - 25) Relocate moveable objects (chairs, tables, desks, coat racks, etc.) out of the work area if practical.
 - 23) Place a drop sheet of rip-proof polyethylene sheeting on the floor of the work area to catch any dust or debris created by the work
 - 24) Vacuum surfaces of insulating material using a HEPA vacuum. Pre-clean any dust or debris in the work area by damp wiping or using a HEPA vacuum.
 - 25) Friable material that will be disturbed or removed during the work shall be thoroughly wetted before the glove bag is attached and at regular intervals during the work.
 - 26) Remove all obstructions from pipes to allow sufficient access.
 - 27) Insure that any knife to be used inside the Glove Bag has a retractable blade and that any saw used is of the flexible wire type. Any brush used inside the Glove Bag must not have metal bristles.
 - 28) Place any tools necessary to remove insulation in the bottom of the Glove Bag. Zip the bag onto the pipe or duct and seal all openings with the straps (do not use duct tape to secure Glove Bags to pipe). For valve Glove Bags, seal valve cover with tape or equivalent.
 - 29) Insert nozzle of spray pump (containing amended water) into Glove Bag through the valve. Place hands into the gloves and place the tools into the tool pouch.
 - 30) Cut or remove exterior insulation covering where applicable to expose asbestos pipe covering. Wet exposed pipe covering with water to suppress any dust. Remove insulation and place in the bottom of the Glove Bag. Wash exposed portion of pipe or duct and top section of bag. Saturate exposed insulation on the pipe and contents of the bag using the amended water sprayer. Any jagged or sharp edges that have been produced during the removal of the metal jacketing shall be handled in such a way so as to minimize the possibility of ripping or puncturing the Glove Bag.
 - 31) Ensure that the pipe and other surfaces are clean of visual residue, dirt or dust prior to removal or relocation of the Glove Bag.

- 32) After cleaning of the pipe, spray encapsulant on the exposed ends of the insulation on the pipe and the contents of the Glove Bag.
- 33) To remove Glove Bag after completion of stripping, wash top section and tools thoroughly and place all tools into the tool pouch.
- 34) Place a labelled waste disposal bag under and around the bottom of the Glove Bag. Tools may be removed from the Glove Bag by placing them in the glove, taping the glove in two locations, cutting it off between the tape and placing in a bucket of water.
- 35) Place the Glove Bag into the waste disposal bag and seal the disposal bag. Dispose of as asbestos waste.
- 36) After removal of the Glove Bag, ensure that the pipe is clean of all residues. If necessary, vacuum all surfaces of the pipe using a HEPA vacuum.
- 37) Cover exposed ends of pipe insulation with tape.
- 38) Clean all surfaces in the work area and equipment using a HEPA vacuum or by damp wiping.
- 39) After wetting the polyethylene drop sheets, repeatedly fold on to itself whereby trapping any debris that may be present in the folds. Dispose of all polyethylene sheeting and tape as asbestos waste, vacuum surfaces in the immediate area including the floor.
- 40) Before leaving the work area, decontaminate protective clothing (including boots) and equipment, etc., using a HEPA vacuum or by damp wiping.
- 41) Clean all non-disposable tools and items (before leaving the work area).
- 42) Wash hands and face at the completion of the work (before leaving the work area). Damp wipe the respirator and store in a proper place.
- 43) Dispose of protective clothing and spent respirator filter cartridges as asbestos waste.
- 44) Shower at the completion of the work if contamination is suspected.

G-14 Minor Asbestos Removal ($\leq 1\text{ m}^2$) - Type 2 Work

Minor removal means planned removal of a small amount of ACM following established procedures. The removal of insulation from one pipe fitting (where the use of a glove bag is not possible) to gain access to a pipe or the removal of a small section of fireproofing to attach a fastening device are examples of minor removals.

This section of work requires the construction of an enclosure for minor removal work. Where an enclosure cannot be constructed to isolate the immediate work item it may be necessary to consider the whole room as the work area. If the room will serve as an enclosure then all openings will have to be sealed, the mechanical system servicing the room disabled and the ventilation ducts to and from

the work area will also have to be sealed. However, it may still be required to cover the floor, walls and ceiling with polyethylene sheeting.

Work Procedure:

- 1) Perform this work during off-hours if at all possible.
- 2) Clear the immediate area of all personnel not assigned to the work.
- 3) Collect all supplies and equipment necessary for performing the work.
- 4) Wear a respirator appropriate for the work being completed and that is approved for use with asbestos.
- 5) Wear disposable full body type coveralls that will not permit penetration by asbestos fibres and is equipped with tight fitting cuffs including head hood and rubber boots or disposable shoe covers, safety glasses with side shields and impermeable gloves.
- 6) Do not use compressed air.
- 7) Do not eat, drink, chew or smoke in the work area.
- 8) Separate the work area from the rest of the workplace using rope barriers. The extent of the work area will depend on the amount of work to be performed, potential for fibre release and the height of the work above floor level.
- 9) Identify the work area with clearly visible warning signs.
- 10) Disable the mechanical ventilation system that services the work area or if not possible, that would service the enclosure and seal with polyethylene sheeting and tape.
- 11) Relocate moveable objects (chairs, tables, desks, coat racks, etc.) out of the work area if practical.
- 12) Construct a frame for the enclosure from 2x4 wood studs or other suitable material (i.e. scaffolding).
- 13) If the potential exists for the disturbance of ACM during the construction of the enclosure, wear a respirator and suitable protective clothing. Ensure that the enclosure is of adequate size to permit the storage of equipment and waste.
- 14) Cover the walls, floor with 8-mil rip-proof polyethylene sheeting (if no debris is present on the floor surfaces) and ceiling of the enclosure with 6-mil clear polyethylene sheeting sealed with duct tape. Overlapping curtains of polyethylene sheeting must be fitted on each side of the entrance to the enclosure (curtain flaps may require weights at the bottoms to ensure proper closing).
- 15) Shut off or isolate electrical power within the enclosure.

- 16) Pre-clean any visible dust or debris in the enclosure using a HEPA vacuum or by damp wiping.
- 17) For thermal insulation applications, carefully cut the outer cover of thermal insulation on the section being worked on. Thoroughly wet the ACM with amended water using a garden sprayer.
- 18) For fireproofing applications, spray repeated fine mist applications of amended water using a garden sprayer. Limit wetting only to area to be removed.
- 19) Remove wetted asbestos material and covering jackets in small sections directly into a 6-mil labelled polyethylene bag.
- 20) Clean surfaces exposed by asbestos removal with a brush and wet sponge. Ensure that all surfaces of piping and other equipment are clean of all residues.
- 21) Immediately after removal of asbestos, clean all surfaces and equipment within the work area including, polyethylene sheeting, using a HEPA vacuum or by damp wiping.
- 22) Seal all surfaces of pipe or other equipment, and ends of exposed insulation which remains, with a suitable encapsulant.
- 23) After satisfactory completion of cleaning and before leaving the work area, decontaminate protective clothing (including boots) and equipment, etc., using a HEPA vacuum or by damp wiping.
- 24) Clean polyethylene drop-sheets and surrounding area, by damp wiping or HEPA vacuuming.
- 25) After wetting the polyethylene sheeting of the enclosure, repeatedly fold on to itself where by trapping any debris that may be present in the folds. Dispose of all brushes, sponges, polyethylene sheeting and tape as asbestos waste, vacuum surfaces in the immediate area including the floor.
- 26) Wash hands and face at the completion of the work (before leaving the work area). Damp wipe the respirator and store in a proper place.
- 27) Clean all non-disposable tools and items (before leaving the work area).
- 28) Dispose of protective clothing and spent respirator filter cartridges as asbestos waste.
- 29) Shower at the completion of the work if contamination is suspected, before leaving work.

G-15 *Emergency Spill or Repair Response - Type 2 Work*

Emergency Response refers to the cleanup of a limited, unintentional spill, of asbestos-containing insulation or spray application, which must be responded to immediately. An emergency would normally be the result of damage to a mechanical system with asbestos-containing thermal insulation or a water leak affecting a fireproofing or acoustic spray application where the friable material has dislodged. Typical examples include vandalism in a public area, or spillage due to water leaks (i.e. roof leak through fireproofing).

THIS PROCEDURE IS TO BE USED FOR EMERGENCY SITUATIONS ONLY AND NOT AS A RESULT OF POOR PLANNING.

Approval must be obtained from the Asbestos Plan Manager or an assigned designate prior to using the Emergency Repairs procedure.

Work Procedure:

- 1) Perform the work during off-hours if at all possible.
- 2) Clear the immediate area of all personnel not assigned to the work.
- 3) Insure that trained personnel are available to perform the work.
- 4) Building-staff are not to attempt a cleanup. Report to the Asbestos Plan Manager or an assigned designate after vacating the immediate area.
- 5) Assemble all supplies and equipment necessary for performing the work. Do not use Building Equipment for the clean up.
- 6) If possible, disable the mechanical ventilation system in the vicinity of the work area.
- 7) Separate the work area from the rest of the workplace using rope barriers. The extent of the work area will depend on the amount of work to be performed, potential for fibre release and the height of the work above floor level.
- 8) Identify the work area with clearly visible warning signs.
- 9) Wear a respirator appropriate for the work being completed and that is approved for use with asbestos.
- 10) Wear disposable full body type coveralls that will not permit penetration by asbestos fibres and is equipped with tight fitting cuffs including head hood and rubber boots or disposable shoe covers, safety glasses with side shields and impermeable gloves.
- 11) Do not use compressed air.
- 12) Do not eat, drink, chew or smoke in the work area.
- 13) Clean any loose or fallen material in the immediate vicinity of the spill by using a HEPA filtered vacuum cleaner or by damp wiping. Work from outside the spill area

to the centre. Do not walk through spill material.

- 14) Only perform work necessary to alleviate the immediate hazard.
- 15) If additional disturbance of ACM is possible during the cleanup then place a drop sheet of rip-proof polyethylene sheeting on the floor of the work area to catch any dust or debris.
- 16) For the limited removal of thermal insulation, carefully cut the outer layer of thermal insulation while spraying a mist of amended water on the section being worked on. Thoroughly wet ACM using garden sprayer equipment.
- 17) Remove wetted asbestos material and covering jackets in small sections directly into a 6-mil labelled polyethylene bag.
- 18) Maintain asbestos in wet condition at all times during removal and or handling operations. Dispose of material in waste bag and seal tightly.
- 19) Clean surfaces exposed by asbestos removal by brushing and wet wiping. Ensure that all surfaces of piping and other equipment are clean of all residues.
- 20) Immediately after removal of insulation, clean all surfaces and equipment within the work area, including polyethylene drop sheet, using HEPA vacuum or by damp wiping.
- 21) Seal all surfaces of pipe and exposed ends of the insulation or other remaining equipment with a suitable encapsulant.
- 22) Refer to other assigned procedures should more extensive work be required.
- 23) Remove polyethylene floor covering, fold inward, and place in 6-mil polyethylene waste bags. Seal bags tightly and dispose of as asbestos waste.
- 24) Before leaving the work area, decontaminate protective clothing (including boots) and dispose of as asbestos waste.
- 25) Clean all non-disposable tools and items (before leaving the work area).
- 26) Wash hands and face at the completion of the work (before leaving the work area). Damp wipe the respirator and store in a proper place.
- 27) Dispose of protective clothing and spent respirator filter cartridges as asbestos waste.
- 28) Shower at the completion of the work if contamination is suspected.

APPENDIX H
REASSESSMENT OF ACM

REASSESSMENT OF ACM

Upon completion of Reassessment, fill out the following form in its entirety and file in this facility's AMP and survey.

Building Name/Address: _____

Dates of Reassessment: _____

Organization completing Asbestos Reassessment:_____

Name of surveyor: _____

Name of surveyor: _____

Others present: _____

Signature of surveyor:_____

Signature of surveyor: _____

Summary of findings: (If no deterioration noted, indicate here – Specifically indicate only areas requiring action).

[illegible]

Room or Location	Material	Comments regarding condition – Disturbed/Undisturbed (if other, explain)	Action Required

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.
- .2 Read this Section in conjunction with the following Sections:
 - .1 Section 03 20 00: Concrete Reinforcing
 - .2 Section 03 30 00: Cast-In-Place Concrete
 - .3 Section 03 35 00: Concrete Floors and Finishing

1.2 **REFERENCES**

- .1 Conform to the latest edition of the following:
 - .1 CAN/CSA-S136 - North American Specification for the Design of Cold-Formed Steel Structural Members
 - .2 CSA-A23.1 - Concrete Materials and Methods of Concrete Construction
 - .3 CSA O121 - Douglas Fir Plywood
 - .4 CSA S269.1 - Falsework and formwork
 - .5 AODA - Accessibility for Ontarians with Disabilities Act

1.3 **SUBMITTALS**

- .1 Shop Drawings: Submit Shop Drawings showing spacing of form ties for architectural concrete walls in accordance with Section 01 33 00. Show size of tie hole, plastic plug and plug recess.

1.4 **PRODUCT DELIVERY, STORAGE AND HANDLING**

- .1 Store materials on Site in a manner to prevent damage thereto. Protect from the weather. Comply with CSA-A23.1.
- .2 Protect Work of this section from damage. Protect other Work from damage resulting from this Work. Replace damaged Work which cannot be satisfactorily repaired

1.5 **TOLERANCES**

- .1 Construct forms to produce plumb and level concrete, and true to linear building lines. Maximum variations (not accumulative) shall conform to CSA-A23.1.
 - .2 A permitted variation in one part of the construction or in one section of the Specification shall not be construed as permitting violation of more stringent requirements for any other part of the construction, or in any other Specification section.
-

2 Products

2.1 **MATERIALS**

.1 Forms

- .1 Plywood: CSA O121, G1S; Douglas fir plywood, sheets as large as practical, exterior grade, waterproof glue, edges sealed with oil-based sealer.
 - .2 Prefabricated steel forms: CAN/CSA S136-M; free of irregularities, dents, sags, rust, and materials that can discolour concrete finish.
 - .3 Used formwork may be used for surfaces which will be concealed.
 - .2 Form ties: Adjustable snap ties, formed to break 25 mm from surface of concrete after form removal, with a minimum working strength of 13 kN. Do not use wire ties.
 - .3 Falsework materials: To CSA S269.1. Where patented accessories, fabricated forms, shoring or scaffolding units are to be used, follow manufacturer's instructions for load carrying capacity and bracing.
 - .4 Plywood form liner: Medium density overlaid plywood marked "COFI Form Plus"; "Ultraform" by Richmond Plywood Corporation, or "Pourform 107" by Ainsworth Lumber Company Ltd.
 - .5 Form tape: Pressure sensitive plastic film.
 - .6 Form ties: Threaded internal disconnecting, spreader type, adjustable in length, minimum working strength of 13 kN when fully assembled. Ties to have maximum break-back of 38 mm from concrete surface. Ties shall incorporate removable tapered plastic spreader cones, with a setback of 38 mm. (Taper of spreader shall match taper of tie hole plugs).
 - .7 Tie hole plugs: Plastic set back plugs, grey to match concrete, 38 mm setback, to fit tightly into tie holes. Include for tie hole plug quantity on the basis of 750 mm each way plug spacing pattern.
 - .8 Bar type waterstops: Preformed bentonite and butyl rubber-based waterstop, "Waterstop RX 101" (others, see above) by DRE Industries Inc. or approved equivalent. Adhesive for concrete, steel, or PVC: water based "WB-Adhesive" by DRE Industries Inc. or approved equivalent.
 - .9 Rubber waterstops: "Durajoint" by Sika, hot fused joints, type 4B, complete with factory welded corner and intersecting pieces.
 - .10 Bar type waterstops: Preformed water-swelling elastic rubber, "Adeka Ultraseal MC-2010M" as distributed by Form and Build Supply Inc. Securement to substrate shall be either adhesive or concrete nail with packing depending on substrate, as recommended by waterstop manufacturer.
 - .11 Tubular forms: Sonoco Products Ltd. "Sonotube" spirally wound fibre forms free of dents and other irregularities, treated internally with release material.
 - .12 Tubular forms: Newark Paperboard Products "Poli-NewForm" fibre forms with seamless plastic liner.
 - .13 Chamfer strips: 13 x 13 mm triangular fillets milled from clear, straight-grain pine, surfaced each side, or extruded vinyl type.
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- .14 Formwork release agent: Imperial Oil "Filmo No 40", Goodco "Noxcrete", W.R. Meadows "Duogard", Euclid "Super Slip", CPD Chemical Form Release Agent or Dayton Superior "Clean-Strip (J-1)". (For formed concrete Work in contact with the soil, use a material that does not alter sulphate resistant qualities of the concrete).
- .15 Dovetail anchor slots: Minimum 0.6 mm thick Z275 galvanized steel with temporary insulation fill in slots; slots sized to receive dovetail anchors specified in Section 04 22 00.

3 Execution

3.1 **FORMWORK**

- .1 Construct formwork in accordance with CSA-A23.1, except where shown otherwise. Do not leave lumber in concrete.
- .2 Construct falsework in accordance with CSA S269.1.
- .3 Obtain Consultant's approval in writing for use of earth cuts as forms for vertical sides of footings and other Work not exposed to view. If approved, hand trim sides and bottoms and remove loose earth before placing concrete.
- .4 Assume full responsibility for the complete design and engineering of formwork including shoring and bracing to resist loads due to wet concrete, forms, wind, etc., and other forces arising from use of equipment to place concrete.
- .5 Do not set shoring and scaffolding on frozen subgrade. Continuously monitor safety of scaffolding.
- .6 Apply formwork release agent by spray in accordance with manufacturer's recommendations. Ensure surfaces of form receive a uniform coating.
- .7 Align form joints and make watertight. Keep form joints to a minimum.
- .8 Form for depressions, recesses, chases, reglets, anchorages and keys required in concrete.
- .9 Set floor screeds with true and straight top edge to proper elevation.
- .10 Form 13 mm x 13 mm minimum chamfered edges on exposed concrete corners unless shown otherwise. Set chamfer strips to achieve a smooth finish and consistent chamfer size throughout length of concrete.
- .11 Construct forms for concrete exposed in the finished Work to achieve the following:
 - .1 Grout-tight forms at corners, panel joints, recesses, arrises and at construction joints to prevent cement paste from leaking.
 - .2 Accurate alignment of concrete surfaces.
 - .3 Surfaces without indentations other than those shown.
 - .4 Sharp and straight corners.
- .12 Use full-size contact form sheeting panels wherever possible. Carefully install contact surfaces of formwork to produce neat and symmetrical joint patterns. Joints shall be either vertical or horizontal and, where possible, stagger so as to maintain structural continuity. Back vertical joints solidly and nail edges of abutting sheets to same stud. Likewise solidly

back horizontal joints. Take care to ensure adjacent form panels fit accurately, tight and flush. Use straight lumber.

- .13 Align forms to ensure no visible defects appear on finished Work.
- .14 Locate wall form ties in accordance with reviewed Shop Drawings; align on a particular member both vertically and horizontally. Arrange reuse of forms so tie holes are also reused. Tighten form ties, particularly at corners.
- .15 Form slab soffits using full size panels where possible. Keep number of smaller size panels to a minimum.
- .16 Take particular care in forming corners and openings. Ensure formwork is tight and braced so no movement occurs.
- .17 Cleaning and tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

3.2 **CONSTRUCTION JOINTS**

- .1 Form construction joints where required and where shown. Construction joints shall conform to CSA-A23.1.
- .2 Form 50 mm x 100 mm bevelled shear keys full length on construction joints, unless detailed otherwise.

3.3 **WALL CONTROL JOINTS**

- .1 Form "vee" groove control joints to details shown.

3.4 **INSTALLATION OF BAR TYPE BENTONITE WATERSTOPS**

- .1 Install continuous waterstops in all pour joints (i.e. wall-to-slab joint) of a concrete structure that is waterproofed by a bentonite clay waterproofing system or as shown.
- .2 Brush clean debris, dirt, and rocks from dry concrete surface. Verify surfaces are dry.
- .3 Ensure proper waterstop placement for sufficient concrete coverage. Install waterstop along interior side of the outer row of steel reinforcement to allow for minimum concrete cover.
- .4 Apply adhesive by roller or brush to 125 microns thick x width of waterstop to prepared concrete surfaces.
- .5 Allow adhesive to dry ten to fifteen minutes or until adhesive appears black in colour.
- .6 Remove release paper from waterstop and press firmly into dried adhesive. Apply pressure for minimum fifteen seconds to ensure adhesion.
- .7 Butt coil ends of waterstop together to form continuous installation. Do not overlap ends.

3.5 **INSTALLATION OF RUBBER WATERSTOPS**

- .1 Using a trowel, finish smooth that portion of concrete where waterstop is to be placed before concrete has set.
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- .2 Install swelling type rubber waterstops in accordance with manufacturer's directions. Join edges minimum 50 mm.
- .3 Fix the waterstop close up against the substrate, without leaving any gap between the surface and the waterstop.

3.6 **STRIPPING FORMWORK**

- .1 Strip (regular) formwork in accordance with CSA-A23.1. Forms may be removed any time after three days from date of placing concrete or otherwise as directed by Consultant. (Remove plastic spreader cones from architectural form ties in preparation for installation of tie hole plugs or grouting application).
- .2 Strip formwork for soffits of beams, slabs and other spanning members which support weight of concrete only when concrete has reached 70% of its compressive strength, but under no circumstances shall formwork be stripped before seven days after pouring. Reshore concrete for fourteen additional days concurrently.
- .3 Strip formwork for beam and slab sides and other concrete not supporting weight of concrete only when no damage will result from stripping operations.
- .4 Strip fibre forms off architectural concrete two days after pouring, using power operated saw. To strip form, set power saw blade slightly less than thickness of the form, make two vertical cuts and remove form. Then, using a broad bladed tool, carefully pry form off with short strokes by pushing handle toward column. Exercise extreme care so not to mar concrete surface. After stripping, replace form halves on column and wire in place to protect column during construction. Leave around columns until after scaffolding and other formwork have been removed at end of construction to ensure column protection.
- .5 Be responsible for the safety of structure, both before and after removal of forms until concrete has reached its specified twenty-eight day compressive strength.
- .6 Take particular care when removing forms to ensure no damage occurs at corners, arris and the like.
- .7 To help avoid colour variations in architectural concrete, ensure length of time between concrete placing and form removal is approximately the same for each portion of Work.
- .8 In hot weather, wood forms remaining in place are not adequate for curing purposes. Instead, loosen forms as soon as practical without damage to the concrete, and run a water sprayer such as a soil soaker hose on the inside face of forms so as to keep concrete moist. In any case, loosen forms only following time frames specified for stripping.
- .9 In cold weather, defer removal of formwork or replace formwork with insulation blankets, to avoid thermal shock and consequent cracking of concrete surface.
- .10 Install tie hole plugs immediately following removal of spreader cones. Install to a snug fit, maximum setback from concrete surface as specified.
- .11 When concrete is dry, install temporary polyethylene rope in reglets to prevent contamination of same.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.
- .1 Read this Section in conjunction with the following Sections:
 - .1 Section 03 11 00: Concrete Forming
 - .2 Section 03 30 00: Cast-In-Place Concrete
 - .3 Section 03 35 00: Concrete Floors and Finishing

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- .1 CSA-A23.1 - Concrete Materials and Methods of Concrete Construction
- .2 CAN/CSA G30.18-M - Billet-Steel Bars for Concrete Reinforcement
- .3 OPSS 905 - Ontario Provincial Standard Specification Construction Specification for Steel Reinforcement for Concrete
- .4 OPSS 1443 - Ontario Provincial Standard Specification Material Specification for Organic Coatings for Steel Reinforcement
- .5 AODA - Accessibility for Ontarians with Disabilities Act

1.3 **SUBMITTALS**

.1 Shop Drawings

- .1 Submit Shop Drawings in the form of bar lists and placing drawings for review in accordance with Section 01 33 00.
- .2 Draw placing drawings to a scale not smaller than 1:50 and include plans, elevations, sections and details. Drawings shall be in accordance with the latest edition of Reinforcing Steel Institute of Canada's (RSIC) "Manual of Standard Practice".
- .3 Show openings in walls as to position and size. Cooperate with trades requiring openings to ascertain necessary information.
- .4 Show embedded items including conduits.

.2 Test Reports

- .1 Submit certification from reinforcing steel manufacturer confirming compliance of supplied Products to specified CSA standard.

1.4 **PRODUCT DELIVERY, STORAGE AND HANDLING**

- .1 Store materials on Site in a manner to prevent damage thereto. Protect from the weather. Comply with CSA-A23.1, clause 9.
- .2 Protect Work of this section from damage. Protect other Work from damage resulting from this Work. Replace damaged Work which cannot be satisfactorily repaired.

1.5 **TESTS OF REINFORCING**

- .1 Refer to "Quality Control" in Section 01 10 00 – General Requirements.

2 Products

2.1 **MATERIALS**

- .1 Reinforcing steel: Conforming to CAN/CSA G30.18-M, Grade 400 (350).
- .2 Mesh reinforcing: Conforming to CSA G30.5-M, flat sheets (rolls not acceptable).
- .3 Chairs and spacers: As manufactured by Drummond and Reeves Ltd., Acrow Richmond, Superior Concrete Accessories Ltd. or Max Frank GmbH & Co., of sufficient strength to rigidly support weight of reinforcement and construction loads.
 - .1 Use non-corrosive type over metal floor deck.
 - .2 Use chairs with flat plate base for reinforcing over rigid insulation.
- .4 Epoxy grout for dowels/rebars: conforming to ASTM C-881, 100% solids high modulus high strength epoxy gel adhesive; J-51 by Dayton Superior or Anchor Fix 3/Sikadur 35 by Sika Canada Inc.

2.2 **FABRICATION OF REINFORCING STEEL**

- .1 Fabricate reinforcing steel in accordance with reviewed Shop Drawings.
- .2 Bend steel cold; no heating will be permitted. Fabricate reinforcement conforming to CSA-A23.1, Clause 12.
- .3 Ship bundles of reinforcing steel, clearly identified in accordance with reviewed bar lists.

3 Execution

3.1 **EXAMINATION**

- .1 Inspect formwork to ensure it has been completed and adequately braced in place before commencing to place reinforcement.

3.2 **PLACING OF REINFORCING STEEL**

- .1 Place reinforcing in accordance with CSA-A23.1, Clause 12, and reviewed placing Drawings. Support with chairs or spacers in as close a spacing as possible to prevent displacement of reinforcement from intended bar position, before and during placing of concrete. Pieces of block, wood, etc. are not acceptable as chairs and spacers.
 - .2 Before placing, remove all loose scale, dirt, concrete residue from previous pours, oil or other coatings, which would reduce bond.
 - .3 Turn the ends of tie wire towards the interior of the concrete.
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- .4 Do not eliminate or displace reinforcement to accommodate hardware to be embedded in concrete.
- .5 Replace kinked and bent bars not called for on Drawings.
- .6 Bars shall be in lengths as long as possible. Where bars are joined, lap at least the length required by CSA-A23.1 unless shown otherwise.
- .7 Lap wire mesh sections at least 150 mm and wire together securely.
- .8 Unless shown otherwise on Drawings, provide reinforcing to housekeeping pads as follows:
 - .1 100 mm thick pad: 10M at 300 mm o.c. each way middle layer.
 - .2 150 mm thick pad: 15M at 300 mm o.c. each way middle layer.

3.3 **ANCHORING OF DOWELS OR REINFORCING BARS**

- .1 Drill holes in accordance with grout manufacturer's printed directions.
- .2 Blow out dust and debris from holes with compressed air.
- .3 Dispense grout cartridges with a dispensing gun, filling anchoring holes.
- .4 Insert dowel or reinforcing bar, turning slowly during insertion. After insertion, holes should be full of epoxy.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

.1 Labour, Products, equipment and services necessary to complete the Work of this section.

.1 Read this Section in conjunction with the following Sections:

.1 Section 03 11 00 - Concrete Forming

.2 Section 03 20 00 - Concrete Reinforcing.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

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|-----|---------------------|--|
| .1 | ASTM A307 | - Carbon Steel Externally Threaded Standard Fasteners |
| .2 | ASTM A563M | - Carbon and Alloy Steel Nuts [Metric] |
| .3 | ASTM C260 | - Specification for Air-Entraining Admixtures for Concrete |
| .4 | ASTM C881 | - Specification for Epoxy-Resin-Base Bonding System for Concrete |
| .5 | ASTM C494 | - Specification for Chemical Admixtures for Concrete |
| .6 | ASTM C920 | - Standard Specification for Elastomeric Joint Sealants |
| .7 | ASTM C 1116 | - Standard Specification for Fiber-Reinforced Concrete |
| .8 | ASTM C 1550 | - Standard Test Method for Flexural Toughness of Fiber Reinforced Concrete (Using Centrally Loaded Round Panel) |
| .9 | ASTM C 1579 | - Standard Test Method for Evaluating Plastic Shrinkage Cracking of Restrained Fiber Reinforced Concrete (Using a Steel Form Insert) |
| .10 | ASTM C 1609 | - Standard Test Method for Flexural Performance of Fiber-Reinforced Concrete |
| .11 | CAN/CSA-A3001 | - Cementitious Materials for Use in Concrete |
| .12 | CSA-A23.1-14 | - Concrete Materials and Methods of Concrete Construction |
| .13 | CSA-A23.2 | - Methods of Test for Concrete |
| .14 | CSA-G40.20/G40.21-M | - General Requirements for Rolled or Welded Structural Quality Steel |

- .15 CISC/CPMA 2.75 - Canadian Institute of Steel Construction Standard 2.75 - A Quick Drying Primer for Use on Structural Steel
- .16 CAN/CSA G164-M - Hot-Dip Galvanizing of Irregularly Shaped Articles
- .17 SDI/ANSI C - 2011 - Standard for Composite Steel Floor Deck – Slabs
- .18 AODA - Accessibility for Ontarians with Disabilities Act

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

- .1 The flooring Contractor shall supply the concrete as per CSA A23.1-14.
- .2 Store materials on Site in a manner to prevent damage thereto. Protect from weather. Comply with CSA-A23.1-14, Clause 5.1.
- .3 Protect Work of this section from damage. Protect other Work from damage resulting from this Work. Repair damaged Work to the satisfaction of Consultant at no cost to Owner.

1.4 ENVIRONMENTAL CONDITIONS

- .1 Conform to CSA-A23.1-14, Clause 7.4.
- .2 During cold weather, Provide temporary heating and enclosures required. Mix, place and protect concrete in accordance with CSA-A23.1-14, Clause 7.4.
- .3 Designate areas for environmentally responsible disposal of excess concrete and truck washout.

1.5 TOLERANCES

- .1 Concrete in place shall be plumb, level and true to linear building lines. Maximum variations (not accumulative) shall conform to CSA-A23.1-14, Clause 6.4.
- .2 A permitted variation in one part of the construction or in one section of the Specification shall not be construed as permitting violation of the more stringent requirements for any other part of the construction, or in any other Specification section.

1.6 INSPECTION AND TESTS

- .1 Refer to “Quality Control” in Section 01 10 00 – General Requirements.
- .2 Materials and concrete Work will be inspected and tested for conformance to CSA-A23.1-14 and to Specifications by an independent inspection/testing company selected and paid for by the Owner.
- .3 Tests include the following:
 - .1 Obtaining certification of cement.
 - .2 Tests of aggregates.
 - .3 Test for setting mixes of concrete and design of mixes.
 - .4 Concrete cylinder test. Three cylinders from each day's placement for each 110 m³ of concrete or for each 30 m³ of concrete placed in small amounts on successive days.

- .5 Air content test and slump test which will be made on same batch of concrete from which test cylinders are made.
- .4 Tests will be made in accordance with CSA-A23.2.
- .5 Inspection/testing company's reports of tests will be forwarded to Consultant and Contractor with an opinion or reason for any abnormalities noted thereon.
- .6 Inspection/testing company will inspect and review placement of reinforcing steel bars and verify size of reinforcing in accordance with reviewed shop and placing Drawings prior to concrete placement. Any and all irregularities may deem installation to be unacceptable and must be rectified prior to concrete placement. Reports of inspection will be forwarded by the inspection/testing company to Consultant and Contractor.

1.7 **SUBMITTALS**

- .1 Product catalogues: Submit as Shop Drawings, up-to-date catalogue of Products proposed for use under this section in accordance with Section 01 33 00. Include the following in submittal:
 - .1 Specified admixtures
 - .2 Column anchor bolts
 - .3 Premoulded joint filler
 - .4 Joint sealant and primer
 - .5 Sealant
 - .6 Anchor bolt protection
 - .7 Bonding agent
- .2 Concrete mix design: Submit concrete Supplier's latest statistical analysis of all concrete mixes to be used on this Project.
- .3 Concrete producer's certification: Certification that plant, equipment and materials to be used in concrete comply with requirements of CSA-A23.1-14.
- .4 Contractor's quality control: Proposed quality control procedures for hot or cold weather conditions, for ensuring correlation of concrete mix with strength or exposure classification for area of placement, and for finishing and curing methods.
- .5 Anchor bolt setting diagrams: Submit detailed Drawings for anchor bolt setting.

1.8 **RECORDS**

- .1 Keep a written record of the following:
 - .1 Concrete placements, showing location of placement, date of placement and cubic yards or metres of concrete placed.
 - .2 Signed trip ticket for each truck.
 - .3 Ambient air temperature and unusual occurrences during each placement.
 - .2 Permit inspection of records by Consultant at any time. At completion of Work, submit a summary of such data in six copies to Consultant.
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2 Products

2.1 **MATERIALS**

- .1 Select one Product from that specified under each material listing. Source liquid admixtures for concrete from one manufacturer.
 - .2 Portland cement: CAN/CSA-A3001 Normal, Type GU Portland Cement, Moderate Type MSb - Mild Exposure, or High Early Strength Type HE or Sulphate Resistant Type HS.
 - .3 Portland cement: Conforming to CAN/CSA-A3001.
 - .1 Sulphate soil conditions: Sulphate resistant, type HS portland cement, or type GU portland cement blended to specified proportion with cementitious hydraulic slag to CAN/CSA-A3001-03, as specified for severe case, Table 3 of CSA-A23.1-14.
 - .2 Normal conditions: Normal, type GU portland cement.
 - .4 Cementitious hydraulic slag: Conforming to CAN/CSA-A3001.
 - .5 Coarse aggregate: Conforming to CSA-A23.1-14, Clause 4.2.3.4 and Table 11, Group I, 40-5 mm for slabs on grade, 20-5 mm for other slabs, and 9 mm maximum aggregate size for concrete fill on concrete filled steel stair treads and landings. Coarse aggregate to be 100% crushed, in cubular size.
 - .6 Fine aggregate: Conforming to CSA-A23.1-14, Clause 4.2.3.3 and Table 10.
 - .7 Water: Conforming to CSA-A23.1-14, Clause 4.2.2.
 - .8 Formwork: Furnish formwork in accordance with Section 03 11 00.
 - .9 Waterproofing admixture: Euclid, "Eucon Vandex AM 10", Everdure "Caltite", Sika "Sika 1 +ViscoCrete 2100", Xypex "C-500 2%" or Kryton International Inc. "Krystol Internal Membrane (KIM) system", Master Builders Solutions (Formerly BASF Corporation) "MasterLife 300D".
 - .10 Air entraining admixture: Conforming to ASTM C260:
 - .1 Master Builders Solutions (Formerly BASF Corporation) "MasterAir" Series
 - .2 Euclid "Airextra"
 - .3 Grace "Darex AEA EH" or "Darex AEA ED"
 - .4 Axim "Catexol AE260"/"Catexol AE360" (for low slump concrete)
 - .11 Wet curing: Water conforming to CSA-A23.1, clause 4.2.2, clear and entirely free from any elements which might cause staining of concrete, and geosynthetic cloth minimum 0.1 mm thick polyethylene film) complying with maximum allowable moisture loss requirements of ASTM C156.
 - .12 Water reducing admixture: Conforming to ASTM C494 Type A:
 - .1 Master Builders Solutions (Formerly BASF Corporation) "MasterPozzolith" Series or "MasterPolyheed" Series
 - .2 Euclid "WR 75"
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- .3 Grace "WRDA" series or "Zyla" series
 - .4 Axim "Catexol 1000N"
 - .13 Retarding admixture: Conforming to ASTM C494, Type B or Type D:
 - .1 Master Builders Solutions (Formerly BASF Corporation) "MasterSet R" Series or "MasterSet DELVO" Series
 - .2 Or accepted equal
 - .14 Accelerating admixture: Conforming to ASTM C494, Type C or Type E:
 - .1 Master Builders Solutions (Formerly BASF Corporation) "MasterSet AC 534" or "MasterSet FP 20"
 - .2 Or accepted equal
 - .15 High-range water-reducing admixture: Conforming to ASTM C494, Type F:
 - .1 Master Builders Solutions (Formerly BASF Corporation) "MasterGlenium" Series or "MasterRheobuild 1000"
 - .2 Or accepted equal
 - .16 Workability-retaining admixture: Conforming to ASTM C494, Type S:
 - .1 Master Builders Solutions (Formerly BASF Corporation) "MasterSure Z 60"
 - .2 Or accepted equal
 - .17 Corrosion inhibiting admixture: Conforming to ASTM C494, Type C, 30% plus or minus 2% calcium nitrite:
 - .1 Euclid "Eucon CIA" at the rate of 10 litres/m³ (15 litres/m³) of concrete
 - .2 Grace "DCI" or "DCI-S" at the rate of 10 litres/m³ (15 litres/m³) of concrete
 - .3 Axim "Catexol 1000 CNCI" at the rate of 10 litres/m³ (15 litres/m³) of concrete
 - .4 Master Builders Solutions (Formerly BASF Corporation) "MasterLife CI 30" at the rate of 10 litres/m³ (15 litres/m³) of concrete.
 - .18 Shrinkage-reducing admixtures: Conforming to ASTM C 494, Type S:
 - .1 Master Builders Solutions (Formerly BASF Corporation) "MasterLife SRA" Series or "MasterLife CRA 007"
 - .2 Or accepted equal
 - .19 Alkali-silica reaction-inhibiting admixtures: Conforming to ASTM C 494, Type S. Shall contain a nominal lithium nitrate content of 30 percent.
 - .1 Master Builders Solutions (Formerly BASF Corporation) "MasterLife ASR 30".
 - .2 Or accepted equal
 - .20 Viscosity-modifying admixture: Conforming to ASTM C 494:
 - .1 Master Builders Solutions (Formerly BASF Corporation) "MasterMatrix" Series
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- .2 Or accepted equal
 - .21 Synthetic fibers: Shall conform to ASTM C 1116/C 1116M, Type III.
 - .1 Macrosynthetic fibers: Shall have an equivalent flexural strength ratio ($R_{e,3}$) of [] percent when tested in accordance with ASTM C 1609/C 1609M.
 - .2 Dosage shall be as recommended by the manufacturer or as shown on a plan.
 - .1 Master Builders Solutions (Formerly BASF Corporation) "MasterFiber MAC" Series.
 - .2 Euclid Chemical Company "TUF-STRAND SF"
 - .3 Or accepted equal
 - .22 Anchor bolts: To meet specified requirements of ASTM A307, Section 1.3. Provide suitable nuts and washers to meet specified requirements of ASTM A563M, Table 11 (hot-dip galvanized to CAN/CSA G164-M).
 - .23 Anchor bolt protection: Clean, non-soluble, rust inhibitive grease and 0.254 mm thickness polyethylene wrapping.
 - .24 Flowable construction grade grout: Pre-mixed, without aggregate fillers, non shrink, flowable type; complete with forms for flowing in place:
 - .1 Euclid "Euco NS"
 - .2 W.R. Meadows "CG-86"
 - .3 Sika "M-Bed Standard" or "Sika Grout 212"
 - .4 Master Builders Solutions (Formerly BASF Corporation) "MasterFlow 100" (formerly) "Construction Grout"
 - .5 CPD "Non-Shrink Construction Grout"
 - .6 Dayton Superior "1107 Advantage Grout"
 - .7 Five Star Products "FSP Construction Grout"
 - .25 Epoxy grout: Premixed, non-shrink, consisting of thermosetting resin base, with inert fillers, with minimum seven-day compressive strength of 10,000 psi, suitable for use on dry or damp surfaces:
 - .1 Dayton Superior "J-54 Sure-Grip Epoxy Grout"
 - .2 Euclid Chemical Company "E3-G"
 - .3 Sika Chemical Company "Sikadur 42 Grout Pak"
 - .4 W.R. Meadows, Inc. "EG-96 Plus"
 - .5 Five Star Products "DP Epoxy Grout"
 - .26 Bonding agent: Conforming to ASTM C881:
 - .1 Sika Chemical "Sika-Dur Hi-Mod"
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- .2 Euclid "452LV or MV"
 - .3 W.R. Meadows "Resi-Weld 1000"
 - .4 Master Builders Solutions (Formerly BASF Corporation) "MasterEmaco ADH 326" (formerly "Concresive Liquid LPL")
 - .5 CPD "Epoocrete (Hi-Mod)"
 - .6 Dayton Superior "Resi-Bond (J-58)"
 - .7 Five Star Products "Bonding Adhesive"
 - .27 Sealant for exposed V-joints: Grey in colour:
 - .1 Sika "RC-1"
 - .2 Euclid "Eucolastic I"
 - .3 Tremco "Vulkem 116"
 - .4 Master Builders Solutions (Formerly BASF Corporation) "MasterSeal NP1" (formerly Sonolastic "NP-1")
 - .28 Sealant - exterior immersion conditions:
 - .1 Vulkem 171 primer and two-part chemical curing, pour grade Vulkem 245 polyurethane sealant.
 - .2 Master Builders Solutions (Formerly BASF Corporation) MasterSeal P 173 primer and MasterSeal SL2 sealant.
 - .29 Asphalt coating (for portion of steel columns embedded in, or located below, concrete): Henry "110-14" or accepted equal, including primers recommended by coating manufacturer.
 - .30 Bond breaker coating: Dayton Superior "Sure-Lift WB (J5)" or Cresset "Crete-Lease 20-VOC" by Form and Build, two-coat application, brush applied.
 - .31 High density insulation: Dupont Styrofoam "HI-40" or Owens-Corning "Foamular 400" unless shown or noted otherwise.
 - .32 Steel angles: New material conforming to CSA-G40.20-M/G40.21-M, Grade 300W cleaned and primed with primer conforming to CISC/CPMA 2.75 (hot-dip galvanized in accordance with CAN/CSA G164-M requirements).
 - .33 Epoxy capsule type anchors: Hilti "HVA Adhesive Anchor", two-part, threaded steel stud and epoxy adhesive filled capsule anchoring system. Install per manufacturer's recommendations.
 - .34 Premoulded joint filler: Rigid grade, closed cell polyethylene or PVC foam, 6 mm thick, unless shown or noted otherwise, conforming to ASTM D1752, Type 1:
 - .1 W.R. Meadows "Deck-O-Foam" pre-scored, conforming to ASTM 1622 and ASTM 3575.
 - .2 CPD "Closed Cell Foam Joint Filler", conforming to ASTM D1056 and ASTM D1667.
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- .35 Premoulded joint filler adhesive: For securing joint filler to abutting adjacent structures, as recommended or supplied by manufacturer of joint filler used.
- .36 Backer rod type "A": "Spal-Pro Rod" by Metzger-McGuire Co. or "CRL Retainer Spline" by C.R. Laurence, Mississauga, Ontario. Use with epoxy sawcut joint sealant for floor slab on grade only. Backer rod size to be slightly greater than joint width to ensure a snug, secure fit.
- .37 Backer rod type "B": Extruded closed cell, circular polyethylene foam, sized 25% larger than sawcut joint. Use with standard joint sealant for sawcuts in concrete on metal deck.
- .38 Standard joint sealant: Two-component chemically reactive polyurethane-modified conforming to ASTM C920, Type M, Grade NS, Class 25, grey. Use one of the following:
 - .1 Euclid "Eucolastic II"
 - .2 Sika "Sikaflex 2C NS/SL"
 - .3 Tremco "Vulkem 245"
 - .4 Sonneborn "Sonolastic SL2"
- .39 Concrete topping to create slopes: Stabilized concrete aggregate, lightweight insulating concrete conforming to ASTM C332, Group I, as manufactured by Specialty Vermiculite Canada Corp. or accepted equal. Slip sheet: 6 mil polyethylene sheet.

2.2 **FLOOR FINISHES SCHEDULE**

- .1 Type 1
 - .1 Hand screed
 - .2 Power steel trowel finish
 - .3 Water cure

2.3 **CONCRETE MIX PROPORTIONS**

- .1 Ready-mixed concrete and concrete proportions to be in accordance with CSA-A23.1-14, Clause 4.3.1, as per Table 5, Alternative (1) Performance and as follows:
 - .1 Minimum allowable compressive strengths at twenty-eight days are as follows unless otherwise noted or shown on Structural Drawings.
 - .1 15 MPa: for lean concrete fill
 - .2 15 MPa: for mud slab
 - .3 35 MPa: for footings
 - .4 35 MPa: for piers, grade beams, curb and walls
 - .5 32 MPa: for slab on grade (interior)
 - .6 35 MPa: for slab on grade (exterior)
 - .7 35 MPa: for exterior aprons

- .2 Minimum cement content as per code requirement: If blended normal Portland cement/cementitious hydraulic slag is used, slag content to be not more than 25% of total volume of cement.
- .3 Slump at point of deposit: 80 mm with a maximum tolerance of plus or minus 20 mm. Not exceeding 225 mm when high-range water-reducing admixtures are used.
- .4 Keep water-cement ratio to a minimum to increase strength and durability of concrete.
- .2 Note:
 - .1 If supplementary cementing materials are used as part of the percentage of recycled content, Supplier must fill the Consultant's material information sheet template.
 - .2 Exposure classification: as defined in Table 2 of CSA-A23.1-14 and as follows, unless otherwise noted on structural Drawings:
 - .1 C-1 for exterior reinforced concrete
 - .2 N-CF for interior slabs on grades
 - .3 C-1 for interior footing
 - .4 F-1 for exterior non-reinforced concrete.
 - .3 Air content for exterior concrete: conforming to CSA-A23.1-14, Clause 4.3.3, Table 4.
 - .4 Add corrosion inhibitor (to concrete mix) (to concrete mix for foundation walls only) at specified rate.
- .3 Concrete proportions for concrete to be in accordance with CSA-A23.1-14, Clause 4.3.1, and as follows:
 - .1 Minimum allowable compressive strength at 28 days: see 2.3.1.1 unless otherwise noted or shown on the drawings.
 - .2 Minimum cement content: If blended normal Portland cement/cementitious hydraulic slag is used, slag content to be not more than 25% of total volume of cement. If blended type 10 Portland cement/cementitious hydraulic slag is used, slag content to be not more than 35% of total volume of cement.

2.4 **ADMIXTURES**

- .1 Admixtures
 - .1 Add admixtures to concrete mix in accordance with manufacturer's recommendations. Have admixture manufacturer make available, at no cost, upon seventy-two hours notice, the services of a qualified, full-time field representative to assure proper use of admixtures.
 - .2 Except where specified otherwise herein, comply with CSA-A23.1-14.
 - .3 The use of calcium chloride or additional admixtures, other than that specified, is not acceptable.
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.2 MVRA Admixture

- .1 Add MVRA in accordance with manufacturer's instructions. Mix designs below 0.42 and above 0.52 to meet CSA standards may require adjustment. Consult with MVRA manufacturer.
- .2 Freshening on site with held back mix water is acceptable so long as it complies with ACI guidelines and does not exceed the original water-to-cementitious material ratio or the instructions of the Consultant.
- .3 Other admixtures are acceptable, but each must be added separately.
- .4 The following admixtures are not acceptable:
 - .1 Shrink Reducing Admixture (SRA)
 - .2 Crystalline Growth admixture

3 Execution

3.1 **EXAMINATION**

- .1 Confirm surfaces on which concrete is to be placed are free of frost, water, and debris before placing concrete.
- .2 Confirm that reinforcement, inserts and other built-in Work are in place and secured before placing concrete.
- .3 Prior to placement of concrete, confirm that reinforcement is secured in correct location.
- .4 Replace incorrectly fabricated reinforcement, relocate misplaced reinforcement and install omitted reinforcement before concrete is placed, as directed by Consultant. Incorrectly fabricated, misplaced or omitted reinforcement will be considered defective Work performed by this section. Establish elevations of compacted underfloor base prior to commencing Work.
- .5 Establish elevations of compacted underfloor base prior to commencing Work.

3.2 **SETTING AND BUILDING-IN**

- .1 Set and build into formwork anchorage devices and other embedded items required for other Work that is attached to or supported by cast-in-place concrete. Use setting Drawings, diagrams, instructions, and directions provided by Suppliers of items to be attached. Refer to CSA-A23.1-14 "Fabrication and Placement of Hardware and Other Embedded Items" for acceptable tolerances.
 - .2 Advise trades well in advance of scheduled concrete placements to allow adequate time for supply of items to be built in. Have respective trades verify location of items supplied by them.
 - .3 Set column anchor bolts to comply with the following tolerances:
 - .1 Tolerance of anchor bolt location: Conform to CSA-A23.1-14, Clause 6.7.
 - .2 Allowable anchor bolt height tolerance: To within plus or minus 12 mm maximum.
 - .3 Tolerance for placing embedded items: Conform to CSA-A23.1-14, Clause 6.7.
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- .4 Set bumper posts in concrete footings and fill with ram packed 20 MPa concrete. Form top of fill to a crown, smooth finish.

3.3 **PLACING OF CONCRETE**

- .1 Place concrete in accordance with CSA-A23.1-14, Clause 6.8.5.4.
- .2 Install sluices to limit height of free fall of concrete to 1200 mm maximum. Place concrete to prevent layering and segregation and vibrate sufficiently to ensure thorough compaction, maximum density and according to CSA-A23.1-14, Clause 6.8.5.4. Hand spade concrete adjacent to forms.
- .3 Before placing fresh concrete against set or partially set concrete, clean surfaces to remove dirt, scum, shavings, debris, laitance, etc. On set surfaces, brush generously with a bonding compound.
- .4 Check work frequently with accurate instruments during placing of concrete.
- .5 If rubber waterstops are used, systematically and thoroughly vibrate concrete around waterstops to avoid honeycombing and voids, to ensure complete contact between waterstop and concrete.
- .6 Work concrete into complete contact with forms and embedded items. Consolidate concrete adjacent to side forms along the entire length of forms and ensure smooth surface finish after stripping of formwork.
- .7 Install sluices to limit height of free fall of concrete to 1.2 m maximum. Place concrete to prevent layering and segregation and vibrate sufficiently to ensure thorough compaction, maximum density and in accordance with CSA-A23.1, Clause 6.8.5.4. Hand spade concrete adjacent to forms with metal spatulas.
- .8 Before placing fresh concrete against set concrete at construction joints, clean surfaces to remove dirt, scum, shavings, debris, laitance, etc.; grease dowels generously at construction joints. Provide bond break between pours.
- .9 Where floor drains occur, level floor around walls and provide minimum uniform slope of 1.6 mm per 300 mm to drains if not specify otherwise on the design drawings.
- .10 Install premoulded joint filler for full depth of slabs.
 - .1 Except in areas to receive subsequent architectural floor finish, knife score joint filler through 75% of its thickness 6 mm from top of material to be set at finish floor elevation.
 - .2 Set premoulded joint filler in adhesive.
 - .3 Set scored face of filler against existing structure and ensure no adhesive is applied to top 6 mm portion which will be stripped just prior to installation of sealant.

3.4 **PLACING OF REINFORCING STEEL**

- .1 Place reinforcing steel in accordance with reviewed Shop Drawings and Section 03 20 00.

3.5 **TREATMENT OF FORMED CONCRETE**

- .1 Treat and finish exposed formed surfaces in accordance with CSA-A23.1-14, Clause 7.7.

- .2 Where top of grade beams or foundation walls will be exposed to view in the finished Work, steel trowel same to a level, smooth finish.
- .3 Treat and prepare surfaces to be waterproofed or dampproofed to a smooth and even finish free from projecting mortar, concrete fins, honeycombing and other irregularities and with juncture of wall and footing covered with masonry mortar. Patch as required in accordance with CSA-A23.1-14, Clause 7.7.2.

3.6 **ARCHITECTURAL CONCRETE**

- .1 All concrete surfaces exposed to public view shall be "Architectural Concrete" quality in accordance with CSA-A23.1-14/A23.2, Clause 8.3 - Architectural Concrete. Finish such exposed concrete to a "light sandblast" finish in accordance with ACI 303R.

3.7 **ANCHOR BOLT PROTECTION**

- .1 Adequately protect unburied portion of anchor bolts set in concrete, including nuts and washers from rusting, corrosion and damage by a heavy coating of specified coating material; wrap in a manner to exclude moisture.
- .2 Clean surfaces to be protected to bare steel followed by the specified protection system.

3.8 **GROUTING**

- .1 Grout column base plates prior to installation of siding, precast panels or decking. Shims or double nuts alone are not structurally stable to carry the foregoing loads.
- .2 Place grout in accordance with the grout manufacturer's printed directions. Form around bases, place grout in a manner which will ensure positive bearing of the full area of the steel plate on top of the supporting surface. Thoroughly compact, leaving no voids.

3.9 **SEALANT APPLICATION**

- .1 Sealant at V-joints: Prime, prepare substrate and apply sealant full joint depth in accordance with manufacturer's printed directions. Tool to a smooth semi-concave finish. Exclude joints in surfaces to receive waterproofing treatment.

3.10 **CONSTRUCTION JOINTS**

- .1 Form construction joints. Dowels occur on construction joints unless detailed otherwise. Grease dowels generously just prior to new pour. Place bond break to adjacent slabs. Place galvanized circular steel forms as column isolation joints as shown..

3.11 **SAWCUTTING CONTROL AND CONSTRUCTION JOINTS – SOFT CUT JOINTS**

- .1 Sawcut control joints and construction joints in slab in straight lines, 3 mm wide x 35 mm deep for slab on grade, and 3 mm wide x 30 mm deep for slab on metal deck.
 - .2 Perform "dry method" using "Soff-Cut saw" as soon as the slab will support the weight of the saw and operator without disturbing the final finish. Perform sawcutting from zero to two hours after final floor finishing or within a concrete cutability window of 1.1 MPa/10.5 kg/cm² to a maximum of 5.6 MPa/56.3 kg/cm². Replace manufacturer's patented anti-ravel skid plate with each new blade to avoid spalling and ravelling.
 - .3 Take sawcut joints to face of columns.
 - .4 After sawcutting, vacuum clean joints to remove dust and debris.
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- .5 When cleaned joints are dry and prior to traffic being allowed over area, install temporary polyethylene backer rod in joints to prevent contamination of same.

3.12 **SAWCUTTING CONTROL AND CONSTRUCTION JOINTS – REGULAR SAWCUT JOINTS**

- .1 Sawcut control joints and construction joints in slab straight lines, 3 mm wide x 35 mm deep for slab on grade, and 3 mm wide x 30 mm deep for slab on metal deck.
- .2 Perform sawcutting twelve to twenty-four hours after concrete (or deferred monolithic traprock topping) has been placed, depending on when saw can be run over concrete surface without leaving tread marks, when concrete can be sawn without dislodging aggregate and before uncontrolled shrinkage has occurred. Do not postpone sawing operations beyond these time limitations. Concrete not utilizing retarding admixtures placed with temperature exceeding 26°C (79°F) shall be sawn not later than twelve hours after placing.
- .3 In strip poured slabs, sawcut joints at locations shown in accordance with the following sequence:
 - .1 Initially, sawcut mid-transverse section of completed strip pour with a fine saw blade.
 - .2 Vacuum out debris and re-run saw over finely cut joint using a blade of size to produce 5 mm wide x 35mm deep sawcuts.
 - .3 Repeat .1 and .2 at one-quarter points (one each side of the mid-sawcut on poured strip).
 - .4 Cut other sawcuts in the strip to 3 mm wide x 35mm deep (i.e. no fine sawcutting required).
- .4 Continuously spray water on saw blade during sawing. Grind edges of sawcuts to eliminate burrs; do not grind to bevel or chamfer joint edges. In sawcutting floor slabs on metal deck, run a wet vacuum cleaner immediately behind sawcutting equipment.
- .5 Take sawcut joints to face of columns.

3.13 **CURING/SEALING OF SLABS**

- .1 At premoulded joints to be subsequently caulked, and after curing/sealing operations are complete, remove scored strip from top of isolation joints in floor slab. Clean joints above premoulded joint filler and place temporary polyethylene rope to prevent contamination of joint until sealant is applied.

3.14 **JOINT FILLER**

- .1 Do not apply filler in areas of concrete slab which are to receive quarry tile, ceramic tile, carpet, resilient flooring or epoxy topping system.
 - .2 Do not fill isolation joints, construction joints, and control joints sooner than 120 days after concrete pours. Execute joint sealing during cool, dry ambient conditions when slab is in contracted state to minimize future joint separation at sealant-filled joints. Provide filler maintenance if filler must be applied sooner than specified as accepted by Consultant.
 - .3 Clean sawcut joints with a high power industrial vacuum cleaner to remove dust and debris. Do a second pass of vacuum cleaner as required to render joints clean.
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- .4 Fill sawcuts in concrete floor slab on grade using heavy duty sawcut joint filler (epoxy or polyurea), as follows:
 - .1 Using epoxy: Provide type "A" backer rod in sawcut joints, push to the bottom of sawcut. Fill joint with filler, finish top flush with the surface of the slab.
 - .2 Using polyurea: Fill joint full depth with filler, finish top flush with the surface of the slab.
- .5 Prime walls of joint as recommended by filler manufacturer. Mix filler as directed by manufacturer. Coat surfaces of metal in contact with filler primer as recommended by filler manufacturer.
- .6 At sawcuts in concrete slabs on metal deck, provide type "B" backer rod, set to allow a sealant depth of 13 mm. Fill remainder of joint with standard joint sealant. Top of sealant to be slightly concaved from the surface of the slab.
- .7 Comply with sealant manufacturer's primer, application and temperature requirements. Mask floor to edge of joints and fill joint with joint filler. After initial set prime sealant surface and refill joints with sealant as required to produce slightly convex joint surface.
- .8 Remove 6 mm scored strip from top of premoulded joint filler. Caulk over premoulded joint filler with standard joint sealant.
- .9 Fill exterior sawn construction and control joints and over premoulded isolation joint filler with specified standard joint sealant (hydrocarbon resistant joint sealant).

3.15 **SITE CLEAN UP**

- .1 Remove excess materials including waste hardened concrete and other debris resulting from Work of this section from Site and leave premises in a condition acceptable to Consultant.

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.
- .1 Read this Section in conjunction with the following Sections:
 - .1 Section 03 11 00: Concrete Forming
 - .2 Section 03 20 00: Concrete Reinforcing
 - .3 Section 03 30 00: Cast-In-Place Concrete

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- .1 ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - .2 ASTM A820 - Standard Specification for Steel Fibres for Fibre Reinforced Concrete
 - .3 ASTM C156 - Test Method for Water Retention by Concrete Curing Materials
 - .4 ASTM C157/157M-08 -Standard Test Method for Length of Change of Hardened Hydraulic-Cement Mortar and Concrete
 - .5 ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
 - .6 ASTM C494 - Standard Specification for Chemical Admixtures for Concrete
 - .7 ASTM C881 - Specification for Epoxy-Resin-Base Bonding Systems for Concrete
 - .8 ASTM C920 - Standard Specification for Elastomeric Joint Sealants
 - .9 ASTM C1260 - Standard Test Method for Potential Alkali Reactivity of Aggregates
 - .10 ASTM C1609 - Flexural Performance of Fiber Reinforced Concrete (Using beam with third-point loading)
 - .11 ASTM D1752 - Standard Specification For Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
 - .12 ASTM G109 - Standard Test Method for Determining Effects of Chemical Admixtures on Corrosion of Embedded Steel Reinforcement in Concrete Exposed to Chloride Environments
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- .13 AASHTO T259 - Standard Test Method to Chloride Ion Penetration (Salt Ponding Method)
- .14 CAN/CSA-A3001 - Cementitious Materials for Use in Concrete
- .15 CSA-A23.1 - Concrete Materials and Methods of Concrete Construction
- .16 CSA-A23.2 - Methods of Test for Concrete
- .17 CAN/CSA G30.18-M - Billet-Steel Bars for Concrete Reinforcement
- .18 CE - *Conformite Europeene* (European Conformity)

1.3

SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Submit manufacturer's Product data, performance criteria and other documentation for each material specified in this section that is proposed for use, including:
 - .1 Admixtures
 - .2 Liquid curing/sealing, curing/hardener and curing/antispalling compound
 - .3 Premoulded joint filler
 - .4 Joint sealant and primer
 - .5 Bonding agent
- .3 Also submit the following:
 - .1 Proposed method for bulkheads and formwork
 - .2 Proposed placement equipment
 - .3 Schedule of events and casting plan regarding placement operations, and records of concrete casts
 - .4 Letter from steel fibre manufacturer certifying that steel fibres have obtained the CE marking of System 1 and a copy of the CE product label.
 - .5 Certification of current membership in good standing, with the Concrete Floor Contractors Association (CFCA).
- .4 Concrete mix design: Submit concrete Supplier's latest statistical analysis of all concrete mixes to be used on this Project.
- .5 In addition to that specified above, submit other documents as defined in the referenced CSA standards which are applicable to Work of this section.

1.4

RECORDS

- .1 Keep a written record of concrete placements, showing location, date, cubic metres of concrete including signed trip ticket for each truck, ambient air temperature, and unusual occurrences during each placement. Permit inspection of records by Consultant at any time. At completion of Work, submit a summary of such data in triplicate to Consultant.

1.5 **QUALITY ASSURANCE**

.1 Single Source Subcontractor

- .1 It is the intent of this section to establish a single competent source being the concrete floor finishing trade Subcontractor to be responsible for providing complete, durable concrete floors and other concrete structures as specified herein, including provision of formwork, reinforcing, concrete and finishing complete as specified herein.
- .2 Slab placing and finishing shall be done by an established Subcontractor with at least five years of proven, accredited and satisfactory experience in this trade, employing skilled personnel. Submit proof of this requirement to Consultant.

.2 Steel Fibre Supplier

- .1 The steel fibre Supplier shall have a minimum five years experience in Canada and provide a list of job histories that demonstrates their Product has been used successfully in a minimum of five projects of similar type, size and complexity.
- .2 If the Supplier of the steel fibres is not the manufacturer, the distributor shall document that they have a minimum five years experience in distributing steel fibres from the same source.
- .3 If steel fibres are supplied from different manufacturing facilities the Supplier shall provide documentation that material being produced meets the same quality at all locations. The Supplier shall provide traceability of the fibre back to the manufacturing facility.

1.6 **INSPECTION AND TESTS**

- .1 Refer to "Quality Control" in Section 01 10 00 – General Requirements.
 - .2 Materials and concrete Work will be inspected and tested for conformance to CSA-A23.1 and to Specifications by an independent inspection/testing company selected and paid for by Owner.
 - .3 Tests include the following:
 - .1 Obtaining certification of cement
 - .2 Tests of aggregates
 - .3 Verification of steel fibre content
 - .4 Test for setting mixes of concrete and design of mixes
 - .5 Concrete cylinder test. Three cylinders from each day's placement for each 110 m³. of concrete, or for each 30 m³. of concrete placed in small amounts on successive days.
 - .6 Slump tests made on the same batch of concrete from which test cylinders are made.
 - .4 Tests will be made for conformance of Work to CSA-A23.1 in accordance with CSA-A23.2.
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- .5 Inspection/testing company's reports of tests will be forwarded to Consultant and to Contractor with an opinion or reason for any abnormalities noted thereon.

1.7 **PRE-CONSTRUCTION MEETING**

- .1 Prior to start of Work, arrange for a Project site meeting of all parties associated with Work of this section. Presided by Consultant, meeting to include Contractor, floor finishing Subcontractor, admixture manufacturer representative, floor Products manufacturer representative, Owner's Representative, and testing company's representative.
- .2 In the meeting, review Specifications for Work included under this section and determine a complete understanding of requirements and responsibilities relative to Work included, storage and handling of materials, materials to be used, placing of underslab vapour retarder or waterproofing, installation of materials, sequence and quality control, Project staffing, restrictions on areas of concrete placements, and other matters affecting the construction, so as to permit compliance with the intent of this section.

1.8 **PRODUCT DELIVERY, STORAGE AND HANDLING**

- .1 Store materials on Site in a manner to prevent damage thereto. Protect materials from inclement weather. Comply with CSA-A23.1, Clause 5.1.
- .2 Protect materials and Work of this section from damage. Protect other Work from damage resulting from this Work. Replace damaged Work which cannot be satisfactorily repaired.

1.9 **ENVIRONMENTAL CONDITIONS**

- .1 During hot weather, conform to CSA-A23.1 Clause 7.4.
- .2 During cold weather, provide temporary heating and enclosures required. Mix, place and protect concrete in accordance with CSA-A23.1, Clause 7.4.
- .3 Use insulated polyethylene blankets over top of interior concrete slabs in addition to geosynthetic cloth when curing concrete in periods of cold weather.
- .4 Do not use propane heaters. All temporary heaters to be vented to outside. Do not use propane or gas powered vehicles during concrete placements.

1.10 **VERIFICATION**

- .1 Verify actual sizes of equipment pads with the mechanical, process and/or electrical Contractors, in advance of placing concrete. If there is deviation from dimensions shown on Consultant's Drawings, inform the Consultant and request authorization to proceed.

1.11 **TOLERANCES**

- .1 Concrete in place shall be plumb, level and true to linear building lines. Maximum variations (not accumulative) shall conform to CSA-A23.1, Clause 6.4.
 - .2 Slabs-on-grade: slab flatness tolerances in accordance with CSA-A23.1, Table 22, Class C: $F_F=35$ and $F_L=25$ specified overall, and $F_F=20$ and $F_L=17$ minimum local. Levelness tolerances (F_L) do not apply to inclined surfaces. Refer to CSA-A23.1 Clause 7.5.1.3.
 - .3 Suspended floor slabs: Slab flatness tolerances in accordance with ACI Standard 302: $F_F=25$ specified overall and $F_F=17$ minimum local. (In the case of suspended floor slab
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receiving thin set tile or resilient flooring: $F_F=30$ specified overall, and $F_F=25$ minimum local.

- .4 A permitted variation in any part of the construction or in any section of Specification shall not be construed as permitting violation of more stringent requirements for any other part of construction or in any other Specification section.

1.12 **WARRANTY**

- .1 Warrant Work of this section against defects and deficiencies for a period of two years from date Work is certified as substantially performed in accordance with the general conditions of the Contract.
- .2 Promptly make good defects and deficiencies which become apparent within the Warranty Period by replacing defective Work satisfactory to the Consultant and at no expense to the Owner.
- .3 Defects shall include but are not limited to de-bonding of deferred topping from structural slab, spalling and/or cracking.

2 **Products**

2.1 **MATERIALS**

- .1 Use one Product from that specified under each material. Source liquid admixtures for concrete from one manufacturer. Source liquid curing/sealing compound by same manufacturer which is supplying shake hardener.
- .2 Non-metallic hardener: Factory pre-mixed dry shake:
 - .1 Master Builders Solutions Canada Inc. "MasterTop 110 ABR"
 - .2 Sika "Diamag 7"
 - .3 Euclid "Surflex"
 - .4 CPD "Floor Hardener Pre-Mix (Standard)"
 - .5 Dayton Superior "Quartz Tuff"
- .3 Metallic hardener: Factory pre-mixed dry shake:
 - .1 Master Builders Solutions Canada Inc. "MasterTop 200"
 - .2 Sika "Ferroplete"
 - .3 Euclid "Eucoplate HD"
 - .4 CPD "Duramet Floor Hardener Pre-Mix"
 - .5 Dayton Superior "Ferro-Tuff"
- .4 Non-oxidizing metallic hardener: Factory pre-mixed dry shake:
 - .1 Euclid "Diamond-Plate"
 - .2 Master Builders Solutions Canada Inc. "MasterTop 210 COR – Natural" (formerly "Lumiplate-Natural")

- .5 Emery hardener: Natural emery aggregate pre-mixed with Type 10 normal Portland cement, superplasticizers and wetting agents:
 - .1 Sika "Emeri-Crete SH Premixed"
 - .2 Euclid "Surflex-E"
 - .3 Dayton Superior "Emery Tuff"
 - .6 Conductive/static disseminating/spark resistant hardener: Factory pre-mixed dry shake:
 - .1 Dayton Superior "Ferro Tuff S.D." or accepted equal.
 - .7 Liquid curing/sealing compound solvent based acrylic: Conforming to ASTM C309 Type 1, Class B and CSA-A23.1, having minimum solids content of 27%:
 - .1 Euclid "Diamond Clear"
 - .2 Dayton Superior "Day-Chem Cure + Seal 30%"
 - .8 Liquid curing/sealing compound
 - .1 Water based acrylic: Conforming to ASTM C309, Type 1, Class B and CSA-A23.1:
 - .1 "Vocomp-25 or Vocomp-20" – used in conjunction with Sure Step (slip-resistant additive).
 - .2 Master Builders Solutions Canada Inc. "MasterKure CC 160 WB"
 - .3 Euclid "Aqua-Cure"
 - .4 Sika "Florseal W.B."
 - .5 CPD "Cure & Seal 20 (Water Based)"
 - .6 Dayton Superior "Safe Cure + Seal (J-18)"
 - .2 Water based acrylic: Conforming to ASTM C309, Type 1, Class B, and CSA-A23.1, but with a minimum solids content of 26%:
 - .1 Master Builders Solutions Canada Inc. "MasterKure CC 1315 WB" (formerly "Kure 1315")
 - .2 Euclid "Super Aqua-Cure"
 - .9 UV-resistant liquid curing/sealing compound - solvent based acrylic: Conforming to ASTM C309, Type 1, Class B, 26% - 30% solids content:
 - .1 Sonneborn "Kure-N-Seal 30"
 - .2 Euclid "Super Diamond Clear"
 - .3 Dayton Superior "Day-Chem Cure + Seal (J-22)"
 - .4 W.R. Meadows "CS309/30"
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- .10 Water for curing: Conforming to CSA-A23.1, Clause 4.2.2, clear and entirely free from any elements which might cause staining of concrete.
- .11 Conductive liquid curing compound: For use with conductive/static disseminating, spark resistant finishes:
 - .1 Dayton Superior "Day-Chem S.D. Cure"
 - .2 Approved equivalent
- .12 Dustproof compound: Concrete floor hardener and dustproofing treatment.
 - .1 Sika "Sealhard 400"
 - .2 Dayton Superior "Day-Chem Hardener (J-15)"
 - .3 Euclid "Surfhard"
 - .4 W.R. Meadows "Med-Cure"
 - .5 Master Builders Solutions Canada Inc. "MasterKure HD 300 WB"
- .13 Liquid densifying/hardening compound: Proprietary blend of silicate polymers:
 - .1 W.R. Meadows "Liqui-Hard"
 - .2 "Ashford Formula" by Duracon Consulting
 - .3 Euclid "Euco Diamond Hard"
 - .4 Dayton Superior "Day-Chem Sure Hard (J-17)"
 - .5 Sika "Sikafloor 3S"
 - .6 Master Builders Solutions Canada Inc. "MasterKure HD 200 WB"
- .14 Concrete Enhancer / protection: "Bellatrix" by WR Meadows, used in conjunction with Liqui-Hard or approved equivalent. Used on previously sealed surfaces, as well as surfaces that have been previously stained or dyed and sealed. Check compatibility with existing sealer prior to full application.
- .15 Geosynthetic cloth for wet curing: Terrafix 240R or approved equivalent.
- .16 Polyethylene film for wet curing: Minimum 0.1 mm thick, complying with maximum allowable moisture loss requirements of ASTM C156.

2.2 **FLOOR FINISHES SCHEDULE**

- .1 Refer to Section 03 30 00 Cast-in Place Concrete

3 Execution

3.1 **EXAMINATION**

- .1 Examine previously constructed Work including placement and compaction of underfloor materials. Check thicknesses and review compaction test results of sub-floor fill to receive this Work. Report to Consultant in writing any defects or discrepancies. Commencement of Work implies acceptance of existing conditions.

- .2 Establish elevations of compacted underfloor base prior to commencing Work.
- .3 Ensure that placing of limestone is sequenced with placing of concrete to avoid displacement of limestone by construction traffic.

3.2 **FLOOR FINISHING**

.1 Laser Screeding

- .1 Laser screed floor slabs as scheduled herein, using a laser screed vehicle. The laser vibratory screed is to be operated only by trained and qualified personnel who are fully familiar with the equipment.
- .2 Machine float and machine trowel floor surfaces to smooth, level and dense surfaces free from trowel marks, ridges and depressions. Equip screeds for super flat floor with laser.
- .3 Use hand-held vibratory screed, float and trowel surfaces in areas inaccessible to laser screed vehicle, to same density and surface quality specified for floors finished with laser screed.

.2 Power Screeding

.1 Interior Slabs

- .1 Power screed floor slabs with mechanical vibratory screeding equipment. Machine float and machine trowel floor surfaces to smooth, level and dense surfaces free from trowel marks, ridges and depressions. Use hand vibrators in non-strip poured concrete slab.
- .2 Immediately following floating, remove water accumulation from slab edges.

.2 Exterior Slabs

- .1 Power screed exterior floor slabs with mechanical vibratory screeding equipment. Float surface to provide a sidewalk "swirl" texture.
- .3 Use hand-held vibrators and hand screed, float and trowel surfaces in areas inaccessible to power equipment, to same density and surface quality specified for floors finished with power operated equipment.
- .4 For concrete mixes containing steel fibre reinforcement, ensure that finishing process leaves surface free of protruding fibres. If fibres protrude from surface after concrete has set, remove protruding fibres. Fill any resulting groove in the floor with an epoxy cement paste, finish smooth and level with the floor.
- .5 Do not contaminate or adulterate various floor finishing mixes.

3.3 **TRAPROCK SHAKE HARDENER**

- .1 Over freshly floated concrete, apply premixed traprock shake in two equal applications at right angles to a total minimum application rate specified. Distribute evenly. Float between application of shake and after second shake applications with power floats. Machine trowel to smooth, level and dense surface, in uniform colour, free from trowel marks, ridges, pinholes and other defects.
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- .2 Vacuum dewater finished traprock topped/hardened floor to remove excess water from the surface of slab.

3.4 **NON-METALLIC HARDENER**

- .1 Power screed floor slab and float area indicated to receive non-metallic hardener.
- .2 Over freshly floated concrete, apply premixed non-metallic shake in two equal applications at right angles, to total application rate specified. Distribute evenly. Do not throw shake. Float between applications of shake and after second shake application with power floats. Machine trowel to smooth, level and dense surface, in uniform colour, free from trowel marks, ridges, pinholes and other defects.

3.5 **METALLIC HARDENER**

- .1 Power screed floor slab and float area indicated to receive metallic hardener.
- .2 Over freshly floated concrete, apply premixed metallic shake in two equal applications at right angles, to total application rate specified. Distribute evenly. Do not throw shake. Float between applications of shake and after second shake application with power floats. Machine trowel to smooth, level and dense surface, in uniform colour, free from trowel marks, ridges, pinholes and other defects.

3.6 **EMERY HARDENER**

- .1 Power screed floor slab and float area indicated to receive emery hardener.
- .2 Over freshly floated concrete, apply emery shake in two equal applications at right angles, to total application rate specified. Distribute evenly. Do not throw shake. Float between applications of shake and after second shake application with power floats. Machine trowel to smooth, level and dense surface of uniform colour, free from trowel marks, ridges, pinholes and other defects.

3.7 **MISCELLANEOUS FINISHES**

- .1 In areas specified to receive subsequent epoxy or urethane floor overlay or coating, finish concrete floor surface with one pass steel trowel.
- .2 Install abrasive nosings to stair treads prior to placement of concrete and hand trowel treads to a swirl, non-slip surface.
- .3 On stair treads to receive resilient floor, steel trowel concrete to a smooth finish.

3.8 **CURING/SEALING OF STRIP POURED SLABS - GENERAL**

- .1 Immediately after finishing of alternate strip pours, and prior to sawcutting, apply liquid curing/sealing compound to strip edges for width of 900 mm from edges.
 - .2 At premoulded joints to be subsequently caulked, and after curing/sealing operations are complete, remove scored strip from top of isolation joints in floor slab. Clean joints above premoulded joint filler and place temporary polyethylene rope to prevent contamination of joint until sealant is applied.
 - .3 Refer to "Floor Finishes Schedule" as specified previously herein for type of curing/ sealing for various floor areas.
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3.9 CURING/SEALING OF SLABS – NON-SUPERFLAT FLOORS

- .1 At premoulded joints to be subsequently caulked, and after curing/sealing operations are complete, remove scored strip from top of isolation joints in floor slab. Clean joints above premoulded joint filler and place temporary polyethylene rope to prevent contamination of joint until sealant is applied.
- .2 Refer to "Floor Finishes Schedule" as specified previously herein for type of curing/sealing for various floor areas.

3.10 WATER CURING AND LIQUID COMPOUND SEALING

- .1 Winter Concreting
 - .1 After sawcutting operations have been completed, water down entire area and cover with geosynthetic cloth and overlay with insulated polyethylene blankets. Remove geosynthetic cloth and blanket after seven consecutive days minimum and allow substrate to dry. When dry, approximately forty-eight hours, apply first coat of liquid curing/sealing compound at rate and by method recommended by manufacturer.
 - .2 Apply second coat at same rate as first coat immediately after first coat has dried, and prior to traffic being allowed over area.
- .2 Non-Winter Concreting
 - .1 After sawcutting operations have been completed, water down entire area and cover with filter cloth. Remove cloth after seven consecutive days minimum and allow substrate to dry. When dry, approximately forty-eight hours, apply first coat of liquid curing/sealing compound at rate and by method recommended by manufacturer.
 - .2 Apply second coat at same rate as first coat immediately after first coat has dried, and prior to traffic being allowed over area.

3.11 WATER CURING AND LIQUID DENSIFYING/HARDENING COMPOUND

- .1 Winter Concreting
 - .1 After sawcutting operations have been completed, water down entire area and cover with geosynthetic cloth and overlay with insulated polyethylene blankets. Remove geosynthetic cloth and blanket after three consecutive days minimum and allow substrate to dry. On the fifth day, apply one coat of liquid densifying/hardening compound by method recommended by manufacturer.
 - .2 (Immediately after first coat of liquid densifying/hardening compound has dried, and prior to traffic being allowed over area, apply a second coat at the rate of 25% of the volume of the first coat).
 - .3 Dry buff applied compound after it has cured for minimum twenty-four hours, to provide immediate gloss.
 - .2 Non-Winter Concreting
 - .1 After sawcutting operations have been completed, water down entire area and cover with filter cloth. Remove cloth after three consecutive days minimum and allow substrate to dry. On the fifth day, apply one coat of liquid densifying/hardening compound by method recommended by manufacturer.
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- .2 (Immediately after first coat of liquid densifying/hardening compound has dried, and prior to traffic being allowed over area, apply a second coat at the rate of 25% of the volume of the first coat).
- .3 Dry buff applied compound after it has cured for minimum twenty-four hours, to provide immediate gloss.

3.12 **CURING OF IN-FILL OR CLOSURE SLABS**

- .1 After sawcutting operations have been completed, apply one coat of curing/sealing compound in accordance with manufacturer's recommendations. Apply second coat at same rate as first coat immediately after first coat has dried, and prior to traffic being allowed over area.

3.13 **LIQUID COMPOUND CURING/SEALING – AGGREGATE SHAKES (AND TOPPINGS)**

- .1 After sawcutting operations have been completed, cure and seal floor finished with shake hardener or topping with one coat of liquid curing/sealing compound at rate and by method recommended by manufacturer.
- .2 Apply second coat at same rate as first coat immediately after first coat has dried, and prior to traffic being allowed over area.
- .3 In static disseminating/spark resistant hardened floor, apply one coat of conductive curing/sealing compound only. After compound has hardened, sweep floor and Provide a temporary building paper covering over the entire area.

3.14 **WATER CURING**

- .1 Water cure floors designated to be surfaced with ceramic or quarry tile, and epoxy or urethane. Do not use curing/sealing compound.
- .2 Using geosynthetic cloth: Immediately after floors have been power trowelled and water sheen has dissipated, cover slabs with geosynthetic cloth for a minimum of seven days. Remove geosynthetic cloth in sections to execute required sawcutting of slabs, then replace as specified herein. Upon completion of curing period, remove and dispose of geosynthetic cloth cover, boards and ballast from the Site.
- .3 Using polysheet: Immediately after floors have been power trowelled and water sheen has dissipated, cover slabs with polyethylene sheet for a minimum of seven days. Lap end and side laps between polyethylene sheets a minimum of 300 mm and apply wood boards over laps to prevent sheet from displacing. Apply additional wood boards or other form of ballast in field of sheet as required to prevent wind and other forms of displacement. Remove polyethylene sheet in sections to execute required sawcutting of slabs, then replace as specified herein. Upon completion of curing period, remove and dispose of polyethylene sheet cover, boards and ballast from the Site.

3.15 **JOINT FILLER**

- .1 Refer to Section 03 30 00 Cast-in-place Concrete.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- | | | | |
|-----|-----------------|---|--|
| .1 | CAN/ULC-S102 | - | Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies |
| .2 | CSA A82.1-M | - | Burned Clay Brick |
| .3 | CSA A165 Series | - | CSA Standards on Concrete Masonry Units |
| .4 | CSA A179 | - | Mortar and Grout for Unit Masonry |
| .5 | CSA A370 | - | Connectors for Masonry |
| .6 | CSA S304.1 | - | Design of Masonry Structures |
| .7 | CSA A371 | - | Masonry Construction for Buildings |
| .8 | CSA W47.1 | - | Certification of Companies for Fusion Welding of Steel Structures |
| .9 | CSA W48.1-M | - | Carbon Steel Covered Electrodes for Shielded Metal Arc Welding |
| .10 | CSA W59-M | - | Welded Steel Construction (Metal Arc Welding) |
| .11 | CSA W117.2 | - | Safety in Welding, Cutting, and Allied Processes |
| .12 | AODA | - | Accessibility for Ontarians with Disabilities Act |

1.3 **SUBMITTALS**

.1 Submit the following in accordance with Section 01 33 00:

.2 Product data: Submit as Shop Drawings, manufacturer's specifications and other data for masonry.

.3 Samples

- .1 Submit two samples of each masonry unit.
- .2 If coloured mortar is specified, submit a sample board incorporating specified unit masonry in selected coloured mortar.
- .3 Ensure materials used do not vary in any respect from approved samples. If variations occur in materials delivered to Site, Consultant may, at its discretion, reject such materials
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- .4 Scaled masonry wall elevations with the following information:
 - .1 Block arrangement, wall thickness
 - .2 Core fills
 - .3 Rebar, rebar designation, laps, dowels, and anchors
 - .4 Openings and lintels
 - .5 Bond beam and horizontal reinforcement
 - .6 Control joint location and extent
- .5 Submit EPD (Environmental Product Declaration) for concrete masonry units.
 - .1 EPD to be prepared in accordance with ISO 14025 and ISO 21930.
 - .2 EPD to report GEP (Global Warming Potential) in units of kg CO2 equivalent per cubic meter of concrete masonry product

1.4 **PRODUCT DELIVERY, STORAGE AND HANDLING**

- .1 Check materials for damage and carefully unload. Remove unsatisfactory materials from the Site and replace with new materials to satisfaction of Consultant at no increase in Contract Price.
 - .2 Store materials on Site in a manner to prevent damage thereto. Stockpile for easy heating if required. Protect from the weather. Do not concentrate storage on any part of the structure so as not to set up any strain beyond the designed load of any portion thereof.
 - .3 Take particular care so as not to overload unsupported portions of the structure which have not attained their full strength.
 - .4 Comply with CSA A371.
 - .5 Protect the following:
 - .1 Masonry materials during storage and construction from wetting by rain, snow or ground water, or inter-mixture with earth or other materials.
 - .2 Metal reinforcing or ties against corrosion or contamination, including ice, which will reduce or destroy bond.
 - .3 Other Work from damage resulting from this Work.
 - .4 Sills, ledges and projections from droppings of mortar.
 - .6 Cover tops of masonry walls not enclosed or sheltered during rain, at the end of each day's construction and at times when Work is not in progress, with waterproof covers temporarily secured against displacement, until flashings are completed. Drape cover over wall and extend 600 mm down both sides. Anchor securely in position. Protect exposed corners against droppings or damage from other trades, by boarding or other means.
 - .7 Prevent grout or mortar from staining the face of masonry to be left exposed or painted. Immediately remove grout or mortar in contact with such masonry.
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- .8 Cold weather protection: Do not lay masonry at air temperatures below 5°C (41°F) without prior review by Consultant of proposed protective measures. Comply with CSA A371.
- .9 Repair or replace damaged Work to satisfaction of Consultant at no increase in Contract Price.

1.5 **JOB MOCK UP**

- .1 Prior to commencing masonry Work, erect a sample wall panel mock-up consisting of specified materials, and illustrating bond, joint tooling, control joint, insulation, air/vapour barrier, ties, brick tint, etc. required for final Work. Coordinate with Section 07 21 00 for the provision of insulation and air/vapour barrier for mock-up purposes.
- .2 Build mock-up at Site, where directed, in full thickness and approximately 1200 mm x 1200 mm including also, the proposed range of colour, texture and workmanship to be expected in the completed Work.
- .3 Obtain Consultant's acceptance of visual qualities of the mock-up before start of Work. Retain mock-up during construction as a standard for judging completed Work; do not alter, move or destroy until Work is completed. Use sample panels to test proposed cleaning procedures.
- .4 Provide separate mock-up panel for brick veneer, glaze block, cavity wall conforming to the same foregoing requirements.

1.6 **SCAFFOLDING**

- .1 Erect, maintain and remove on completion, scaffolding adequate for the proper execution of the Work.
- .2 Conform to "Occupational Health and Safety Act". Lay masonry from scaffolds erected on same side as face Work. Do not support scaffolding from finished building surfaces.

1.7 **WELDING**

- .1 Retain a firm certified in accordance with CSA W47.1 Division 1 or 2.1 to perform welding of anchor clips.
- .2 Employ welding operators licensed per CSA W47.1 for types of welding required by the Work.

1.8 **TEMPORARY BRACING**

- .1 Temporarily brace masonry Work during erection to prevent damage due to winds or other lateral loads until permanent structure provides adequate bracing.

2 **Products**

2.1 **MATERIALS**

- .1 Brick Veneer: Metric modular, hard burned clay brick masonry units, conforming to CSA A82.
 - .1 Finish exposed ends of brick at external corners, headers, control joints, expansion joints and openings same as the face.

- .2 To match existing brick in all respects, modular size, with special shapes and sizes as detailed. Provide samples of existing and proposed brick.
 - .3 Where brick veneer masonry type is not specified, provide Type X, exterior grade.
 - .4 Manufacturer:
 - .1 Brampton Brick
 - .2 Skycon
 - .3 Shaw Brick
 - .4 Forterra Brick
 - .5 Sills: in accordance with Contract Drawings. Colours to match existing or as selected by Consultant.
- .2 Brick
- .1 Face Brick: Provide face brick, including specially molded, ground, cut, or sawed shapes where required to complete masonry work. Provide units with physical properties, colors, color variation within units, surface texture, size, and shape to match existing brick in all respects.
 - .2 3600 Danforth and 1313 Woodbine
 - .1 Type: Modular facebrick, molded style confirming to ASTM C216 or ASTM C652
 - .2 Size: 92 x 57 x 194 mm (3-5/8" x 2-1/4" x 7-5/8")
 - .3 Colours: Contractor shall use equal parts of the following colours to match existing conditions.
 - .1 52-DD Modular (red), Cushwa Series, Antique Red, modular
 - .4 Mortar: SGS "A" Series by Solomon Colors. Colour 41A or match existing
 - .5 Manufacturer:
 - .1 Glen-Gery by Brampton Brick
 - .2 Or accepted equal
 - .3 116 Dorset
 - .1 Type: Modular facebrick, extruded style confirming to ASTM C216 or ASTM C652
 - .2 Size: 92 x 57 x 194 mm (3-5/8" x 2-1/4" x 7-5/8")
 - .3 Colour and Texture: to match existing. Provide samples of existing and proposed brick
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- .4 Manufacturer:
 - .1 Glen-Gery by Brampton Brick
 - .2 Or accepted equal
 - .3 Brick tint: mineral base, semi-transparent brick stain. "1020 SiLazur" by PermaTint, Nawkaw equivalent or accepted equal. Tint shall match existing brick colours
 - .4 Concrete blocks:
 - .1 Normal weight and lightweight units, metric modular, moisture controlled units conforming to CSA-A165.1, Type(s) H/15/A/M (and S/15/A/M), and Type(s) H/15/C/M (and S/15/C/M). For the purpose of fire resistance rating, lightweight block shall conform to the requirements of L220S as specified in the National Building Code. Size as indicated on Drawings.
 - .1 Exposed surfaces: Free of cracks, chips or other blemishes and broken corners. Include required sash blocks for control joints, and around openings for rolling steel doors or shutters, solid block where noted, and concrete block lintels over openings in concrete block walls unless steel lintels are shown.
 - .2 Units on external corners of exposed interior block: Bullnosed type.
 - .3 Special shapes: Manufacture to shape shown; do not field cut stretcher units to make special shapes.
 - .4 Do not use lightweight units for walls in contact with earth or where exposed to the weather.
 - .5 Cure concrete blocks using carbon capturing technology with a minimum sequestration rate of 225 grams per 190 x 190 x 390 mm concrete block. Adjust this rate on a volumetric basis for other block sizes.
 - .2 Mortar: Conforming to CSA A179-M, Type "S".
 - .1 Rendering, patching or leveling: Quick-setting, polymer-modified, fiber-reinforced cementitious rendering mortar for interior and exterior concrete wall and floors. Minimum 3 mm thickness and requiring water to be added in the mixer per mortar manufacturer's directions. "Planitop 330 Fast" by Mapei or approved equal.
 - .2 Exterior wythe blocks in cavity wall: Conforming to CSA A179-M, Type "N", 1:1:6 ready mixed, as supplied by Maxi Mix or Daubois Inc. Use pre-mixed/pre-bagged/pre-gauged cement-lime requiring water to be added in the mixer per mortar manufacturer's directions. No loose sand allowed on site. Mix colour pigment manufactured by Harcros Pigment Canada or Solomon Colours, Inc. to produce coloured mortar colour; colour as selected by the Consultant.
 - .5 Grout: Conforming to CSA A179-M, coarse.
 - .6 Horizontal masonry reinforcement (for single wythe masonry block walls): Welded wire, galvanized units in heavy duty truss or ladder two-side rod design by Dur-O-Wal, Blok-Lok, or Hohmann and Barnard, prefabricated in straight lengths of not less than 3 m with matching corner "L" and intersection "T" units. Overall width shall be such that side
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rods are positioned at the centreline of both face shells of the concrete block. Reinforcing gauge and finish to meet requirements of the Ontario Building Code and referenced CSA Standards.

- .7 Ties from outer wythe to inner wythe: Hot-dip galvanized of types as specified below complete with insulation support and V-tie by Fero Corporation as distributed by Stuart & Associates:
 - .1 For tying brick, concrete block and masonry unit veneers to concrete block: use Fero Block Shear Tie in combination with two-wire ladder horizontal reinforcing 3.66 mm diameter wire side and cross rods.
 - .1 Block shear length: to suit concrete block (inner wythe) width and thickness of insulation.
 - .2 V-tie length: as required to provide placement of V-tie legs at centreline of veneer (outer wythe). Provide block shear ties at 800 mm horizontal x 600 mm vertical spacing and 300 mm maximum spacing around wall openings, top, base and corners or as noted on Drawings.
 - .2 For tying brick, concrete block and masonry unit veneers to cast in place concrete and structural steel: Use Fero RAP ties fastened to backup with U-CAN fasteners.
 - .1 RAP plate length: To suit thickness of insulation.
 - .2 V-ties: Of length to provide placement of V-tie legs at the centreline of veneer (outer wythe). Provide ties at 600 mm x 600 mm spacing and 300 mm maximum spacing around wall openings, top, base and corners or as noted on Drawings.
 - .3 For tying brick, concrete block and masonry units to structural columns and beams: Use Fero CAT tie attached with UCAN fasteners.
 - .1 V-ties: Of length to provide placement at the centreline of veneer (outer wythe). Provide CAT ties.
 - .4 For tying brick, concrete block and masonry unit veneers to metal studs: Use Fero side mounting RAP ties attached to side of stud with U-CAN fasteners.
 - .1 Side mounting RAP plate length: To suit width of metal stud and thickness of sheathing/insulation.
 - .2 V-ties: Of length to provide placement of V-tie legs at the centreline of veneer. Provide side mounting RAP ties at 400 mm x 600 mm vertical spacing and 300 mm maximum spacing around wall openings, top, base and corners or as noted on Drawings.
 - .5 For tying brick, concrete block and masonry unit veneers to wood studs: Use Fero Adjustable BVTs attached to stud with UCAN fasteners as supplied by Stuart & Associates. The Fero Adjustable BVTs length to suit width of insulation/sheathing.
 - .6 The Fero V-ties shall be of length to provide placement of V-tie legs at the centreline of veneer (outer wythe). Provide adjustable BVTs at 400 mm horizontal x 600 mm vertical spacing and 300 mm maximum spacing around wall openings, top, base and corners or as noted on Drawing.
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- .8 Masonry anchors: 6 mm thick steel plate anchors and clips to laterally support masonry walls from other walls or structural elements. For interior or dry locations, clean to SSPC-SP3 and prime with CISC/CPMA solvent reducible primer. For exterior or humid conditions, hot-dip galvanize to CSA G164. For non-structural anchorage, Blok-Lok "Flex-O-Lok" may be used.
 - .9 Masonry-to-precast concrete (concrete) anchors: 1.5 mm (16 gauge) galvanized steel dovetail anchors. Supply filled 0.9 mm (20 gauge) galvanized steel dovetail slots for building-in in concrete (precast concrete).
 - .10 Vertical reinforcement: Conforming to CAN/CSA G30.18-M, Grade 400.
 - .11 Insulation adhesive: Synthetic rubber based compatible with insulation as recommended by insulation manufacturer.
 - .12 Concrete block cell insulation: "Zonolite" granular vermiculite by W.R. Grace.
 - .13 Compressible filler atop non-fire rated masonry walls: Where ceiling is used as a return air plenum use:
 - .1 "Zero Draft Z2-600" by Can-Am Building Envelope Systems, a foamed-in-place material with a flame spread rating of 25 or less in accordance with CAN/ULC-S102, or
 - .2 Mineral wool sealed with a firestop spray meeting the maximum flame spread and smoke ratings as above, as manufactured by 3M, Tremco or Johns Manville.
 - .14 Compressible filler atop non-fire-rated masonry walls: Where ceiling space is not used as a return air plenum, use soft grade closed cell foam joint filler strips by CPD.
 - .15 Premoulded control joint gasket: Dur-O-Wal "Rapid Control Joint" in "Wide-Flange" design of type to suit wall thickness. (Use "Regular" design for control joints at pilasters or columns.) For fire-rated control joint gaskets, use fire-rated closed cell neoprene conforming to ASTM D1056 or ASTM D2056.
 - .16 Brick Control Joints Material:
 - .1 Neoprene Sponge by Blok-Lok Limited.
 - .2 NS - Closed Cell Neoprene Sponge by Hohmann & Barnard Company
 - .17 Expansion joint flashings: Insulated Lexsuko "Lexpand" wall expansion joint with rigid polyvinyl nailing strips, of type to suit joint width shown. Adhesive to be as supplied by flashing manufacturer, and 0.6 mm thick x 25 mm (24 gauge x 1") wide metal batten strips with oval head galvanized "Confas" masonry anchors for securement of expansion joint flashing nailing strips to masonry substrate.
 - .18 Dampproof course and through-wall flashings: "Blueskin SA" by Monsey Bakor, or "Soprasedal Stick" by Soprema, self-adhesive grade.
 - .19 Cavity wall ventilation inserts: Dur-O-Wal "Cell Vent Weep-Hole Ventilator". Colour as selected by the Consultant.
 - .20 Cavity wall drainage net: High density polyethylene or nylon woven mesh type mortar dropping control devices with trapezoidal zigzag-shaped top edge, design to allow moisture/water to flow/drain downward in cavity to weep holes, 25 mm thick x 250 mm high x manufacturer's standard lengths "Mortar Net" with insect barrier or "Mortar Trap" by Hohmann and Barnard Inc.
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- .21 Precast concrete sills and wall caps: Of sizes and profiles shown complete with slopes and drips, 35 MPa concrete poured in rigid forms, high frequency vibrated, colour pigments added to match finish of the wall face in which they occur. Pigments as manufactured by Harcros Pigment Canada. Use same mortar specified for brick veneer, for setting sills and caps.
- .22 Brick and block vents: Titus "Model OXL-77" complete with duct extension and birdscreen; exposed surfaces clear anodize finished.
- .23 Anchor bolts: Minimum 9 mm diameter steel, in length shown on Drawings, hot-dip galvanized to CAN/CSA G164-M.
- .24 Foamed-in-place air seals: Class 1, single component polyurethane foam conforming to CAN/ULC-S710.1, with flame spread rating of 20 or less and smoke developed of 25 or less. Density of 20.8 to 28.8 kg/m³, "Zerodraft Foam Sealant" by Canam Building Envelope Specialists Inc., or "Great Stuff Pro" by Dow Chemical Company, or "LEF" by Tremco or accepted equal.
- .25 Parging: "Gem Foundation Coating" by Gemite Products Inc.

3 Execution

3.1 **MORTAR MIXING**

- .1 Mix mortar with the maximum amount of water consistent with workability to provide maximum tensile bond strength within the capacity of the mortar. Use a mechanical mixer. No hand mixing permitted.
- .2 Do not use mortar which has begun to set or if more than 2½ hours has elapsed since initial mixing. Retemper mortar during the 2½ hour period only as required to restore workability.
- .3 Retain the same brand and source of materials used to mix coloured mortar.
- .4 Place a thoroughly experienced, reliable and competent person in charge of mortar mixing.

3.2 **BRICK REMOVAL**

- .1 Carefully demolish or remove entire units from joint to joint, without damaging surrounding masonry, in a manner that permits replacement with full-size units.
 - .2 Support and protect remaining masonry that surrounds removal area. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.
 - .3 Remove in an undamaged condition as many whole bricks as possible.
 - .4 Replace removed damaged brick with other removed brick in good quality, where possible, or with new brick matching existing brick, including size. Do not use broken units unless they can be cut to usable size.
 - .5 Lay brick in such a way that vertical joints in alternate brick courses are plumb from the top course to the bottom course
 - .6 Tooth intersections of walls with alternating units, except as otherwise shown or where control joints and expansion joints occur.
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- .7 Install replacement brick into bonding and coursing pattern of existing brick. If cutting is required, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.

- .1 Maintain joint width for replacement units to match existing joints.

- .2 Use setting buttons or shims to set units accurately spaced with uniform joints

3.3 **PATCHING BRICK**

- .1 Remove loose material from masonry surface. Carefully remove additional material so patch will not have feathered edges but will have square or slightly undercut edges on area to be patched and will be at least 1/4 inch (6 mm) thick, but not less than recommended by patching compound manufacturer.
- .2 Mask adjacent mortar joint or rake out for repointing if patch will extend to edge of masonry unit.
- .3 Mix patching compound in individual batches to match each unit being patched.
- .4 Rinse surface to be patched and leave damp, but without standing water.
- .5 Brush-coat surfaces with slurry coat of patching compound according to manufacturer's written instructions.
- .6 Place patching compound in layers as recommended by patching compound manufacturer, but not less than 6 mm or more than 50 mm thick. Roughen surface of each layer to provide a key for next layer.
- .7 Trowel, scrape, or carve surface of patch to match texture and surrounding surface plane or contour of the masonry unit. Shape and finish surface before or after curing, as determined by testing, to best match existing masonry unit.
- .8 Keep each layer damp for 72 hours or until patching compound has set.

3.4 **GENERAL MASONRY CONSTRUCTION**

- .1 Lay replacement brick with completely filled bed, head, and collar joints. Butter ends with sufficient mortar to fill head joints and shove into place.
 - .2 When thumbprint hard, tool exposed joints shallow concave with non-staining round jointer. Tool joints flush where shown and where gypsum wallboard, ceramic tile and resilient base are to be applied as finish.
 - .3 Lay prefaced block in running bond, in full mortar beds and with vertical joints filled with mortar. Neatly tool joints shallow concave with non-staining tools.
 - .4 Lay ledge blocks in running bond in full mortar beds and with vertical joints filled with mortar. Tool joints flush.
 - .5 Keep masonry walls 25 mm clear of underside of steel building frame, roof or floor and deck over. For non-fire rated masonry walls used as air plenum, pack the clear space with the specified material of either fibrous filler and spray seal combination, or foam-in-place. For non-fire rated masonry walls that are not used as air plenum, fill the clear space with specified foam strips. Compress to 50% of original thickness.
-

- .6 Cut masonry units using a motor-driven table saw designed to cut masonry with clean, sharp, unchipped edges. Cut units as required to provide pattern shown and to fit adjoining work neatly. Use full-size units without cutting wherever possible.
- .7 Match coursing, bonding (colour and texture) of new masonry work with existing Work where indicated.
- .8 Build control joints in masonry walls at 9000 mm unless shown otherwise. Provide joints using sash block units. Fill chase and joint with premoulded gasket full height of control joints. Leave a depth of 12 mm for caulking. Locate control joints in modular dimensions.
- .9 Coordinate building-in of anchors as required for the proper installation of the Work of other trades.
- .10 Provide solid block or Provide metal lath under block and fill block cells solid for lintel bearing and as required to secure built-in anchor bolts and/or anchors.
- .11 Build-in door frames, borrowed light and glazed screen frames, anchors, inserts, loose lintels, shelf angles, conduits and other items required to be built into masonry. Set anchors between frames and masonry and fill voids between metal frames and masonry walls with mortar.
- .12 Build recesses to receive items recessed in masonry.
- .13 Build-in anchor bolts for wood copings on tops of masonry walls and other locations. Install anchor bolts in a staggered arrangement to prevent wood blocking from "cupping".

3.5 **REINFORCING, TIES AND ANCHORS**

- .1 Build-in continuous masonry reinforcement in horizontal courses terminating at vertical terminations such as control and expansion joints, full height of walls and partitions, at every second block course. Install reinforcing in first and second courses over door and window openings.
 - AND/OR -
- .2 Build-in continuous masonry reinforcement in horizontal inner wythe courses of cavity wall, terminating at vertical terminations such as control and expansion joints, full height of walls, at specified spacing. Install reinforcing in first and second courses over door and window openings.
- .3 Maintain continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut, bend and lap reinforcing units as per printed directions of manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.
- .4 Where a new masonry wall is superimposed on an existing masonry wall, tie same to the existing masonry wall in accordance with the code.
- .5 Build-in dovetail anchors.
- .6 Weld masonry anchor clips to structural steel in accordance with the following standards:
 - .1 CSA W48.1-M: For electrodes. If rods are used, only coated rods are allowed.
 - .2 CSA W59-M: For design of connections and workmanship.
 - .3 CSA-W117.2: For safety.

- .7 Thoroughly clean welded joints and expose steel for a sufficient space to perform welding operations. Touch-up disturbed primer paint with matching primer.
- .8 Where shown, install vertical steel reinforcing and fill block cells with grout. At lintels, install reinforcing per schedule and fill with grout. Allow 200 mm minimum bearing on each lintel end up to 1200 mm span; 400 mm minimum bearing on each end for spans exceeding 1200 mm. Temporarily support lintels until concrete has cured.

3.6 **CAVITY WALL CONSTRUCTION**

- .1 Lay block as specified under "General Masonry Construction".
- .2 Tie exterior wythe to interior wythe using shear connectors spaced 600 mm vertically and 800 mm horizontally.
- .3 Lay damp course and through-wall flashings. Lap joints 50 mm minimum. Roll with steel hand roller to ensure proper contact at laps. Carry through-wall-flashings continuous past exterior steel columns.
- .4 Extend flashing membrane one block course up the back wall and return into mortar joint a minimum 25 mm.
- .5 Install cavity wall ventilator inserts in vertical brick or block joints immediately over dampproof courses and through-wall flashings, at 600 mm o.c. Set 3 mm from the face of masonry unit. Ensure inserts are not plugged with mortar or debris. Slope flashings towards the exterior in order that any water that penetrates the exterior wythe and drains to the bottom, is directed back to the exterior through the inserts.
- .6 Install through-wall flashings at any interruption of the air space behind the face veneer such as:
 - .1 Bottom of cavity walls
 - .2 Over shelf angles and lintels in exterior walls
 - .3 At other locations shown
- .7 Flashing above windows and doors that is discontinuous shall be turned up at ends to form a dam.
- .8 Place continuous run of drainage net on top of through-wall flashing.
- .9 Keep exterior wall cavities free from mortar droppings. Strike mortar joints facing cavity flush.
- .10 Coordinate masonry Work with the application of sheet membrane air/vapour barrier on cavity side of inner masonry wythe.

3.7 **CAVITY WALL INSULATION**

- .1 Place insulation in horizontal parallel courses in full bed of adhesive, tightly fitted between masonry reinforcement and in firm contact with adhesive. Apply adhesive in accordance with manufacturer's directions.
 - .2 Cut and fit insulation to provide complete unbroken installation with minimum joints. Fit insulation tightly around ties. Butter insulation joints with adhesive.
-

- .3 Progressively install insulation, retaining wedges at maximum spacing of 400 mm horizontally at each masonry reinforcing course. Ensure that wedge presses insulation in tight and firm contact with adhesive. Wherever possible have wedge occur at junction of vertical and horizontal joint.

3.8 **COMPOSITE WALL CONSTRUCTION**

- .1 Lay face brick on exposed face in running bond (with full headers every sixth course as shown) (with split headers every sixth course).
- .2 Wet bricks before using in dry weather; keep dry and cover in freezing weather. Wet tops of walls where Work is left off before Work is resumed.
- .3 Parge back of face brick wythe and face of masonry block back-up with setting mortar to ensure void is filled. Lay face brick with shove joint in full mortar bed and with vertical joints filled solid.
- .4 Provide brick joints 10 mm wide horizontally and vertically, finished to a shallow concave finish.
- .5 Lay block and brick as specified under "General Masonry Construction".
- .6 Block cell insulation: As block masonry is being built, pour vermiculite insulation in block cells. Do not lay more than six block courses between pours. Rod insulation into cells to ensure that no voids or air pockets are left unfilled.
- .7 Wall expansion joint flashings: Secure flashing flaps to substrate with a full coat of adhesive and mechanically fasten every 300 mm through metal strips. Extend flashing as required to provide proper connection with roof expansion joint

- .1 Parge predampened masonry walls with type S mortar applied in two uniform coats to a total thickness of 19 mm. Scarify first parging coat to ensure full bond to subsequent coat.
- .2 Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 3 mm per m.
- .3 Damp cure parging for at least twenty-four hours and protect until cured.

3.10 **FIELD QUALITY CONTROL**

- .1 The Owner may engage an inspection and testing company to observe workmanship and to conduct block, mortar and grout strength tests in accordance with CSA A165.1, CSA A179, and CSA S304, and will pay all costs thereto.

3.11 **REPAIR, POINTING AND CLEANING**

- .1 Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout; point to eliminate evidence of replacement.
 - .2 Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar.
 - .3 Point-up joints including corners, openings and adjacent Work to provide a neat, uniform appearance, properly prepared for application of sealant compounds.
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- .4 Rake out to 12 mm depth, joints between sills and between ends of sills and masonry. Point to full 12 mm depth with pointing material specified. Tool pointing to a slightly concave smooth condition.

3.12 **FINAL CLEANING**

- .1 After mortar is thoroughly set and cured, clean one-half of sample wall panel. Obtain Consultant's acceptance of sample wall panel cleaning before proceeding to clean building masonry Work.
 - .1 Dry clean to remove large particles of mortar using wood paddles and scrapers. Use chisel or wire brush if required.
 - .2 Scrub down wall with stiff fibre brush.
- .2 Acid cleaning of masonry is not permitted.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

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|-----|---------------------|---|
| .1 | ASTM A325M | - Standard Specification for High-Strength Bolts for Structural Steel Joints [Metric] |
| .2 | ASTM A563M | - Standard Specification for Carbon and Alloy Steel Nuts [Metric] |
| .3 | ASTM A570 | - Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality |
| .4 | ASTM B695 | - Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel |
| .5 | ASTM F959 | - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use With Structural Fasteners |
| .6 | ASTM F1554 | - Standard Specification for Carbon Steel Bolts and Studs, 60 000 psi Tensile Strength |
| .7 | CSA-G40.20/G40.21-M | - General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel |
| .8 | CAN/CSA S16.1 | - Limit States Design of Steel Structures |
| .9 | CSA S136 | - Cold-Formed Structural Steel Members |
| .10 | CAN/CGSB 1.181 | - Ready-Mixed Organic Zinc-Rich Coating |
| .11 | CGSB 85-GP-16M | - Painting Galvanized Steel |
| .12 | CISC | - Canadian Institute of Steel Construction, "Code of Standard Practice" |
| .13 | CISC/CPMA 2.75 | - Canadian Institute of Steel Construction/Canadian Paint Manufacturers Association "A Quick-Drying Primer for Use on Structural Steel" |
| .14 | CMAA No. 70 | - Crane Manufacturers Association of America, Specification #70 |
| .15 | CSA W47.1 | - Certification of Companies for Fusion Welding of Steel Structures |
| .16 | CSA W48 Series | - Electrodes |

- | | | |
|-----|-------------|---|
| .17 | CSA W48.1-M | - Carbon Steel Covered Electrodes for Shielded Metal Arc Welding |
| .18 | CSA W59-M | - Welded Steel Construction (Metal Arc Welding) |
| .19 | CSA-W117.2 | - Safety in Welding, Cutting, and Allied Processes |
| .20 | CSA W178.1 | - Certification of Welding Inspection Organizations |
| .21 | CSA W178.2 | - Certification of Welding Inspectors |
| .22 | SSPC | - The Society for Protective Coatings, "Steel Structures Painting Manual, Vol. 2" |
| .23 | AODA | - Accessibility for Ontarians with Disabilities Act |

1.3

DESIGN CRITERIA

.1 Framing Design

- .1 Building has been designed on the basis of steel sections shown and it is the intent of Contract that designated shapes, thicknesses, arrangements and grades of material be used.
- .2 If for any reason sections shown are not available, substitute sections may be proposed for use and must be accepted in writing by Consultant prior to use. Consultant may consider such substitutions only if proposed members provide equal or greater strength with deflection compatible with adjacent construction, and do not interfere in any way with the architectural construction or the installation of mechanical, process and electrical utilities. No increase in payment will be made because of substitutions. Proposed substitutions to Class IV sections must be accompanied by calculations which are to be sealed and signed by a Professional Engineer licensed to practice in the province of Ontario.

.2 Design Requirements

- .1 Obtain written acceptance from Consultant before fabricating members with randomly located butt welded splices.
- .2 Obtain location of maximum stresses in members where randomly located butt welded splices will occur.
- .3 If members with randomly located butt welded splices are used, have visual and non-destructive inspection/testing executed by an independent inspection/testing company, qualified in accordance with the Specifications, and pay all costs thereto. Refer to "Source Quality Control" herein for testing required. Identify unit costs for such testing as an attachment to the Tender. Submit test results to Consultant.

1.4

SUBMITTALS

.1 Shop Drawings

- .1 In advance of preparation of detail Shop Drawings, submit for review, typical details of connections, special connections, and connections which do not meet requirements of "Beam Connections" article specified herein.

- .2 Submit Shop Drawings for fabrication and erection of structural steel in accordance with Section 01 33 00.
- .3 Clearly show and describe in detail, steel members, dimensions and connections, etc.
- .4 In the case of trusses, show complete elevations of members and welded connection details on the same Drawing. Multiple letter-size detail sheets for connection welds will not be accepted.
- .5 Steel data: In addition, submit mill test reports, equivalent test data or manufacturer's certification, that steel provided conforms to Specifications.
- .6 Test results and certifications: Submit test reports, procedure Specifications and certifications as required to substantiate welded connection design, and welder qualifications.
- .7 Submit EPD (Environmental Product Declaration) for structural steel framing (if available).
 - .1 EPD to be prepared in accordance with ISO 14025 and ISO 21930.
 - .2 EPD to report GWP (Global Warming Potential) in units of kg CO2 equivalent per tonne of steel.
- .2 Diagrams/templates: Submit to installing trade, anchor bolt diagrams and/or templates for anchor bolt locations, in accordance with installing trade's schedule requirements.
- .3 Maintenance: Submit six 4 litre cans of primer-finish paint in the same colour and type as shop-applied primer, in accordance with Section 01 10 00 - General Requirements. Provide labels on each can identifying contents, manufacturer and trade name, colour, date, generic paint type and intended use (touch-up of structural steel).

1.5 **QUALITY ASSURANCE**

- .1 Welding Qualifications
 - .1 Welding: Executed by an organization certified in accordance with CSA W47.1 Division 1 or 2.1.
 - .2 Operators employed on the Work: Qualified "Class O" per CSA W47.1 for work as required by Contract.
 - .3 Inspection/testing company, and welding inspector and supervisors: Meeting qualifications per CSA W178.1 and CSA W178.2 and are certified by the Canadian Welding Bureau in Category (a), Buildings.
 - .4 Have welding undertaken by companies and welders fully approved to CSA W47.1 and CSA W59-M.
 - .2 Testing and Inspection
 - .1 Refer to "Quality Control" in Section 01 10 00 – General Requirements.
 - .2 Except for inspection/testing of splices introduced by fabricator in steel sections at random locations as specified herein, Owner will employ an inspection/testing company to perform other shop and field inspection/testing as specified herein, and will pay costs for same.
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- .3 Inspection/testing company's representative will visit fabrication plant and submit reports of each visit, with copies to Contractor and Consultant. Reports will show tonnage fabricated and inspected, with comments on conformity to Specifications, workmanship and listing of defects or inaccuracies encountered. Reports will also be submitted for inspection of field erection per CAN/CSA S16.1.
 - .4 Mill inspection: Inspection will determine that materials conform to Specifications. Mill test reports, properly correlated to materials, will be accepted in lieu of physical tests.
 - .5 Shop inspection: Inspection will establish that structural steel is fabricated within specified tolerances and in accordance with reviewed Shop Drawings and in conformance with specified fabrication and welding procedures; surface preparation and prime painting as specified herein. Steel will also be inspected in the shop prior to shipment to Site.
 - .6 Extent of inspection/testing during fabrication and erection will be as specifically detailed to inspection/testing company by Consultant. Cooperate with inspection/testing company personnel and allow access and facilities for inspection and testing.
 - .7 Inspection and testing does not relieve Contractor of its responsibility for quality control but is a precaution against errors. Defective materials and/or workmanship may be rejected, regardless of previous inspection, whenever found.
 - .3 Welded joints: Inspection/testing company will perform non-destructive testing of 25% of welded connections chosen at random as follows:
 - .1 Moment connections involving use of fillet welds: 100% magnetic particle inspection for fillet welds.
 - .2 Moment connections involving use of full penetration groove welds: 100% ultrasonic testing for groove welds.
 - .3 Where moments are transferred by either fillet welds or groove welds into end plates in "T" joint configurations, base metal is to be examined by Ultrasonics for lamellar tearing or cracking.
 - .4 Prime Painting
 - .1 Inspection/testing company will inspect cleaning and prime painting in fabricator's shop.
 - .2 Inspection/testing of surfaces will generally take place after preparation and cleaning of surfaces but prior to application of primer paint. Notify inspection/testing company in advance of surface preparation and primer paint application. Preparation of substrate will be inspected and evaluated for conformance with the referenced SSPC specifications, in particular, peak profile.
 - .3 Primer paint system will be tested for dry film thickness using non-destructive method; it will be inspected for cure and film imperfections such as runs, sags and embedded foreign matter; inspection/testing company will also inspect field touch-up and preparation of surfaces to receive same.
-

- .4 Correct deficiencies and have such corrected Work approved by inspection/testing company before resumption of Work.

1.6 **PRODUCT DELIVERY, STORAGE AND HANDLING**

- .1 Handle and store materials in shop and at site in a manner to prevent damage to primer finish. Repair or replace damaged materials due to improper storage or handling at no cost to Owner.
- .2 Deliver anchor bolts, base, bearing and leveling plates, cast-in hardware and other material that is supplied only under Work of this section to section responsible for installation, to location directed at time required by construction schedule.
- .3 Handle and store structural steel and cold-formed elements to prevent damage or corrosion to stored or erected Work, or to other property.
- .4 Verify paint delivery dates with paint supplier to ensure primer paint is supplied to coincide with schedule of Work.
- .5 Exercise care in handling shop-primed materials. Do not handle steel until primer paint has cured sufficiently to handle without damage to same.
- .6 Use nylon slings for handling and a combination of wood and/or polystyrene blocking between units, in stockpile and in transit. Schedule and sequence the Work so a minimum of handling occurs prior to erection.
- .7 Prevent the formation of wet storage stain on galvanized articles by complying with the following measures:
 - .1 Stack articles or bundle to allow air between the galvanized surfaces during transport from supplier. Load materials in such a manner that continuous drainage can occur.
 - .2 Raise articles from the ground and separate with strip spacers to provide free access of air to most parts of the surface. Incline in a manner which will allow continuous drainage. Do not lay galvanized steel on cinders, clinkers, wet soil or decaying vegetation.
 - .3 Handle galvanized articles in such a manner as to avoid any mechanical damage and to prevent distortion.

1.7 **PROJECT CONDITIONS**

- .1 Environmental requirements: Maintain ambient temperature and humidity conditions compatible to proper workability of primer paint material as specified by manufacturer and to a successfully completed installation. Keep a daily log of ambient temperature and humidity conditions during primer application. Have log made available for examination by the inspection/testing company.
- .2 Existing conditions: Field verify existing Site conditions and measurements which could have affect on the Work.

1.8 **WARRANTY**

- .1 Submit a written warranty in a form approved by Owner, warranting primer-finish paint system against chipping, cracking, flaking, blistering, peeling on delamination from substrate for a period of two years, commencing from date of Substantial Performance.
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2 Products

2.1 **MATERIALS**

- .1 Structural shapes, plates, etc.: New material conforming to CSA-G40.20/G40.21-M, Grade 350W for W and H shapes, and Grade 300W for other shapes, and plates.
- .2 Hollow structural sections: New material conforming to CSA-G40.20/G40.21-M Grade 350W, Class C.
- .3 Checker plate: To CSA G40.21, Grade 300W, with rolled in embossments to provide non-slip surface.
- .4 High strength bolts, nuts and washers: Conforming to ASTM A325M, with each type and size of bolt and nut of same manufacture and of same lot.
 - .1 Bolts: Heavy, hexagon head high strength structural bolts, of standard size, of lengths required for thickness of members joined and for type of connection.
 - .2 Nuts: Heavy hexagon semi-finished nuts per ASTM A563M.
 - .3 Washers: Flat and smooth hardened washers, quenched and tempered.
- .5 Machine bolts and anchor rods: As specified below, complete with hexagon heads and nuts:
 - .1 Common bolts: Conforming to ASTM A307, Grade A, of lengths required to suit thickness of material being joined, but not projecting more than 6 mm beyond nut, without the use of washers.
 - .2 Anchor rods: Conforming to ASTM F1554, grade 55, of lengths noted, but projecting not less than 13 mm beyond nut unless otherwise noted.
 - .3 Nuts: Per ASTM A563M.
- .6 Expansion bolts: Stud/wedge type; Carbon Steel Hilti Kwik Bolts, medium duty or Rawl-stud (threaded version) by Rawlplug Canada Ltd. Galvanize bolts per ASTM B695. Refer to Drawing for bolt diameter and length.
- .7 Anchor bolt sleeves: High impact, high density polyethylene plastic sleeves; "Wilson" by Acrow Richmond, or "Contec D-I-S" by Dayton Superior.
- .8 Welding electrodes: To meet CSA W48 series on welding electrodes. Any process which produces deposited weld metal meeting requirements of applicable CSA W48 series standard for any grade of arc welding electrodes shall be accepted as equivalent to use of such electrodes.
- .9 Primer paint: Solvent-reducible alkyd, light grey, in fast drying, lead and zinc-chromate free formulation conforming to CISC/CPMA 2.75. Use one brand of primer paint throughout the Work, in any of the following, tinted to the specified colour:
 - .1 "97-680" by PPG Canada Inc.
 - .2 Selectone "MR-05-3" by Selectone Paints Ltd.
 - .3 ICI Devoe "Rustguard 4140-6120"
 - .4 "Kem Bond HS-B50WZ4" by Sherwin-Williams

- .10 Primer paint: Solvent reducible alkyd, white, in fast drying, lead and zinc-chromate free formulation conforming to CISC/CPMA 2.75. Use one brand of primer paint throughout the Work, in any of the following:
 - .1 "97-680" by PPG Canada Inc.
 - .2 Selectone "MR-05-5" by Selectone Paints Ltd.
 - .3 ICI Devco "Rustguard 4140"
 - .4 "Kem Bond HS-B50WZ4" by Sherwin-Williams
- .11 Galvanizing: Hot-dip galvanizing with minimum zinc coating of 600 g/m² to CAN/CSA G164-M.
- .12 Galvanized primer: Zinc rich conforming to CGSB 1-GP-181M for new galvanized metal in compliance with CGSB 85-GP-16M. For galvanized fabrications touchup to remain unpainted in finished Work, use W.R. Meadows of Canada Ltd. "Galvafrid" or Kerry Industries "Z.R.C." or Niagara Paint Inc. "PL052898" zinc rich coating.

2.2 **WORKMANSHIP AND FABRICATION**

- .1 Design details and execute Work in accordance with CAN/CSA S16.1.
- .2 Shop weld per welding requirements specified herein.
- .3 Carefully make and fit details and take special care so finished Work presents a neat and workmanlike appearance.
- .4 Assemble members true and without twists or open joints.
- .5 Properly cut and size holes for connecting Work of other trades where such can be determined prior to fabrication. Where possible, show such holes on Shop Drawings.
- .6 Beam Connections
 - .1 Of type to adequately resist reactions produced by framing or load conditions.
 - .2 Beam and girder to column connections to be of type which applies vertical reaction with negligible eccentricity at connecting face of column, such as double angle web connections or unstiffened seats, unless otherwise shown.
 - .3 Comply with requirements of CISC Handbook of Steel Construction, except that length of beam or girder web angles shall not be less than half the depth of beam or girder, and single angles shall not be used for beams or girders except as otherwise shown on the Drawings.
 - .4 Use direct connections to flanges of spandrel beams to restrain twisting.
 - .5 Do not use fish plate or shear plate connections.
- .7 Holes
 - .1 Cut holes and reinforce openings only where shown. Cutting of holes in structural members in the field will not be permitted except with written approval of Consultant.
 - .2 Prevent accumulation of water in tubular members by providing drainage holes.

- .8 Columns and base plates: Sawcut bottom of columns and weld to flattened base plates. Size holes in base plates to allow for slight field adjustment to bring columns into line.
 - .1 Follow suggested anchor rod hole sizes by CISC Handbook of Steel Construction, latest edition.
 - .2 Provide washers with standard size holes, added beneath the nuts and sized to cover entire hole when anchor rod is located at the edge of the hole. Washer thickness must be adequate to prevent pulling through the hole and not less than 1/3 the anchor rod diameter.
 - .3 Weld washers appropriately to base plates of columns which belong to the braced bays and/or the moment frame.
- .9 Beams, Girders, Purlins, Girts and Sag Rods
 - .1 Beams, purlins, girts and sag rods are as shown and as required to complete the Work. Machine bolts may be used for girts, and door frames not connecting to columns if they are not in a braced bay, and therefore not part of bracing system.
- .10 Trusses and sway frames: Welded construction, with lines of truss members intersecting at panel points, and with connections to withstand stresses shown. Place welded spacers in double members in accordance with the Ontario Building Code. Camber trusses as shown on Drawings.
- .11 Door Frames
 - .1 Select frames for trueness of web and flange. Straighten sections as required so finished frames are uniform, square and true.
 - .2 Provide door frames with plates, extensions, stops, lintels, including required expansion bolts and anchors for field installation.
 - .3 Fabricate and assemble frames by welding. Join built-up members by plug welding. Continuously weld exposed joints, with welds ground smooth.
 - .4 Tack weld temporary steel spreaders to prevent frames from springing out of shape. Grind welds smooth following removal of spreaders.

2.3 **SURFACE PREPARATION AND PRIME PAINTING**

- .1 Clean structural steel to SSPC SP3 - Power Tool Cleaning.
 - .2 Prepare paint material in accordance with paint manufacturer's written directions. Material may be thinned if required, using materials recommended by paint manufacturer, using minimum amounts, but not exceeding paint manufacturer's maximum allowable mixing ratio. Provide for paint manufacturer representation in shop for application instructions. Comply with paint manufacturer's recommendations relative to equipment and application techniques.
 - .3 Prime Painting
 - .1 Shop prime steel with one coat of primer paint to a dry film thickness of 0.051 mm to 0.064 mm.
 - .2 Clean but do not paint surfaces to be field welded or buried in concrete or masonry (or surfaces to receive sprayed fireproofing).
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- .3 Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7°C (45°F).
- .4 Paint surfaces which will be inaccessible after assembly with two coats of primer paint before assembly. Paint surfaces inaccessible during general painting of the building with two shop coats before erection.
- .5 Paint materials under cover and leave under cover until paint is thoroughly dry. Thoroughly work paint into joints and open surfaces. Follow paint manufacturer's recommendations regarding application methods, equipment, temperature and humidity conditions.
- .6 Use one brand of paint throughout the Work.

2.4 **HOT-DIP GALVANIZING**

- .1 Galvanize specified steel members.
- .2 Perform hot-dip galvanizing after fabrication. Provide relief and drain holes. After galvanizing, ream holes to proper size and re-tap threads. Straighten shapes and assemblies true to line and plane after galvanizing. Repair damaged galvanized surfaces with galvanize primer in accordance with manufacturer's printed directions.
- .3 Wet storage stain: Remove wet storage stain that may have developed in the coating before installation so that premature failure of the coating does not occur. Remove wet storage stain in accordance with galvanizer's recommendations.
- .4 Repair of galvanized items: Repair coatings damaged by welding, cutting, or during handling, transport or erection using cold galvanizing compound specified, and as follows:
 - .1 Ensure surface is clean, dry, and free of oil, grease and corrosion.
 - .2 Power clean surface to near white metal condition, extending into undamaged galvanized coating.
 - .3 Apply touch up material to a dry film thickness of 0.203 mm minimum. If touched up Work is to remain exposed in the finished Work, apply a finish coat of aluminum paint to provide a colour blend with the surrounding galvanizing.
 - .4 Coating shall be continuous, adherent, smooth and evenly distributed.

2.5 **SOURCE QUALITY CONTROL**

- .1 Non-destructive testing of randomly located butt welded splices: Using ultrasonic, radiographic or other non-destructive test method acceptable to Consultant, test butt welded splices which are composed of random lengths of structural sections as follows:
 - .1 100% of splices in beams, beam columns, girts or any other member in the zone where tensile bending stresses are greater than 0.90 times the design maximum bending stress. For simply spanning members this may be taken to be any splice within the central third of span.
 - .2 10% of splices located elsewhere, chosen at random.

3 Execution

3.1 **REMOVALS**

- .1 Take precautions to protect the existing structure from damage.
- .2 Dismantle and cut existing structural steel as required. Provide temporary shoring and bracing required for these operations. Retain a Professional Engineer to design the temporary shoring and to review this Work on site.
- .3 Remove and dispose of off site, existing steel which is dismantled but not designated for reuse. It shall become the property of the Contractor.

3.2 **EXAMINATION**

- .1 Verify that location of concrete piers, foundations and anchor bolts are correct and at proper elevations to allow for subsequent grouting of structural steel base plates.
- .2 Check location of anchor bolts in sufficient time to allow any required corrective Work to be performed by Contractor responsible before commencement of structural steel erection, to assure that schedule of steel erection is maintained.

3.3 **ERECTION**

- .1 Erect structural steel Work conforming to CAN/CSA S16.1.
 - .2 Set steel accurately to lines and elevations shown. Set column bases and shim to proper elevations, ready for grouting.
 - .3 Obtain Consultant's written permission prior to any field cutting or altering of structural members.
 - .4 Only light drifting to draw parts together will be permitted; any enlargement of holes to execute bolted connections shall be done by reaming with a twist drill. Burning is not permitted for forming of holes, enlarging of holes, or matching of unfair holes.
 - .5 Guying and bracing: Structure has been designed to resist loads shown only in its completed, fully-clad state. Review the structure for loads, including wind and temperature effects, acting on frames under various stages of erection until completion of structure. Make provision for horizontal and vertical erection loads and for temporary guying and bracing to keep structural frame safe, plumb and in true alignment per CAN/CSA S16.1.
 - .6 Tolerance: Plumb and level individual pieces of structural steel frame in accordance with CAN/CSA S16.1.
 - .7 General Connections
 - .1 Weld or otherwise bolt main member connections with high tensile-strength bolts using CISC double angle header connections, except where specifically noted or shown otherwise. Provide high tensile-strength bolted connections per "Bolted Connection" paragraph specified herein using minimum 19 mm diameter bolts conforming to ASTM A325M.
 - .2 Do not permit connections to encroach on clearance lines required for the installation of Work of other contracts and subcontracts.
 - .3 Support the dead load of the steel structure plus the weight of the metal deck and siding on steel shims or double-nuts until grouting is completed.
-

.8 Bolted Connections

- .1 Perform high tensile-strength bolted connections in accordance with CAN/CSA S16.1. Accurately space holes of size 2.0 mm larger than nominal diameter of bolt.
- .2 Furnish compressors or electrical equipment capable of supplying and maintaining required pressure at wrench. Make connections without the use of erection bolts, some high tensile-strength bolts will serve that purpose. Nuts on bolts, except high tensile-strength bolts, shall be prevented from becoming loose by burring bolt thread or by lock washers or lock nuts. In the case of sag rods, connect each end with double nuts; in other words, one nut above and one nut below the web of the girt.

.9 Welded Connections

- .1 Perform welding without causing damage or distortion to the Work. Should there be, in opinion of Consultant, inspection/testing company will test such welds for efficiency. Remove any Work not meeting CSA standards and replace with new Work satisfactory to Consultant. Execute welding in accordance with the following standards:
 - .1 CSA W48.1-M - for electrodes (If rods are used, only coated rods are allowed)
 - .2 CSA W59-M - for design of connections and workmanship
 - .3 CAN/CSA-W117.2-M - for safety
- .2 Take necessary safety precautions in accordance with CSA standards when welding is carried out in cold weather.

3.4 **FIELD QUALITY CONTROL**

- .1 Field inspection by an inspection/testing company will be performed to meet requirements as specified under "Inspection/Testing" specified herein, and include:
 - .1 Inspection of erection and fit-up, including placing, plumbing, leveling and temporary and permanent bracing.
 - .2 Inspection of bolted connections.
 - .3 Inspection of welded joints.
 - .4 General inspection of field cutting and alterations.
 - .5 General inspection of preparation, prime painting and field touch up of prime painting.

3.5 **CLEANING AND TOUCH-UP**

- .1 As steel is erected, clean bolt heads, washers and nuts, previously unprimed connections, surfaces damaged during erection, welds and burned or scratched surfaces, with power wire brush to SSPC-SP3, then touch-up with same primer used in the shop, and to shop paint dry film thickness. Coverage of touch-up paint to a given area shall be concentrated to disturbed, damaged or unpainted portion, and extend to limits as required to maintain continuity and integrity of paint film and appearance.

- .2 As steel is erected, thoroughly wash down with clean water, or other means as approved by paint manufacturer, to remove mud, erection marks and other foreign matter from steel.

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- | | | | |
|-----|---------------------|---|---|
| .1 | ASTM A307 | - | Standard Specification for Carbon Steel Bolts and Studs, 60 000 psi Tensile Strength |
| .2 | ASTM A325M | - | Standard Specification for High-Strength Bolts for Structural Steel Joints [Metric] |
| .3 | ASTM A563M | - | Standard Specification for Carbon and Alloy Steel Nuts [Metric] |
| .4 | CSA-G40.20/G40.21-M | - | General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel |
| .5 | CAN/CSA-S16.1 | - | Limit States Design of Steel Structures |
| .6 | CISC | - | Canadian Institute of Steel Construction, "Code of Standard Practice" |
| .7 | CISC/CPMA 1-73a | - | Canadian Institute of Steel Construction/Canadian Paint Manufacturers' Association, A Quick-Drying One-Coat Paint for use on Structural Steel |
| .8 | CSA W47.1 | - | Certification of Companies for Fusion Welding of Steel Structures |
| .9 | CSA W48.1-M | - | Carbon Steel Covered Arc Electrodes for Shielded Metal Arc Welding |
| .10 | CSA W59-M | - | Welded Steel Construction (Metal Arc Welding) |
| .11 | CSA W117.2 | - | Safety in Welding, Cutting, and Allied Processes |
| .12 | CSA W178.1 | - | Certification of Welding Inspection Organizations |
| .13 | CSA W178.2 | - | Certification of Welding Inspectors |
| .14 | SSPC | - | The Society for Protective Coatings, "Steel Structures Painting Manual, Vol. 2" |

1.3 **SUBMITTALS**

.1 Shop Drawings

- .1 Submit in accordance with Section 01 33 00. Submit in one uniform size.
- .2 Submit joist manufacturer's Shop Drawings and information per CAN/CSA-S16.1. Clearly show and describe in detail, steel members, dimensions, connections,

etc., as required. Upon request of Consultant, submit calculations and such further proof necessary to show proposed joist design conforms to requirements shown and specified herein. Where joist manufacturer does not have published standards and where additional stresses will result from point loads, submit sufficient design data and calculations for proposed joist designs.

- .3 Design calculations shall clearly show properties of joists, top and bottom chords, web member sizes, thicknesses, profiles, member properties such as moment of inertia, section modulus, etc.
- .4 Shop Drawings and design calculations must bear the seal of a Professional Engineer licenced in the province of Ontario.

1.4 **QUALITY ASSURANCE**

- .1 Welding Qualifications
 - .1 Welding: Executed by organizations certified in accordance with CSA W47.1 Division 1 or 2.1.
 - .2 Welding operators: Qualified "Class O" per CSA W47.1 for Work as required by Contract.
 - .3 Inspection/testing company, welding inspector and supervisors: To meet qualifications per CSA W178.1 and CSA W178.2 and are certified by the Canadian Welding Bureau in Category (a), Buildings.
 - .4 Have welding undertaken by companies and welders fully approved to CSA W47.1 and CSA W59-M.
 - .2 Joist design: Performed by a Professional Engineer licensed to practice in the province of Ontario, to the parameters and loads noted on Drawings.
 - .3 Testing and Inspection
 - .1 Refer to "Quality Control" in Section 01 10 00 – General Requirements.
 - .2 Submit mill test reports, equivalent test data or manufacturer's certification, that steel used in the Work conforms to the Specification herein.
 - .3 Owner will employ an inspection/testing company, prior to commencement of fabrication, to perform complete shop and field inspection, and will pay costs in connection therewith.
 - .4 Inspection/testing company's representative will visit mill and fabricating plants regularly and submit reports of each visit, with copies to Contractor and Consultant. Reports will show tonnage fabricated and inspected, with comments on conformity to Specifications, workmanship and listing of defects or inaccuracies encountered. Similar reports will be submitted for inspection of field erection, which covers identification of materials, connections, welding and bolting, plumbing and levelling, etc.
 - .5 Extent of inspection/testing during fabrication and erection will be as specifically detailed to inspection/testing company by Consultant. Cooperate fully to allow access and facilities for inspection/testing, including special tests as required.
-

1.5 **PRODUCT DELIVERY, STORAGE AND HANDLING**

- .1 Arrange schedule of delivery and erection to conform to building schedule and to avoid delays and interference.
- .2 Cover joists to limit rusting and bleeding after joists are prime painted and during storage, transportation to Site and prior to erection.
- .3 Handle and store materials at the Site in a manner to prevent damage. Repair or replace damaged materials due to faulty storage or handling without expense to Owner and to approval of Consultant.

2 Products

2.1 **MATERIALS**

- .1 Structural shapes, plates, etc.: New material conforming to CSA-G40.20/G40.21-M, Grade 350W for W and H shapes, and Grade 300W for other shapes, and plates.
- .2 Hollow structural sections: New material conforming to CSA-G40.20/G40.21-M, Grade 350W, Class C.
- .3 Welding electrodes: To meet CSA W48 series on welding electrodes. Any process which produces deposited weld metal meeting requirements of applicable CSA W48 series standard for any grade of arc welding electrodes shall be accepted as equivalent to use of such electrodes.
- .4 High-strength bolts, nuts and washers: Conforming to ASTM A325M, with each type and size of bolt and nut of same manufacture and of same lot.
 - .1 Bolts: Heavy, hexagon head high-strength structural bolts, of standard size, of lengths required for thickness of members joined and for type of connection.
 - .2 Nuts: Heavy hexagon semi-finished nuts per ASTM A563M.
 - .3 Washers: Flat and smooth hardened washers, quenched and tempered.
- .5 Primer paint: Quick-drying alkyd conforming to CISC/CPMA 1-73a, same colour as structural steel primer paint.

2.2 **WORKMANSHIP AND FABRICATION**

- .1 Design details and fabricate Work in accordance with CAN/CSA-S16.1.
 - .2 Execute shop welding to welding requirements specified under "Quality Assurance" and "Welding" specified herein.
 - .3 Carefully make and fit details and take special care so finished Work presents a neat and workmanlike appearance.
 - .4 Assemble members without twists or open joints.
 - .5 Cut holes to proper size for connecting Work of other trades where such holes can be determined prior to fabrication. Where possible, show such holes on Shop Drawings.
 - .6 Place holes in such a way as not to cause an appreciable reduction in the strength of member.
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- .7 Furnish baseplates and anchor bolts to other trades for building in.

- .8 Joists and Bridging

- .1 Of type shown, conforming to design, fabrication, inspection and erection requirements of CAN/CSA-S16.1, with joist top and bottom chords of high strength steel. Upon request of Consultant, submit calculations and such further proof as may be necessary to show that proposed joist construction conforms to the Specifications. Where manufacturer does not publish standards and where additional stresses will result from point loads, submit sufficient design data and calculations for the joists proposed for Consultant's review.
 - .2 Include horizontal and diagonal bridging as required to conform to the latest edition of the Ontario Building Code and CAN/CSA-S16.1.

- 2.3 **SURFACE PREPARATION AND PRIME PAINTING**

- .1 Clean joists to SSPC SP3 requirements. Wire brush and clean welds free of flux and contamination.
 - .2 Prime Painting
 - .1 Clean joists and apply one shop coat of primer paint specified, to minimum dry film thickness of 0.038 mm to 0.051 mm.
 - .2 Paint materials under cover and leave under cover until paint is thoroughly dry. Work paint into joints and open surfaces.

- 3 Execution

- 3.1 **ERECTION**

- .1 Erect joists and associated Work in accordance with CAN/CSA-S16.1.
 - .2 Set steel accurately to the lines and elevations shown.
 - .3 Obtain written permission of Consultant if cutting or alteration of structural members is necessary.
 - .4 Assume full responsibility for correct alignment and setting of joists; guys, braces, etc., necessary to maintain the Work secure during erection.
 - .5 Setting and Anchoring
 - .1 Set joists accurately and true to line. Anchor joists securely to supports with a minimum of 38 mm welds at each side of joist shoe and/or bolt to supporting members.
 - .2 Tie joists on column lines.
 - .3 Erect bridging and secure in place in accordance with CAN/CSA-S16.1 and as shown.
 - .4 Set and secure in place, extensions from joists to adjacent structure.
 - .6 Bracing: Structure as shown is not necessarily adequate for all erection purposes. Be solely responsible for providing and removing upon completion, supplementary or
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temporary bracing required to maintain the steel plumb and in true alignment. Provide protection against wind and other natural forces during fabrication and erection.

- .7 Tolerance: Plumb and level individual pieces of joists to a tolerance not exceeding one to five hundred.

3.2 **CONNECTIONS**

- .1 Welded connections: Perform welding in such a way as to preclude damage or distortion to the Work. Provide continuous welds on exterior Work to provide proper weathering. Should there be, in opinion of Consultant or inspection/testing company, reasonable doubt as to adequacy of welds, inspection/testing company will test such welds for efficiency. Replace Work not meeting standards with new Work satisfactory to Consultant. Execute welding in accordance with the following standards:

- .1 CSA W48.1-M: For electrodes (If rods are used, only coated rods are allowed)
- .2 CSA W59-M: For design of connections and workmanship
- .3 CSA-W117.2-M: For safety
- .4 Take necessary safety precautions in accordance with CSA standards when welding is carried out in cold weather.

- .2 Bolted connections: Execute high tensile-strength bolted connections in accordance with CAN/CSA-S16.1. Accurately space holes of size 2.0 mm larger than nominal diameter of bolt. Provide compressor or electrical equipment capable of supplying and maintaining required pressure at wrench. Make connections without use of erection bolts, some high tensile bolts will serve that purpose. Nuts on bolts, except high-strength tensile bolts, shall be prevented from becoming loose by burring bolt thread, or by lock washers or lock nuts.

3.3 **FIELD TOUCH-UP**

- .1 Touch-up bolt heads, washers and nuts, previously unpainted connections, surfaces damaged during erection, welds and burned or scratched surfaces, with primer to match shop primer. Remove mud, dirt, and other foreign matter from joists by washing as the Work progresses.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- | | | |
|-----|---------------------|--|
| .1 | ASTM A123/A123M | - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products |
| .2 | ASTM A153/A153M | - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware |
| .3 | ASTM A653/A653M | - Specification for Steel Sheet, Zinc Coated, (Galvanized) or Zinc-Iron Coated Alloy Coated (Galvannealed) by the Hot-Dip Process |
| .4 | CSA-G40.20/G40.21-M | - General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels |
| .5 | CSA S136 | - Cold-Formed Steel Structural Members |
| .6 | CSA W47.1 | - Certification of Companies for Fusion Welding of Steel Structures |
| .7 | CSA W48 Series | - Electrodes |
| .8 | CSA W59-M | - Welded Steel Construction (Metal Arc Welding) |
| .9 | CSA W178.1 | - Certification of Welding Inspection Organizations |
| .10 | CSA W178.2 | - Certification of Welding Inspectors |
| .11 | CISC/CPMA 2.75 | - Canadian Institute of Steel Construction/Canadian Paint Manufacturers Association, A Quick-Drying Primer for Use on Structural Steel |
| .12 | AODA | - Accessibility for Ontarians with Disabilities Act |

1.3 **DESIGN CRITERIA**

- .1 Base design on CSA S136.
- .2 Unit stress under full live and dead loads not to exceed 138 MPa (20,000 psi) and live load deflection (of metal roof deck) not to exceed L/240th of the span. Refer to structural Drawings for loadings, and related data. Minimum base steel thickness of all deck is as shown on Drawings.
- .3 Roof deck to conform with Factory Mutual "Loss Prevention Data Sheets 1-28, Wind Design; 1-28R, Roofing Systems and 1-29, Roof Deck Securement and Above-Deck Roofing Components" for Zone 1 uplift pressures.
- .4 Comply with roof deck requirements of the Ontario Building Code.
-

- .5 Design metal deck to generally span over four or more supports (three or more spans). For one-span or two-span conditions, heavier gauge deck may be required.

1.4 **SUBMITTALS**

- .1 Shop Drawings: Submit in accordance with Section 01 33 00. Show the following:
 - .1 Design loads
 - .2 Materials, gauges and dimensions
 - .3 Layout and installation details
 - .4 General notes indicating material and installation compliance with the Specifications
- .2 The design and Shop Drawings shall bear the seal of a qualified Professional Engineer licensed to practice in the Province of Ontario. .

1.5 **QUALITY ASSURANCE**

- .1 Metal deck installer: Manufacturer's construction forces, or by an installer accredited by deck manufacturer.
- .2 Welding Qualifications
 - .1 Welding: Executed by organizations certified in accordance with CSA W47.1 Division 1 or 2.1.
 - .2 Operators employed on the Work: Qualified "Class 0" per CSA W47.1 for Work as required by Contract.
 - .3 Inspection/testing company, welding inspector, and supervisors: Meeting qualifications per CSA W178.1 and CSA W178.2 and are certified by the Canadian Welding Bureau in Category (a), Buildings.
 - .4 Welding undertaken by companies and welders approved to CSA W47.1 and CSA W59-M.
- .3 Testing/Inspection
 - .1 Refer to "Quality Control" in Section 01 10 00 - General Requirements.
 - .2 The Owner may appoint and pay for an independent inspection/testing company to perform field inspection and testing.
 - .3 The inspector will inspect welded joints and will perform visual inspection of 25% of welded connections chosen at random. The inspector will also inspect button clinching, cutting, screws used, and to observe workmanship in general.

1.6 **PRODUCT DELIVERY, STORAGE AND HANDLING**

- .1 Comply with CSSBI guidelines, and the requirements specified herein.
 - .2 Protect the Work of this section from damage. Protect other Work from damage resulting from this Work. Replace damaged Work that cannot be satisfactorily repaired.
 - .3 Store materials on Site in a manner to prevent damage thereto, or deterioration of finish. Materials which show evidence of "white rust" will not be accepted.
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- .4 Stockpile panels tilted to provide water run-off, free from ground contact on firm, level, non-staining supports extending full width of sheet and spaced not more than 900 mm apart. Where possible, pile individual sheets or panel length and types separately. Cover components with non-plastic sheet coverings to protect from direct sunlight and moisture penetration. Tie coverings to prevent blow-off. Vent to allow air movement.
- .5 Store panels away from chemically corrosive substances (e.g. salt, cement), away from materials that could contaminate the surface (e.g. diesel oil, paint, grease), and away from construction traffic.
- .6 Transport materials to Site in a manner to prevent in-transit damage. These measures include, but are not limited to crating, polyethylene wrapping system, etc.

2 Products

2.1 **METAL DECK**

- .1 General: Source deck from one manufacturer.
- .2 Sheet metal for metal deck and accessories: Conforming to ASTM A653/A653M, having zinc coating in the following designations:
 - .1 ZF75 zinc coating: Where deck is designated to be painted in the field
 - .2 Z275 zinc coating: Where deck is to be left exposed.
- .3 Roof deck profile: 38 mm depth, in any one of the following:
 - .1 VicWest "RD-938"
 - .2 Agway "RD 36"
 - .3 The Roll Form Group "S-15"
 - .4 Canam Steel Works "P3615"
- .4 Floor deck profile: 38 mm depth, composite, (inverted type,) in any of the following:
 - .1 VicWest "HB 938"
 - .2 Agway "CD 36"
 - .3 The Roll Form Group "S-15-K"
 - .4 Canam Steel Works "P3615 Composite"
- .5 Floor deck profile: 38 mm depth, non-composite type, in any of the following:
 - .1 VicWest "FD-938"
 - .2 Agway "RD-36"
 - .3 The Roll Form Group "S-15"
 - .4 Canam Steel Works "P-3615"
- .6 Roof deck profile: 76 mm depth, in any one of the following:
 - .1 VicWest "RD-308"

- .2 Agway "RD-75-200"
- .3 The Roll Form Group "S-30-8"
- .7 Floor deck profile: 76 mm depth, non-composite type, in any one of the following:
 - .1 VicWest "FD-306"
 - .2 Agway "CD-75-150"
- .8 Smoke curtains: Same as metal deck complete with specify gauge angle trim, reinforcing, stiffeners, etc.

2.2 **SHEET STEEL ACCESSORIES**

- .1 Closure plates, flute closures: Sheet steel in base thickness of 0.914 mm (20 ga). Notch flute closures to fit flute profile.
- .2 Roof sump pans at roof drains: Sheet steel in base thickness of 1.9 mm (14 ga) in overall size as shown, of slope design to fit roof slope, formed with depressed level and flat bottom 38 mm below adjacent roof deck surface at low side. Form 75 mm flanged edges to fit flat on top of adjacent roof deck.
- .3 Ridge and valley plates: Fabricate from single width sheet steel in base thickness of 1.2 mm (18 ga), in sections as long as possible. Fabricate to form transition slopes required, not less than 115 mm effective width per side, with 75 mm flange for securing to roof deck.
- .4 Metal cants: Sheet steel in base thickness of 1.9 mm (14 ga).
- .5 Curbs around roof openings: Sheet steel in base thickness of 1.6 mm (16 ga). For curb openings in excess of 1200 mm, use 1.9 mm thick (14 ga).
- .6 Mechanical equipment curbs: By mechanical division.
- .7 Deck edge supports: Steel sheet in base thickness and zinc coating same as deck, complete with welded anchor straps.
- .8 Inverted floor deck lock plates: Sheet steel in base thickness of 1.6 mm (16 ga).

2.3 **COATING SYSTEM**

- .1 Coating system for underside of prepainted deck: Silicone modified polyester (SMP) system, coil coated, using US Steel Supply "WeatherX" or ArcelorMittal "Perspectra Series". Coil coated surface pretreated and primed prior to application of coating. Unexposed surface primed and wash coat finished. Colour: to later selection by Consultant from manufacturer's full colour range.

2.4 **DECK SECUREMENT**

- .1 Welding electrodes: To meet CSA W48 series on welding electrodes. Any process which produces deposited weld metal meeting requirements of applicable CSA W48 series standard for any grade or arc welding electrodes shall be accepted as equivalent to use of such electrodes.
 - .2 Mechanical fasteners: Hilti or Construction Fasteners Limited, FM-approved fasteners for Class 1-60 (1-90) Windstorm Resistance.
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2.5 **MISCELLANEOUS ACCESSORIES**

- .1 Mechanical fasteners (for sheet metal to sheet metal connections): Self drilling, self-drilling sheet metal screws not less than No. 14.
- .2 Stud shear connectors: Size and pattern as indicated on Drawings.
- .3 Zinc rich primer: For touch-up of galvanized metal, use W.R. Meadows "Galvafrid" or Kerry Industries "Z.R.C."
- .4 Compressible flute closures: Closed cell neoprene, moulded to fit flute profile.
- .5 Waterproof tape, caulking: Self adhesive waterproof tape, and Tremco "Butyl Sealant".
- .6 Acoustic deck insulation: Custom cut in a square cross section to fill entire width, thickness and length of deck flute, Owens Corning Canada "AF 100", Fibrex Insulation "Sound Attenuation Batt", or Roxul "RXL20". Supply to roofer for installation.
- .7 Structural shapes and plates, etc.: Structural quality conforming to CSA-G40.20-M/ G40.21-M, primer to match that of structural steel and conforming to CISC/CPMA 2.75 (others).
- .8 Structural shapes and plates: Structural quality steel conforming to CSA-G40.20-M/ G40.21-M, hot-dip galvanized to ASTM A123. For nuts, bolts and other hardware, hot-dip galvanize in accordance with ASTM A153.

3 Execution

3.1 **INSTALLATION**

- .1 Install deck in accordance with reviewed Shop Drawings.
 - .2 Roof deck and floor deck to generally span over four or more supports. For one or two span conditions, a heavier gauge metal deck may be required.
 - .3 Roof deck and connections to steel framing shall be capable of resisting direct uplift due to wind immediately upon erection. (Wind uplift forces as shown on Drawings). Roof deck and connections to steel framing shall also be capable of resisting diaphragm action, if required.
 - .4 Roof deck acts as a diaphragm structurally. Mechanically fasten or weld decking to steel and button clinch interlocking rib joints in accordance with the structural steel Drawings. End joints between deck sections shall be on supports.
 - .5 Patching or replacement of less than full sheets of metal decking will not be permitted.
 - .6 Damaged, bent or dished sheets shall be rejected and removed from the Site.
 - .7 Place metal decking on supporting steel members so a continuous bearing is obtained. Minimum end bearing of any decking unit shall be 50 mm. Make end joints over supports. Where 50 mm bearing is not achievable, place metal deck supports as required. These deck supports shall be designed by a Professional Engineer licensed to practice in the province of Ontario, and shall be shown on Shop Drawings.
 - .8 Provide deck edge supports as required to support high deck flutes where deck runs parallel to structural steel at building perimeter, roof and floor openings, and at interface with walls.
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- .9 Align metal deck units end to end to provide accurate fit with corresponding units, with sections parallel, level and straight.
- .10 Place closures and closure plates on ends of decks, around openings and along deck edges where walls and flute direction are parallel.
- .11 Screw vertical closure plates to steel deck.
- .12 Properly secure all deck sheets on the roof prior to leaving the jobsite at the end of each Working Day. Remove from the roof and lower to the ground, all steel deck cuttings, strapping, packaging material and other debris resulting from decking Work at the completion of each Working Day.

3.2 **DECK SECUREMENT**

- .1 Secure deck to structural steel by mechanical fastening or by welding.
- .2 Welding
 - .1 Thoroughly and securely weld decking to supporting steel by means of 19 mm effective diameter fusion welds at 300 mm on centre maximum or as noted or shown otherwise. End joints between deck sections shall be on supports.
 - .2 Conform to CSA Welding Standards W59-M, W48 Series and W117.2.
 - .3 Button clinch interlocking rib joints at 900 mm on centres or as noted or shown otherwise. Screw interlapping side joints at 900 mm o.c. or as noted or shown otherwise. To ensure that joints are fully engaged, stand on high flute of deck while clinching.
 - .4 Hold deck in contact with adjoining member while welding.
- .3 Mechanical Fastening
 - .1 (Install prepainted deck using mechanical fasteners only.) Secure decking to structural steel framing with mechanical fasteners.
 - .2 Type and frequency of fasteners shall be as specified by the deck manufacturer's Design Engineer.
 - .3 All end joints between deck sections shall be over structural steel support framing.
 - .4 Button clinch interlocking rib joints at maximum 900 mm on centres or as noted or shown otherwise. To ensure joints are fully engaged, stand on high flutes of deck while clinching.

3.3 **CUTTING AND FITTING**

- .1 Field cut metal decking to fit around columns, supports, passage of mechanical or process equipment and other projections where indicated and/or required. Ensure that information on size and location of openings is obtained before fabrication commences. Have respective trades mark the location of cuts prior to cutting.
 - .2 Perform cutting using power operated devices without the use of torches. Accuracy of the opening shall be to within 3 mm of the opening size shown. Remove sharp burrs caused by cutting process and touch up with zinc rich primer.
-

- .3 Cut circular openings for roof drains as coordinated with mechanical trade.
- .4 Coordinate location and size of openings with mechanical trades to permit the hoisting of roofing materials. Cut openings and reinforce opening perimeter to suit. Provide safeguards and weather protection for each opening as required by the Work. Close openings with roof deck material to match existing installed as progress of roofing Work dictates.
- .5 Provide protection around deck openings to meet Ministry of Labour requirements.

3.4 **REINFORCING DECK OPENINGS**

- .1 Reinforce roof openings up to maximum 450 mm in either dimension (square or diameter)
 - .1 For roof deck openings up to 150 mm across the flutes, no reinforcement is necessary provided that not more than two vertical deck webs are removed.
 - .2 For roof deck openings over 150 mm to 300 mm across the flutes, reinforce with not less than a 51 x 51 x 6 mm steel angle across each side of the opening in a direction perpendicular to the flutes. Weld angles to at least two flutes on each side of the opening. Alternatively, provide reinforcing of design based on a structural analysis of the loads involved. Show this reinforcing on Shop Drawings.
 - .3 For roof deck openings over 300 mm to 450 mm across the flutes, Provide suitable reinforcement of design based on a structural analysis of the loads involved. Show this reinforcing on Shop Drawings.
- .2 Reinforce floor openings up to 300 mm in either dimension
 - .1 Provide reinforcing in accordance with structural Drawings.

3.5 **PLACEMENT AND FASTENING OF ACCESSORIES**

- .1 Install equipment and roof penetration curbs. Fasten to metal deck at maximum 300 mm on centres with mechanical fasteners.
- .2 Set roof sump pans in locations for roof drains, with bottom level. Screw fasten to roof deck at 150 mm centres around perimeter of pan.

3.6 **TAPING AND CAULKING**

- .1 Tape and caulk around columns, openings and at edges of deck for concrete slab as required to prevent leakage of concrete and/or water. Tape all end joints; caulk all side joints.

3.7 **FIELD TOUCH-UP**

- .1 Touch up marred galvanized surfaces and welds after installation, with zinc rich primer, to the satisfaction of Consultant. Touch up welds at top surface of metal deck.
 - .2 Repair welding burn holes in metal deck that miss structural supports to the satisfaction of the Consultant.
 - .3 Touch-up surfaces of prepainted material marred due to welding or otherwise, with matching prepaint material.
-

- .4 Remove and replace any deck panels with excessive welding burn holes at the discretion of the Consultant.

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- | | | |
|-----|---------------------|---|
| .1 | ASTM A53 | - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless |
| .2 | ASTM F1554 | - Standard Specifications for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength |
| .3 | ASTM A325M | - High-Strength Bolts for Structural Steel Joints [Metric] |
| .4 | ASTM A500 | - Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes |
| .5 | ASTM A653/A653M | - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process |
| .6 | ASTM B209M | - Specification for Aluminum and Aluminum-Alloy Sheet and Plate |
| .7 | ASTM B210M | - Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes |
| .8 | ASTM B221M | - Specification for Aluminum-Alloy Extruded Bars, Rods, Profiles and Tubes |
| .9 | ASTM B241/B241M | - Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube |
| .10 | ASTM B308/B308M | - Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles |
| .11 | ASTM D635 | - Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position |
| .12 | ASTM E84 | - Test Method for Surface Burning Characteristics of Building Materials |
| .13 | ASTM F436 | - Hardened Steel Washers (for Use with High Strength Bolts) |
| .14 | ANSI ASC A14.3-2008 | - Ladder – Safety Requirements (R2018) |
| .15 | CAN3-S157-M | - Strength Design in Aluminum |

- .16 CSA-G40.20/G40.21-M - General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel
- .17 CAN/CSA-S16.1 - Limit States Design of Steel Structures
- .18 CAN/CGSB-1.181 - Ready Mixed Organic Zinc Rich Coating
- .19 CGSB 85-GP-16M - Painting Galvanized Steel
- .20 CAN/CSA G164-M - Hot-Dip Galvanizing of Irregularly Shaped Articles
- .21 CSA W47.1 - Certification of Companies for Fusion Welding of Steel Structures
- .22 CSA W47.2 - Certification of Companies for Fusion Welding of Aluminum
- .23 CSA W48 Series - Electrodes
- .24 CSA W59-M - Welded Steel Construction (Metal Arc Welding)
- .25 CSA-W117.2 - Safety in Welding, Cutting and Allied Processes
- .26 CISC/CPMA 2.75 - Canadian Institute of Steel Construction/Canadian Paint Manufacturers Association "A Quick-Drying Primer for Use on Structural Steel"
- .27 CISC - Canadian Institute of Steel Construction, "Code of Standard Practice"
- .28 OPSS - Ontario Provincial Standard Specifications
- .29 SSPC - Steel Structures Painting Council, "Steel Structures Painting Manual, Vol. 2"

1.3 **SUBMITTALS**

- .1 Shop Drawings
 - .1 Submit Shop Drawings for fabrication and erection of miscellaneous metals in accordance with Section 01 33 00.
 - .2 Clearly show and describe all items; sections, dimensions, erection details, anchors and fastenings, connection and jointing details.
 - .3 Shop Drawings for stairs, handrails, ladder and support members shall bear the seal and signature of a licenced Ontario Professional Structural Engineer responsible for their design.

1.4 **QUALITY ASSURANCE**

- .1 Retain a firm certified in accordance with CSA W47.1 Division 1 or 2.1 to perform welding. (For aluminum Work, retain a firm certified in accordance with CSA W47.2-M to perform welding.
 - .2 Employ welding operators licensed per CSA W47.1 for types of welding required by the Work.
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1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- .1 Coordinate deliveries to comply with construction schedule and arrange ahead for strategic off-the-ground, covered storage locations. Do not load areas beyond the designed limits.
- .2 Handle and store metal materials at job Site in a manner to prevent damage to other materials, to existing buildings or property.
- .3 Handle components with care, and Provide protection for surfaces against marring or other damage. Ship and store members with cardboard or other resilient spacers between surfaces. Use lifting chokers of material which will not damage surface of steel members.
- .4 Use strippable coatings or wrappings to protect exposed surfaces of prefinished metal Work which does not receive Site finishing. Use materials recommended by finishers or manufacturers of metals, to ensure that method is sufficiently protective, easily removed, and harmless to the finish.
- .5 Prevent the formation of wet storage stain on galvanized articles by complying with the following measures:
 - .1 Stack articles or bundle to allow air between the galvanized surfaces during transport from Supplier. Load materials in such a manner that continuous drainage could occur.
 - .2 Raise articles from the ground and separate with strip spacers to provide free access of air to most parts of the surface. Incline in a manner which will allow continuous drainage. Do not lay galvanized steel on cinders, clinkers, wet soil or decaying vegetation.
 - .3 Handle galvanized articles in such a manner as to avoid any mechanical damage and to prevent distortion.
- .6 Tag metal fabrications, including associated anchor bolts, sleeves, and bases, or otherwise mark for ease of identification at Project site.

1.6 COORDINATION

- .1 Supply to concrete, masonry and/or other sections, materials requiring setting and/or building-in in concrete, masonry or other trades. This includes inserts, anchors, frames, sleeves, etc. Verify locations of said materials.

1.7 PROJECT CONDITIONS

- .1 Field measurements: Take measurements at the building to assure proper fitting, fabrication, and erection of the Work. Check dimensions in the field, whether or not shown, upon which the accurate fitting together and building-in of the metal fabrication Work may depend or which affects the proper installation of the Work of others.

2 Products

2.1 MATERIALS

- .1 General: Metals shall be free from defects which impair strength or durability, or which are visible. Metals shall be new, of best quality and free from rust, waves or buckles, and

- clean, straight throughout entire length, sharply defined profiles and true in web and flange.
- .2 Structural shapes, plates, etc.: New material conforming to CSA-G40.20/G40.21-M, Grade 350W for W and H shapes, and Grade 300W for other shapes, and plates.
 - .3 Hollow structural sections: New material conforming to CSA-G40.20/G40.21-M Grade 350W, Class H.
 - .4 Handrails:
 - .1 Steel pipe handrails, conforming to ASTM A53, Type "S", Grade B steel pipe, powder coat finish. Exterior metal handrails shall be hot-dip galvanized.
 - .2 Secure handrail to bracket with 2#10 FHMS through two countersunk holes in bracket.
 - .3 Colour to be later selected by Consultant from manufacturer's standard colour range.
 - .4 Provide all fittings and components, sleeves, hardware, backing plates, and accessories as required for complete and finished handrail installations.
 - .5 Handrail brackets:
 - .1 Julius Blum cast steel model 378 (377), powder coat finish, and with flanges tapped for bolting. Exterior handrail brackets shall be hot-dip galvanized, malleable iron, manufactured for the purpose, for anchorage to concrete walls.
 - .2 Secure bracket to post with 2#10 FHMS through countersunk holes into threaded insets in the post.
 - .3 Colour to match steel pipe handrails
 - .6 Steel Pipe Railings:
 - .1 Pipe for railings shall be seamless steel pipe, conforming to ASTM A53/A53M, Type S, of diameters and sizes indicated on Drawings.
 - .2 Finish: powder coat finish. Exterior pipe railing shall be hot-dip galvanized. Colour to be later selected by Consultant from manufacturer's standard colour range.
 - .3 Provide all required fasteners, anchors, miscellaneous components, and accessories as required for complete and finished railing installations. Bolts and studs, nuts, and washers shall conform with ASTM A307, A449, and A563, as applicable, and shall be galvanized in accordance with ASTM A153/A153M.
 - .7 Bollards
 - .1 Exterior Pipe Bollards
 - .1 Surface mounted, bolted down bollards with square base plate, hot dipped galvanized steel bollards. Fabricated in accordance with CSA G40.20/G40.21, Grade 350W, Class H or Schedule 40 steel pipe, grade B, in accordance with ASTM A53/53M.
 - .2 Bollard Cover with reflective stripe, plastic cover, 6 mm thick.
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- .1 Finish: safety yellow finish.
- .8 Pass Through Trays / Metal Liner: minimum 18 gauge stainless steel sheet to ASTM A167, type 304 to AISI No. 4 finish. Thickness as indicated on Drawings, Sheet to be levelled, free of buckles, warps and imperfections. Sizes as indicated on Drawings.
- .9 Checkered plate: To ASTM A36, 6 mm thick, with raised diamond floor surface pattern
- .10 Welding materials: Conforming to CSA W48.1-M and CSA W59-M.
- .11 High strength bolts, nuts and washers: Conforming to ASTM A325M, with each type and size of bolt and nut of same manufacture and of same lot.
- .1 Bolts: Heavy, hexagon head high strength structural bolts, of standard size, of lengths required for thickness of members joined and for type of connection.
- .2 Nuts: Heavy hexagon semi-finished nuts per ASTM A563M.
- .3 Washers: Flat and smooth hardened washers, quenched and tempered.
- .12 Machine bolts and anchor rods: As specified below, complete with hexagon heads and nuts:
- .1 Common bolts: Conforming to ASTM A307, Grade A, of lengths required to suit thickness of material being joined, but not projecting more than 6 mm beyond nut, without the use of washers.
- .2 Anchor rods: Conforming to ASTM F1554, Grade 36, of lengths noted, but projecting not less than 13 mm beyond nut unless otherwise noted.
- .3 Nuts: per ASTM A563M.
- .13 Galvanized sheet steel: 0.0897 mm (13 ga) core thickness commercial quality to ASTM A653/A653M, Grade A, with Z275 zinc coating designation.
- .14 Steel pipe bumpers: Conforming to ASTM A500, cold rolled, bare, seamless steel pipe of sizes shown.
- .15 Stainless steel pipe: To ASTM A312, Type 304, 180-grit finish.
- .16 Drilled inserts: Ramset "Mega" or Hilti "HSL" heavy-duty anchors installed in accordance with manufacturer's directions, to sizes shown. Load capacity when embedded in 25 MPa concrete shall not be less than:
- | <u>Diameter</u> | <u>Pullout kN</u> | <u>Shear kN</u> |
|-----------------|-------------------|-----------------|
| 8 mm | 30.0 | 36.0 |
| 10 mm | 43.6 | 57.2 |
| 12 mm | 53.6 | 82.8 |
| 16 mm | 83.6 | 149.6 |
| 20 mm | 119.6 | 205.6 |
- .17 Epoxy capsule type anchors: Hilti "HVA Adhesive Anchor", two-part, threaded steel stud and epoxy adhesive filled capsule anchoring system. Install per manufacturer's recommendations.
- .18 Galvanizing: Hot-dip galvanizing with minimum zinc coating of 600 g/m² to CAN/CSA G164-M.

- .19 Galvanized primer: Zinc rich conforming to CAN/CGSB-1.181 for new galvanized metal in compliance with CGSB 85-GP-16M. For galvanized fabrications touchup to remain unpainted in finished Work, use W.R. Meadows of Canada Ltd. "Galvafrid" or Kerry Industries "Z.R.C." or Niagara Paint Inc. "PL052898" zinc rich coating.
- .20 Primer paint: Solvent reducible alkyd, light grey, in fast drying, lead and zinc-chromate free formulation conforming to CISC/CPMA 2.75. Use one brand of primer paint throughout the Work, in any of the following, tinted to the specified colour:
 - .1 "97-680" by PPG Canada Inc.
 - .2 Selectone "MR-05-3" by Selectone Paints Ltd.
 - .3 "Kem Bond HS-B50WZ4" by Sherwin-Williams

2.2 **BASIC MATERIALS - ALUMINUM**

- .1 Aluminum rolled or extruded shapes: Structural quality to ASTM B308/B308M, Alloy 6061-T6.
- .2 Aluminum bar, rod, wire: To ASTM B221M.
- .3 Aluminum sheet or plate: To ASTM B209M.
- .4 Aluminum checkered plate: To ASTM B209M, Alloy 5086.
- .5 Aluminum drawn tubes: To ASTM B210M.
- .6 Aluminum pipe: To ASTM B241/B241M, Schedule 40, 6061 alloy.
- .7 Stainless steel bolts: Expansion bolts using high strength stainless steel conforming to ASTM A193, Grade B8, Type 316.
- .8 Aluminum finish: (plain mill finish) (clear anodic finish, designation AA-M12C22A41)
- .9 Accessories
 - .1 Steel bolts: To (ASTM F1554 grade 36) (ASTM A325M), hot-dip galvanized to CAN/CSA-G164-M, minimum zinc coating of 600 g/m².
 - .2 Bituminous paint: Henry "410-02" Bituminous paint.

2.3 **BASIC MATERIALS - STAINLESS STEEL**

- .1 Stainless steel sheet: To ASTM A167, type 304 to AISI No. 4 (2B) finish.
 - .2 Stainless steel plate: To ASTM A167, type 304 to AISI No. 4 (2B) finish.
 - .3 Stainless steel shapes: To ASTM A276, type 304 to AISI No. 4 (2B) finish.
 - .4 Stainless steel fasteners: Type 304, (316).
 - .5 Stainless steel pipe: To ASTM 312, type 316, 180 grit finish.
 - .6 Stainless steel bolts: Expansion bolts using high strength stainless steel conforming to ASTM A193, Grade B8, Type 316.
-

2.4 SHOP FABRICATION

- .1 Fabricate items that are to be built into masonry or concrete and deliver to Project site for setting; furnish items complete with bolts, anchors, clips, etc., ready to set. Furnish, completely install and connect other items. Erect items to proper lines and levels, plumb and true, and in correct relation to adjoining Work. Secure parts in a rigid and substantial manner using concealed connections where practicable.
 - .2 Where necessary to secure Work to the structure by means of expansion bolts, cinch anchors, and similar connections, lay out the Work and install such connections, install the Work and bolt up, unless otherwise noted.
 - .3 Provide bolts, shims, blocks, nuts, washers, wedging pieces, etc., required for complete installation, unless otherwise noted.
 - .4 Drill field holes for bolts or rivets. Do not burn holes.
 - .5 Furnish fitting-up bolts, drift pins, other tools and equipment and do necessary reaming of unfair holes found in field connections. New holes or enlargement of unfair holes by use of cutting torch is cause for rejection of the entire member. Replacement shall be made at Contractor's expense.
 - .6 Mill joints to a tight, hairline fit; cope or miter corners. Form joints exposed to weather to exclude water.
 - .7 Remove burrs from all exposed cut edges.
 - .8 Execute shop welding conforming with welding requirements specified under "Quality Assurance" and "Welding" herein. (Fabricate structural aluminum in accordance with CAN3-S157 and in accordance with reviewed Shop Drawings).
 - .9 Accurately cut, machine and fit joints so that finished Work presents a neat appearance.
 - .10 Assemble members without twists or open joints.
 - .11 Drill properly sized holes for connecting the Work of other trades where such can be determined prior to fabrication. Where possible, show such holes on Shop Drawings. Place holes so not to cause an appreciable reduction in strength of member.
 - .12 Certain miscellaneous metal elements are listed with a corresponding description below. Such listing is intended to provide clarity or to specify requirements for the given elements, and not to represent the scope of metal fabrications work.
 - .13 Constructed railing and guard to withstand both required vertical and horizontal loadings.
 - .14 Steel Pipe Handrails
 - .1 Close open ends of steel pipe handrail with 1.9 mm (14 gauge) closure neatly welded and ground smooth.
 - .2 Pipe railing to consist of top rail and intermediate rail, and with matching vertical standards.
 - .3 Form changes in direction of railing members by mitering or inserting prefabricated flush elbow fittings.
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- .1 Form curves by bending in jigs to produce uniform curvature without buckling, flattening, twisting, cracking, or otherwise deforming exposed surfaces.
 - .4 Perform all welding and joining in shop prior to finishing.
 - .5 Assemble end-to-end connections and splice joints by using internal sleeves, bonded by epoxy adhesive or by field welding. Do not field weld.
 - .15 Pipe Bollard and Sleeves
 - .1 Constructed of steel pipe sizes shown, complete with lifting hole where bollard is to be removable, and 6 mm thick plate closure welded to bottom of guard post sleeves.
 - .16 Pipe Railings
 - .1 Fabricate the same as steel pipe handrails.
 - .2 Where railings are permanently inserted into concrete floors, Provide steel pipe sleeve of adequate size to be cast into concrete with a 3 mm thick steel plate welded to bottom and required anchor rods to ensure a securely set sleeve.
 - .3 Fabricate removable railings in sections to permit for easy removal. Provide steel sleeves into which railing uprights will be inserted. Fabricate sleeves to sliding fit over uprights and to provide adequate support.
 - .17 Stainless Steel Pipe
 - .1 Thoroughly clean welds and surrounding substrate area of weld spatter, flux or scale by wire brushing, grinding and polishing.
 - .2 Remove excess weld by grinding to provide for continuous weld line. Grind, polish, and buff welds exposed to view to match finish of parent material.
 - .18 Flat Bar Handrails, Pickets
 - .1 Handrails: Continuous top and bottom flat bars supporting both ends of pickets.
 - .2 Pickets: Welded to top and bottom flat bar handrails.
 - .3 Connection to stairs: Weld both sides of bottom rail continuously to top flange of stringer.
 - .4 Wall brackets: Provide for railings supported from walls.
 - .5 Handrail cap: Cover top flat bar full length with extruded plastic handrail cover. Weld all joints in vinyl.
 - .19 Channel Door Frames
 - .1 Structural channel sections, selected for trueness of web and flange, with joints welded and ground smooth. Furnish (bar stop) and bent bar anchors for anchorage to masonry or concrete as required.
 - .2 Fit frames with temporary spreaders to prevent frame from springing out of shape.
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- .20 Steel Frames for Miscellaneous Openings
 - .1 Connections: Connect built-up members of frames by means of plug welding. Miter or cope and join members with continuous welding beads.
 - .2 Top of frames embedded in concrete: Fabricate frames so top of frames are flush with finish floor elevation.
- .21 Lintels
 - .1 Weld pairs of members back to back together and in no case shall lintels be more than 25 mm less in width than wall they support.
 - .2 Extend lengths to allow 150 mm minimum end bearing on masonry. Unless otherwise shown, lintels in block walls shall be of steel furnished under this section.
- .22 Lateral Supports for Masonry Walls
 - .1 Minimum size 100 x 100 x 150 x 6 mm thick, steel angles along top of concrete block walls as shown. Fasten angles to structure above and space at not over 1800 mm o.c. on both sides of the walls, staggering the angles, that when combined, angles are not over 900 mm o.c.
- .23 Millwork Supports and Brackets
 - .1 Design, fabricate, and supply metal framing and connections in accordance with Contract Drawings for support of the following: Millwork, washroom vanities, counters, and similar items. Supply stainless steel mounting hardware, brackets, bolts, sleeves, and the like for metal supports as required. Size of members and hardware.
- .24 Mechanical Equipment Fabricated Supports
 - .1 Design, fabricate, and Provide supplementary steel framing to support mechanical equipment at locations and elevations in accordance with Contract Drawings.
 - .2 Coordinate Work with appropriate mechanical technical Sections. Obtain dimensions and weights of equipment from reviewed Shop Drawings.
- .25 Checkered plate covers: Diamond shaped raised pattern, of nominal thickness shown exclusive of raised pattern.
- .26 Floor plate: Shearing, cutting, or punching shall leave clean, true lines and surfaces. Drill countersunk holes in plate where it will be bolted in place.
- .27 Kickplates: Continuous, 150 mm high x 6 mm thick.

2.5 **WELDING**

- .1 Execute welding to avoid damage or distortion to the Work. Should there be, in the opinion of Consultant or inspection and testing company, doubt as to adequacy of welds, such welds shall be tested for efficiency and any Work not meeting specified standards shall be removed and replaced with new Work satisfactory to Consultant. Execute welding in accordance with the following standards:
 - .1 CSA W48-M: For electrodes. If rods are used, only coated rods are allowed.

- .2 CSA W59-M: For design of connections and workmanship.
- .3 CAN/CSA-W117.2-M: For safety.

- .2 Thoroughly clean welded joints and expose steel for a sufficient space to perform welding operations. Neatly finish welds. Where exposed to view and finish painted, apply weld continuously and grind to a uniformly smooth finish.

2.6 **CLEANING, SHOP PRIMING**

- .1 Omit prime painting of miscellaneous metals that will be painted with epoxy as specified in Division 9.
- .2 Clean steel to SSPC SP3 (SP6) and remove loose mill scale, weld flux and splatter.
- .3 Shop prime with one coat of primer paint to dry film thickness of 0.025 mm. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7°C (45°F). Paint items under cover and leave under cover until primer is dry. Follow paint manufacturer's recommendations regarding application methods, equipment, temperature, and humidity conditions.
- .4 Clean but do not paint surfaces being welded in field.
- .5 Do not paint surfaces embedded in concrete.
- .6 Do not paint surfaces in friction connections.
- .7 Treat surface of aluminum in contact with or embedded in dissimilar materials in accordance with CAN3-S157-M. Treat as if material is installed in the presence of moisture.

2.7 **HOT-DIP GALVANIZING**

- .1 Galvanize members exposed to exterior elements when in final location; members embedded on the exterior side of exterior walls; members embedded in concrete; members specified in this section or noted on Drawings.
- .2 Perform hot-dip galvanizing after fabrication. Plug relief vents air tight. After galvanizing, remove plugs, ream holes to proper size and re-tap threads. Straighten shapes and assemblies true to line and plane after galvanizing. Repair damaged galvanized surfaces with galvanize primer in accordance with manufacturer's printed directions.
- .3 Wet storage stain: Remove wet storage stain that may have developed in the coating before installation so that premature failure of the coating does not occur. Remove wet storage stain in accordance with galvanizer's recommendations.
- .4 Repair of galvanized items: Repair coatings damaged by welding, cutting, or during handling, transport or erection using cold galvanizing compound specified, and as follows:
 - .1 Ensure surface is clean, dry, and free of oil, grease and corrosion.
 - .2 Power clean surface to near white metal condition, extending into undamaged galvanized coating.
 - .3 Apply touch up material to a dry film thickness of 0.203 mm (8 mils) minimum. If touched up Work is to remain exposed in the finished Work, apply a finish coat of aluminum paint to provide a colour blend with the surrounding galvanizing.

- .4 Coating shall be continuous, adherent, smooth and evenly distributed.

3 Execution

3.1 **ERECTION**

- .1 Fit joints and intersecting members accurately. Make Work in true planes with adequate fastenings. Build and erect Work plumb, true, square, straight, level and accurate to sizes detailed, free from distortion or defects detrimental to appearance or performance.
- .2 Stairs, Rails and Handrails
 - .1 Erect rigid and free from whip.
 - .2 Continuously weld connections for railings attached directly to steel stringers. Where rails return to wall Provide end returns and wall brackets.
 - .3 Provide temporary supports and bracing required to position stairs and landings.
 - .4 Adjust railings prior to securing in place to ensure proper matching at butting joints and correct alignment throughout their length.
 - .5 Continuously weld connections between handrails and balusters and in lengths of handrails.
 - .6 Secure wall brackets to walls with through bolts and plate where these can be concealed, otherwise use bolts and expansion shields to achieve maximum rigidity of rail. Wood plugs for fixing to walls will not be permitted. Use metal anchoring devices.
- .3 Fit door frames and jambs with temporary steel spreaders to prevent springing frames and jambs out of shape.
- .4 Weld as specified herein.
- .5 Take adequate care to prevent damage to any material such as weld burns, etc.
- .6 Include all cutting and patching of masonry walls where necessary. Obtain Contractor's approval of cutouts in advance.
- .7 Insulate where necessary to prevent electrolysis due to dissimilar metal to metal contact, or metal to masonry and concrete. Use bituminous paint, butyl tape, building paper or other approved means.
- .8 Install materials in a good and workmanlike manner, cleaning and grinding all welding laitance and touching up primer where necessary.
- .9 Fixed Ladders
 - .1 Install in accordance with Contract Drawings and reviewed Shop Drawings.
 - .2 Coordinate location with other equipment and mechanical equipment.
 - .3 Before installation, verify acceptable clearances to set up the ladder.

3.2 **CONNECTIONS**

- .1 Weld or high strength bolt main member connections. Use CISC double angle header connections wherever possible. High strength bolted connections shall be bearing type

using 19 mm diameter bolts conforming to ASTM A325M. Secondary members may be bolted with machine bolts.

- .2 Perform high tensile bolted connections in accordance with CSA-S16.1. Accurately space holes of size 1.6 mm larger than the nominal diameter of the bolt. Install bearing type high tensile bolted connections unless shown otherwise on Drawings. Provide compressor or electrical equipment capable of supplying and maintaining required pressure at the wrench. Make connections without the use of erection bolts; some high tensile bolts will serve that purpose. Prevent nuts on bolts, except high tensile bolts, from becoming loose by burring bolt thread, by welding or by lock washers or lock nuts.
- .3 Execute welding as specified under shop welding in Part 2 and as follows:
 - .1 Provide continuous welds on exterior Work to provide proper weathering.
 - .2 Take necessary safety precautions in accordance with CSA standards when welding is carried out in cold weather.

3.3 **FIELD TOUCH-UP**

- .1 Paint bolt heads, washers, nuts, field welds and previously unprimed items. Touch up shop primer and galvanizing damaged during transit and installation with material to match shop primer or galvanize coating.
- .2 Clean off dirt on installed miscellaneous metal surfaces.
- .3 Touch up all damaged surfaces of aluminum Work with one coat of zinc chromate primer.

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- .1 ESR-3269 ICC-ES - Evaluation Report, International Code Council Standards for Glass Balustrade Guard Rail Applications
- .2 ASTM C1048 - Standard Specifications for Heat Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated Glass
- .3 ASTM E2358-04 - Standard Specification for Performance of Glass in Permanent Glass Railing Systems, Guards, and Balustrades
- .4 NAAMM - Metal Finishes Manual; National Association of Architectural Metal Manufacturers

1.3 **SYSTEM DESCRIPTION**

.1 Performance Requirements for Handrail Assembly:

- .1 Support distributed load of 50 pounds per linear foot (0.73kN/M), applied horizontally at right angles in any direction to the top/grab rail.
- .2 Support concentrated horizontal load of 200 pounds (0.89kN), applied in any direction at any point along top/grab rail system.
- .3 50 lbs (0.22kN) on 1 sf (0.093 m²) at any point in system, including panels, intermediate rails, balusters, or other elements composing infill area
- .4 Distributed loads and concentrated loads not to be applied simultaneously.
- .5 Maximum deflection of top of glass is height/24.

1.4 **SUBMITTALS**

.1 Shop Drawings

- .1 Submit Shop Drawings for fabrication and erection of glass guards in accordance with Section 01 33 00.
- .1 Submit fully detailed drawings showing configuration, dimensions, materials, finishes, connections, supports, reinforcement and accessories.
- .2 Elevations shall include joint locations, transitions and terminations.
- .3 Manufacturer's installation and maintenance instructions.

- .2 Shop Drawings shall bear seal and signature of a Professional Engineer licensed to practice in the Province of Ontario.

- .2 Product Data: Submit Manufacturer's technical product data of the system components and accessories.

- .3 Samples of manufacturer's finishes (as selected by the Consultant).

1.5 **QUALITY ASSURANCE**

- .1 Components and installation are to be in accordance with the Ontario Building Code.

- .2 All components and fittings shall be furnished by the same manufacturer.

1.6 **PRODUCT DELIVERY, STORAGE AND HANDLING**

- .1 Deliver materials properly protected against damage to finished surfaces during transit.

- .2 Inspect materials upon delivery for damage. Unless minor defects can be made to meet the Consultant's specifications and satisfaction, damaged parts should be removed and replaced.

- .3 Store materials at building site under cover in dry location.

2 **Products**

2.1 **MANUFACTURERS**

- .1 "P-Series Post Railing System" by CR Laurence Co., Inc. (Basis of Design)

- .2 or accepted equal.

2.2 **MATERIALS**

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

- .2 Stainless Steel Components: Type 316/316L

- .1 Bar: ASTM A 167

- .2 Pipe and Tubing: ASTM [A 269] [A 312]

2.3 **COMPONENTS**

- .1 Glazing: Clear tempered glass with DuPont SentryGlas (Ionoplast™) interlayer, conforming to ASTM C1048 Kind FT, Quality Q3, Low iron.

- .1 Thickness: 21.52 mm (27/32").

- .2 Edge type: polished

- .2 Glazing Clamps: Square clamps, brush stainless steel

- .1 Acceptable Product: "Z-clamp" by CR Laurence or accepted equal.

- .3 Post Railing

- .1 Centre Post:

- .1 Surface mounted, 25 mm x 51 mm (1" x 2") rectangular tubing, 180-degree centre post railing.
 - .2 Height: 1067 mm (42")
 - .3 Finish: Brushed Stainless steel, Type 316
 - .4 Acceptable Product:
 - .1 "Part No. P942CBS" by CR Laurence or accepted equal.
 - .2 End Post:
 - .1 Surface mounted, 25 mm x 51 mm (1" x 2") rectangular tubing, end post railing.
 - .2 Height: 1067 mm (42")
 - .3 Finish: Brushed Stainless steel, Type 316
 - .4 Acceptable Product:
 - .1 "Part No. P942EBS" by CR Laurence or accepted equal.
 - .3 Blank Post:
 - .1 25 mm x 51 mm (1" x 2") Rectangular tubing, 180-degree blank post.
 - .2 Height: 1372 mm (54")
 - .3 Finish: Brushed Stainless steel, Type 316
 - .4 Acceptable Product:
 - .1 "Part No. P9BPFBS" by CR Laurence or accepted equal.
 - .4 Blank Post:
 - .1 Rectangular tubing railing post with adjustable saddle
 - .2 Height: 1372 (54")
 - .3 Finish: Brushed Stainless steel, Type 316
 - .4 Acceptable Product:
 - .1 "Part No. P9BPSBS" by CR Laurence or accepted equal.
 - .4 Post Cap:
 - .1 Vertical Adjustable Post Cap
 - .1 Finish: Brushed Stainless steel, Type 316
 - .2 Acceptable Product:
 - .1 "Part No. P9VFBS" by CR Laurence or accepted equal.
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- .2 Vertical Adjustable Post Cap for Standoff Saddles
 - .1 Finish: Brushed Stainless steel, Type 316
 - .2 Acceptable Product:
 - .1 "Part No. P9VSBS" by CR Laurence or accepted equal.
 - .3 Top Post Cap
 - .1 Finish: Brushed Stainless steel, Type 316
 - .2 Acceptable Product:
 - .1 "Part No. P9CAPBS" by CR Laurence or accepted equal.
 - .5 Post Mounting Hardware
 - .1 Fascia Post Mounting Bracket
 - .1 Finish: Brushed Stainless steel, Type 316
 - .2 Acceptable Product:
 - .1 "Part No. P9FBBS" by CR Laurence or accepted equal.
 - .2 Post Surface Mount Stanchions
 - .1 Finish: Stainless steel, Type 316
 - .2 Acceptable Product:
 - .1 "Part No. P9BFS" by CR Laurence or accepted equal.
 - .6 Metal Handrail Tubing:
 - .1 Profile: Rectangular pipe rail tubing, 25 mm x 51 mm (1" x 2")
 - .2 Finish: Type 316 Brushed Stainless Steel.
 - .3 Acceptable Product
 - .1 Part PR1X2BS20 by CR Laurence or accepted equal.
 - .7 Pipe Connector Sleeve:
 - .1 Size: 25 mm x 51 mm (1" x 2") Pipe rail splice connector
 - .2 Length: 127mm (5")
 - .3 Finish: Mill Stainless Steel, Type 316
 - .4 Acceptable Product
 - .1 Part No. PR1X2CSS by CR Lawrence or accepted equal.
 - .8 Pipe End Cap:
 - .1 Rectangular end cap for pipe railing.
 - .2 Finish: Type 316 Brushed Stainless Steel.
-

- .3 Size: 25 mm x 51 mm (1" x 2")
- .4 Acceptable Product
 - .1 "Part No. PR1X2ECBS" by CR Lawrence or accepted equal.
- .9 Base Flange: "Part No. P9BFP" by CR Lawrence or accepted equal.
- .10 Flange Cover: Brush Stainless Steel, "Part No. P9FCBS" by CR Lawrence or accepted equal.
- .11 Fasteners: Select fasteners of type, grade, class and size indicated on Shop Drawings.
- .12 Anchors to Cast-in-Place Concrete: fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in concrete, as determined by testing per ASTM E488.
- .13 Sill angles for tempered glass railing assemblies: Steel angle profiles conforming to ASTM A36, with anchoring devices, sizes indicated in Shop Drawings, drilled and tapped for fastener types, sizes and spacing indicated.
- .14 Welding materials: CSA W59

2.4 **FABRICATION**

- .1 Fabricate handrail assembly components to lengths and configurations complying with Shop Drawings.
- .2 Machine joint edges smooth and plane to produce hairline seams when site assembled; supply concealed sleeve connectors for joints.
- .3 Isolate dissimilar metals to prevent electrolytic action by applying primer to concealed surfaces of metal components.

3 Execution

3.1 **EXAMINATION**

- .1 Examine substrates to receive the Work of this section and ensure that Work of other sections is complete and that there are no conditions which will adversely affect the Work of this section.
- .2 Notify the Consultant immediately of any unsatisfactory conditions. Do not proceed with the Work of this section until unsatisfactory conditions have been corrected.
- .3 Commencement of the Work of this section implies acceptance of surfaces and conditions.

3.2 **INSTALLATION**

- .1 Assemble and erect Work plumb, true, square, straight, level and accurate to size detailed, to reviewed shop drawings, free from distortion and defects detrimental to appearance and performance.
 - .2 Isolate metals where necessary to prevent corrosion between dissimilar metals and between metals, masonry and concrete. Use bituminous paint or butyl tape.
 - .3 Install glass using skilled glass craftsmen.
-

- .4 Set glass in place and securely anchored and held in alignment.

3.3 **CLEANING**

- .1 Clean glazing surfaces after installation, complying with requirements contained in the manufacturer's instructions. Remove excess glazing sealant compounds, dirt or other substances.
- .2 Remove protective films from metal surfaces.

3.4 **PROTECTION**

- .1 Institute protective measures required throughout the remainder of the construction period to ensure that all the materials do not incur any damage or deterioration.
- .2 Repair components damaged by subsequent construction activities in accordance with manufacturer's recommendations. Replace damaged components that cannot be repaired to Consultant's acceptance.

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- .1 CAN/CSA O80 Series - Wood Preservation
- .2 CAN/ULC-S102 - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
- .3 CSA O121-M - Douglas Fir Plywood
- .4 NLGA - National Lumber Grades Authority
- .5 AODA - Accessibility for Ontarians with Disabilities Act

1.3 **QUALITY ASSURANCE**

- .1 Each piece of pressure treated lumber and fire retardant treated lumber supplied to the job Site shall be shop marked with the pressure treatment brand, and ULC monogram respectively, in accordance with CAN/CSA O80-M.

1.4 **PRODUCT DELIVERY, STORAGE AND HANDLING**

- .1 Store lumber in a dry area. Stack 150 mm clear of floor and with 6 mm spacers 1200 mm apart across each layer.
- .2 Cover materials with tarpaulins or polyethylene sheets to prevent moisture absorption and impairment of structural and aesthetic properties. Vent to allow air movement. Tie covering to keep in place.

1.5 **ROOF LUMBER PROTECTION**

- .1 During transit, storage, and immediately following installation, protect roof lumber from rainwater and condensation to prevent decay. Likewise, Provide protection whenever work is interrupted for whatever reason. Use waterproof tarpaulins tied down to prevent wind blow-off. Moisture control must be properly practiced to prevent the occurrence of lumber decay. Pressure treated lumber is not used in this Project.

2 Products

2.1 **MATERIALS**

- .1 Dimension lumber: Grade stamped, dressed, kiln dried lumber having a maximum moisture content at time of installation, of 15% for 50 mm or less in thickness, and 19% for stock over 50 mm thick in accordance with NLGA.
 - .1 Interior blocking, furring, nailers: NLGA, 122c - Standard Light Framing Grade Spruce, Pine or Fir (S-P-F), S4S.

- .2 Roof lumber: NLGA, 122b - Construction Light Framing Grade Spruce, Pine or Fir (S-P-F), S4S.
- .3 Roof lumber (for PVC/EPDM roofing): NLGA (202c), "C Cedar Industrial Clear", Western Red Cedar, surfaced, kiln dried. Pressure treated wood is unacceptable.
- .4 Lumber exposed to the exterior elements: Jack Pine, Grade No. 2 or better, pressure treated with CCA salt preservative in accordance with CAN/CSA O80 Series, or "C Cedar Industrial Clear", Western Red Cedar, surfaced, kiln dried.
- .2 Fire retardant treatment of lumber and plywood: "Dricon" fire retardant treatment by J.A. Biewer or equivalent, conforming to CAN/CSA-O80.20 and CAN/CSA-O80.27 respectively, to provide a flame spread rating of 25 or less in accordance with ULC test method CAN/ULC-S102.
- .3 Plywood: 19 mm thick (others), waterproof, grade stamped exterior grade Douglas fir plywood, (select unsanded for concealed uses) (good one side-sanded for use with single ply roofing) in accordance with CSA O121-M.
- .4 Insulation within curbs and parapets: E'NRG'Y 3 AGF as supplied by Johns Manville, "Ikotherm III" by IKO Industries Ltd. Or "ACFoam III" by Atlas, polyisocyanurate insulation, fully adhered with mastic adhesive. Cover with plywood mechanically fastened through insulation to steel curb.
- .5 Rough hardware: Bolts, anchors, nails, screws, expansion shields and other fastenings required to frame and fix rough carpentry as follows:
 - .1 Hardware for lumber to lumber in exterior locations: Steel screws or spiral nails hot-dip galvanized to ASTM A-153. Wood screws shall be countersunk head, full thread type.
 - .2 Hardware for lumber to metal in exterior locations: Self-drilling with fluoropolymer type barrier coating.
 - .3 Hardware for lumber to masonry or concrete in exterior locations: Drilled-in expansion shields or drilled in self-drilling masonry concrete screws with fluoropolymer type barrier coating.
 - .4 Hardware in interior locations: As specified above, but with electrogalvanized coating.

2.2 **SELECTION OF LUMBER PIECES**

- .1 Carefully select all members; select individual pieces so that knots and obvious defects will not interfere with placing bolts or proper nailing or making proper connections.
- .2 Discard wood members with defects which will render a piece unable to serve its intended function; lumber may be rejected by Consultant whether or not it has been installed, for excessive warp, twist, bow, crook, mildew, fungus, or mould, as well as for improper cutting and fitting.

3 **Execution**

3.1 **ROOF LUMBER**

- .1 Construct rough carpentry from wood pieces of longest available length.

- .2 After cutting treated lumber, apply two liberal coats of preservative on cut surfaces of lumber.
- .3 Fasten plywood, wood nailers and blocking at maximum 400 mm o.c. in staggered pattern unless noted otherwise, and in accordance with FM 1-49.
- .4 Install vapour barrier under curb insulation and wood nailers, and in accordance with FM 1-90. Seal as required to provide vapour tight condition.
- .5 Unless held in place by plywood, mechanically fasten insulation to vertical surfaces using screw and plate method. Substrate to receive insulation shall be completely dry.

3.2 **MISCELLANEOUS WOODWORK**

- .1 Install miscellaneous wood blocking, strapping and nailers required for attachment of Work of all trades, in addition to roof woodwork. Set accurately so that they will be completely concealed.
- .2 Except where steel supports are specifically shown, Provide wood blocking and supports in metal stud partitions for fastening of items such as casework and other wall mounted accessories. Have respective trades approve the location of such wood blocking.
- .3 Use fire retardant lumber for blocking/framing in ceiling spaces, partitions and bulkheads.
- .4 Install and secure 50 mm x 250 mm full length temporary spruce, pine or fir treads and landings on steel stairs shown to receive concrete fill.
- .5 Install temporary wood protection strips at door jambs in high traffic areas.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- | | | | |
|-----|----------------|---|--|
| .1 | AWI/AWMAC | - | American Woodwork Institute/Architectural Woodwork Manufacturers Association of Canada |
| .2 | ANSI A208.1 | - | Particleboard |
| .3 | ANSI A208.2 | - | Medium Density Fiberboard (MDF) for Interior Applications |
| .4 | CAN3-O188.1-M | - | Interior Mat-Formed Wood Particleboard |
| .5 | CSA O80 Series | - | Wood Preservation |
| .6 | CSA O115-M | - | Hardwood and Decorative Plywood |
| .7 | CSA O121-M | - | Douglas Fir Plywood |
| .8 | CAN/ULC-S102 | - | Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies |
| .9 | NEMA LD3 | - | National Electrical Manufacturers Association, High Pressure Decorative Laminates |
| .10 | AODA | - | Accessibility for Ontarians with Disabilities Act |

1.3 **SUBMITTALS**

.1 Shop Drawings

- .1 Submit in accordance with Section 01 33 00.
- .2 Show on Shop Drawings, vanities, counters, cupboards, and other casework.
- .3 Show fabrication details, including exact sizes and description of anchorage and hardware, nature of the materials which are to be used as component parts, and installation and interface conditions.

.2 Samples: Submit duplicate samples wood for colour and sheen verification.

1.4 **QUALITY ASSURANCE**

.1 Special Experience Requirements

- .1 Manufacturer/fabricator: Architectural woodwork shall be manufactured by a current member firm of AWI/AWMAC, and having a minimum of five years experience on Work of similar size and quality to that indicated and specified.

- .2 Installer qualifications: Engage an installer who is a current member firm of AWI/AWMAC, and who has successfully completed two architectural woodwork projects similar in scope, materials and design to that indicated and specified within the last five years.

1.5 **PRODUCT DELIVERY, STORAGE AND HANDLING**

- .1 Deliver units to meet installation schedule. Arrange for strategic, off-the-ground, covered storage locations with constant minimum temperature of 16°C (61°F) and maximum moisture content of 12% when measured with moisture meter.
- .2 Provide adequate protection until finally accepted.

1.6 **WARRANTY**

- .1 Warrant Work of this section against defects and deficiencies for a period of two years from date Work is certified as substantially performed in accordance with the general conditions of the Contract.
- .2 Promptly make good defects and deficiencies which become apparent within the Warranty Period by replacing defective plastic laminate Work satisfactory to the Consultant and at no expense to the Owner.
- .3 Defects shall include, but not be limited to, warping and delamination.

1.7 **COORDINATION**

- .1 Coordinate with the frame Suppliers as to the time at which such items will be required for installation. Receive and store such items.

2 **Products**

2.1 **MATERIALS**

- .1 Wood Materials
 - .1 Restriction of source of supply: 50% of wood Products used in Work of this section must be Forest Stewardship Council (FSC) Certified, with chain of custody verification.
 - .2 Provide materials that comply with requirements of the AWI/AWMAC Manual for each type of woodwork and quality grade indicated and, where Products are part of woodwork, with requirements of the referenced Product standards that apply to Product characteristics indicated.
 - .3 Lumber: To AWI/AWMAC manual with the following requirements:
 - .1 Hardwood for concealed blocking and framing: Economy grade, any species that, when painted, will not show any defects.
 - .2 Moisture content: Provide kiln-dried (KD) lumber with an average moisture content range of 6% to 11% for interior Work. Maintain temperature and relative humidity during fabrication, storage and finishing operations so that moisture content values for woodwork at time of installation do not exceed 5% to 10%.

- .3 Solid hardwood for transparent finish grade: to Architectural Woodwork Standards, Edition 1-2009, Grade I. Wood species and cut: To later selection by Consultant.
 - .4 Architectural lumber: Clear, straight, kiln dried, select yellow birch for urethane or varnish finished fitments and door jambs. Lumber shall be kiln dried to 5% moisture content and free from blemishes that would be apparent after finish is applied.
 - .2 Hardboard: In accordance with CAN/CGSB-11.3, Type 2, Density: Minimum 500 kg/m³, tempered hardboard, 6 mm thickness unless indicated otherwise, one face smooth. Colour to be selected bin Consultant.
 - .3 Melamine surfaced boards: 720 kg/m³ density particleboard core with thermally fused low pressure laminate finish by Domtar, Arborite or Uniboard. Colour as selected by the Consultant.
 - .4 Medium Density Fibreboard (MDF): Meeting ASTM D1037 and ANSI A208.2, Premium Grade for interior use, minimum 700 kg/m³ density; formaldehyde emissions shall be 0.30 ppm or less per 0.424m²/m³ of room volume.
 - .1 Medium Density Fibreboard (MDF): moisture resistant; composed of wood particles reduced to fibres, made with high waterproof resin binders; of grade to suit application; sanded faces.
 - .5 Wood veneer: Uniform, clean veneer without open defects or characteristics detrimental to appearance. Piece veneers shall be parallel chipped, jointed by tapeless splicer and edge glued. Face veneers shall not contain open joints, face depressions, glue stain, patches, plastic repair or any other manufacturing irregularities or defects Panels and doors continuous matched vertically and book matched horizontally.
 - .1 Species: to match reviewed samples, minimum 0.8 thick, selected architectural quality with respect to cutting lengths, uniformity of colour, figure grain and defects.
 - .6 Particle Board: to ANSI A208.1, Grade M-2, minimum 635 kg/m³ density, 100% post-industrial wood fibres, no added urea formaldehyde, thickness as indicated on Drawings. Uniboard Canada, or accepted equal.
 - .7 Plywood:
 - .1 Softwood to CSA O151
 - .2 Douglas fir conforming to CSA O121, G2S
 - .3 Hardwood plywood: conforming to CSA O115. Exposed faces shall be good grade and unexposed faces shall be sound grade, good one side and sound one side, G2S, depending on exposure.
 - .4 Marine Grade Plywood: Marine Douglas Fir, G2S, sanded, to CSA O121, 9 ply – 3/4 inch (19 mm) thick.
 - .5 Fire retardant treated plywood: Pressure-impregnated fire retardant treated plywood conforming to CSA O80.27, to provide a flame spread rating of 25 or less, in accordance with CAN/ULC-S102.
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- .8 Wood Handrail:
 - .1 In accordance with Architectural Woodwork Standard,
 - .2 Species: White Oak, Maple or Hemlock finish selected for compatibility with grain and finish to match existing.
 - .3 Model SH114-H04 by Colonial Elegance or accepted equal.
 - .9 Wood Trim:
 - .1 Softwood trim: In accordance with Architectural Woodwork Standards, Premium Grade, dressed 4 sides. Suitable for paint finish in profiles as indicated on Contract Drawings.
 - .2 Hardwood trim: In accordance with Architectural Woodwork Standards Premium Grade. Kiln dried. Species and finished lumber (S4S), selected for compatible grain and colour. Edge grain (vertical).
 - .1 Suitable for clear or stain finish in profiles as indicated on Contract Drawings and for window and door casings and Chair rails.
 - .3 MDF Base trim: pre-primed medium density fiberboard, 75 mm height or as indicated on Drawings.
 - .10 Plastic Laminate (PLAM): Refer to Section 06 47 00 Plastic Laminate
 - .11 Solid Surfacing Countertops: Refer to Section 12 36 00 Countertops.
 - .12 Casework hardware:
 - .1 Adjustable shelf hardware: Extra heavy duty; Knape and Vogt No. 87 ANO standards, No. 187LL ANO shelf brackets and matching shelf rests or Richelieu equivalent, all in anochrome finish. Locate standards at 600 mm o.c. maximum.
 - .2 Linen Closet shelf bracket: extra heavy duty cold rolled steel wall shelf support with 19 mm wide steel support struts; Knape and Vogt No. 208 L-bracket or Richelieu equivalent. Size: 400mm (15.5") deep x 254mm (10") high. Finish in white to match shelves.
 - .3 Steel closet rods: 27 mm (1-1/6") O.D. wall thickness 3 mm (1/8"), chrome plated, with end flanges and intermediate supports at 700 mm (28") o.c., 770-1 x 734 x 760 by Knape & Vogt or approved manufacturer.
 - .4 Vanity brackets: Hebco table brackets.
 - .13 Accessories:
 - .1 Supply all rough hardware to frame and fix finish carpentry. This includes bolts, anchors, nails, expansion shields and other fastenings required. Ensure bolts and screws are galvanized or non-ferrous material. Wood screws shall be full thread screws.
 - .2 Anchors: select material, size, finish, and type required for each substrate for secure anchorage
 - .3 Cover caps: Proved plastic cover caps where mortise of fastener head or drawdowns are exposed.
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- .4 Wood cleats: hardwood cleats located where indicated on drawings. Size and quantity to suit application.
- .5 Wood screws: as per CSA O86, plain type and size to suite application. Wood screws shall be full thread screws.
- .14 Fire retardant treated plywood: Pressure-impregnated fire retardant treated plywood conforming to CSA O80.27, to provide a flame spread rating of 25 or less, in accordance with CAN/ULC-S102.
- .15 Insulation: Unfaced fibreglass batt insulation, Owens Corning.

2.2

FABRICATION

- .1 Obtain and verify dimensions at the building before fabrication of casework takes place, and in ample time to prevent unnecessary delays in the Work.
 - .2 Make Work plumb, level and true, in as long lengths as practicable with joints arranged to be as inconspicuous as possible, and with proper provision for shrinkage.
 - .3 Machine sand wood surfaces to an even, smooth surface, ready for finish. Hand clean Work and securely fix. Accurately fit joints of shop assembled Work. Dovetail and glue drawer slides to fronts and backs. Groove drawer bottoms 6 mm deep into drawer fronts, sides and back. Connect other joints by means of mortise and tenons, dowels, stub tenons, dovetails, dadoes or lock joints, as applicable for the jointing condition. Ensure end grain on finished surfaces, unless part of the design, are not exposed. Nails shall have concealed heads and with all screw and bolt heads countersunk and covered with matching wood plugs in exposed surfaces.
 - .4 Tool marks on exposed surfaces is deemed sufficient cause for rejection.
 - .5 Neatly and accurately scribe, mitre and joint Work. Carefully mitre all exposed corners. Neatly cope intersecting moulds at inside corners; do not mitre.
 - .6 Rout or groove back of flat trim; kerf backs of wide flat members, except for members with backs exposed in finished Work.
 - .7 Assemble Work at the shop, unless impractical, and deliver ready for installation, with ample allowance for cutting, fitting and scribing.
 - .8 Ensure that mill assembled units are of sizes that can be transported through the building to their final location.
 - .9 Construct Work as shown or noted on the Drawings and Shop Drawings. Adequately frame as required to provide a firm and rigid installation complete with all gables, divisions and other members. Conceal all fastenings.
 - .10 Veneered Panels
 - .1 Apply hardwood veneers on (fire retardant) wood particleboard core, in minimum thickness indicated, with solid edge strips.
 - .2 Finished panels are required to have a flame spread rating of not more than 150 in accordance with the Ontario Building Code. Finish for veneered panels is supplied and applied under Section 09 91 00. However the responsibility for ensuring that this requirement is met rests with this section. Submit to the Consultant two 300 mm x 600 mm representative sample panels illustrating finish for approval.
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- .3 Provide backing sheet of sufficient thickness to compensate stresses caused by facing sheet. Apply uniform coating of sealer on exposed veneered edges. Finish panel edges with self-edge straight-line edging, 1 mm standard material. Apply with same adhesive as facing sheet.
 - .4 Provide cut-outs as required for inserts, fixtures and fittings. Use radius corner and chamfer edges around cut-outs to avoid chipping laminated.
 - .5 Use specified exposed mechanical fasteners to attach wood panels to strapping in walls.
 - .11 Standing and running trim.
 - .1 Butt and cope internal joints of baseboards to make snug, tight, joint. Cut right angle joints of casing and base with mitred joints.
 - .2 Fit backs of baseboards and casing snugly to wall surfaces to eliminate cracks at junction of base and casing with walls.
 - .3 Make joints in baseboard, where necessary using a 45° scarf type joint.
 - .4 Install door and window trim in single lengths without splicing.
 - 3 Execution
 - 3.1 **EXAMINATION**
 - .1 Inspect existing conditions upon which Work of this section is dependent. Report to the Consultant in writing any defects or discrepancies. Commencement of Work implies acceptance of existing conditions.
 - 3.2 **INSTALLATION**
 - .1 Set and secure materials and components in place, rigid, plumb and square, and in accordance with reviewed Shop Drawings. Be responsible for a rigid and secure attachment.
 - .2 Casework: Install level plumb and true and complete in all respects. Rigidly and securely fasten to retaining structures using heavy duty hardware. Fit and scribe as required to achieve neat junctures with retaining structure and to conceal voids at such points. Install finish hardware for casework in accordance with manufacturers' directions. Adjust as required for a perfect fit and for ease of operation.
 - .3 Wood Handrails
 - .1 Secure wood stair handrails, level, square and true to the required lines, slopes or curves.
 - .2 Bolt handrails to retaining angle welded atop edge steel framing. Likewise, secure handrail to retaining angle at stairs and landings. Let bolt heads in finished Work and cap with edge grain wood caps, dress and finish flush.
 - .3 Finish woodwork in maximum possible lengths. Scarf, glue and properly fasten joints between lengths. Match material being jointed reasonably well for grain and colour.
 - .4 Accurately cut, mitre, fit and joint Work together to produce tight hairline joints, rigidly secured together in a permanent manner using glue or blind screw fixing.
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- .5 Hand sand after installation to remove roughness, planer marks, etc. Sanding shall be done with the grain of the wood and finished with fine grit paper to leave a smooth scratch-free surface suitable to receive finish.
- .4 Paneling: Panels shall be anchored to supporting substrate with concealed panel-hanger clips using blind nailing on backup strips, splined connection strips, and associated trim and framing. Do not use face fastening, unless otherwise indicated.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.
- .2 By definition, "casework" means cabinets, vanities, counters, cupboards, wardrobes, closets, shelving, desks, tables, benches, showcases, door jambs.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- .1 AWMAC - Architectural Woodwork Manufacturers Association of Canada
- .2 ANSI A208.1 - Particleboard
- .3 CAN3-A172-M - High Pressure, Paper Base, Decorative Laminates
- .4 CAN3-O188.1-M - Interior Mat-Formed Wood Particleboard
- .5 CSA O115-M - Hardwood and Decorative Plywood
- .6 CSA O121-M - Douglas Fir Plywood
- .7 NEMA LD-3 - High Pressure Decorative Laminates
- .8 AODA - Accessibility for Ontarians with Disabilities Act

1.3 **SUBMITTALS**

- .1 Submit Shop Drawings to illustrate fully all details of Work and conditions adjoining the Work, in accordance with Section 01 33 00.
 - .2 Show fabrication details including exact sizes and description of anchorage and hardware, the nature of the materials which are to be used as component parts.
 - .3 Clearly cross reference components on the Shop Drawings to the Contract Working Drawings indicating location, number required and name of unit.
 - .4 Certification: Submit a certificate from the National Hardwood Lumber Association stating compliance of supplied hardwood lumber to the Specification.
 - .5 Samples: Submit samples of casework sections in accordance with Section 01 33 00. Sample units for submission shall be as follows:
 - .1 Two 150 x 150 mm plastic laminate applied on 19 mm core showing finish for cupboard doors and adjustable shelves.
 - .2 Two manufacturer's standard sample sizes or wood veneer showing species, grade, and finish required.
 - .3 Apply plastic laminate on sample materials on both faces and on three sides only of core, in thicknesses specified.
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- .4 Samples shall depict exactly, the Work required to be provided with regards to finish and material on which finish is applied. Finish all casework equal in quality and finish to those approved.
- .5 Identify samples with Project name and number, date of submission, material name and Subcontractor's name.

1.1 **QUALITY ASSURANCE**

- .1 Special Experience Requirements
 - .1 Manufacturer/fabricator: Architectural woodwork shall be manufactured by a current member firm of AWI/AWMAC, and having a minimum of five years experience on Work of similar size and quality to that indicated and specified.
 - .2 Installer qualifications: Engage an installer who is a current member firm of AWI/AWMAC, and who has successfully completed two architectural woodwork projects similar in scope, materials and design to that indicated and specified within the last five years.
- .2 Quality standard: Comply with AWI/AWMAC Architectural Woodwork Standards Edition 1-2009 ("AWI/AWMAC Manual"), "Custom Grade".
- .3 Execute plastic laminate Work to CAN3-A172-M, except as specified otherwise.

1.2 **PRODUCT DELIVERY, STORAGE AND HANDLING**

- .1 Deliver units to meet installation schedule. Arrange for strategic, off-the-ground, covered storage locations with constant minimum temperature of 16°C (61°F) and maximum moisture content of 12% when measured with moisture meter.
- .2 Cover plastic laminate faced surfaces and varnished surfaces at the factory with 480 kg/m³ kraft paper. Protect all surfaces with corrugated cardboard.
- .3 Provide adequate protection until finally accepted.

1.3 **WARRANTY**

- .1 Warrant Work of this section against defects and deficiencies for a period of two years from date Work is certified as substantially performed in accordance with the general conditions of the Contract.
- .2 Promptly make good defects and deficiencies which become apparent within the Warranty Period by replacing defective plastic laminate Work satisfactory to the Consultant and at no expense to the Owner.
- .3 Defects shall include, but not be limited to, warping and delamination.

1.4 **EXAMINATION**

- .1 Examine the Drawings and Specifications and previously constructed Work which is to receive this Work. Notify the Consultant in writing of any conditions beyond acceptable tolerances which may prejudice the proper completion of this Work.
 - .2 Obtain and verify all dimensions at the building before any fabrication of casework takes place, and in ample time to prevent unnecessary delays in the Work.
 - .3 Commencement of Work on the Site shall constitute acceptance of existing conditions.
-

2 Products

2.1 **MATERIALS**

.1 Plastic Laminate

.1 Refer to Section 06 47 00 Plastic Laminates.

.2 Core: Conforming to NEMA LD3, Particleboard core of minimum 720 kg/m³ density and conforming to CAN3-0188, sanded faces, or Douglas Fir plywood conforming to CSA O121-M, G2S.

.1 Grades:

.1 General Purpose Standard Grade (GP)

.2 Postforming Standard Grade (PF)

.3 Plastic laminate backing sheet: Backing Grade (BK) 0.511 mm, Product of manufacturer of face sheet used.

.2 Types: Standard Types (S)

.3 Lower Cabinets (PLAM-1): laminate face sheets, thickness as indicated on Drawings.

.4 Upper Cabinets (PLAM-2): laminate face sheets, thickness as indicated on Drawings

.5 Adhesive: Thermosetting to suit laminate application without failure.

.2 Wood Veneer (VNR-1): Playcare Room Millwork

.1 Rift cut, high performance decorative multilaminar veneer impregnated with a protective polyurethane coated layer, pulp/wood veneer layer and backer fused with melamine resin-impregnated kraft sheet. Face veneers shall not contain open joints, face depressions, glue stain, patches, plastic repair or any other manufacturing irregularities or defects. Grain to match approved samples.

.1 Type: Maple

.2 Finish: to match existing

.3 Thickness: 0.74mm ± 0.08mm or as indicated on Drawings.

.4 Acceptable Manufacturer: "Classic Species" by NewLeaf Performance Veneers or accepted equal.

.2 Backing Sheets: Kraft-paper core sheets impregnated with phenolic resin.

.3 Adhesive: as recommended by manufacturer.

.3 Hardboard: confirming to CGSB 11-GP-3M.

.4 Rough hardware: Supply all bolts, anchors, nails, expansion shields and other fastenings required for this Work. All bolts and screws shall be non-ferrous materials.

- .5 Casework Hardware: As follows:
 - .1 Provide cabinet hardware and accessory materials for complete installation, except for items in accordance with Section 08 71 00 Door hardware
 - .1 Hinges: Blum "Clip 170" or Hettich "Euromat Topsafe 4955", 170 degree opening angle, concealed, self-closing, nickel plated.
 - .2 Adjustable shelf hardware (cupboard shelves): Knappe & Vogt No. 255 standards and No. 256 shelf brackets, or Richelieu or accepted equal.
 - .3 Adjustable Shelf for Cabinets: recessed pilaster strips and rests.
 - .4 Door and drawer pulls: Canadian Builders Hardware CBH 220 or Hafele 116.05.922 or accepted equal, 88 mm long aluminum. Finish to be later selected by Consultant.
 - .5 Drawer slides: Full extension, rated 100 lb. load, Knappe & Vogt 1400 or Accuride 3832.
 - .6 Cabinet door and drawer lock: Knappe & Vogt 986, nickel plated.
 - .7 Refuse Cabinets: full extension carburized steel ball bearing, bottom mounting, 79 kg capacity heavy duty load rating, cold rolled steel slide members and ball retainers, cushioned in and out stops, progressive action, positive stop, bright electro zinc plate finish.

2.2 **SHOP FABRICATION AND WORKMANSHIP**

- .1 Carry out all finish joinery Work in accordance with first quality cabinet making practice, by skilled mechanics, under the supervision of a competent supervisor. Erect casework plumb, level and true, in lengths as long as practicable with joints arranged to be as inconspicuous as possible, and with proper provision for shrinkage.
- .2 Machine sand wood surfaces to an even, smooth surface, ready for finish. Hand clean and securely fix all joints accurately fitted, no end grain exposed on finished surfaces, unless part of the design; and concealing nail heads with all screw and bolt heads countersunk and covered with matching wood plugs in finished Work.
- .3 Tool marks on exposed surfaces is deemed sufficient cause for rejection.
- .4 Do all scribing, mitres and jointing accurately and neatly. Carefully mitre all exposed corners. Neatly cope intersecting moulds at inside corners and do not mitre.
- .5 Assemble and finish Work completely at the shop, unless impractical, and deliver ready for installation. Where Work is to be built in, construct casework with ample allowance for cutting and fitting.
- .6 Ensure that mill assembled units are of sizes that can be transported through the building to their final location.
- .7 Construct Work adequately framed, and complete with gables, divisions, blocking and other members as required to provide a firm and rigid installation. Cover all exposed braces and brackets of wood with plastic laminate covered on all exposed edges and faces. Conceal all fastenings.
 - .1 Doors: Cupboard doors, unless otherwise detailed, of 19 mm thick five-ply construction and installed with edging strips on sides, top and bottom, rebated

- into the core so as to conceal the joint as much as possible. Provide hardwood core.
- .2 Adjustable shelves: Shelves in cabinets of 19 mm thick plywood, unless detailed otherwise on the Drawings, edge lipped with solid wood and adjustable at 13 mm intervals on pilaster track and brackets.
 - .3 Drawers: Drawers front, sides and back shall have 13 mm thick veneer plywood or 13 mm solid birch, cut for lock hardware, with carefully fitted glued dovetail joints or rabbet joints. Mortised or nailed construction will not be accepted. Drawer bottoms shall be 6 mm plywood grooved into drawer sides, back and front. Install all hardware to drawers, doors and fitments. Finish drawer front face panel in plastic laminate finish as indicated on Drawings.
 - .4 Pipe frames: Construct pipe frames and metal bracing to tables and benches where indicated. Pipe shall be standard 32 mm diameter, Schedule 40 pipe with rails and braces fitted and welded and ground smooth. Form channel braces of 38 x 38 mm sections bolted to framing. Feet shall be standard flange type, welded to legs.
 - .8 Confirm base height with flooring subcontractor. Toe space to be designed to accommodate base height as indicated on Drawings.
 - .9 Coordinate with mechanical trades and cut fitments for sinks, services and wastes.
 - .10 Plastic Laminate Application
 - .1 Veneer plastic laminate to core material in accordance with manufacturer's printed directions. Apply laminate face sheet to exposed surfaces of casework. Apply backing grade to underside of shelves and counters. Use melamine finished core for interior surfaces of drawers and cabinets only.
 - .2 Neatly butt plastic laminate, with self edging applied before face veneers. Seal core at joints and edges and where sink cut-outs are provided, with water-resistant material to retard movement of moisture to, or from, the assembly. Mechanically shop fasten backsplash core material to the top core with 1.5 mm (16 gauge) concealed brackets at 300 mm centres. Carry counter laminate material up at back edges to form integral coved backsplash.
 - .3 Joints in plastic laminate Work are not permitted except in pieces exceeding 2400 mm in length.
 - .4 Backsplash, unless otherwise shown on the Drawings, to be 100 mm high, but where installed over a counter and below an overhead cupboard, the backsplash shall be for the full height between the two fitments. Butt joints in all surfaces to be spliced and drawn together with "draw-bolts" of type recommended by manufacturer of laminate material. All such butt joints to be located not nearer than 600 mm from any sink. Backsplash to be mechanically shop fastened at the counter top with 1.5 mm (16 gauge) brackets at 300 mm centres.

2.3 FINISHES

- .1 Prime paint all metal Work (except galvanized iron) with one coat primer conforming to CISC/CPMA 2.75, finished with two coats alkyd enamel in colours selected later by the Consultant.
- .2 Chrome/Nickel Plating: to ASTM B456, Type SC 2, satin.

- .3 Stainless Steel: to ASTM A167, No. 4 – brushed, or as indicated on Drawings.
- .4 Cover all exteriors of fitments, braces, shelves, countertops, aprons and backsplash, and the interior faces of doors, with plastic laminate finish as hereinbefore specified. Exterior shall mean all faces, edges and ends not concealed behind doors. All door edges shall be similarly faced.

OR

- .5 All painted wood to receive one coat of interior wood primer and two coats interior alkyd enamel, low gloss, colours as later selected by the Consultant. Prime all concealed wood surfaces such as cupboard backs against walls, cupboard supports under bottom shelves, etc; before installation.

3 Execution

3.1 **EXAMINATION**

- .1 Inspect existing conditions upon which Work of this section is dependent. Report to the Consultant in writing any defects or discrepancies. Commencement of Work implies acceptance of existing conditions.

3.2 **INSTALLATION**

- .1 Set and secure materials and components in place, rigid, plumb and square, and in accordance with reviewed Shop Drawings. Be responsible for a rigid and secure attachment.
- .2 Rigidly and securely fasten to retaining structures using heavy duty hardware. Fit and scribe as required to achieve neat junctures with retaining structure and to conceal voids at such points. Install finish hardware for casework in accordance with manufacturers' directions. Adjust as required for a perfect fit and for ease of operation.
- .3 Provide wood blocking, framing and furring shown on Drawings as part of the millwork fabrication and erection.
- .4 Provide closers, filler strips in matching finish as required to ensure a neat and complete finished assembly.
- .5 Install all finish hardware supplied by the finishing hardware Supplier.

3.3 **CLEAN-UP**

- .1 Clean-up and remove from the Owner's premises on a daily basis all rubbish and surplus materials resulting from this Work.
- .2 Immediately prior to final acceptance of finished Work, thoroughly clean and polish all Work of this trade to an acceptable finish.

End of Section

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Appendices

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Appendix B1:	Designated Substance Survey (DSS), Ref. No. FE-P 21-11706, 87 Main Street, issued December 2021 by Fisher Environmental Ltd.
Appendix B2:	Designated Substance Survey (DSS), Ref. No. FE-P 21-11706, 313 Pharmacy Avenue, issued December 2021 by Fisher Environmental Ltd.
Appendix B3:	Designated Substance Survey (DSS), Ref. No. FE-P 21-11706, 351 Birchmount Ave, issued December 2021 by Fisher Environmental Ltd.
Appendix B4:	Designated Substance Survey (DSS), Ref. No. FE-P 21-11706, 1313 Woodbine Ave, issued December 2021 by Fisher Environmental Ltd.
Appendix B5:	Designated Substance Survey (DSS), Ref. No. FE-P 21-11706, 1859 Kingston Rd, issued December 2021 by Fisher Environmental Ltd.
Appendix B6:	Designated Substance Survey (DSS), Ref. No. FE-P 21-11706, 1904 Queen St. E, issued December 2021 by Fisher Environmental Ltd.
Appendix B7:	Designated Substance Survey (DSS), Ref. No. FE-P 21-11706, 3600 Danforth Ave, issued December 2021 by Fisher Environmental Ltd.
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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section, including but not limited to the following:

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- .1 ASTM C836, Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.
- .2 ASTM D412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.
- .3 ASTM D570, Standard Test Method for Water Absorption of Plastics.
- .4 ASTM D903, Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.
- .5 ASTM D1876, Standard Test Method for Peel Resistance of Adhesives (T-Peel Test).
- .6 ASTM D1970, Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
- .7 ASTM D3767, Standard Practice for Rubber-Measurement of Dimensions.
- .8 ASTM D5385, Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes.
- .9 ASTM E96/E96M, Standard Test Methods for Water Vapor Transmission of Materials.
- .10 ASTM E154, Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls or as Ground Cover.
- .11 CAN/CGSB 11.3, Hardboard.
- .12 CAN/CSA A179, Mortar and Grout for Unit Masonry.
- .13 CSA B111, Wire Nails, Spikes and Staples.

1.3 **SUBMITTALS**

.1 Product Data

- .1 Submit manufacturer's Product data in accordance with Section 01 33 00.
- .1 Submit Product data for each Product indicating: Installation details, physical properties and detailed application and installation instructions.

.2 Shop Drawings

.1 Submit Shop Drawings in accordance with Section 01 33 00 indicating:

.1 Typical layouts and special details as required for:

.1 Final configuration, sequence, method of attachment to excavation support system, means and methods of supporting membrane externally or internally which will not puncture or injure membrane, and which will prevent sagging or loss of contact with excavation support system.

.2 Location of each membrane penetration and membrane penetration details.

.3 Certificates

.1 Submit certifications for items required at least eight weeks prior to installation of Work of this section.

.2 Submit manufacturer's certification that waterproofing system materials and accessories supplied are compatible and meet Specification requirements and that supervisor and installer is approved by membrane manufacturer.

.3 Submit names of successful membrane installations in which certified personnel have performed tasks of comparable complexity and scope within preceding five years.

.4 Submit inspection reports and certification by manufacturer confirming that installations are in accordance with the Contract Documents and manufacturer's recommendations.

.5 Submit Quality Control Plan detailing quality control procedures to be used to meet manufacturer and Specification requirements. Obtain acceptance of Quality Control Plan from Consultant before starting the Work of this Section.

1.4 **QUALITY ASSURANCE**

.1 Manufacturer's qualifications: Perform Work of this section by company manufacturer's having minimum of ten years recent experience in Work of comparable complexity and scope.

.2 The Work of this section shall be performed by a qualified applicator trained and approved by waterproofing manufacturer.

.3 Applicator shall have minimum three years proven satisfactory experience in this type of Work, having adequate equipment and skilled personnel to complete the Work of this section in an efficient and workmanlike manner.

.4 Applicator must be a member in good standing, prior to bidding, of the Sealant and Waterproofing Association of Ontario.

1.5 **MANUFACTURER'S INSPECTIONS**

.1 Manufacturer's representative shall visit Site prior to commencing the Work and verify, in writing, that conditions and substrates are acceptable to receive this work.

- .2 Manufacturer's representative shall visit Site during this Work and verify in writing, that application is in accordance with this Specification and manufacturer's recommendations. Upon completion of this Work, manufacturer's representative shall verify, in writing, that the application has been completed in accordance with this Specification and manufacturer's recommendation.

1.6 **DELIVERY, STORAGE AND HANDLING**

- .1 Deliver Products to Site undamaged and with seals and labels intact. Inspect containers to verify that they have not been opened.
- .2 Store Products as required by the manufacturer.

1.7 **SITE CONDITIONS**

- .1 Do not install waterproofing system on wet surfaces that would cause waterproofing to hydrate prematurely.
- .2 Do not install waterproofing during rain, showers, inclement weather or conditions detrimental to a proper installation.
- .3 Maintain air temperature and structural base temperature at waterproofing installation area above 5°C for twenty-four hours before, during and twenty-four hours after installation.
- .4 Keep flammable Products away from spark or open flame. Post "NO SMOKING" signs. Do not allow spark producing equipment to be used during installation and until all vapours have dissipated.

1.8 **WARRANTY**

- .1 Submit warranty for waterproofing Work in accordance with the General Conditions, except warranty period extended to ten years against defects and deficiencies. Promptly correct to satisfaction of Consultant and at no expense to the Owner, any defects and/or deficiencies which become apparent within the warranty period. Defects include but are not limited to leakage.

2 **Products**

2.1 **MATERIALS**

- .1 Use Products of only one manufacturer for the Work of this section. The Contractor to ensure that all materials are compatible in order to provide a water-tight finish which meets or exceeds the performance criteria as set out within the Contract.
- .2 Waterproofing system: Pre-applied, integrally bonded sheet waterproofing membrane 1.7 mm thick. When covered with poured-in-place concrete membrane shall form an integral bond to prevent water migration through concrete.
- .3 Acceptable Products
 - .1 "Sikaproof A-12" by Sika Canada Inc.
 - .2 "Coreflex 60" by DRE Industries
 - .3 Or accepted equal

2.2 ACCESSORIES

- .1 Protection board: In accordance with CAN/CGSB 11.3, 6 mm thick.
- .2 Mechanical fasteners: In accordance with CSA B111, hot dip galvanized.
- .3 Adhesive: Recommended by waterproofing membrane manufacturer.
- .4 Prefabricated drainage sheet: Lightweight geocomposite drainage board consisting of dimple-raised core bonded to a high strength geotextile fabric, 11 mm deep x 1220 mm wide:
 - .1 "Sarnadrain" by Sika Canada Inc.
 - .2 "Aquadrain 15XP" by CETCO.
 - .3 Or accepted equal
- .5 Joint tape: Recommended by installer and acceptable to Consultant.

3 Execution

3.1 EXAMINATION

- .1 Verify condition of previously installed Work upon which this section depends. Report defects to Consultant. Commencement of Work means acceptance of existing conditions.
- .2 Verify that substrates to receive membrane waterproofing are clean, sound, smooth, free of fins and sharp edges and free of curing agents, loose and foreign matter, oil and grease detrimental to waterproofing membrane adhesion.
- .3 Have manufacturer's technical representative verify that conditions are acceptable for installation of membrane waterproofing, including installation of reinforcement and pouring of concrete.
- .4 Allow a minimum of seven days curing time before application on new concrete.

3.2 PREPARATORY WORK

- .1 Install drainage sheet over lagging in accordance with manufacturer's recommendations.
- .2 Terminate waterproofing at strut penetrations or anchor tie backs as per manufacturer's recommendations. Include additional lap length to tie in waterproofing of openings upon removal of struts.
- .3 Prepare all surfaces as per manufacturer's recommendations to ensure water-tight finish.
- .4 Protect waterproofing membrane to prevent damage caused by backfill or construction traffic.

3.3 INSTALLATION

- .1 Install membrane waterproofing in accordance with reviewed Shop Drawings and manufacturer's recommendations.
 - .2 Waterproofing termination details to follow system per manufacturer's recommendations.
 - .3 Control joints shall be installed with Sika Hydrotite CJ 725 or approved alternative.
-

- .4 Take particular care at vertical/horizontal junctions and corners and to seal around all penetrations and obstructions to ensure 100% waterproofing coverage
- .5 Cut and attach a strip of panel waterproofing roll centered over all soldier piles. Extend roll a minimum 100 mm onto the lagging on both sides of soldier piles.
- .6 Detail around all penetrations and tie-backs with 19 mm cant of trowel grade sodium bentonite compound over substrate a minimum of 150 mm around penetrations and tie backs. Cut panel rolls to fit snugly around all penetrations and tie-backs.
- .7 Inspect finished installation and repair any damaged areas, prior to concrete placement.
- .8 Temporarily protect completed waterproofing from precipitation and from contact with ground water in accordance with manufacturer's recommendations until ready for placing of concrete.
- .9 Remove temporary protection for inspection before placing of concrete.
- .10 Ensure that completed waterproofing system is acceptable to Consultant and manufacturer's representative.

3.4

CLEAN-UP

- .1 Upon completion of this Work, remove debris, equipment and excess materials from Site.
- End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- .1 CAN/ULC-S701 - Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering
- .2 CAN/ULC-S702 - Standard for Thermal Insulation, Mineral Fibre, for Buildings
- .3 ULC CAN4-S101-M - Standard Methods of Fire Endurance Tests of Building Construction and Materials
- .4 AODA - Accessibility for Ontarians with Disabilities Act

1.3 **DELIVERY, STORAGE AND HANDLING**

- .1 Deliver materials to Site, clean and undamaged, and in manufacturer's distinctly identified cartons or wrappings. Remove unsatisfactory materials from Site and replace at no cost to the Owner.
- .2 Take precautionary measures to avoid fires and abide by fire protection regulations.
- .3 Place suitable forms or skids under the insulation upon delivery to protect the insulation from absorbing dampness from the surrounding terrain or floor. Cover material with approved tarpaulins and secure. Do not store insulation in direct contact with the earth, road surface, or floors.
- .4 Store materials indoors at Site, in an area at a temperature of not less than 4°C (39°F) for a minimum of twelve hours prior to use.

1.4 **PROTECTION**

- .1 Place protective covers, boards, tapes and take other measures to protect all surfaces, and in particular the building cladding, from being marred or contaminated.
- .2 Supervise the Work of other trades where such Work is closely associated with the Work of this section and report any damage.

1.5 **SUBMITTALS**

.1 Submit the following in accordance with Section 01 33 00.

- .1 Samples: Submit representative samples of each specified insulation material, insulation clips, adhesives, fasteners, and other material for review.
- .2 Manufacturer's Product data:
- .1 Submit manufacturer's Product data sheets for Products proposed for use in the Work of this section.
-

- .2 Submit data and installation instructions for materials and prefabricated devices, providing descriptions sufficient for identification at the place of the Works.
- .3 Submit data from manufacturer's or independent laboratory indicating compatibility and adhesive results of proposed materials.

2 Products

2.1 **MATERIALS - INSULATION**

- .1 Mineral Wool: Exterior Thermal Batt Insulation for exterior steel frame wall, floor and ceiling construction
 - .1 Performance characteristics: Mineral fibre, non-combustible, semi-rigid mineral wool batt insulation, manufactured from basalt rock and slag, in accordance with CAN/ULC S702 Type 1 or ASTM C665, Type I. Non-combustible in accordance with CAN/ULC S114
 - .2 Facing options: Unfaced or foil faced.
 - .3 Thickness: as indicated on Drawings
 - .4 Acceptable Manufacturers:
 - .1 Rockwool ComfortBatt by Rockwool Inc.
 - .2 Thermafiber UltraBatt by Owens Corning
 - .3 Or accepted equal
 - .2 Mineral Wool: Exterior Insulation for exterior wall continuous insulation and Rainscreen cavity wall
 - .1 Performance characteristic: Mineral fibre, semi-rigid or rigid board, manufactured from basalt rock and slag, Conforming to CAN/ULC 702 Type 1 or ASTM C612, Type IVB.
 - .2 Thermal Resistance: RSI-value 0.74/25 mm (R-value 4.3/inch) in accordance with ASTM C518.
 - .3 Density: to ASTM C303
 - .1 Thicknesses below 50 mm Density: 70 kg/m³.
 - .2 Thicknesses 65 mm and above Density: Outer layer: 100 kg/m³; Inner layer: 60 kg/m³
 - .4 Non-combustible in accordance with CAN/ULC S114.
 - .5 Acoustic: 1.00/51 mm NRC in accordance with ASTM C423.
 - .6 Thickness as indicated on Contract Drawings.
 - .7 Acceptable Manufacturer:
 - .1 Cavityrock by Rockwool Inc.
 - .2 Thermafiber RainBarrier 45 by Owens Corning
-

- .3 Thermafiber RainBarrier HD by Owens Corning
 - .4 Or accepted equal
- .3 Mineral Wool: For Continuous Insulation Systems
 - .1 Performance characteristic: Conforming to ASTM C612, Type IVB and CAN/ULC S702, Type 1, Non-combustible, rigid, water repellent, mineral wool insulation board for exterior non-structural commercial and industrial high performance insulation sheathing applications and or "screws through insulation assembly" where the dense board is sandwiched with strapping, furring or hat track. It can also be used below slabs, on exterior insulated below grade walls, and in other continuous insulation board application.
 - .2 Thickness: as indicated on Drawings
 - .3 Acceptable Manufacturer:
 - .1 Density: 8lb/ft³
 - .1 Comfortboard 110 by Rockwool Inc.
 - .2 or accepted equal
 - .2 Density 11lb/ft³
 - .1 Comfortboard 110 by Rockwool Inc.
 - .2 or accepted equal
- .4 Mineral Wool: Multipurpose Board Insulation for Thermal and Acoustic Applications
 - .1 Performance characteristic: Semi-rigid or rigid board, manufactured from basalt rock and slag, and having the following properties:
 - .2 Density: Nominal 64, 96, 80 kg/m³ in accordance with ASTM C303.
 - .3 Non-combustible in accordance with CAN/ULC S114.
 - .4 Thermal Resistance: RSI-value 0.71-0.74/25 mm (R-value 4.1-4.2/inch)
 - .5 Thickness as indicated on Drawings
 - .6 Acoustic: Coefficients at frequencies in accordance with ASTM C423.
 - .7 Acceptable Manufacturer:
 - .1 Density: 64 kg/m³ = 1.00/51 mm NRC
 - .1 Acceptable Manufacturer:
 - .1 RockBoard 40 by Rockwool Inc.
 - .2 Thermafiber VersaBoard 40 by Owens Corning
 - .3 Or accepted equal
 - .2 Density: 96 kg/m³ = 0.95/51 mm NRC
 - .1 Acceptable Manufacturer:

- .1 RockBoard 60 by Rockwool Inc.
 - .2 Thermafiber VersaBoard 60 by Owens Corning
 - .3 Or accepted equal
 - .3 Density: $128 \text{ kg/m}^3 = 0.80/51 \text{ mm NRC}$.
 - .1 Acceptable Manufacturer:
 - .1 RockBoard 80 By Rockwool Inc.
 - .2 Thermafiber VersaBoard 80 by Owens
 - .3 Or accepted equal
 - .5 Mineral Wool: Firestopping Insulation for firestop applications at perimeter floor and wall penetrations
 - .1 Performance Criteria: Mineral fibre, semi-rigid board, manufactured from basalt rock and slag, in accordance with ASTM C612 Types IA, IB, II, III, or IVA
 - .2 Thermal Resistance: RSI-value 0.74/25 mm (R-value 4.2/inch) in accordance with ASTM C518.
 - .3 Non-combustible in accordance with CAN/ULC S114.
 - .4 Acceptable Manufacturer:
 - .1 Roxul Safe by Rockwool Inc.
 - .2 Thermafiber Safing by Owens Corning Canada LP.
 - .3 Or accepted equal
 - .6 Mineral Wool: Exterior Fire Containment Insulation for aluminum spandrel curtain wall, steel stud framed gypsum sheathing curtain wall, glass spandrel curtain wall, or precast concrete spandrel panel applications
 - .1 Performance Criteria: Mineral fibre, rigid board, manufactured from basalt rock and slag, in accordance with CAN/ULC S702 Type 1, Type 3 (foil), or ASTM C612, Type IA, IB, III, or IVB.
 - .2 Facing options: Unfaced or foil faced.
 - .3 Thermal resistance: RSI-value: 0.74/25 mm (R-value 4.2/inch) in accordance with ASTM C518.
 - .4 Density: In accordance with ASTM C303.
 - .5 Non-combustible in accordance with CAN/ULC S114.
 - .6 Fire-resistance rating of the system tested in accordance with ASTM E2307.
 - .7 Acceptable Manufacturers:
 - .1 Density 64 kg/m³:
 - .1 CurtainRock 40 by Rockwool Inc.
-

- .2 Thermafiber FireSpan 40 or Therma fiber FireSpan FF 40 by Owens Corning
 - .3 Or accepted equal
 - .2 Density 128 kg/m3:
 - .1 CurtainRock 80 by Rockwool Inc.
 - .2 Thermafiber FireSpan 90 or Thermafiber FireSpan FF 90 by Owens Corning
 - .3 Or accepted equal
 - .7 Rigid Insulation - XPS (Perimeter Foundation Insulation)
 - .1 Extruded polystyrene (XPS), closed-cell foam, rigid insulation board, smooth skin, to CAN/ULC S701-01, Type 4 or ASTM C578, Type IV.
 - .2 Thermal resistance: RSI-value 0.88/25 mm (R-value 5.0/inch) in accordance with ASTM C518.
 - .3 Compressive strength, ASTM D1621, 207 kPa
 - .4 Combustible in accordance with CAN/ULC S114.
 - .5 Thickness: as indicated on Drawings
 - .6 Acceptable Manufacturers:
 - .1 Styrofoam brand SM by DuPont
 - .2 Foamular C-300 by Owens Corning.
 - .3 Or accepted equal
 - .8 Rigid Insulation - XPS (under slab Insulation)
 - .1 Extruded polystyrene (XPS), closed-cell foam rigid insulation board, to CAN/ULC S701-05, Type 4.
 - .2 Compressive strength, ASTM D1621-04a, 275 kPa (40 psi) minimum (measured at 5% deformation or at yield, whichever occurs first).
 - .3 Thickness: as indicated on Drawings
 - .4 Acceptable Manufacturers:
 - .1 Styrofoam brand Highload 40 by DuPont
 - .2 Foamular 400 by Owens Corning.
 - .9 Rigid Insulation - XPS (Lift Cavity Wall)
 - .1 Extruded rigid polystyrene (XPS), closed-cell foam rigid insulation board, to CAN/ULC S701, Type 3.
 - .2 Thermal resistance: RSI-value 0.88/25 mm, in accordance with ASTM C518.
 - .3 Compressive strength, 140 kPa (20 psi). in accordance with ASTM D1621.
-

- .4 Thickness: as indicated on Drawings
- .5 Acceptable Manufacturers:
 - .1 Foamular C-200 or Foamular NGX C-200 by Owens Corning.
 - .2 Or accepted equal
- .10 Loose insulation: Loose glass fibre by Owens Corning Canada, basalt wool by Fibrex Insulations Inc. or mineral wool by Roxul Inc.
- .11 Foamed-in-place air seals: One component polyurethane foam for installation within closures and fillers; "Enerfoam" by Abisko Manufacturing Inc. or "Foam Sealant" by Zerodraft Products Inc.
- .12 Adhesives
 - .1 Polystyrene foam insulation adhesive: Canadian Adhesive "Lepage PL Premium" or accepted equal.
 - .2 Glass fibre or mineral wool insulation adhesive: Henry "200-02" or accepted equal.
 - .3 For installing insulation clips direct to masonry, concrete or metal: High strength, resilient adhesive having a drying time of zero to thirty minutes (rapid initial set), and twenty-four hours final set. Adhesive shall be compatible with insulation and air/vapour barrier and shall be non-corrosive to galvanized steel and membrane air/vapour barrier.
 - .4 Mechanical fasteners to concrete: Galvanized "Gripcon" screws with plastic plates. For use with vinyl faced insulation, use white head screws and white plastic plates to match vinyl.
 - .5 Insulation clips: Insul-Anchors, adhered to substrate with Tactoo adhesive and with self locking washers by Continental Stud Welding. Clip size and type to suit application and insulation thickness. Alternative adhesive at obstructions: Air-Bloc 21 by Henry or accepted equal.

3 Execution

3.1 **MECHANICAL FASTENERS**

- .1 Install rigid insulation on masonry, concrete, metal, behind precast panels and where use of wedges is not possible using stick clips.
 - .2 Use five stick clips per 600 mm x 1200 mm x up to 75 mm thick. Use six stick clips per 600 mm x 1200 mm x 100 mm thick or thicker.
 - .3 Apply clips with mastic adhesive, allowing it to "ooze" out through the perforations and/or around the clip base.
 - .4 Install clips to liquid membrane by softening membrane with torch and installing fasteners into softened areas. Supplement with a small power activated pin fastener applied through fastener base to structure.
 - .5 Support adhesive-installed clips in place until adhesive has set.
-

3.2 **RIGID MINERAL FIBRE INSULATION**

- .1 Clean surfaces to receive rigid insulation free of moisture, grease and oil. Ensure surfaces are reasonably smooth and free of mortar projections.
- .2 Knife cut and fit boards neatly around beams, pipes, ducts, openings and corners, reinforcing and bonding ties, and other obstructions.
- .3 Butt insulation boards together and stagger joints to ensure thermal tight construction. Apply firm hand pressure to level insulation boards.
- .4 Where cutting is necessary, use the largest module of insulation possible to reduce the number of joints. Patch holes and tears with the same material.
- .5 Do not install insulation in any part of the building where protection against inclement weather has not yet been provided, and where the insulation could thereby be exposed to damage.
- .6 Insulation on liquid membrane air/vapour barrier: Apply board in 100% bond to 3.2 mm thick liquid air/vapour barrier.
- .7 Insulation on sheet membrane air/vapour barrier: Apply board using daubs of adhesive at 300 mm o.c.
- .8 Air/vapour barrier covered by insulation: Install "stick clips" to concrete or masonry substrate. After clip adhesive has cured, apply liquid air/vapour barrier to serve as insulation adhesive over the entire area to receive insulation. Apply to a uniform thickness of 3 mm. Press insulation against adhesive and stick clips. Install washers in stick clips to lock insulation in place.
- .9 Insulation covered by air/vapour barrier (and no gypsum board is subsequently applied): Apply daubs of adhesive to substrate at 300 mm o.c. into which, press insulation board. To ensure positive adhesion of insulation, mechanically fasten insulation at the middle and at each end with galvanized fasteners with smooth plastic washer buttons, at the rate of 4 per 600 mm x 1200 mm board. Depress fastener heads slightly from surface of insulation. Double tape all fastener points with vapour barrier tape.
- .10 Where more than one layer of insulation is required, stagger successive layer joints with the joints of the preceding layer and bed in adhesive trowelled solidly over the preceding layer.

3.3 **HIGH DENSITY INSULATION**

- .1 Place high density insulation under or within poured-in-place concrete in accordance with the Drawings.
- .2 Foamed-In-Place Insulation
 - .1 Install foam insulation at jambs of all doors and windows in pool in accordance with manufacturer's recommendations.
 - .2 Insulation will be inspected by the Consultant prior to the installation of the internal caulking seal.

3.4 **LOOSE INSULATION**

- .1 Install in exterior hollow metal frames, wall voids formed by metal closures, and at locations where loose insulation packing is shown on Drawings.
-

3.5 WALL VOID INSULATION

- .1 Fill exterior wall voids, such as within and around beams, under metal closures at sills of openings, and other miscellaneous locations as shown, using specified glass fibre material.

3.6 BATT INSULATION

- .1 Install batt insulation between steel studs; at metal closures and where shown elsewhere. Extend nailing flanges over stud faces and secure with adhesive or sheet metal screws. Install batts with vapour barrier face on warm side. Tape at top and bottom of stud spaces and at junctions with other materials, provide a complete vapour seal.

3.7 PATCHING

- .1 Perform cutting and patching necessary to accommodate irregularities in the Work including piping, ductwork and electrical conduit projecting through the insulation.
- .2 Ensure the continuity of the insulation where such above items project through the insulation. Allow for expansion and contraction and linear movement of these items.
- .3 Where there is a possibility of heat loss through ductwork or conduit which passes through the insulation, extend insulation around the duct or conduit a distance of 300 mm minimum on both sides of the barrier.
- .4 After installation under other sections of heating equipment and other construction adjacent to the Work of this section, conduct an inspection and replace insulation as necessitated by unavoidable minor damage caused in the course of the Work of the other sections.

3.8 FIELD QUALITY CONTROL

- .1 Insulation installations will be inspected and approved by the Consultant prior to the installation of ceiling and wall finishing materials. Notify Consultant forty-eight hours in advance of inspection.

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- .1 ASTM C920 - Standard Specification for Elastomeric Joint Sealants
- .2 CAN/ULC-S705.15 - Standard for Thermal Insulation - Spray-Applied Rigid Polyurethane Foam, Medium Density: Material Specification
- .3 CAN/ULC-S705.2-05 - Spray Application of Rigid Polyurethane Cellular Plastic Thermal Insulation for Building Construction
- .4 CAN/ULC-S710.1 - Standard for Thermal Insulation - Bead-Applied One Component Polyurethane Air Sealant Foam, Part 1: Material Specification
- .5 CCMC - Canadian Construction Materials Centre
- .6 CALIBER - Quality Solutions Site Quality Assurance Program (SQAP)
- .7 AODA - Accessibility for Ontarians with Disabilities Act

1.3 **SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00.
- .2 Submit manufacturer's Product data, confirmation of compliance to requirements specified herein. Submit in addition, copy of Subcontractor's licence as specified under Quality Assurance.

1.4 **TEST RESULTS**

- .1 Submit the following prior to commencing with the Work:
 - .1 Test reports verifying quantities of insulation meet or exceed requirements of this Specification.
 - .2 Submit the results of all air barrier system tests including transition membrane adhesion verification to an approved CCMC testing facility approved according to the CCMC's Technical Manual #07 27 09.01 conducted in order to prove that the air barrier system with transition membrane meets National Building Code requirements.
 - .3 Name of installer complete with proof that installer is licensed by CALIBER.

1.5 **PROTECTION**

- .1 Ensure the Work area is adequately ventilated.
-

- .2 Install temporary partitions in order to prevent any effect on the ambient air – outside of the Work area – from the sprayed-on insulation material.
- .3 Protect all adjacent structures in accordance with the manufacturer's recommendations.
- .4 Protect all adjacent surfaces and equipment against any damage that may be caused by dispersion and overspray of insulation material beyond prescribed limits.
- .5 Clean equipment in areas designated for this purpose and neutralize the contents of the empty containers according to CAN/ULC-S705.2-05.
- .6 Provide adequate protection against possible overspray onto nearby vehicles or properties. Carry liability insurance for this purpose in amount mutually agreed upon with the Contractor.

1.6 **DELIVERY, STORAGE AND HANDLING**

- .1 All materials should be delivered and stored in their original packaging bearing the manufacturer's name, quantity, CCMC numbers, and other appropriate technical indicators or references. The production and expiry date must also appear on the containers as per CAN/ULC-S705.15.

1.7 **QUALITY ASSURANCE**

- .1 Contractor performing Work under this section shall be licensed under CALIBER for a minimum of five years. Applicators shall be trained and certified by CALIBER. These certified individuals must have their certification cards in their possession and available for presentation upon request.
 - .2 Keep a copy of the manufacturer's installation manual or guide for the application of sprayed-on polyurethane foam and membrane on Site.
 - .3 Conduct tests daily on both core density and cohesion/adhesion to the substrate in accordance with CAN/ULC-S705.2-05. Enter the results of these tests in the daily report forms.
 - .1 Upon request submit copy of all completed forms to Consultant prior to making application for payment.
 - .4 Once the curing time required by the membrane manufacturer has elapsed, conduct a test to verify adhesion between the membrane and the substrate. Perform all adhesion tests using Com-Ten Industries Series 301N1M equipment or an equivalent. If adhesion is lower than the required minimum of 103 kPa (15 psi), the membrane must be mechanically fastened.
 - .5 Perform adhesion tests on all corners and building angles, wall to concrete slab, and wall to roof intersection.
 - .6 Perform transition membrane adhesion tests at perimeter openings.
 - .7 Perform adhesion tests on the transition membranes at every tenth column or beam.
 - .8 Adhesion tests are not required if the membrane is mechanically attached.
 - .9 Permit access to the jobsite by manufacturer's representative for the purpose of technical assistance, verification of operator certification or the confirmation of the quality of the polyurethane foam application.
-

- .10 Submit a copy of all adhesion tests to Consultant prior to making application for payment.

1.8 **ENVIRONMENTAL REQUIREMENTS**

- .1 Apply insulation material only within the manufacturer's prescribed surface and ambient air temperature limits.
- .2 Comply with requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labeling and provision of Material Safety Data Sheets acceptable to Labour Canada.

2 **Products**

2.1 **MATERIALS**

- .1 Sprayed Air/Vapour Barrier/Insulation
 - .1 Polyurethane foam: A spray polyurethane foam meeting the requirements of CAN/ULC-S705.1-15 and CAN/ULC S705.2-05, with CCMC listed as an air barrier system, according to CCMC technical manual #07 27 09.01. Choose one from the following Products:
 - .1 WALLTITE CM01 or XL01 by BASF as represented by Building Resource Inc., Phone 416-410-4055.
 - .2 SealTite One by Carlisle Spray Foam Insulation, Phone 1-855-742-3626.
 - .3 Heatlock Soya by Demilec. Phone 519-896-9307.
 - .2 Primers: As recommended by sprayed air/vapour barrier/insulation.
 - .2 Air sealant foam (for window installations and for gaps less than 50 mm wide): Bead applied, gun foam, one-component polyurethane sealant conforming to CAN/ULC-S710.1 (Material Specification), with flame spread of 25 and smoke developed of 50 as tested to CAN/ULC-S102 or ASTM-E84. Zerodraft Foam Sealant manufactured by Zerodraft or Handi Foam by Fomo Products.
 - .3 Insulating air sealant (for window installations and for gaps greater than 50 mm wide): Bead applied, gun foam, two-component polyurethane sealant conforming to CAN/ULC-S711.1 (Material Specification), with flame spread of 25 and smoke developed of 50 as tested to CAN/ULC-S102 or ASTM-E84. Zerodraft Insulating Air Sealant manufactured by Zerodraft or Handi Foam by Fomo Products.
 - .4 Sealant: Non-sag type, per ASTM C920, Type S, Grade NS, Class 25, Use NT, M and A. MasterSeal NP-1 by Master Builders. Furnish in standard colours as selected by the Contractor.
 - .5 Membrane air/vapour barrier/transition membrane: 1 mm thick modified bituminous composite sheet, Perm-A-Barrier by W.R. Grace, Blueskin SA by Bakor Inc., Air-Shield by W.R. Meadows, or Sopraseal Stick 1100 by Soprema, Tremco EXO AIR 110 complete with primer, mastic and liquid membrane as required
 - .6 Sprayed thermal barrier: Flame Seal-TB-C™ Manufactured by Flame Seal Products (UL CAW07.R38231) and represented by Building Resource Inc, Z3306 by Grace Canada or Cementitious Thermal Barrier by A/D Fire Protection.
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- .7 Insulation Foam Stops: low thermal conductivity, extruded PVC angles, 1.5mm (60 mils) thick. JAM-EX® as distributed by SRP Canada Inc.

3 Execution

3.1 **PREPARATION**

- .1 Ensure that surfaces to receive insulation are clean, dry, firm, straight, and free from loose material, projections, ice, frost, slick, grease, oil or other matter detrimental to bond of insulation.
- .2 Check metallic surfaces to ensure oxidization has not occurred. Perform an adhesion test to determine bond strength. If bond is below prescribed requirements the use of a primer is strongly recommended.
- .3 Maintain surface and ambient temperatures during application and curing of insulation at temperature recommended by insulation manufacturer.

3.2 **INSTALLATION - TRANSITION MEMBRANE**

- .1 Install airseal transition membrane in width to properly bridge and seal joints around windows, door frames, dissimilar materials, and where indicated.

3.3 **INSTALLATION - FOAM SEALANTS**

- .1 Fill miscellaneous voids, hidden cavities, and penetrations with foam sealant of type suitable for the size of opening. Trim excess spray.

3.4 **INSTALLATION - SPRAYED AIR/VAPOUR BARRIER/INSULATION**

- .1 Cover or fill all excessively wide joints before applying the polyurethane foam.
 - .2 Install transition membranes. Roll in place to ensure positive contact onto substrate.
 - .3 Install sealant at outside edge of transition membrane at vertical to horizontal membrane locations.
 - .4 Spray polyurethane foam with a tolerance of +6/-0 mm in relation to the thickness indicated or specified.
 - .5 Avoid the formation of sub-layer air pockets when applying.
 - .6 Avoid spraying the foam on any surfaces other than those indicated. Use drop sheets or masking tape to protect other surfaces.
 - .7 Once the foam has hardened, remove all overspray from non-prescribed surfaces.
 - .8 Do not allow polyurethane foam, once applied, to be damaged during Work by other trades.
 - .9 Ensure the subsequent coverage of the applied insulating foam will be completed within the manufacturer's prescribed timeframe.
 - .10 Spray polyurethane foam in overlapping layers, so as to obtain a smooth, uniform surface.
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- .1 When applying on a flat surface of more than 30 lineal meters in either direction, apply the first layer in 3 m strips at 1 m intervals. After the curing period (\pm four hrs) has elapsed, spray the polyurethane foam on the unfilled spaces.
- .2 In cold weather follow the same procedure for a minimum surface area of 15 lineal meters.
- .11 Do not spray polyurethane foam any closer than 75 mm from heating vents, steam pipes, recessed lighting fixtures, and other heat sources. Do not spray the insides of any exit openings or electrical junction boxes.
- .12 In temperatures below +10°C (50°F) use transition membranes specifically formulated for low temperature application. If required, mechanically fasten transition membranes to achieve the required pull strength.
- .13 Cover all mechanical fixation with polyurethane foam in order to reduce thermal bridging. This can be achieved through the use of a galvanized drywall corner bead, screwed 200 mm oc through the membrane.
- .14 Spray under through-wall flashings to provide the same integrity of air/vapour barrier/insulation at such locations. Foam board is unacceptable as substitute.

3.5 **SPRAYED THERMAL BARRIER**

- .1 Where exposed to open flame or welding, protect spray insulation in accordance with CAN/ULC S705.2.
- .2 Cover exposed sprayed insulation above ceiling space (not covered with gypsum board) with a spray application of cementitious thermal barrier. Spray to provide complete cover, to a thickness of 18 mm in accordance with the manufacturer's directions.

3.6 **SITE TESTS**

- .1 Conduct daily visual inspection, adhesion/cohesion testing and density measurements as outlined by the CAN/ULC S705.2 installation standard.
- .2 Complete the daily Work record and record all information required including the results of the testing. Keep the daily Work record on Site for routine inspection. Forward a copy of the daily Work record to the Consultant upon request. Submit a copy of the daily Work record or monthly summaries to the insulation manufacturer.
- .3 Bear the costs incurred for daily testing and inspection and the completion of the daily Work record.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCE**

.1 Conform to the latest edition of the following:

- .1 AODA - Accessibility for Ontarians with Disabilities Act

1.3 **AIR/VAPOUR BARRIER REQUIREMENTS**

- .1 Every situation where an air/vapour barrier is required is not necessarily shown on Drawings. However it is a requirement in the design of the building that an integral monolithic impermeable air/vapour barrier be provided to resist the diffusion of water vapour and air movement under a vapour and air pressure difference, at the inner face of the insulation.
- .2 Be responsible for the continuity of the air/vapour barrier from the wall to the roofing system and/or doors and windows as required to complete the building envelope. Ensure compatibility prior to starting Work.

1.4 **PRE-INSTALLATION CONFERENCE**

- .1 A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this Work with related and adjacent Work. Agenda for meeting shall include but not be limited to the following:
- .1 Review of submittals.
- .2 Review of surface preparation, minimum curing period and installation procedures.
- .3 Review of special details and flashings.
- .4 Sequence of construction, responsibilities and schedule for subsequent operations.
- .5 Review of mock-up requirements.
- .6 Review of inspection, testing, protection and repair procedures.

1.5 **MANUFACTURER'S REPRESENTATIVE**

- .1 Provide a manufacturer's trained technician on-site periodically during membrane Work to review installation procedures.

1.6 **DELIVERY, STORAGE AND HANDLING**

- .1 Deliver materials to Site, clean and undamaged, and in manufacturer's distinctly identified cartons or wrappings. Remove unsatisfactory materials from Site and replace at no cost to the Owner.

- .2 Take precautionary measures to avoid fires and abide by fire protection regulations.
- .3 Place suitable forms or skids under the insulation upon delivery to protect the insulation from absorbing dampness from the surrounding terrain or floor. Cover material with approved tarpaulins and secure. Do not store insulation in direct contact with the earth, road surface, or floors.
- .4 Store materials indoors at Site, in an area at a temperature of not less than 4°C (39°F) for a minimum of twelve hours prior to use.

1.7 **PROTECTION**

- .1 Place protective covers, boards, tapes and take other measures to protect all surfaces, and in particular the building cladding, from being marred or contaminated.
- .2 Supervise the Work of other trades where such Work is closely associated with the Work of this section and report any damage.

1.8 **INSPECTION AND TESTING**

- .1 Cooperate and coordinate with the Owner's inspection and testing agency. Do not cover any installed air and vapour barrier membrane until it has been inspected, tested and approved.

1.9 **SUBMITTALS**

- .1 Submit the following as Shop Drawings in accordance with Section 01 33 00.
 - .1 Product data of all materials.
 - .2 Details of metal air/vapour barrier.

2 **Products**

2.1 **MATERIALS - AIR/VAPOUR BARRIER**

- .1 Air/vapour barrier membrane: Minimum 1 mm thick modified bituminous composite sheet. Choose one of the following:
 - .1 Perm-A-Barrier by W.R. Grace Co. of Canada Ltd.
 - .2 Blueskin SA by Henry
 - .3 Air-Shield by WR Meadows
 - .4 Sopraseal Stick 1100 by Soprema
 - .5 ExoAir 110/110LT by Tremco
 - .2 Primer, mastic, liquid membrane and adhesive: Manufacturer's standard with the air/vapour membrane system used.
 - .3 Air/vapour barrier - liquid type: For sealing breaks, holes and wall ties, use Henry "Air-Bloc 06" or Soprema "Sopracol 300".
 - .4 Air/vapour barrier sealant: Recommended by manufacturer of air/vapour adhesive and sheet membrane. Material to be a permanent air/vapour seal and be compatible with the Products used for the air/vapour barrier for the building.
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- .5 Self-Adhered air/vapour barrier membrane: Acrylic, pressure sensitive adhesive. Primer as recommended by manufacturer.

- .1 3M "3015 Self-adhered Air and Vapor Barrier Membrane"

- .2 Or accepted equal

3 Execution

3.1 **PREPARATION**

- .1 Surfaces shall be sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods that are acceptable to manufacturer of the fluid-applied air/vapour barrier.
- .2 New concrete should be cured for a minimum of fourteen days and must be dry before air/vapour barrier membranes are applied.
- .3 Seal joints between panels of exterior grade gypsum, plywood and other panel type substrates prior to the application of liquid membrane. Exterior sheathing panels: Ensure that the boards are sufficiently stabilized with corners and edges fastened with appropriate screws. Pre-treat all board joints with 50-75 mm wide, reinforced self-adhesive tape or fibreglass mesh style wallboard tape. Fill gaps greater than 6 mm with mastic or caulk, allowing sufficient time to fully cure before application of the tape and liquid membrane.
- .4 Seal large cracks in masonry and concrete with a strip of air/vapour barrier membrane. Lap a minimum of 75 mm on both sides of the crack. Apply to the substrate prior to the application of liquid membrane.
- .5 Related materials: Treat construction joints and install flashing as recommended by manufacturer.

3.2 **PRIMER FOR PRIMARY AND THROUGH-WALL FLASHING MEMBRANE**

- .1 Apply primer for self-adhering membranes at rate recommended by manufacturer.
- .2 Apply primer to all areas to receive transition sheet and or through-wall flashing membrane as indicated in Drawings, by brush or heavy nap natural-material roller or spray and allow minimum thirty minute open time.

3.3 **MEMBRANE AIR/VAPOUR BARRIER**

- .1 Install the membrane in strict accordance with the manufacturer's written instructions and the representative's on-site instructions.
 - .2 Ensure complete coverage of and adhesion to all substrate to receive the air/vapour barrier membrane, including all wall protrusions. Extend membrane 150 mm below top of foundation walls. Co-operate with other sections to ensure continuity of the barrier.
 - .3 Apply the membrane to primed substrate in 2400 mm lengths or as recommended by the membrane manufacturer.
 - .4 Apply membrane so that horizontal joints overlap with the upper sheet over the lower sheet, shingle style. Lap all horizontal joints minimum 50 mm all side joints minimum
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- 64 mm and all end joints minimum 150 mm. Stagger vertical joints to avoid four way joints.
- .5 Apply a trowelled head of mastic to all terminations of the membrane at the end of a day's work and at membrane terminations.
 - .6 Reinforce all inside and outside corners with a continuous 300 mm wide sheet membrane prior to installing the air/vapour barrier.
 - .7 Fill gaps and joints with liquid membrane and reinforce with a continuous 300 mm wide sheet membrane prior to installing the air/vapour barrier.
 - .8 Use liquid membrane at all protrusions and difficult detail areas and provide a minimum 64 mm overlap with the sheet membrane.
 - .9 Apply air/vapour barrier so that the exterior wall is airtight, with airtight junctures at openings, penetrations and edges.
 - .10 Inspect air/vapour barrier for continuity immediately prior to installation of insulation. Do not cover the air/vapour barrier until it has been inspected.
 - .11 Repair punctures, rips and tears with pieces of membrane completely adhered to the damaged membrane.
 - .12 Where punctures and tears are extensive, replace entire damaged section.
 - .13 Install membrane over doors, windows and other openings to exterior walls.
 - .14 At openings, extend membrane 200 mm beyond jambs, heads and sills.
 - .15 Use mastic or fixing bars to adhere membrane to windows, doors, etc. to maintain continuity of the barrier.

3.4 **PATCHING**

- .1 Perform cutting and patching necessary to accommodate irregularities in the Work including piping, ductwork and electrical conduit projecting through the air/vapour barriers.
- .2 Ensure the continuity of the air/vapour barriers where such items project through the barriers. Allow for expansion and contraction and linear movement of these items.
- .3 After installation under other sections of heating equipment and other construction adjacent to the Work of this section, conduct an inspection and perform such reasonable taping and patching of air/vapour barriers and replacing of insulation as necessitated by unavoidable minor damage caused in the course of the work of the other sections.

3.5 **PROTECTION AND CLEANING**

- .1 Remove any masking materials after installation. Clean any stains on materials that would be exposed in the completed Work using procedures as recommended by manufacturer.
 - .2 Protect membranes to avoid damage from other trades and construction materials during subsequent operations. Protection Products may be installed on the same day as the membrane. Bonding of the insulation is achieved if the compatible insulation Products are installed when the membrane is tacky, generally within one to two hours after the membrane is installed.
-

- .3 Schedule work to ensure that the air and vapour barrier system is covered as soon as possible after installation. Protect air and vapour barrier system from damage during subsequent operations. If the air and vapour barrier system cannot be covered within thirty days after installation, apply temporary UV protection such as dark plastic sheet or tarpaulins.

3.6 **FIELD QUALITY CONTROL**

- .1 Installations will be inspected and approved by the Consultant prior to the installation of wall finishing materials. Notify Consultant 48 hours in advance of inspection.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.
- .2 Asphalt shingle roof for Barrier Free Lift at Scarborough Arts Council located at 1859 Kingston Road.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- .1 CAN/CGSB-19.13-M - Sealing Compound, One-Component, Elastomeric, Chemical Curing
- .2 CAN/CGSB-37.4-M - Fibrated, Cutback Asphalt, Lap Cement for Asphalt Roofing
- .3 CAN/CGSB-37.5-M - Cutback Asphalt Plastic Cement
- .4 CAN/CGSB-93.1-M - Sheet, Aluminum Alloy, Prefinished, Residential
- .5 CSA A123.1/A123.5 - Asphalt Shingles Surfaced with Mineral Granules
- .6 CSA A123.2-M - Asphalt Coated Roofing Sheets
- .7 CSA A123.3-M - Asphalt or Tar Saturated Roofing Felt
- .8 CAN3-A123.51-M - Asphalt Shingle Application on Roof Slopes 1:3 and Steeper
- .9 CAN3-A123.52-M - Asphalt Shingle Application on Roof Slopes 1:6 to Less than 1:3
- .10 CSA B111 - Wire Nails, Spikes and Staples
- .11 CAN/ULC-S107-M - Standard Methods of Fire Tests of Roof Coverings

1.3 **SUBMITTALS**

.1 Shop Drawings

- .1 Submit Shop Drawings showing method of installation and layout of each layer, fastening and flashings at edges, flashing of protrusions and penetrations in accordance with Section 01 33 00.
- .2 Shop Drawings shall be signed and sealed by a Professional Engineer licensed to practice in the Province of Ontario.
- .3 Shop Drawings shall be reviewed and signed by manufacturer's representative.

- .2 Samples: Submit to Consultant, a full size sample of asphalt shingles showing colour and type of shingle.
-

.3 Maintenance Data

- .1 Supply to Consultant, all necessary maintenance data and repair instructions for binding into maintenance manuals described in Section 01 33 00, and a name, address and phone number of nearest manufacturer's representative listing.

1.4 **QUALITY ASSURANCE**

- .1 Perform Work using skilled and experienced roofing tradespeople fully conversant with standards, methods and techniques required for installation of roofing system specified herein.
- .2 Conform to Canadian Roof Contractor's Association (CRCA) Specification Manual, as amended to date of this Specification, as applicable, except where indicated or specified otherwise.

1.5 **DELIVERY, STORAGE AND HANDLING**

- .1 Deliver materials to Site, protected, with manufacturer's seals and labels intact. Unload and place in temporary storage in manner to prevent damage.
- .2 Keep roofing felts dry, stored in rolls standing on end and elevated from contact with moisture, at temperatures not less than 5°C (41°F) or more than 49°C (120°F). Handle rolls with care to avoid crushing, puncturing or other damage.
- .3 Store shingles on raised platform not stacked higher than 1.2 m and protected by tarpaulin or plastic sheet. Allow for air circulation.
- .4 Protect sheet metal materials from bending and scratching.

1.6 **EXISTING CONDITIONS**

- .1 Modifications are to take place on existing adjacent roof areas as part of Work of this section. Do not use existing roof areas as storage, except to extent required for removal, alteration and replacement Work.
- .2 Determine existing conditions, limitations and requirements for protection of this and adjacent Work and of occupants.
- .3 Existing roofing is covered by roofing warranty or guaranty. Obtain from Owner's designee all necessary information regarding such warranty or guaranty, and notify guarantor system manufacturer and guarantor roofing contractor by letter before Work is commenced on existing roofing system.
- .4 Execute alteration Work in manner as to maintain existing warranty or guarantee.

1.7 **WARRANTY**

- .1 Warrant Work of this section against defects and deficiencies for a period of fifteen years. Promptly correct to satisfaction of Consultant and at no expense to Owner, any defects or deficiencies which become apparent within Warranty Period.

1.8 **MAINTENANCE**

- .1 Turn over to Owner 30 m² of shingles for the building upon completion and deliver where directed.
-

2 Products

2.1 **MATERIALS**

- .1 General: Ensure materials are compatible.
 - .2 Asphalt shingles: CAN/CSA A123.1-M, strip, self-sealing, first class, minimum mass of 100 kg/10m². Colour to match existing and selected by Consultant from manufacturer's standard range.
 - .1 Acceptable Manufacturer
 - .1 IKO Industries Ltd.
 - .2 Canada Specialty
 - .3 Or accepted equal
 - .3 Eaves protection: Self adhesive, self sealing composite sheet membrane composed of high-density, cross laminated polyethylene and rubberized asphalt. ArmourGard Ice and Water Protection by IKO Industries Ltd, or Colphene 1000 GSA by Soprema Waterproofing Inc. or Eaveshield by Exeltherm Inc., or Eaveguard by Henry.
 - .4 Roll roofing: CSA A123.2-M, Type S for smooth surface and Type M for mineral surface. Colour to match colour of shingles.
 - .5 Sheathing paper: CAN/CGSB 51.32-M; asphalt saturated.
 - .6 Roofing felts: CSA A123.3-M, No. 15, organic felt, asphalt saturated.
 - .7 Plastic cement: CAN/CGSB 37.5-M.
 - .8 Lap cement: CAN/CGSB 37.4-M.
 - .9 Roofing nails: CSA B111, 10 to 12 gauge galvanized steel nails, sufficient length to penetrate deck minimum 12 mm.
 - .10 Sheet metal: Minimum 0.49 mm overall thickness, zinc coating Z275 galvanized sheet steel, or Galvalume by Dofasco Inc., prepainted to Stelcolour 5000 by Stelco Inc. or System 5000 by Dofasco Inc. Colour and finish as selected by Owner's designee from manufacturer's standard.

OR
 - .11 Sheet metal: Prefinished aluminum alloy, postforming and non-postforming sheet finish coated one side, 0.60 mm minimum base sheet thickness, CAN2-93.1-M; by Alcan Building Products or Reynolds Aluminum Co. of Canada. Colour and finish as selected by Consultant from manufacturer's standard.
 - .12 Drip edge: To profile indicated on Drawings and fabricated from specified metal.
 - .13 Eavestroughs: Standard profiles of sizes indicated on Drawings and fabricated from specified metal, complete with corners, stops and drops for downpipe connections.
 - .14 Rainwater leaders: To profile indicated on Drawings with positive lock seams throughout
 - .15 Soffit: Preformed, prefinished, ventilated aluminum sheet metal crimped for stiffness, complete with corners, stops, trims and connections. Colour and finish shall be selected by Consultant from manufacturer's standard.
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- .16 Fascia: wood fascia to match existing.
- .17 Sealant: One-component, chemical curing, CAN/CGSB-19.13-M, Class M-2-25-B-N.
- .18 Roof ventilators: Dual baffle aluminum roof ventilators with seamless collar and base construction complete with insect screen. Minimum free area 650 cm², by Leigh Metal Products Ltd. or Buckley's Sheet Metal Manufacturing Ltd.
- .19 Vents and ducts penetrating roof: Mechanical Division.
- .20 Conduits penetrating roof: Electrical Division.

3 Execution

3.1 EXAMINATION

- .1 Report any defects or irregularities in roof deck detrimental to roof application. Do not proceed until corrected.
- .2 Ensure openings, walls and projections through deck are completed and affixed and reglets and nailing strips are in place prior to installation.
- .3 Ensure that deck substrate scheduled to receive roof system are smooth, dry, clean and free of sharp projections.

3.2 PREPARATION

- .1 Do no roofing during rain, fog, sleet or snow, or upon surfaces covered with dust, water, dew, ice, frost, snow and similar conditions.
- .2 Sweep roof surfaces clean; remove debris, water, dew, frost, snow, ice and foreign materials (oil/grease) which could impair Work.
- .3 No salt or calcium shall be used to remove ice or snow.
- .4 Remove existing shingles, eavestrough, fascia soffits, flashing at designated roof locations indicated on Drawings.
- .5 Re-nail loose plywood sheathing.
- .6 Install new Work promptly after removal of existing roofing minimizing exposure to weather.
- .7 Obtain smooth and even surface. Cut and nail down buckles, raised tabs or curled edges. Remove or drive in any protruding nails.

3.3 NOTCHING AND DRILLING

- .1 Holes drilled in roof or ceiling framing members shall be not larger than one-fourth the depth of the member and located not less than 50 mm from the edges, unless the depth of the member is increased by the size of the hole.
 - .2 Roof and ceiling framing members may be notched provided the notch is located on the top of the member within one-half the joist depth from the edge of bearing, and is not deeper than one-third the joist depth, unless the depth of the member is increased by the size of the notch.
-

- .3 Do not notch, drill, or otherwise weaken roof truss members unless such notching or drilling is allowed for in the design of the truss and approved in writing by the Consultant.

3.4 **INSTALLATION**

.1 General

- .1 Install asphalt shingles on roof slopes 1:6 to less than 1:3 in accordance with CAN3-A123.51.
- .2 Drip edge: Install drip edge along eaves directly to deck and at all rakes over underlayment, overhanging 13 mm with minimum 50 mm flange extending onto roof decking. Nail to deck at 400 mm oc maximum.
- .3 Eave protection: Install eaves protection as indicated on Drawings from edge of roof extending onto roof to a line not less than 600 mm with inner face of exterior wall. Lap ends a minimum of 150 mm. When more than one width required, overlap second course minimum 100 mm over first course.
- .4 Underlayment: Lay one-ply roofing felt underlayment horizontally over entire roof deck overlapping eave protection by 100 mm. Nail sufficiently to hold in place until shingles are applied. Overlap succeeding course minimum 50 mm and 100 mm at end lap except at hips and ridges where end lap shall be 150 mm.
- .5 Flashings at valleys: Provide (roll roofing) (600 mm") wide sheet metal) flashing centred down valleys.
 - .1 Lay 450 mm wide strip of mineral surface roll roofing with mineral surface face down in centre of valley, from eave to top of ridge. Press sheet firmly in place and nail 25 mm from exterior edges, using only enough nail to hold it in place. Cut bottom edge flush to eaves of roof. Apply 100 mm wide strip of plastic cement to both edges. If joints are required, overlap upper section 300 mm over lower section and cement with cement. Centre 930 mm wide strip of mineral surface roll roofing, surface side up on top of previous strip. Press firmly in cement and nail in same manner.
- .6 Shingles Application
 - .1 Before applying shingles, snap two chalk lines full length of valley, 100 mm from centre at ridge and opening 10 mm/m approaching eaves to maximum of 200 mm.
 - .2 Lay shingles down to edge of chalk lines and cut to fit. Cut off top corner of each end shingle at an angle, to prevent water from penetrating between roofing courses. Cement shingles at chalk lines with 75 mm width of plastic cement to seal and nail down.
 - .3 Install asphalt shingle starter course granule side up, facing tabs up roof slope, overhanging eave edge 6 mm to provide drip; nail along bottom edge 300 mm oc.
 - .4 Starting at edge of rake, apply full shingles across width of roof, overhanging drip edge 6 mm. Moderately butt shingles together. Stagger joints one half tab in succeeding courses to permit vertical alignment. Continue this operation commencing every fifth course with full shingle.

- .5 Use four nails per shingle. Provide one nail 25 to 40 mm from each side edge and remaining two nails above cut-outs just below self-sealing strip and to manufacturers printed directions. Do not nail into or above factory applied adhesive strip. Drive nails straight and flush. Do not use staples.
 - .6 Apply additional sealer under each tab after application.
 - .7 Apply last course of shingles so that exposed granular surface is within 145 mm of ridge. Turn head lap of shingle over ridge and nail on opposite slope. Once both slopes have been terminated as specified, apply ridge capping.
 - .8 Cut full size shingles into three parts and cut off both corners of each section at an angle or use manufactured ridge capping shingles.
 - .9 Bend cap down centre so as to have equal exposure on each side of ridge. In cold weather, warm cap before bending.
 - .10 Beginning at bottom of hip or at end of ridge opposite prevailing wind, apply caps. Overlap to provide 125 mm exposure.
 - .11 Nail cap with one nail each side, 150 mm from exposed end and 25 mm from each side.
 - .7 Flashings
 - .1 Install step flashings from specified sheet metal on mechanical, electrical, or structural Work passing through roof or located on roof and make them watertight.
 - .2 Supply each piece of metal flashing with minimum 50 mm side lap, of size to extend 100 mm up vertical surfaces and 50 mm onto roof deck.
 - .3 At soil or vent stacks location through roof, use smooth surface roll roofing cut to fit over pipe and extend 100 mm below, 200 mm above and 150 mm to each side of pipe, or pre-fabricated metal flange to flash before shingles are laid. Slip flange over pipe and lay flat on roof. Form collar around pipe using plastic cement and work in to obtain good adhesion. Continue laying shingles and cement in all areas that overlap flange.
 - .8 Lock joint and seal flashing seams. Wedge and seal flashings into masonry joints or reglets.
 - .9 Roof Appurtenances
 - .1 Install roof ventilators in locations indicated and make watertight.
 - .2 Install eavestroughs as detailed and indicated on Drawings and secure to building at 750 mm oc with eavestrough spikes through spacer ferrules. Slope eavestroughs to downpipes as indicated. Seal joints watertight.
 - .3 Install downpipes and provide goosenecks back to wall. Secure downpipes to wall with straps at 1.8 m oc; minimum two straps per downpipe. Connect downpipes to drainage system and seal joints.
 - .4 Provide precast concrete splash pans where indicated.
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.10 Roof and Ceiling Framing

- .1 Shape rafter supports to provide even bearing surfaces and support directly above the exterior walls.
- .2 Hip and valley rafters shall be not less than 50 mm greater in depth than the common rafters, and not less than 38 mm thick, actual dimension.
- .3 Dwarf walls and struts may be used to provide intermediate support to reduce the span for rafters and joists and when struts are used, they shall be not less than 50 mm x 100 mm material extending from each rafter to a load-bearing wall at an angle of not less than forty-five degrees to the horizontal.
- .4 When dwarf walls are used for rafter support, frame in the same manner as load-bearing walls and securely fasten top and bottom to the roof and ceiling framing to prevent overall movement and install solid blocking between floor joists beneath dwarf walls that enclose finished rooms.
- .5 Where rafters are tied, the ties may consist of tie rods or ceiling joists forming a continuous tie for opposing rafters and members may be fastened together either directly or through a gusset plate.
- .6 Restrain from twisting roof joists supporting a finished ceiling other than plywood along the bottom edges by means of furring, blocking, cross-bridging or strapping.
- .7 Ceiling joists supporting part of the roof load from the rafters shall be not less than 25 mm greater in depth than required for ceiling joists not supporting part of the roof load, except that when the roof slope is 3/32 or less, the ceiling joist sizes shall be determined from the span tables for roof joists.
- .8 Install plywood roof sheathing with the surface grain at right angles to the roof framing. Nail to trusses and blocking with common wire galvanized nails. Where panel-type roof sheathing requires edge support, the support shall be not less than 38 mm x 114 mm blocking securely nailed between framing.

3.5 **FIELD QUALITY CONTROL**

- .1 Owner may engage independent inspection company to inspect Work of this section. Give at least two weeks' notice of starting Work and allow inspector free access.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- .1 ASTM A653/A653M - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Coated Alloy with Improved Formability
- .2 ASTM C920 - Standard Specification for Elastomeric Joint Sealants
- .3 CAN/CSA-S16.1 - Limit States Design of Steel Structures
- .4 CAN/CSA-S136 - Cold Formed Steel Structural Members
- .5 CAN3-S157-M - Strength Design in Aluminum

1.3 **DESIGN CRITERIA**

- .1 Design metal siding, soffits and fasteners to support a positive wind load of 0.96 kN/m² (20 lbs/sq.ft.) and a negative wind load of 0.575 kN/m² (12 lbs/sq.ft.), with maximum deflection of L/180th of the span at full load. Components of siding system shall not vibrate when subjected to the effects of wind.
- .2 Yield stress shall not exceed 230 MPa (33,000 psi).
- .3 Base general design on CAN/CSA-S16.1 and CAN/CSA-S136.
- .4 Conform to the rainscreen principle of design as advocated by National Research Council of Canada (NRC)
- .5 Design metal siding assemblies capable of withstanding structural movement, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.
- .6 Design explosion release panels in accordance with Factory Mutual, National Fire Code of Canada, NFPA No. 68, and authorities having jurisdiction, by a Professional Engineer registered in the province of Ontario.
- .1 Design for 1.2 kPa (25 psf) pressure disengagement.
- .2 Design in unison with preformed siding components for integrity of system appearance.
- .7 General: Source siding from one manufacturer.

1.4 **TESTING**

- .1 The Owner may employ an independent testing company to perform quality control testing for each coil of sheet metal to be coated, as specified under "Source Quality Control", and will pay all costs thereto.

1.5 SUBMITTALS

- .1 Shop Drawings: Submit Shop Drawings in accordance with Section 01 33 00. Show the following:
 - .1 Materials, gauges and dimensions. Include all fixings, fasteners, sealants.
 - .2 Layouts and installation details; building movement provisions.
 - .3 All conditions at parapet, windows, doors, junctions, corners, trims, and interface with other finishes.
 - .4 General notes indicating material and installation compliances with the Specifications.
 - .5 Explosion release panel assembly; such Shop Drawing to bear the seal and signature of a Professional Engineer licenced in the province of Ontario.
- .2 Samples
 - .1 Submit to Consultant, two 300 mm x sheet width prepainted sample sections of (each) siding and liner panel profile painted to colour specified. Ensure finished Work matches accepted samples in colour, gloss and texture.
 - .2 Submit to coating material manufacturer, two 300 x 300 mm prepainted samples from each coil of coated steel for the manufacturer to verify quality of coating application.
 - .3 Submit to independent testing company upon request, two 300 x 300 mm prepainted samples from each coil of coated steel for the testing company to verify quality and performance of coating application.
- .3 Test results: Submit to the Consultant in duplicate, reports of the following:
 - .1 Coating applicator's in-house quality control meeting "Source Quality Control" requirements herein.
 - .2 Coating manufacturer's testing of coating application quality.

1.6 QUALITY ASSURANCE

- .1 Installer: Manufacturer's construction forces or by an installer accredited by the deck manufacturer.
- .2 Coating system: Sourced from one coating manufacturer for entire Project as required to ensure colour match.
- .3 Metal coating system application: Applicator to ensure materials are applied in accordance with quality and performance specifications published by specified coating manufacturers for (each) coating system specified.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Comply with CSSBI guidelines, and the requirements specified herein.
 - .2 Store materials on Site in a manner to prevent damage thereto, or deterioration of finish. Galvanized surfaces which show evidence of "white rust" will not be accepted. Store away from chemically aggressive substances and away from site traffic.
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- .3 Stack panels tilted to provide water run-off, free from ground contact on firm, level, non-staining supports extending full width of sheet and spaced not more than 450 mm³⁶ apart.
- .4 Where possible, pile individual sheets or panel length and types separately. Cover components with non-plastic sheet coverings loosely shrouded over stacks, to protect from direct sunlight and moisture penetration. Anchor coverings to prevent blow off. Vent to allow air movement but not to allow entry of wind driven rain.
- .5 Conduct transport of materials to job site storage compound in such a manner to prevent in-transit damage. These measures include, but are not limited to crating, polyethylene wrapping system, etc.

1.8 **WARRANTY**

- .1 Generally, warrant Work of this section against defects and deficiencies for a period of two years from date Work is certified as substantially performed in accordance with the general conditions of the Contract.
- .2 Finish Warranty: Furnish siding manufacturer's written warranty covering failure of the factory-applied exterior finish on metal for twenty years. This warranty shall be in addition to, and not a limitation of, other rights the Owner may have against the Contractor under the Contract Documents.
- .3 Promptly make good defects and deficiencies which become apparent within the Warranty Period by replacing defective Work satisfactory to the Consultant and at no expense to the Owner.

2 **Products**

2.1 **SHEET METAL MATERIALS**

- .1 Galvanized ribbed exterior sheet steel cladding (corrugated): Z275 zinc coating galvanized sheet steel, conforming to ASTM A653/A653M, Grade 230, with minimum base steel thicknesses as specified:
 - .1 Nominal Core thickness: 0.60 mm (24 ga)
 - .2 Fastening System: exposed fastener
 - .3 Panel depth: 38 mm
 - .4 Direction of installation: as indicated on Drawings
 - .5 Acceptable Manufacturer:
 - .1 VicWest "CL 6025"
 - .2 Agway "CL6150 NF"
 - .3 The Roll Form Group "S-15-SB" (no flutes)
 - .4 Or accepted equal
- .2 Sub-girts, Z-bars: preformed galvanized metal, oe piece and adjustable types made from sheet steel in 1.214 mm (18 ga), with Z275 zinc coating.

- .3 Closures and flashings: Of same material and thickness as specified for exterior sheets, prepainted to match adjacent siding where exposed to view.
- .4 Interior corner stiffeners: Steel sheet in required thickness, zinc coating type to match liner sheet or prepainted where used with prepainted liner.
- .5 Liner sealant: Type as recommended by liner manufacturer.

2.2 **FINISH**

- .1 Metal coating system for exterior sheets: Silicone modified polyester (SMP) system, coil coated using US Steel Supply "WeatherX" or ArcelorMittal "Perspectra Series". Coil coated surface pretreated and primed prior to application of coating.
 - .1 Unexposed surface primed and wash coat finished.
 - .2 Colour: As selected by Consultant manufacturer's standard colour selection.

2.3 **ACCESSORIES**

- .1 Insulation: Refer to Section 07 21 00 Thermal Insulation. Thickness as indicated on Drawings.
- .2 Adhesive: Rapid setting, synthetic rubber based adhesive, Henry "830-05". Adhesive to be compatible with vapour barrier at acoustic liner.
- .3 Fasteners: Galvanized, with exposed fasteners colour matched to cladding.
- .4 Provide all trims and accessories as required for a complete installation, including at soffits.
 - .1 Accessories: cap flashings, drip flashings, internal corner flashings, copings and closures for head, jamb, sill and corners, of same material, thickness and finish as exterior cladding, brake formed to shape.
- .5 Expansion joints: as recommended by Manufacturers Instructions.
- .6 Sealant: Concealed sealant: Tremco "Butyl Sealant" to TT-S-001657, Type 1.
- .7 Exposed sealant: Non-sag type, one part polyurethane per ASTM C920, Type S, Grade NS, Class 25, in colour selected by Consultant.
 - .1 Sika "RC-I"
 - .2 Tremco "Dymonic"
 - .3 Sonneborn "NP-1"
- .8 Neoprene rib closures: Closed-cell, moulded to fit rib profile.
- .9 Zinc rich primer: Primer for touch up of galvanized sheet steel; W.R. Meadows "Galvafruid", Kerry Industries "Z.R.C." or Niagara Paint Inc. "PL052898".
- .10 Siding to roof air/vapour barrier connections and expansion joint membrane: Reinforced modified vinyl membrane sheet, Lexsuco "FR-40". Bond to substrates with Lexsuco "CA-103" adhesive.
- .11 Foamed-in-place air seals: Class 1, single component polyurethane foam conforming to CAN/ULC-S710.1, with flame spread rating of 20 or less and smoke developed of 25 or

less. Density of 20.8 to 28.8 kg/m³, "Zerodraft Foam Sealant" by Canam Building Envelope Specialists Inc., or "Great Stuff Pro" by Dow Chemical Company, or "LEF" by Tremco.

2.4 **SOURCE QUALITY CONTROL - COATING SYSTEM**

- .1 Perform testing to include but not limited to the following:
 - .1 Dry film thickness: 25 microns \pm 3 microns for "Perspectra" or WeatherX" coating system, and 22.5 microns \pm 5 microns for "Series 10000" coating system.
 - .2 Colour measurements: ASTM D2244 or NCCA 6.1.5.
 - .3 Specular gloss: 30 \pm 5 gloss units measured with a Gardner 60° Glossmeter to ASTM D523 or NCCA 6.1.6.
 - .4 Dry film hardness: Minimum hardness of HB to F for "Perspectra" or WeatherX" coating system, and minimum hardness of HB for "10000 Series" coating system to ASTM D3363 or NCCA 4.2.5.
 - .5 Weathering: Twenty-five years for film integrity and twenty years for colour change for "Perspectra" or WeatherX", and ten years for "10000 Series" coating system exterior exposure and showing no evidence of cracking, chipping, peeling, crazing, spotting or loss of adhesion. Chalking shall not exceed #8 for vertical installations, and #6 for non-vertical installations to ASTM D659 or NCCA 5.5.2.
 - .6 Other testing as required by Consultant to determine source quality of coated steel.
 - .7 Samples must meet minimum DFT for coating systems specified for all testing.

2.5 **FABRICATION**

- .1 Fabricate to conform to requirements of Contract Documents and reviewed shop drawings, and to allow for structural movements within the systems.
- .2 Ensure that metal panels are free of steel contamination from rollers.
- .3 Fabricate siding to prevent entry of water into building and from collection within system assembly.
- .4 Join intersecting parts together to provide tight, accurately fitted joints with adjoining surfaces in true planes.

3 **Execution**

3.1 **EXAMINATION**

- .1 Verify condition and dimensions of previously installed Work upon which this Section depends.
 - .1 Examine substrates to receive work and surrounding adjacent surfaces for conditions affecting installation. Coordinate with related sections to ensure proper dimensions are maintained.
 - .2 Verify site dimensions by accurate field measurements so that work will be accurately designed, fabricated and fitted to the structure.

- .3 All penetrations through the façade for the work of other trades shall be fitted with a watertight sleeve. Verify flashings are in place, sealed with waterproof membrane and covered with building membranes.
- .4 Maintain sheathing membrane integrity.
- .5 Report defects to Consultant. Commencement of Work means acceptance of existing conditions.

3.2 **LINER SHEET**

- .1 Apply continuous bead of concealed caulking on face of top and bottom supports of siding liner sheet, and between flashing and liner sheet, to provide a complete seal. Completely seal back of liner sheets to face of supporting members. Plug "Vee" ribs with sealant.

3.3 **FACE SHEET ASSEMBLY**

- .1 Fasten Z-bars to concrete block at spacing indicated using masonry fasteners.
 - .2 Install continuous thermal barrier cork tape between liner sheets and sub-girts. Direct metal-to-metal contact will not be accepted.
 - .3 Install insulation with adhesive. Tightly butt joints.
 - .4 Install corner supports, interior corner pieces, closures and related accessories, etc. rigid and tight.
 - .5 Secure exterior face sheets to sub-girts in accordance with the manufacturer's standards exposed fasteners.
 - .6 When cutting or drilling prefinished material, exercise care to ensure that cuttings do not remain to rust on exposed prefinished surfaces and be removed as quickly as possible. Where practicable, conduct cutting and drilling so that cuttings do not strike or accumulate on exposed cladding.
 - .7 Closures, Flashing, And Trim
 - .1 Install all closures, flashing and trim as required to produce a neat, finished, weathertight installation. Provide formed steel closures around openings. Provide proper end laps sealed with sealant in all long runs to allow for thermal movement and to remain weathertight. Secure all such members in accordance with manufacturer's recommendations, but at minimum 300 mm o.c. Bed exposed flashing and trim, and members subject to rain penetration, in sealant. Apply sealant around siding, and openings in siding, and below metal flashings to siding.
 - .2 Copings and scuppers: Coordinate installation under the roofing section.
 - .3 Wall expansion joints: Install metal trim at joints as shown.
 - .4 Gutters and downspouts: Install where and as shown; lap joints in direction of flow. Provide tail pieces for downspouts; secure downspouts to wall. Slope gutters to downspouts. Seal all joints.
 - .5 Install premolded closures at top and bottom ends of siding materials, at cap flashings, and above sill or ledge flashings to keep building weathertight; and, vermin and insect protected.
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- .6 Set closures in place with a daub of sealant to keep closure from falling out when metal flexes.
- .7 Prime surfaces as required by sealant manufacturer. Tool caulked joints. Remove excess sealant.

3.4 **EXPANSION JOINT ASSEMBLIES**

- .1 Install insulated flexible flashings or flexible flashings at siding and roof transitions between liner panel, girt and roof curb. Install on a continuous butyl tape on each support. Roll flashing to tape with a steel roller to achieve a completely air tight seal. Butt tape ends tightly to each other.
- .2 At siding expansion joints install flaps of insulated flexible flashings in a continuous butyl tape applied on each supporting member. Roll flashing to tape with a steel roller to achieve completely air tight seal. Butt tape ends tightly to each other.
- .3 Lap joints of insulated flexible flashings and flexible flashings a minimum of 100 mm and heat weld.

3.5 **METAL LOUVRES**

- .1 Install in accordance with Section 08 91 00.

3.6 **TEMPORARY OPENINGS FOR EQUIPMENT ACCESS**

- .1 Leave temporary openings in siding for equipment access at locations shown on Drawings.
- .2 Remove temporary closures and close openings with permanent siding assembly after equipment has been delivered in the building.

3.7 **SEALANT WORK - GENERAL REQUIREMENTS**

- .1 Preparation
 - .1 Prepare joints to receive compound and verify suitability. Failure of compound in the future, due to claimed unsuitability of joint, will not be valid. Installation of compound is considered as evidence that joint is suitable to receive compound.
 - .2 Clean recesses to receive compound to be free of dirt, dust, loose material, oil, grease, form release agents and other substances detrimental to compound's performance.
 - .3 Apply masking tape to metal surfaces adjacent to recesses to prevent smearing or staining of such metal surfaces.
 - .4 Depth of recess to receive compounds are not to exceed one-half the joint width up to a maximum of 12 mm and not less than 6 mm at centre of joint. Where depth of recess is in excess of specified depth, place back-up material in recess, forced into place under compression, to provide 6 mm recess depth.
 - .2 Installation
 - .1 Use materials as received from manufacturers, without additives or adulteration.
 - .2 Install compound immediately after adjoining Work is in condition to receive such Work. Fill joints completely, regardless of variation of joint widths, and to proper
-

depth as specified. Install compounds under pressure, without smearing adjacent surfaces. Sealant compounds must have full and uniform contact with, and adhesion to, side surfaces of recess.

- .3 Finish face of compound in recesses smooth and even. At recesses in angular surfaces, finish compound with a flat face, flush with face of material at each side. At recesses in flush surfaces, finish compound with a concave face, flush with face of material at each side.
- .4 Surface of compounds to be free from dirt, stain or other defacements and be uniform in colour.

3.8 **TOUCH UP**

- .1 Touch up marred prepainted surfaces with air dry formulation to match pre-finished material, or replace if necessary.
- .2 Clean and touch up marred galvanized surfaces after installation, with zinc rich primer.

3.9 **CLEANING-UP**

- .1 Leave siding Work clean and free of grime, dirt and sealant stains. Remove stains on adjacent Work of other trades resulting from sealant Work.

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- | | | |
|-----|------------------|---|
| .1 | ASTM D4637 | - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane |
| .2 | ANSI/RMA RP-2 | - Minimum Requirements for Fabric-Reinforced Black EPDM Rubber Sheets for Use in Roofing Applications |
| .3 | CAN/CGSB-51.20-M | - Thermal Insulation, Polystyrene, Boards and Pipe Covering |
| .4 | CAN/CGSB-51.26 | - Thermal Insulation, Urethane and Isocyanurate, Boards, Faced |
| .5 | CAN/CGSB-51.33-M | - Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction |
| .6 | CRCA | - Canadian Roofing Contractors Association |
| .7 | CSA A23.1 | - Concrete Materials and Methods of Concrete Construction |
| .8 | FM | - Factory Mutual Engineering Corporation (FM): "Loss Prevention Data, Insulated Steel Deck I-28", and FM "Approval Guide" |
| .9 | ULC | - Underwriters' Laboratories of Canada "List of Equipment and Materials Volume II Building Construction" |
| .10 | CAN/ULC-S107-M87 | - Standard Methods of Fire Tests of Roof Coverings |
| .11 | CAN/ULC-S126-M86 | - Standard Method of Test for Fire Spread Under Roof Deck Assemblies |

1.3 **ROOFING SUBCONTRACTOR**

.1 Subcontractor Qualifications

- .1 Trained and approved by the manufacturer of roofing system to be installed, with minimum five years working experience on projects of similar size and in climates similar to that of this Contract.

1.4 **QUALITY CONTROL**

- .1 Design criteria for materials and roofing system construction: In accordance with requirements of Factory Mutual "Class 1-60" (1-90 prior to Dec. 31, 2005), CAN/ULC-

S107-M minimum "Class A" and CAN/ULC-S126-M tested and approved, and the Ontario Building Code.

.2 Applicator Qualifications

- .1 Member in good standing of the Canadian Roofing Contractors Association (CRCA) with a minimum of three years experience in installing the specified roofing system, and has specialized equipment in proper operating condition to perform the Work in accordance with manufacturer's printed instructions.
- .2 The applicator shall have been trained and approved by the manufacturer of roofing system to be installed.

1.5 **INSPECTION**

- .1 Refer to "Quality Control" in Section 01 10 00 – General Requirements.
- .2 Inspection and testing of roofing assembly installation will be performed by an independent roofing inspection and testing company selected and paid for by the Owner.
- .3 Be responsible for having the representative of the roofing system manufacturer on Site to inspect the installation as the Work proceeds and to certify the assembly as "Approved" upon completion.

1.6 **SUBMITTALS**

- .1 Submit the following in accordance with Section 01 33 00.
 - .1 Product data for:
 - .1 Vapour barrier
 - .2 Roof insulation
 - .3 Insulation fasteners
 - .4 Tapered insulation boards
 - .5 Roofing and flashing membranes
 - .6 Roof accessories
 - .2 Layouts
 - .1 Insulation fastener layout
 - .2 Layout of tapered insulation
 - .3 Membrane fastener layout
 - .4 Layout of building area indicating roofing sequence, equipment set up and material laydown area
 - .5 Roof expansion joint systems
 - .3 Factory Mutual layout and number of fasteners.

.4 Certificates

- .1 Copy of roofing system manufacturer's FM test data certifying compliance with Factory Mutual Approval "Class 1-60" ("Class 1-90") for overall roof assembly as specified herein.
- .2 Copy of roofing system manufacturer's ULC "Fire Resistance Ratings" listing certifying compliance with Underwriters Laboratories of Canada minimum "Class A" rating and CAN/ULC-S126-M for the roof covering materials assembly as specified herein.
- .3 Copy of insulation manufacturer's ULC listing certifying insulation's compliance with specified requirements.

1.7 **DELIVERY, STORAGE AND HANDLING**

- .1 Deliver and store materials undamaged in original containers with manufacturer's labels and seals intact. Store membrane rolls flat and protected from moisture.
- .2 Store solvent base liquids, adhesives, and sealants away from excessive heat and open flames, and at temperatures between 15°C and 26°C (59°F and 79°F). Contact adhesives and cleaning fluids are extremely flammable, avoid open flame and sparks. Smoking is prohibited in the area of roofing application or where materials are being stored. Contact adhesives contain petroleum distillates; avoid breathing vapours and provide adequate ventilation when using same within enclosed areas. Store uncured neoprene flashing membrane in enclosed areas off roof at temperatures below 25°C (77°F).
- .3 Store materials at the Site within temporary sheds or trailers; such facilities must be well sealed and heated as required to ensure materials remain dry in terms of roofing.
- .4 Do not store more than one day's supply of materials on the roof at any time. On roof, stack materials on pallets, and completely cover with incombustible waterproof tarpaulin whenever Work is interrupted, or when there is precipitation of any kind.
 - .1 Securely tie covering to the pallets in such a way as to be weathertight and to prevent tarpaulin from blowing off in a windstorm.
 - .2 Plastic covers and shrinkwrap covers by manufacturers are not acceptable for Project site storage and shall be removed upon delivery and prior to site storage.
- .5 Do not lift rigid insulation in slings which will damage insulation edges. Remove damaged insulation and replace with new material at no cost to Owner.
- .6 Distribute materials stored on roof to stay within the designated live load limits of the roof construction. Provide ample bases under equipment and materials to distribute the weight. Do not store materials on, or transport materials across, completed roof areas.

1.8 **PROTECTION**

- .1 Adequately protect materials and Work of this section from damage by weather, traffic and other causes. At the end of each day's work install temporary water cutoff between finished roofing membrane and roof deck to prevent weather damage and water from entering below finished assemblies. Remove such temporary cutoff strip completely prior to commencing Work.
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- .2 Protection covering: Place 19 mm thick plywood underlaid with 25 mm thick polystyrene insulation boards adhered to plywood sheathing. Place protection covering over all roofed areas when working from, or over, such roof surfaces such as below hoist rigs, ladders, pallets of material, and in other circumstances where the roofing membrane is exposed to potential damage. Provide weights as required to prevent blow-off.
- .3 Grease, oil, and fats may cause deterioration of membrane. Do not allow same to come in contact with the roofing system.
- .4 Protect Work of other trades from damage resulting from the Work of this section. Make good such damage at no cost to the Owner.
- .5 Provide fire extinguishers at each installation and storage location, of proper type for materials being used and stored.
- .6 Do not cut lumber at roof level.

1.9 **ENVIRONMENTAL REQUIREMENTS**

- .1 Do not install materials in rain, cold, moisture, frost, snow or other climatic conditions which could jeopardize proper application of materials. Refer to and comply with manufacturer's recommendations and limitations relative to this subject.

1.10 **COORDINATION, SEQUENCING, SCHEDULING**

- .1 Prior to the start of Work on Site, arrange a Project site meeting of all parties concerned consisting of the Roofing Contractor, Roofing Warrantor, (Manager), Consultant, Owner's Representative, and inspection/testing agency, to review the Specifications and Drawings for the Work included in this section, its requirements and responsibilities. Notify the Consultant two weeks in advance of meeting.
- .2 Phased construction of the roofing system is not an acceptable construction method and will not be allowed.
- .3 Coordinate with Section 05 30 00 for that section to leave out sections of metal roof deck as required to facilitate moving of roofing materials.

1.11 **WARRANTY**

- .1 Submit in duplicate copies, two warranty provisions which shall run concurrently commencing from period specified in the general conditions.
 - .1 Standard workmanship warranty (by Roofing Contractor): Warrant the roofing and flashing membranes against workmanship defects for a period of two years and agree to promptly make good any defects which occur or become apparent within the Warranty Period, such defects to include but not to be restricted to leakage, failure to stay in place, lifting and deformations. Temporary repairs done during inclement weather shall be replaced with permanent Work as soon as weather permits. Use Canadian Roofing Contractors Association Standard Form of Guarantee.
 - .2 Total systems warranty (by roofing material manufacturer): Warrant the roofing and flashing membranes from defects caused by workmanship and material deficiencies for a period of ten years and agree to promptly make good any defects which occur or become apparent within the Warranty Period, such defects include but not to be restricted to leakage, failure to stay in place, lifting and deformations. Temporary repairs done during inclement weather shall be

replaced with permanent work as soon as weather permits. Warranty shall be on Appendix R, Total Roofing System Warranty appended to this section. The warranty shall cover the cost of labour, workmanship and material to restore the roof to a watertight condition. Warranty shall be issued by one of the manufacturers listed below, herein referred to as "Roofing Warrantor". In Part 2 of this section, roofing Supplier is referred to in its short form for simplicity.

2 Products

2.1 **ROOFING MATERIALS**

- .1 60 mills (1.52 mm) Non-Reinforced, black cured synthetic single-ply membrane composed of ethylene propylene diene terpolymer (EPDM).

.1 Firestone "RubberGard EPDM Membrane"

.2 Johns Manville EPDM NR

.3 Carlisle EPDM

.4 or accepted equal

- .2 Vapour barrier: SBS fully adhered self-adhesive modified bitumen adhesive, intended for use as a direct to deck air/vapor barrier in roofing systems, factory-laminated to a tri-laminate woven, polyethylene top surface. Release liner protecting adhesive.

.1 Thickness: 0.826 mm minimum, when tested in accordance with ASTM D 5147.

.2 Low Temperature Flexibility: -35°C when tested in accordance with ASTM D 5147.

.3 Moisture Vapor Permeance: 0.02 Perms maximum, when tested in accordance with ASTM E96.

.4 Air Permeability: 0.007 L/sec·m² maximum, when tested in accordance with ASTM E2178.

.5 Acceptable Product:

.1 V-Force Vapor Barrier Membrane by Firestone

.2 JM Vapour Barrier SAR by Johns Manville

.3 Sopraseal Stick 1100T by Soprema

.4 Or accepted equal

- .3 Insulation

.1 Faced and Unfaced Insulation: Rigid mineral wool board insulation made from basalt rock and slag with a rigid upper layer, in accordance with ASTM C726.

.1 Provide two layers of 50 mm insulation or as indicated on Drawings.

.2 Faced insulation: top surfaced impregnated with a bitumen layer which is compatible with adhesive applied roofing membrane.

.3 Compressive strength: Top layer at 25%, 252 KPa in accordance with ASTM C165. Density: Top layer, 220 kg/m³ in accordance with ASTM C612

.4 Acceptable Products:

.1 Unfaced insulation Rockwool Toprock DD by Rockwool Group Inc or accepted equal

.2 Faced insulation Rockwool Toprock DD Plus by Rockwool Group Inc or accepted equal

OR

.2 Polyisocyanurate foam rigid roof insulation board, Type 2, Class 2, manufactured with HCFC-free blowing agent bonded to inorganic, coated glass facers on top and bottom surfaces during the manufacturing process meeting the requirements of CAN/ULC-S126 and CAN/ULC-S107, conforming to CAN/ULC-S704 and CAN/ULC-S770 for Long Term Thermal Resistance (LTTR) R-values, approved and listed by Factory Mutual Global for Class 1-60 (1-90) windstorm classification and FM4450 approval requirements for Class 1 fire as a component in roof deck construction. Acceptable Products:

.1 "E'NRG'Y 3 CGF" as supplied by Johns Manville Canada

.2 "Resista" by Firestone

.3 "Ikotherm III" by IKO Industries Ltd.

.4 "ACFoam III" by Atlas

.5 Or accepted equal

.3 Tapered insulation: Of same material as roof insulation specified, factory tapered as required to provide slopes in areas shown. Minimum slope to be 2%.

.4 Membrane accessories

.1 Perimeter membrane fastening: Firestone "AP" fasteners, Carlisle "HP" or Johns Manville "Ultrafast", with corrosion coating.

.2 Perimeter edge flashing reinforcement strips: Firestone Reinforced Perimeter Fastening (RPF) strip with QuickSeam tape or accepted equal.

.3 Flashing membrane: Minimum 1.5 mm thick, non-reinforced, Firestone "RubberGard EPDM FormFlash" or accepted equal by Johns Manville or Carlisle

.4 Seam Primer: for cleaning and priming of EPDM membranes. Firestone "QuickPrimee Plus" or accepted equal.

.5 Splice tape: 100% solids rubber polymer tape, Firestone "Quickseam Splice Tape", Carlisle "Secur-Tape", Johns Manville "EPDM Seam Tape".

.6 Bonding adhesive (flashings): Firestone "RubberGard Bonding Adhesive", Carlisle "90-8-30A", Johns Manville "EPDM Bonding Cement".

.7 Lap sealant: Firestone "Lap Sealant LS-3029", Carlisle "Lap Sealant", Johns Manville "EPDM Lap Caulk".

- .8 Water cut-off mastic: Firestone "Water Block Seal S-20", Carlisle "Water Cut-Off Mastic", Johns Manville "EPDM Nite Stop", to seal membrane terminations.
 - .9 Pourable sealer: Firestone "S-10", Johns Manville "Pourable Sealer" or Carlisle equal.
 - .5 Roof-to-roof expansion joint system: Consisting of, or a combination of, the following:
 - .1 Single ply membrane flashing: Specified roof membrane.
 - .2 Insulated flexible flashing to suit joint width, and utilizing EPDM bellows, Johns Manville "Expand-O-Flash" or Carlisle equivalent or accepted equal.
 - .3 Loose insulation: Loose fibreglass, basalt wool or mineral wool.
 - .4 Flexible flashing bottom support: Lexcor "FR40" or accepted equal.
 - .6 Butyl tape: Tremco 440 II Tape, 3 mm thick x 25 mm wide or accepted equal.
 - .7 Ballast
 - .1 Nominal clear 40 mm to ASTM D448 Size 4, dry, clean, smooth river washed stone with rounded edges and corners free of fractures, loam, sand, dust or other foreign substances that will contribute to membrane degradation.
 - .2 Capable of withstanding weather exposure without significant deterioration.
 - .8 Gypsum-Based Cover Board: Non-combustible, water resistant gypsum core with embedded glass mat facers, complying with ASTM C1177/C 1177M, and with the following additional characteristics:
 - .1 Thickness: 13 mm thickness or as indicated on Drawings.
 - .2 Surface Water Absorption: 2.5 g, maximum, when tested in accordance with ASTM C473.
 - .3 Spanning Capability: Recommended by manufacturer for following minimum flute spans:
 - .4 Surface Burning Characteristics: Flame spread of 0, smoke developed of 0, when tested in accordance with ASTM E84.
 - .5 Combustibility: Non-combustible, when tested in accordance with ASTM E136.
 - .6 Factory Mutual approved for use with FM 1-60 and 1-90 rated roofing assemblies.
 - .7 Mold Growth Resistance: Zero growth, when tested in accordance with ASTM D3273 for minimum of 4 weeks.
 - .8 Pre-primed for better adhesion.
 - .9 Acceptable Product:
 - .1 DensDeck Prime Roof Board by Georgia-Pacific
 - .2 DEXcell FA by Johns Manville Canada
 - .3 Or accepted equal.
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2.2 SHEET METAL FLASHING

- .1 As specified in Section 07 60 00.

2.3 ROOF ACCESSORIES

- .1 Roof drains: Thaler Metal Industries Inc. "RD-4A" or Altra Metal Specialties Inc. "ABD-AR-CR" aluminum body complete with underdeck clamping ring and stainless steel securement bolts with double nuts.
 - .1 Provision of adaptors for connection to roof drain bodies is specified in Division 22 – Plumbing.
- .2 Plumbing vent stack sleeve assembly: Aluminum preinsulated stack jack; Thaler Roofing Specialties Products Inc. "SJ-27/EPDM" of sizes, quantity and locations as required for the entire Project.
- .3 Pipe/conduit sleeve assembly: Thaler "Model MEF-1A/EPDM" with storm collar flashing of size, quantity and locations as required for the entire Project.
- .4 Large pipe/"B" vent stack sleeve assembly: Thaler "Model SJ-2 EPDM" with storm collar flashing of sizes, quantity, and location as required for the entire Project.
- .5 Walkway grating: 900 mm overall width rooftop walkway system with bolt seats and walkway mitre sections; ISG Safety Grating Products "Roof Grip" or Fisher Ludlow "Shur-Grip".

2.4 PAVER-SURFACED ROOF ASSEMBLY

- .1 Precast concrete pavers: 35 MPa, air entrained, in size of 600 x 600 x 50 mm neutral grey colour, smooth finish, square edges, patio quality, complying with CSA A23.1 and passing the salt scaling test, with built-in pedestal system, Brooklin "Pedslab".
- .2 Filter fabric: Black, woven, polyolefin fabric, 86 g/m², "Fabrene VIE" by Dupont of Canada Ltd.
- .3 Rigid insulation sheathing: Extruded, expanded polystyrene to CAN/CGSB-51.20-M, Type 4, thickness as shown, Dow "Roofmate" with shiplap joints.

3 Execution

3.1 GENERAL

- .1 Perform Work per printed instructions of material manufacturer for specified system installation and as per installation parameters specified herein.
 - .2 Execute interface Work to existing adjacent roofing system, and have necessary inspection done by the warrantor in accordance with the terms and requirements of existing warranty and warrantor requirements.
 - .3 Do not phase roofing installation. Install complete roof system for a given roof area on a daily basis, including flashings.
 - .4 Have manufacturer's representative on Site on first week of roofing Work and ensure roofing installation techniques and procedures are acceptable.
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3.2 **INSPECTION**

- .1 Inspect all surfaces to be covered by this Work.
- .2 Ensure steel decks are suitably anchored and free from excessive deflection and differential movement. Note: steel decks are metric type.
- .3 Ensure that plywood and lumber nailer plates are installed and secured as required by the roofing system.
- .4 Before commencing Work, ensure environmental and Site conditions are suitable for installation of material in accordance with manufacturer's recommendations.
- .5 Ensure that substrates are free of bituminous substances, smooth, clean and dry and of sufficient strength to withstand construction traffic and equipment; and that flutes are free of standing water, ice, and debris.
- .6 Report to Consultant in writing, any conditions which may prejudice a proper installation. Commencement of Work implies acceptance of existing conditions.

3.3 **VAPOUR BARRIER**

- .1 Install vapour barrier in conjunction with insulation placement. Overlap side laps 100 mm on top of ribs, and end laps 150 mm, and seal with full bed of adhesive. Install vapour barrier parallel to deck flutes.
- .2 Provide removable galvanized sheet metal supports at vapour barrier end joints to enable proper lapping and sealing of joints. Place perpendicular to deck flutes. Lap and seal vapour barrier end joints only at sheet metal supports. Remove metal supports after sealing laps.
- .3 Apply vapour barrier to deck areas taking care not to puncture or damage vapour barrier and extend vertically set in adhesive to top of abutting vertical projections including curbs, parapets, etc. Seal ends to substrates with adhesive to provide continuity of building air/vapour barrier envelope.
- .4 Coordinate and sequence with roof woodwork installation so that only as much roof woodwork is installed as can be covered in any given day, and so that it is not exposed to inclement weather and does not become wet. Remove or replace warped or wet substrates.

3.4 **INSULATION**

- .1 Install insulation in straight parallel rows. Stagger side joints in adjacent rows 50% in the long dimension.
- .2 Install insulation with a full coat of adhesive.

3.5 **TAPERED INSULATION**

- .1 Install tapered insulation over the base roof insulation board to provide backslopes and crickets where indicated using adhesive. Do not mechanically fasten.
 - .2 Butt joints tight to adjacent boards and abutting surfaces, cut to fit as required.
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3.6 ROOFING MEMBRANE

- .1 The following paragraphs are general installation parameters and do not necessarily represent one manufacturer's system. Immediately following award of Contract, submit detailed installation instructions for system to be installed.
 - .2 Position a 1400 mm wide membrane sheet along the perimeter of the roof over insulation.
 - .3 Unroll membrane without stretching, and draw tight without folds or wrinkles. Allow membrane to relax for approximately one-half hour prior to joint splicing, fixing and flashing. Lap edges as recommended by manufacturer. When installed over metal deck, run membrane perpendicular to direction of flutes, where possible.
 - .4 Position membrane in shingle fashion wherever possible. Stagger end laps in such a way that a four-corner lap condition does not occur, that is, end lap of next sheet is staggered from the preceding sheet. Install an additional layer of membrane at points to receive wood sleepers for galvanized metal walkways.
 - .5 Fully Adhered Installation
 - .1 Turn back membrane and apply bonding adhesive at about the same time to both the exposed underside of the sheet and the substrate to which it will be adhered so as to allow approximately the same flash-off time. Apply adhesive evenly, avoiding globs, with a solvent-resistant paint roller or a spray rig designed to apply adhesives. Apply by rolling the adhesive on to both mating surfaces. Take precaution so as not to apply adhesive over any area that is to be later cleaned and spliced to another sheet or flashing.
 - .2 Allow adhesive to flash off until tacky. Touch the adhesive surface with a clean, dry finger to be certain that the adhesive does not stick or string.
 - .3 Roll the previously coated portion of the sheet into the coated substrate slowly and evenly so as to minimize wrinkles. To ensure proper contact, compress the bonded half of the sheet to the substrate with a stiff push broom using heavy pressure.
 - .6 Lap Splices
 - .1 Fold top sheet back about 300 mm to allow for cleaning of two mating surfaces. Remove dirt and excess dust and clean both dry mating surfaces at splice area using clean natural fiber rags saturated with specified cleaner. Change cloths and cleaning solution often to ensure a thorough cleaning of mating surfaces. Finished surface should be solid black in colour.
 - .2 Apply splice cement to both mating surfaces at rate prescribed by membrane manufacturer. Apply smoothly, continuously and relatively even to achieve a heavy coat.
 - .3 Just prior to closing splice, apply a continuous bead of in-seam sealant approximately 4 mm in diameter and no more than 6 mm wide along the edge of the fastening plate which is nearest the outside edge of the top membrane.
 - .4 After splice cement has dried to a point that it does not string or stick to a dry finger, allow top sheet lap to mate with lower sheet lap. Avoid stretching and wrinkling while brushing with hand pressure toward splice edge.
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- .5 Roll splice with a 50 mm steel roller, using positive pressure toward outer edge of splice to remove air and securely bond splice for 100% adhesion.
 - .6 Following time interval required by manufacturer, apply lap sealant to all splices.
 - .7 Check the splice edge for dust, dirt or other contaminants.
 - .8 Feather the lap sealant with a specially preformed tool so that the high point or the crown of the lap sealant is located over the edge of the splice. Clean the specially preformed tool occasionally for consistent crowning of the lap sealant.
- .7 Provide mechanical securement at the perimeter of roof, roof section, and at roof protrusions. Provide perimeter fastening and flashing system per manufacturer's specifications and standard details.

3.7 **MEMBRANE FLASHINGS**

- .1 Install flashings per reviewed Shop Drawings in strict accordance with manufacturer's printed instructions.
- .2 Clean rubber membrane substrates to be adhered. Apply bonding adhesive evenly, without globs or puddles, with a 230 mm plastic core paint roller. Apply bonding adhesive to both flashing and surface to which it is being bonded, at rate prescribed by membrane manufacturer.
- .3 After bonding adhesive has dried to point that it does not string or stick to a dry finger, roll flashing into adhesive. Care must be taken to ensure that flashing does not bridge where there is a change of direction.
- .4 Apply in-seam sealant on all vertical adhesive splices between adjoining sections of cured membrane flashing.
- .5 Extend flashing to points shown and fasten leading edge at 200 mm on center set in substrate adhesive.
- .6 Install flashing membrane as required to form inside and outside corners and other flashing details per manufacturer's standard details.
- .7 Overlay all vertical field splices at the base of a wall or curb with a 150 x 150 mm section (with rounded corners) of uncured pressure-sensitive flashing (black only) centered over the field splice.
- .8 Apply uncured flashing to overlay vertical seams (as required at angle changes), or to flash inside/outside corners, vent pipes, scuppers and other unusually shaped penetrations where the use of premoulded pipe flashings, cured EPDM membrane or pressure-sensitive flashing is not practical.

3.8 **ROOF DRAINS**

- .1 Install roof drain centered in depressed area of roof sump. Cut hole through insulation assembly and metal deck, to outside diameter and profile of drain body. Secure roof drain flange through insulation and roof deck with underdeck clamping ring.
 - .2 Cut out membrane for roof drain opening allowing for clamping of membrane with cast aluminum dome. Set leading edge of membrane in bed of mastic. Secure cast aluminum dome with integral clamping ring with double nuts on threaded studs.
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3.9 **ROOF BALLAST**

- .1 Install ballast over completed roof system at the following minimum rates:

- .1 Field: 50 kg/m²
.2 Perimeter: 60 kg/m²

3.10 **WATER CUT-OFFS**

- .1 Exercise daily care to prevent water from flowing beneath or into roof assembly by temporarily sealing loose edges of membrane at end of each day's Work and when inclement weather is threatening. Provide water cut-offs as follows:

- .1 Thoroughly mix components of water cut-off mastic to instructions on can labels.
.2 Substrates must be clean and dry to obtain adhesion.
.3 Apply water cut-off mastic and embed membrane; check for continuous contact and weight edge over entire length of cut-off.
.4 Pull sheet free from substrate surface before roofing installation resumes.

3.11 **ROOF ACCESSORIES**

- .1 Install prefabricated miscellaneous roof accessory units in accordance with manufacturer's details and directions.

3.12 **ROOF-TO-ROOF EXPANSION JOINTS**

- .1 Lap flexible flashing membrane 150 mm into roof vapour barrier and seal. Carry up on steel channel members and metal curbs and over top forming a "U" configuration. Use adhesive recommended by membrane manufacturer. Lap end joints minimum 100 mm and fuse using hot air welding methods in accordance with the printed directions of the flashing manufacturer. Fill "U" void with loose insulation.
.2 Coordinate placing of wood blocking atop wings of flexible flashing.
.3 Place insulated flexible flashing. Nail flaps to wood blocking at 200 mm o.c. staggered. Lap joints as specified for flexible flashing above.
.4 Over-cover entire assembly with roofing membrane, carry 200 mm down vertical face each side of curb with adhesive. Apply lap sealant at edge termination.

3.13 **FINAL CONNECTIONS AT SIDING-TO-ROOF EXPANSION JOINTS**

- .1 The installation of siding-to-siding expansion joints is in Section 07 46 19.
.2 Likewise, the installation of insulated flexible flashings or flexible flashings at siding and roof transitions between liner panel, girt and roof curb is also in Section 07 46 19.
.3 Connect the foregoing into roof construction. Install on a continuous butyl tape on each support. Roll flashing to tape with a steel roller to achieve a completely air tight seal. Butt tape ends tightly to each other.
.4 Splice all joints of insulated expansion joint flashings, and flexible flashings. Lap joints a minimum of 100 mm.
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- .5 Coordinate with metal deck and siding trade to maintain continuity of building air/vapour barrier system.

3.14 **EXPANSION JOINTS IN NEW ROOF**

- .1 Lap membrane air/vapour barrier 150 mm into roof vapour barrier and seal. Carry up on steel channel members and metal curbs and over top forming a "U" configuration. Use adhesive recommended by membrane manufacturer. Lap end joints minimum 100 mm and fuse using hot air welding methods in accordance with the printed directions of the flashing manufacturer. Fill "U" void with (preformed foam insulation) (batt insulation).
- .2 Install two ply base flashing to specified requirements. Carry up and over wood blocking. Terminate at edge of wood blocking and nail on at 200 mm o.c.
- .3 Over base flashing, install flexible flashing membrane. Adhere to substrate and lap joints as specified for air/vapour barrier above. Final securement shall be through mechanical fasteners driven from face of metal flashing. Provide a bed of rubberized sealing compound on flexible flashing at fastener points to seal around fastener penetrations.
- .4 Connect wall expansion joint system to roofing expansion joint system.

3.15 **BALLAST**

- .1 Install ballast over completed roof system at the following minimum rates:

<u>Location</u>	<u>Weight</u>
Field:	50 kg/m ²
Perimeter:	60 kg/m ²

3.16 **INSTALLATION - PAVED ROOF**

- .1 Insulation
 - .1 Place insulation sheathing over top of single ply membrane.
 - .2 Use full size sheathing boards wherever possible, and minimum half boards at abutting vertical surfaces. Place boards in tight contact at shiplap joints between boards and at abutting surfaces. When cutting board, cut completely through board thickness and trim to provide plain butt joints; do not break or tear insulation board to fit detail. Any areas of insulation system having voids will be rejected.
 - .3 Stagger end joints of insulation in adjacent rows 50%.
 - .4 Do not lay more insulation than can be completely covered as a finished roofing system on the same day. Install insulation board in straight parallel rows. Install insulation board in a tight fit to parapet walls.
 - .2 Filter Fabric
 - .1 Apply fabric unbonded over installed insulation.
 - .2 Install fabric shingle-fashion with edges overlapped 300 mm minimum. Use minimum sheet size 1800 mm in any direction.
 - .3 Slit fabric over roof penetrations. Cut out around roof drains and other openings.
-

- .4 Extend fabric up roof perimeter and roof protrusions. Do not secure fabric under metal counterflashing.
 - .5 Install pavers as fabric is placed.
 - .3 Precast Concrete Pavers
 - .1 Place paver seats over filter fabric.
 - .2 Gently place precast concrete, accurately aligned, with joints butt to moderate contact and with upper surface of pavers flush to each other.
 - 3.17 **TESTING AND INSPECTION**
 - .1 Inspect completed membrane and flashings for punctures, tears and discontinuous seams. Apply additional layer of membrane over punctures and tears, extending minimum 75 mm beyond damaged area in all directions.
-

The EPDM Roofing System consists of roofing Products supplied by the Roofing Supplier and an approved method of installing those Products. The Roofing Supplier hereby warrants that Roofing Supplier's supplied Products used in the Roofing System, as applied to the building specified below, will be free from defects in materials or workmanship and that the installation of those Products will be free from defects in workmanship. In the event that said Roofing System fails due to defects in materials or workmanship within a period of 10 years from the date installation is completed, the Roofing Supplier will, at its option, make repair or replacement of said Roofing System including the cost of the component roofing Products and the installation thereof.

This warranty does not cover structural damage to the roof physically inflicted by accidents, man-made causes, acts of God, acts of nature and the like or damage arising through misuse, abuse or use of said Roofing System in any way other than that specifically recommended by the roofing manufacturer.

This express warranty is in lieu of all other warranties expressed or implied, whether by law or otherwise, and the Roofing Supplier's liability shall not extend beyond the Warranty Period. The Owner's sole and exclusive right and remedy and the Roofing Supplier's sole obligation for any failure of the Roofing System shall be as provided under this warranty. The Roofing Supplier shall not be liable for consequential damages of any nature arising from failure of the Roofing System. In no event shall the Roofing Supplier's liability under this warranty or otherwise exceed the original cost to the Owner of the Roofing System including the cost of the component Roofing Products and the installation thereof.

This warranty will extend to the Owner identified below for the building specified upon the Owner's acceptance of its terms. It shall not be assignable but shall re-issue to subsequent owners during the Warranty Period for the balance of the Warranty Period upon their acceptance of its terms by written signature on a duplicate form and its submittal to the Roofing Supplier.

Claims under this warranty should be directed to the Roofing Supplier:

Building Owner

Address of Building

Area of Building

Date Installation Complete

AGREED

By _____
Building Owner

End of Section

Date Final Inspection and Approved

THE ROOFING SUPPLIER
(REFERRED TO IN SECTION 07 53 23 AS
"ROOFING WARRANTOR")

By _____
Serial Number

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- | | | |
|----|------------------|--|
| .1 | ASTM A167 | - Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip |
| .2 | ASTM A653/A653M | - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process |
| .3 | ASTM B370 | - Standard Specification for Copper Sheet and Strip for Building Construction |
| .4 | ASTM C920 | - Standard Specification for Elastomeric Joint Sealants |
| .5 | CAN/CGSB-37.29-M | - Rubber Asphalt Sealing Compound |
| .6 | CSA B111-74 | - Wire Nails, Spikes and Staples |
| .7 | AODA | - Accessibility for Ontarians with Disabilities Act |

1.3 **SUBMITTALS**

.1 Shop Drawings and Samples

- .1 Submit in accordance with Section 01 33 00.
- .2 Submit detailed Shop Drawings showing proposed method of shaping, forming, jointing, fastening, and application of sheet metal Work. Submit lists of materials to be used.
- .3 Submit a representative sample section of prepainted metal flashing illustrating "S" lock jointing, minimum 600 mm long. Submit sample well in advance of material fabrication.

1.4 **DELIVERY, STORAGE AND HANDLING**

- .1 Protect the Work of this section from damage. Replace damaged Work which cannot be satisfactorily repaired, restored or cleaned, at no cost to Owner.

1.5 **WARRANTY**

- .1 Warrant Work of this section for one year from damage including but not restricted to loosening and splitting of the flashing seams.

2 Products

2.1 **MATERIALS**

- .1 Prepainted sheet steel: 0.607 mm (24 ga) minimum thickness, commercial quality to ASTM A653/A653M, with Z275 zinc coating designation, prepainted with baked-on "WeatherX" or "Perspectra Series" in colour selected by Consultant.
- .2 Sheet steel: 0.607 mm (24 ga) minimum thickness, commercial quality to ASTM A653/A653M, with Z275 zinc coating designation.
- .3 Utility sheet aluminum: Furnish plain (embossed) pattern, 1.2 mm minimum thickness.
- .4 Copper sheet: Conforming to ASTM B370 cold rolled with a mass of 4882 g/m².
- .5 Stainless steel sheet: Conforming to ASTM A167, Type 316 (302) (304).
- .6 Isolation coating: Henry "410-02" or approved alternative.
- .7 Sealing compound: Rubber asphalt conforming to CAN/CGSB-37.29-M.
- .8 Sealant: One part polyurethane, Sika "RC-1", Tremco "Dymonic", or Sonneborn "NP-1", conforming to ASTM C920, Type S, Grade NS, Class 25.
- .9 Sealer for sealant boxes: "Chemlink M1 primer and 1-Part Pourable Sealer" as distributed by Building Resource.
- .10 Starter strips: Furnish a continuous run of starter strips of Z275 galvanized sheet metal, 20 gauge thick, of height shown on Drawings, with metal flashing interlocked to the starter strip. Where shown on the Drawing or where starter strips are exposed to view, use same prepainted metal as for flashing.
- .11 Back-up plates: Of same material and gauge as flashing used, (minimum 300 mm wide).
- .12 Fasteners: Conforming to CSA B111 of same material as sheet metal secured, of type, length and size suitable for the particular conditions. Where exposed fasteners are permitted, use colour matched nylon heads with cupped neoprene washers.

2.2 **SHEET METAL FABRICATION**

- .1 Brakeform prepainted sheet material to form copings shown on Drawings. End joints where adjacent length of metal flashing meet shall be made in accordance with jointing method specified hereinafter.
 - .2 Brakeform miscellaneous metal flashings and accessories on roof such as:
 - .1 Sheet metal flashings at roof expansion joints
 - .2 Starter strips
 - .3 Flashings at roof openings
 - .4 Overflow scuppers
 - .3 Use competent tradesmen and work accurately to details indicated and as herein specified.
 - .4 Hem exposed edges at least 12 mm for appearance and stiffness. Mitre and seal corners with sealant. Provide 25 mm upstand joint at corners.
 - .5 Apply a coat of isolation coating on the back side of aluminum in contact with dissimilar materials.
-

- .6 Downspouts and Overflow Scuppers
 - .1 Fabricate scupper drains, gutters and downspouts in shapes and sizes indicated, with mitered and welded corners. Include steel straps formed from galvanized sheet of thickness indicated. Include hangers and other attachment devices, end plates, trim, and other accessories required for complete installation.
 - .1 Gutters, scupper drains and downspouts: Form from galvanized steel sheet not less than 1.5 mm thick before galvanizing, and pre-painted.
 - .2 Profiles
 - .1 Gutter: Three-sided, size and profile as indicated on Drawings.
 - .2 Downspout: Rectangular, four-sided.
 - .3 Scupper drains: Four-sided.
 - .3 Additional Parts and Features
 - .1 Downspout hangers: Rigid construction.
 - .2 Downspout starters or fascia sump with downspout starter hole.
 - .3 Expansion joints: Loose-locked waterproof, at least one midway between outfall points.
 - .4 Transition for downspout to grade: Provide forty-five degree section.
- .7 Sealant Boxes and Sealant Fill
 - .1 Form sealant boxes as open topped boxes with topped edges stiffened by seaming. Make boxes not less than 50 mm larger than the object being flashed, 100 mm depth, and with minimum 100 mm flanges for stripping-in.

3 Execution

3.1 **INSTALLATION**

- .1 Install Work to details shown on Drawings.
 - .2 Exposed fastenings will not be permitted on horizontal Work exposed to view from the building exterior.
 - .3 Install starter strips where indicated or required to present a true, non-waving, leading edge. Anchor to back-up to provide rigid, secure installation. Secure starter strips with screws only, in accordance with FM 1-49 requirements.
 - .4 End joints where adjacent lengths of metal flashing meet shall be made using an "S-lock" joint. Execute by inserting the end of one coping length in a 25 mm deep "S" lock formed in the end of adjacent length. Extend concealed portion of the "S" lock 25 mm outwards and nail to substrate prior to installation of subsequent sheets. Face nailing of joints will not be permitted.
 - .5 End joints where adjacent lengths of metal flashing meet shall be made using a 300 mm long back-up flashing secured in place before installing flashing. Apply two beads of caulking compound on each side on the face of the back-up plate to seal ends of metal flashing. Leave 12 mm wide space between ends of adjacent lengths of metal flashing.
-

Fabricate back-up plates of the same material and finish as the metal flashing with which it is being used. Make back-up plate profile of the flashing allowing for metal thickness.

- .6 Install sealant boxes at locations and to details indicated. Fill boxes with insulation and sealer and slope top away from object being flashed. Coordinate with ACCU manufacturer for number of conduits, wires, etc.
- .7 Prepare and touch up scratches on prepainted material with air drying formulation of the coil coating paint. Replace material at no cost to Owner, if touching up is unacceptable to the Consultant.

3.2 **SEALANT**

- .1 Apply sealant where required to form weathertight seal between flashing and adjoining surface and between flashing and other Work of this section. Sealant Work consists of bedding between members where possible and with neatly formed sealant bead where exposed.

End of Section

-
- 1 General
 - 1.1 **SUMMARY**
 - .1 Section Includes
 - .1 Labour, Products, equipment and services necessary to complete the Work of this section.
 - 1.2 **REFERENCE**
 - .1 Conforms to the latest edition of the following
 - .1 AODA - Accessibility for Ontarians with Disabilities Act
 - 1.3 **QUALITY CONTROL**
 - .1 Applicator Qualifications
 - .1 Provide Work of this section, executed by competent applicators with minimum five years experience in application of Products, systems and assemblies specified and with approval, training and certification of Product manufacturers.
 - .1 Submit proof of manufacturer's installer certification for each fireproofing applicator.
 - .2 Applicator shall designate one individual as Works foreperson who shall be present at the place of the Works at all times throughout the work of this section when the work of this section is being performed.
 - 1.4 **PRODUCT DELIVERY, STORAGE AND HANDLING**
 - .1 Deliver the materials to the place of the Works in the manufacturer's unopened containers, containing the classification label, with labels intact and legible at time of use.
 - .2 Store materials in accordance with manufacturer's recommendations with proper precautions to ensure fitness of material when installed.
 - .3 Protect Work of this section from damage. Protect other Work from damage resulting from this Work. Repair damaged Work to the satisfaction of Consultant at no cost to Owner.
 - .4 Do not use damaged or adulterated materials and materials exceeding their expiry date.
 - 1.5 **ENVIRONMENTAL CONDITIONS**
 - .1 Maintain a 5°C (41°F) air and substrate temperature for twenty-four hours before, during, and twenty-four hours after application in accordance with manufacturer's instructions.
 - .2 Ventilate to dry fireproofing. In enclosed areas circulate interior air and exhaust to exterior. Do not apply intumescent fireproofing if relative humidity exceeds manufacturer's recommended percentage.
 - .3 Protect adjacent surfaces and equipment around application areas from overspray, marring or damage. Clean, polish or replace materials damaged to acceptance of Consultant.
-

1.6 **WARRANTY**

- .1 Warrant Work of this section against defects and deficiencies for a period of two years from date of Substantial Completion in accordance with the terms of the Contract, and provide such further extended warranty as may be required by the Contract.

1.7 **SUBMITTALS**

- .1 Product catalogues: Submit as Shop Drawings, up-to-date catalogue of Products proposed for use under this section in accordance with Section 01 33 00. Include the following in submittal:
 - .1 Materials list of Products proposed for use in the Work of this section.
 - .2 Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
 - .3 Certificates: Submit manufacturer's certification that installed fireproofing Products are suitable for the use indicated and comply with specified requirements.
 - .4 Field test report: Submit report of field tests to confirm compliance with Specifications and Drawing requirements.
- .2 Certification:
 - .1 Submit certified documentation for each worker performing Work of this section, to substantiate five years minimum of experience in intumescent fireproofing installation.
 - .2 Submit installer's certification verifying compliance with Specification requirements.
 - .3 For assemblies not tested and rated in accordance with CAN/ULC S101 and CAN/ULC S102, submit proposals based on related designs using accepted fireproofing design criteria.
- .3 Contractor's quality control: Proposed quality control procedures for hot or cold weather conditions, and for finishing and curing methods.

2 Products

2.1 **MATERIALS**

- .1 Intumescent fireproofing - interior exposure: A/D Firefilm III System including basecoat and protective decorative finish coat by A/D Fire Protection Systems Inc. or accepted equal:
 - .1 Primer: One coat Carboguard 635.
 - .2 Intumescent coating: Water based, A/D Firefilm III.
 - .3 Topcoat: A/D Colorcoat
 - .4 Colour: As selected by the Consultant.
-

- .2 Intumescent coating - Water based, thin film, fire resistant intumescent coating with low VOC for interior wood floor. Coating shall be applied to achieve up to 2 hour fire rating, unless indicated otherwise.
 - .1 Surface burning characteristics in accordance with ASTM E119 or CAN/ULC-S101.
 - .2 Acceptable Manufacturer
 - .1 Forcefield Fireguard E-85 by Shield Industries Inc.
 - .2 Or accepted equal

2.2 **MIXING**

- .1 Mix Products to manufacturer's instructions.

3 Execution

3.1 **EXAMINATION**

- .1 Verify condition and dimensions of existing Work. Immediately report defects in writing, to Consultant. Commencement of Work will be considered acceptance of existing conditions.
- .2 Verify substrates compatible and have suitable bonding characteristics to receive fireproofing. If requested by Consultant, carry out Commercial Blast Cleaning (SSPC-SP6/NACE No. 3) for steel surfaces.
- .3 Ensure items required to penetrate fireproofing placed before installation of fireproofing.
- .4 Ensure ducts, piping, equipment, or other items, which would interfere with application of fireproofing not positioned until fireproofing completed.

3.2 **APPLICATION**

- .1 Use temporary enclosures to prevent spray from contaminating air beyond application area. Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of fireproofing material. Protect walls, windows, floors and other surfaces around areas to be fireproofed, from marring or damage.
 - .2 Clean surfaces to be fireproofed of any foreign matter which would affect adhesion.
 - .3 Apply primer as recommended by fireproofing manufacturer for the particular substrate to be fireproofed.
 - .4 Apply fireproofing in separate coats in accordance with the manufacturer's instructions to total thickness required to achieve fire ratings shown on Drawings. Comply with accepted ULC or WHI design.
 - .5 Apply decorative finish coat according to manufacturer's recommendations.
 - .6 Maintain continuity of fireproofing without gaps or voids.
 - .7 Repair fireproofing damaged by other trades, as directed by the Consultant.
-

3.3 **FIELD QUALITY CONTROL**

- .1 In addition to field tests required by authorities having jurisdiction, perform random tests, or as directed by Consultant, to verify thickness of intumescent fireproofing in accordance with technical manual 12B, First Edition, Standard Practice for the Testing and Inspection of Field-Applied Thin-Film Intumescent Fire-Resistive Materials; an Annotated Guide, published by the Association of the Wall and Ceiling Industries - International. Inspection shall be carried out prior to application of the protective top coat.

3.4 **SITE CLEAN UP**

- .1 Remove excess materials and other debris resulting from Work of this section from Site and leave premises in a condition acceptable to Consultant.
- .2 Clean exposed wall, ceiling or other surfaces of fireproofing materials to acceptance of Consultant

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.
- .2 Work of this section includes but is not necessarily limited to, the following:
 - .1 Firestopping and smoke seals at penetrations through fire rated assemblies to match fire rating of such structures, in accordance with the Contract Documents, including but not limited to the following locations:
 - .1 Penetrations through fire resistance rated masonry and gypsum board
 - .2 Top of fire resistance rated masonry walls and gypsum board walls
 - .3 Intersection of fire resistance rated masonry and gypsum board
 - .4 Control joints in fire resistance rated masonry and gypsum board
 - .5 Openings and sleeves installed for future use in fire resistance rated separations
 - .6 Perimeter of floors at exterior walls
 - .7 Process and building services penetrations through floors
- .2 Ensure firestopping system provides fire-resistance rating (flame and temperature) not less than fire resistance rating of surrounding floor, wall or assembly, in accordance with requirements of OBC.
- .3 Firestop system rating: Comply with F, FH, FT, or FTH ratings as required by authorities having jurisdiction.

1.2 **RELATED SECTIONS**

- .1 Divisions 21, 22, 23, 26 and 27: Mechanical, Electrical and Communications: Firestopping and smoke seals within mechanical assemblies (i.e. inside ducts, dampers) and electrical/communication assemblies (i.e. inside bus ducts).

1.3 **REFERENCES**

- .1 Conform to the latest edition of the following:
 - .1 ULC-S115, Standard Method of Fire Tests of Firestop Systems
 - .2 CAN/ULC S102-M, Standard Test Method for Surface Burning Characteristics of Building Materials
 - .3 ASTM E2174, Standard Practice for On-Site Inspection of Installed Fire Stops
 - .4 ASTM E2307, Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi Story Test Apparatus
-

.5 International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgements

.6 AODA, Accessibility for Ontarians with Disabilities Act

1.4 QUALIFICATION

.1 Subcontractor qualifications: Accredited firm with not less than five years satisfactory experience as recommended by firestopping/smoke seal manufacturer.

1.5 SUBMITTALS

.1 Shop Drawings: Submit in accordance with Section 01 33 00.

.2 Submit manufacturer's Product data for each material to be used, and fire test certifications for assemblies as applicable to the Work.

.3 Submit details of each type of penetration and materials to be incorporated as smoke stop and/or firestopping assembly.

1.6 QUALITY ASSURANCE

.1 Job mock-up: Provide sample application at each type of penetration at the Site, in the presence of Consultant. After approval, such mock-up to constitute standard of acceptance for remainder of Work.

.2 Firestopping assemblies through fire rated structures are to comply with ULC or Warnock Hersey approved assemblies.

.3 An approved manufacturer's representative to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.

.4 Firestop systems do not re-establish the structural integrity of load bearing partitions/assemblies or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

.5 For those firestop applications that exist for which no ULC or cUL tested system is available through a manufacturer, a manufacturer's engineering judgement derived from similar ULC or cUL system designs or other tests will be submitted to local Authorities Having Jurisdiction for their review and approval prior to installation. Engineer judgement drawings must follow the requirements set forth by the International Firestop Council.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials in original unopened containers or unopened packages, with manufacturer's labels attached, installation instructions, and lot numbers intact and legible.

.2 Store materials in original containers, out of weather, and at a temperature below 32°C (90°F).

1.8 JOBSITE CONDITIONS

.1 Unmixed liquid components of foam are to rest in their original, unopened containers at a temperature between 18°C and 27°C (65°F and 80°F) for twelve hours before use.

.2 Sealant may be applied at temperatures ranging from -38°C to +71°C (-35°F to +160°F).

- .3 Do not apply materials when temperature of substrate or ambient air exceeds manufacturer's stated limits.

2 Products

2.1 **PERFORMANCE REQUIREMENTS**

- .1 Provide fire stopping composed of components that are compatible with each other, the substrates forming openings and the items, if any, penetrating the fire stopping under conditions of service and application, as demonstrated by the fire stopping manufacturer based on testing and field experience.
 - .2 Provide components for each fire stopping system that are needed to install fill material. Use only components specialized by the fire stopping manufacturer and approved by the qualified testing agency for the designated fire resistance rated systems.
 - .3 Fire stopping materials are either "cast-in-place" (integral with concrete placement) or "post-installed". Provide cast-in-place firestop devices prior to concrete placement.
 - .4 Provide a round fire-rated cable management device whenever cables penetrate the fire rated walls, where frequent cable changes and additions may occur. The fire-rated cable management device shall consist of a corrugated steel tube with zinc coating, contain an inner plastic housing, intumescent material rings and inner fabric smoke seal membrane. The length of the sleeve shall be 315 mm. The fire-rated cable management device shall contain integrated intumescent firestop wrap strip materials sufficient to maintain the hourly rating of the barrier being penetrated. The fire-rated cable management device shall contain a smoke seal fabric membrane or intumescent firestop plugs sufficient to achieve the L-rating requirements of the barrier type. Install device per the manufacturer's published installation instructions.
 - .5 Penetrations in the fire resistance rated walls: Provide fire stopping with ratings determined in accordance with CAN/ULC S115-11.
 - .1 F-Rating: Not less than the fire resistance rating of the wall construction being penetrated.
 - .6 Penetrations in horizontal assemblies: Provide fire stopping with ratings determined in accordance with CAN/ULC S115-11.
 - .1 F-Rating: Minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.
 - .2 T-Rating: When penetrant is located outside of a wall cavity, minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.
 - .3 W-Rating: Class 1 rating in accordance with water leakage test per UL 1479.
 - .7 Penetrations in smoke barriers: Provide fire stopping with ratings determined in accordance with UL 1479 or ASTM E814.
 - .1 L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at both ambient and elevated temperatures.
-

- .8 Mold resistance: Provide penetration fire stopping with mold and mildew resistance rating of 0 as determined by ASTM G21.

2.2 **MATERIALS**

- .1 Fire stopping and smoke seal systems - general: Asbestos-free systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with ULC-S115, and suitable to actual Project application and installation conditions.

- .1 Acceptable manufacturers of rated systems:

- .1 Hilti
 - .2 A/D Fire Protection Systems
 - .3 Tremco
 - .4 Dow Corning
 - .5 3M
 - .6 Or accepted equal

- .2 Firestop fibre: Mineral fibre (complete with galvanized steel insulation clips and) bearing ULC or Warnock Hersey label, in width 25% - 33% larger than the space to be filled. Use one of the following:

- .1 "Firebarrier Firestopping" by A/D Fire Protection Systems
 - .2 "RXL Safe" by Roxul
 - .3 "Fire-Bloc 1" by M.W. McGill and Associates Limited

- .3 Cable management: Re-penetrable device for installation in wall and floor applications and resists temperatures up to 100°C. Steel with zinc coating, ABS plastic and glass-fiber fabric:

- .1 "Speed Sleeve CP 653" by Hilti Canada.

- .4 Damming materials, supports and anchorages: To firestopping/smoke and seal manufacturer's recommendations, as required by assembly.

- .5 Sheet metal closures: Galvanized sheet metal closures and fasteners appropriate to adjacent structures to be secured to. Sheet metal to be in accordance with ASTM A653/A653M with ZF75 zinc coating designation.

3 Execution

3.1 **PREPARATION**

- .1 Remove combustible materials and loose impediment from penetration opening and involved surfaces.
 - .2 Remove oil and other free liquids from penetration opening. Clean metal substrates with non-alcohol solvent.
-

3.2 **INSTALLATION**

- .1 Install firestopping and smoke seal systems in accordance with manufacturer's instructions and fire rated assembly requirements to establish continuity and integrity of fire separations.
- .2 Install primers as recommended by firestop Product manufacturers.
- .3 Install temporary forming, damming and back-up as required. Remove after firestopping and smoke seal materials have achieve initial cure and able to resist displacement.
- .4 Use resilient, elastomeric firestopping systems in the following locations:
 - .1 Openings and sleeves for future use.
 - .2 Penetration systems subject to vibration or thermal movement.
 - .3 Penetration systems in acoustical containment enclosures.
- .5 Trowel and tool exposed firestop Product surfaces to uniform, smooth finish.
- .6 Repair damaged firestopped surfaces to acceptance of Consultant.

3.3 **FIBRE FIRESTOPPING INSTALLATION**

- .1 Install fibre firestopping with minimum 25% to 33% compression in accordance with Product manufacturer's recommendations.
- .2 Butt succeeding sections of firestopping tightly against preceding piece. Do not leave any void.
- .3 Use two impaling clips per 1220 mm length of firestopping.

3.4 **FOAM INSTALLATION**

- .1 Follow manufacturer's installation instructions for damming penetration.
- .2 Seal gaps or cracks left after damming materials are in place.
- .3 Immediately after mixing, dispense liquid foam into penetration opening in accordance with manufacturer's installation instructions.
- .4 Do not overfill penetration openings with liquid foam. Foam expands approximately three times its original volume during cure. Comply with the following:
 - .1 When dispensing liquid foam continuously, be sure the thickness of liquid foam does not exceed 25 mm at any given spot.
 - .2 If opening is not filled when cured foam has completed its expansion, repeat injection and cure procedure until opening is filled to desired level.
- .5 Leave temporary damming in place for twenty-four hours to allow foam to fully cure.

3.5 **SEALANT INSTALLATION**

- .1 Apply sealant from cartridge or with trowel or putty knife from pail as applicable to detail or condition. Ensure sealant contacts with substrates of opening.
-

3.6 FIELD QUALITY CONTROL

- .1 Perform manufacturer's in-line quality control check at least once daily, and upon changing to new lot of material, to ensure performance of both dispensing equipment and foam Product prior to installing penetration seals.
- .2 Inspect cured penetration seal after twenty-four hour cure by removing temporary damming materials to examine seal.
- .3 Cured foam should completely fill penetration. Fill remaining gaps with freshly mixed foam or fire stop sealant. Reinspect after added material has cured twenty-four hours.
- .4 Damming materials required to achieve a specific fire rating must remain in penetration. Sheet metal closures which are shown on Drawings are to be reinstalled after inspections.

3.7 IDENTIFICATION

- .1 Identify each firestop penetration assembly with permanent label listing following:
 - .1 Assembly and rating in hours.
 - .2 Date of installation.
 - .3 Installing company's name and telephone number.

3.8 ADJUSTMENT AND CLEANING

- .1 Clean up foam or sealant spills following manufacturer's instructions on container label.
 - .2 Trim excess cured foam with a sharp knife or blade if required for finished appearances.
 - .3 Remove equipment, materials and debris, leaving area in undamaged, clean condition.
- End of Section
-

1 General

1.1 **SUMMARY**

.1 Section Includes

.1 Labour, Products, equipment and services necessary to complete the Work of this section, including but not limited to, the following:

.1 Type "A" conditions: All exposed joints on the exterior and interior of wall envelope and all joints throughout that are subject to movement. The principal locations are as follows:

.1 Perimeter of exterior hollow metal frames and steel channel frames at junctions with adjacent construction.

.2 Control joints in exterior masonry and concrete walls.

.3 Joint between truck dock shelter or door seals and adjacent construction.

.4 Other locations indicated on the Drawings.

.2 Type "B" conditions: All joints on the building interior that are not subject to movement and that require filling for appearance or sanitary reasons. The principal locations are as follows:

.1 Masonry control joints.

.2 Joints between metal frames of all kinds and adjacent construction, in interior partitions.

.3 Masonry wall inside corners in exposed locations; masonry-to-column junctures where masonry is anchored to steel.

.4 Other locations indicated on the Drawings.

.3 Type "C" conditions: Exposed areas on the building interior which require a mildew resistant sealant. The principal locations are as follows:

.1 Joints around washroom accessories, water closets, urinals, lavatories, vanities and shelves.

.2 Joints around counters at walls.

.3 Joints around shower accessories.

.4 Other locations indicated on the Drawings.

.4 Type "D" conditions: expansion and control joints, metal panel joints, curtain wall, perimeter seal around window frames, new and remedial construction.

1.2 **SEALANTS SPECIFIED IN OTHER SECTIONS**

.1 Section 03 30 00: Sealant in "vee" groove control joints.

.2 Section 07 60 00: Sealant within roof flashings.

- .3 Section 08 40 00: Sealant around aluminum entrances, windows, glazed curtain walls or windowwalls, both sides of wall.
- .4 Section 08 80 00: Sealant in conjunction with glazing.
- .5 Section 09 29 00: Sealant in conjunction with acoustically insulated gypsum board partitions.
- .6 Divisions 22 and 23: Packing and sealant around pipe and ductwork penetrations.
- .7 Divisions 26 and 27: Packing and sealant around electrical conduit and equipment penetrations.

1.3 REFERENCES

- .1 Conform to the latest edition of the following:
 - .1 ASTM C920 - Standard Specification for Elastomeric Joint Sealants
 - .2 SCAQMD - State of California's South Coast Air Quality Management District
 - .3 AODA - Accessibility for Ontarians with Disabilities Act

1.4 SUBMITTALS

- .1 Shop Drawings
 - .1 Submit in accordance with Section 01 33 00.
 - .2 Submit as Shop Drawings, printed literature of each sealant Product specified describing composition, together with recommendations or directions for surface preparation, material preparation and material installation.
 - .3 Product data submitted to show validation by the Sealant, Waterproofing and Restoration Institute (SWRI) for exterior sealants.
 - .4 In addition, submit colour charts for each sealant material for colour selection.

1.5 QUALITY ASSURANCE

- .1 Installer qualifications: The Work of this section shall be carried out by an installer having specialized in this Work as its primary business for at least five years, and having performed satisfactorily Work of this type, size and scope. Employ craftsmen who are thoroughly skilled and completely familiar with the specified requirements. Provide the services of a competent foreman or supervisor who shall be available at all times during the progress of the Work of this section.
- .2 Single source: Provide sealants of each joint type from one manufacturer.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials in manufacturers' original unopened containers with manufacturers' labels and seals intact. Labels to identify manufacturer's name, brand name, date of manufacture, grade and type, application directions, and expiry date or shelf life.
 - .2 Handle and store materials in accordance with manufacturers' printed directions. Arrange for suitable storage areas. Store flammable materials in safe, approved containers to eliminate fire hazards.
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1.7 **PROJECT SITE CONDITIONS**

- .1 Protect adjacent Work from damage resulting from Work of this section. Replace damaged Work at no increase in Contract Price.
- .2 Do not install sealants when ambient air temperature is less than 4°C (40°F) (-28°C (-20°F) for silicones) or when recesses are wet or damp; Provide temporary heated enclosures to comply with this requirement.
- .3 Protect adjacent exposed finished surfaces from damage, by masking or other approved means, prior to performing Work. Remove protection when no longer required and clean adjacent, exposed surfaces of any sealant deposited upon such surfaces.

1.8 **WARRANTY**

- .1 Warrant the Work for three years. Repair leakage, cracking, crumbling, melting, shrinkage, running, loss of adhesion or staining adjacent surfaces, occurring during the Warranty Period.

2 **Products**

2.1 **SEALANT**

- .1 General
 - .1 Low VOC: Use sealants with low volatile organic content to comply with SCAQMD Rule 1168
 - .2 Validation: Sealants are to have the validation of Sealants, Waterproofing and Restoration Institute (SWRI).
 - .3 Provide joint sealants that are compatible with backing material, accessories, substrates and adjacent sealants for the intended uses based on the testing, recommendations, experience, and written instructions of the sealant manufacturer.
 - .4 Colours for exposed joint sealants caulking: Provide joint sealant colours as selected by the Consultant from the manufacturer's full range of colours.
- .2 Sealant - type "A" conditions: Multi-component type in polysulphide or polyurethane type, as follows:
 - .1 Multi-component polysulfide: ASTM C920, Type M, Grade NS, Class 25, in standard colours as selected by the Consultant:
 - .1 W.R. Meadows "CM-60-7900-252"
 - .2 Sonneborn "Sonolastic Polysulfide Sealant"
 - .3 Sika "Duoflex NS/SL"
 - .4 Euclid Chemical, "Tammsflex NS/SL"
 - .2 Multi-component polyurethane: ASTM C920, Type M, Grade NS, Class 25, in standard colours as selected by the Consultant:
 - .1 W.R. Meadows "Dualthane 7900-232"

- .2 Sonneborn "Sonolastic NP 2"
 - .3 Tremco "Dymeric" or "Vulkem 227"
 - .4 Sika "Sikaflex 2C NS/SL"
 - .5 Euclid Chemical, "Eucolastic 2 NS or SL"
- .3 Sealant - type "A" conditions: One-component polyurethane or one-component silicone sealant to ASTM C920, Type S, Grade NS, Class 25, Use NT, M and A in standard colours as selected by the Consultant.
- .1 Tremco "Dymonic"
 - .2 Sonneborn "NP 1"
 - .3 Dow Corning "CWS or CCS"
 - .4 Bondaflex "PUR 25" (polyurethane) or Bondaflex "SIL 199" (silicone)
 - .5 Euclid Chemical, "Eucolastic 1 NS or SL"
- .4 Sealant - type "A" conditions: Silicone sealant to ASTM C920, Type S, Grade NS, Class 25, Use T, NT and M in standard colours as selected by the Consultant.
- .1 Dow Corning Corp. "790 Building Sealant" or "795 Building Sealant"
 - .2 GE "Silpruf LM"
 - .3 Tremco "Spectrem 1"
 - .4 Bondaflex "SIL 290"
- .5 Sealant - type "B" conditions: Non-sag, one part, acrylic polymer caulk, in standard colours as selected by the Consultant.
- .1 Tremco "Mono 555"
 - .2 DAP Inc. "Acrylic Polymeric Sealant"
- .6 Sealant - type "C" conditions: Mildew resistant silicone sealant to ASTM C920, Type S, Grade NS, Class 25, and meeting the requirements of FDA Regulation 21 CFR 177.2600, in standard colours as selected by the Consultant.
- .1 Dow Corning "786 Mildew Resistant Silicone Sealant" or "Tub Tile and Ceramic"
 - .2 GE Silicones "Sanitary 1700"
 - .3 Sonneborn "Sonolastic Omniplus"
 - .4 Bondaflex "SIL 100 WF"
- .7 Sealant type "D": Low dirt-pick-up, non-staining silicone sealant to ASTM C920, Type S, Grade NS, Class 50, Use T, NT and M in standard colours as selected by the Consultant.
- .1 Dow Corning "756 SMS Silicone Building Sealant"
 - .2 Bondaflex "SIL 295"; Matt Rogers (440) 487-2397
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- .8 Sealant type "S": Refer to Section 08 41 23 for Type S silicone sealant in fire rated glazing applications.
- .9 Sealant - exterior immersion conditions: Vulkem 171 primer and two-part chemically curing, pour grade Vulkem 245 polyurethane sealant or Bondaflex "PUR 25 with Primer 1000".

2.2 ACCESSORIES

- .1 Primers: As recommended by sealant manufacturers for various substrates, to allow proper adhesion and to prevent staining of adjacent surfaces.
- .2 Joint backing: Round, solid section, skinned surfaced, soft polyethylene foam gasket stock, to be under compression and to suit joint width and anticipated movement. Skin shall be of proper consistency to prevent bonding to sealant.
- .3 Bond breaker: Recommended by sealant manufacturers to prevent bonding of sealant to backing surface of recess.
- .4 Cleaning agents: As recommended by sealant manufacturer.

3 Execution

3.1 PREPARATION

- .1 Prepare joints to receive sealant and verify suitability. Failure of sealant in the future, due to claimed unsuitability of joint, will not be valid. Installation of sealant is considered as evidence that joint is suitable to receive sealant.
- .2 Clean recesses to receive sealant, free of dirt, dust, loose material, oil, grease, form release agents and other substances detrimental to sealant's performance. Remove lacquer or other protective coatings from metal surfaces, without damaging metal finish, using oil-free solvents.
- .3 Apply masking tape to metal surfaces adjacent to recesses to prevent smearing or staining of such metal surfaces.
- .4 Depth of recess to receive sealants are not to exceed one-half the joint width up to a maximum of 12 mm and not less than 6 mm at centre of joint.
 - .1 Where depth of recess is in excess of specified depth, place back-up material in recess, forced into place under compression, to provide specified recess depth.
 - .2 Where recess is less than specified depth, cut the back surface of recess to specified recess depth.
- .5 Recess to be dry when sealants are installed. Where recess for sealants is at proper depth, apply bond-preventative material to back surface of recess. Prime sides in accordance with sealant manufacturer's recommendations, to develop proper mechanical adhesion to negate latent moisture.

3.2 INSTALLATION

- .1 Use materials as received from manufacturers, without additives or adulterations. Use one manufacturer's Product for each kind of Product specified.
 - .2 Mix multi-component sealant until the sealant is thoroughly and uniformly blended and install sealant prior to start of hardening or curing cycle.
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- .3 Fill joints completely, regardless of variation of joint widths, and to proper depth as specified. Install sealants under pressure, without smearing adjacent surfaces.
 - .1 Type "A" sealant must have full and uniform contact with, and adhesion to, side surfaces of recess.
 - .2 Type "B" and Type "C" sealants must have full and uniform contact with, and adhesion to, all surfaces of recess.
- .4 Finish face of sealant smooth and even. At recesses in angular surfaces, finish sealant with a flat face, flush with face of material at each side. At recesses in flush surfaces, finish sealant with a concave face, flush with face of material at each side.
- .5 Sealant may be tooled, provided that such tooling does not damage seal nor tear sealant. Surface of sealants to be free from dirt, stain or other defacements and be uniform in colour.

3.3 **ADJUSTING AND CLEANING**

- .1 Remove any sealants not complying with requirements specified herein. Re-prepare recesses and install new sealants to provide finish Work complying with requirements specified, at no increase in Contract Price.
- .2 Clean surfaces adjacent to filled joints and remove sealant smears. At metal surfaces, remove masking tape and other residue. Exercise care in cleaning and removal operations, so as not to mar or damage finishes on materials adjacent to joints. Repair or replace marred or damaged materials, at no increase in Contract Price.

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **SUBMITTALS**

.1 Shop Drawings

- .1 Submit in accordance with Section 01 33 00.
- .2 Submit Shop Drawings showing extent of expansion joint assemblies. Include details showing profiles of assemblies, splice joints between sections, end conditions, anchorage, relationship to adjoining work, and finishes.
- .2 Submit manufacturer's product literature and installation instructions.
- .3 Submit samples of finishes for approval and colour selection.

1.3 **QUALITY ASSURANCE**

- .1 Conform to all applicable codes and the requirements of authorities having jurisdiction.
- .2 Expansion Joint Assemblies to conform to fire ratings indicated for construction assemblies into which they are to be incorporated.
- .3 Standard floor covers to withstand point load of 225 kg without damage. Heavy duty covers to withstand 900kg point load without damage.
- .4 Applicator Qualifications: Applicator specializing in applying the Work of this Section and with minimum 5 years documented experience.

1.4 **DELIVERY, STORAGE AND HANDLING**

- .1 Deliver materials in manufacturers' original unopened containers with manufacturers' labels and seals intact. Labels to identify manufacturer's name, brand name, date of manufacture, grade and type, application directions, and expiry date or shelf life.
- .2 Handle and store materials in accordance with manufacturers' printed directions. Arrange for suitable storage areas.

1.5 **PROJECT SITE CONDITIONS**

- .1 Protect adjacent Work from damage resulting from Work of this section. Replace damaged Work at no increase in Contract Price.
- .2 Apply Products only when ambient air and substrate temperature is less than 5°C and rising.
- .3 Protect adjacent exposed finished surfaces from damage, by masking or other approved means, prior to performing Work. Remove protection when no longer required and clean adjacent, exposed surfaces of any sealant deposited upon such surfaces.
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2 Products

2.1 **EXPANSION JOINT**

- .1 Fire-rated Connections: 1-hour fire-rated, watertight, non-staining, sound-attenuating, energy-efficient primary seals for structural expansion joints in vertical-plane applications. Use for joints from 12 mm up to 100 mm as indicated on Drawings. Fire-retardant-impregnated foam is factory pre-coated on both facing sides with a coat of waterproof silicone.

.1 Acceptable Manufacturer:

.1 "Emshield WFR1" by Emseal

.2 Or accepted equal

- .2 Wall and Roof: pre-coated, preformed, pre-compressed, self-expanding, low-modulus, factory applied silicone sealant system with an open-cell polyurethane foam infused with a water based, non-drying acrylic dispersion.

.1 Acceptable Manufacturer:

.1 "Seismic Colorseal" by Emseal

.2 Or accepted equal

- .3 Foundation: heavy-duty, double-cell, extruded thermo-plastic rubber gland with integral side flashing flanges, termination bars and anchors.

.1 Acceptable Manufacturer:

.1 "BG System" by Emseal

.2 Or accepted equal

2.2 **EXPANSION JOINT COVERS**

- .1 Extruded sections fabricated from aluminum alloy AA6063 T6C. Finish to be later selected by Consultant.

- .2 Expansion joint covers shall be manufactured by Construction Specialties (CS) or K.N. Crowder, Inpro equivalent or accepted equal:

.1 Wall to wall:

.1 CS "SM-1", K.N.C. "Xpanda WC-1", or Inpro equal, surface mounted, continuous for the length of the joint; covers with continuous vinyl seal on one side.

.2 Wall to ceiling:

.1 CS "SMC" or K.N.C. "Xpanda CC-1", or Inpro equal, surface mounted, continuous for the length of the joint; covers with continuous vinyl seal on one side.

.3 Floor to floor, floor to wall:

.1 CS Model "ELY" or Permaquik "FG" for floor to floor, and "FX2R" for floor to wall, recessed type", or Inpro equal.

3 Execution

3.1 **PREPARATION**

- .1 Examine surfaces to receive Work. Do not proceed unless conditions are acceptable for installation. Notify the Consultant, in writing, if defects exist which would prevent the satisfactory completion of this Work.
- .2 Verify all dimensions on site.
- .3 In fire rated separations, firestopping shall be completed prior to installation of expansion joint covers.

3.2 **FABRICATION**

- .1 Fabricate expansion joint covers, square, true, straight and accurate to required sizes and profiles.
- .2 Fabricate in maximum practical lengths to minimize joints.
- .3 Shop assemble covers ready for installation where practicable.
- .4 Fabricate joint cover assemblies with anchors, levelling nuts, filler inserts or shop applied protection as required for a complete installation to suit installation and project requirements.
- .5 Fabricate acceptable means of anchorage, such as anchor clips, expansion bolts and shields, welded studs or toggles.
- .6 Factory fabricate terminations and transitions.

3.3 **INSTALLATION**

- .1 Apply expansion joint assemblies in accordance with manufacturer's printed instructions.
- .2 Set Work plumb, square, level, free from distortion.
- .3 Install joint cover assemblies in true alignment and in correct relationship to expansion joints and adjacent surfaces.
- .4 Provide for thermal expansion and contraction of metal.
- .5 Set floor covers flush with adjacent floor finishes.
- .6 Install all covers securely, in continuous contact with adjacent surfaces.
- .7 Assemblies must be continuous, with mechanically aligned spliced joints. Keep end joints to a minimum.
- .8 Install preformed seals in continuous lengths; minimize number of end joints. Heat seal sliced joints.
- .9 Apply adhesive, as recommended by manufacturer, to both frame interfaces prior to installing seals.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- .1 ANSI/NAAMM HMMA-841- Tolerances and Clearances for Commercial Hollow Metal Doors and Frames
- .2 ANSI/NAAMM HMMA-867- Guide Specifications for Commercial Laminated Core Hollow Metal Doors and Frames
- .3 ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
- .4 ASTM A924/A924M - Standard Specification for Steel Sheet, Zinc-Coated Galvanized or Zinc Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- .5 ASTM D4726 - Standard Specification for Rigid PVC Exterior Profile Extrusions Used for Assembled Windows and Doors
- .6 CAN4-S104-M - Standard Method for Fire Tests of Door Assemblies
- .7 CAN4-S105-M - Standard Specification for Fire Door Frames Meeting the Performance Required by CAN4-S104
- .8 CSA W47.1 - Certification of Companies for Fusion Welding of Steel
- .9 CSA W59-M - Welded Steel Construction (Metal Arc Welding)
- .10 NFPA 80 - Standard for Fire Doors and Other Opening Protective
- .11 AODA - Accessibility for Ontarians with Disabilities Act

1.3 **SUBMITTALS**

.1 Shop Drawings

- .1 Submit in accordance with Section 01 33 00. Clearly show in detail, gauges of metal Work, assemblies, large screen frame sections and assembly details, fastenings, hardware cutouts and reinforcing, anchorage and finish.
- .2 Indicate doors and frames which are fire rated.
- .3 Submit manufacturer's Product data brochure as part of Shop Drawing submittal.

1.4 **COORDINATION**

- .1 Coordinate with finish hardware Supplier to ensure proper preparation of hollow metal doors and frames for finish hardware.
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- .2 Coordinate with electrical division for doors requiring conduits.

1.5 **DELIVERY, STORAGE AND HANDLING**

- .1 Protect Work against rust and damage during manufacture and delivery. Handle carefully to prevent distortion and wracking.
- .2 Protect hollow metal Work from damage. Replace damaged Work which cannot be satisfactorily repaired, restored or cleaned. Store materials on site in a manner to prevent damage.

2 **Products**

2.1 **MANUFACTURERS**

- .1 Source doors and frames from one of the following:
 - .1 Fleming Door Products Limited
 - .2 Artek Door
 - .3 Baron Metal Industries
 - .4 Daybar Industries Limited
 - .5 Or accepted equal

2.2 **MATERIALS**

- .1 Sheet steel: Commercial grade sheet steel conforming to ASTM A653/A653M. Sheet steel thicknesses specified are base metal thicknesses prior to galvanizing.
 - .1 Exterior Doors: coating designation Z275 (G90)
 - .2 Interior Doors: coating designation ZF75.
- .2 Frame Anchors: Commercial grade steel conforming to ASTM A653/A653M, Type B with minimum G90 (Z275).

2.3 **HOLLOW METAL DOORS (AND TRANSOM PANELS)**

- .1 General:
 - .1 Doors in general use areas:
 - .1 Interior and Exterior doors: 18 gauge skin thickness, polystyrene insulated, tack welded and filled edges.
 - .2 Doors in high security or sensitive facilities such as Police Stations where additional security is required:
 - .1 Exterior doors: 16 gauge skin thickness, steel stiffened, insulated.
 - .3 Provide 1-3/4" doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces without visible joints or seams on exposed faces unless otherwise indicated.

.2 Exterior Doors:

- .1 Medium duty: Insulated, polystyrene core. Minimum R-Value 2.6 in accordance with ASTM C1363 in thermally broken frame. Thermal performance maximum U-factor 0.39. Refer to Door Schedule for fire rating.
- .2 Heavy duty: Insulated, stiffened hollow steel core with polyurethane insulation in accordance with ASTM C1029. Minimum R-value 3.4 in accordance with ASTM C1363 in thermally broken frame. Thermal performance maximum U-factor 0.29. Refer to Door Schedule for fire rating.

.3 Interior Doors:

- .1 Medium duty: Manufacturer's standard kraft-paper honeycomb or one-piece polystyrene core, securely bonded to both faces.
- .2 Heavy duty: Stiffened hollow steel core with mineral fibre semi-rigid blanket and batt insulation in accordance with ASTM C592 or ASTM C553, Type 1.

.4 Adhesive:

- .1 Honeycomb core and steel components: Heat-resistant, spray grade resin reinforced neoprene/rubber based, low viscosity, contact cement meeting manufacturer's requirements and testing in accordance with UL/ULC certification requirements.
- .2 Interlocking edge seams for honeycomb cores: Resin reinforced polychloroprene (RRPC), fire resistance, high viscosity, sealant/adhesive meeting manufacturer's requirements and tested in accordance with UL/ULC certification requirements.

.5 Interior stiffeners: 0.91 mm thick (20 ga) steel.

.6 Sound deadening and insulating material: Semi-rigid fibreglass, 24 kg/m³ minimum density, to fill core space.

.7 Top caps: Rigid PVC extrusions conforming to CGSB 41-GP-19Ma. Fire labelled exterior doors to have factory installed flush steel top caps.

.8 Glazing stops: 1.5 mm thick (16 ga) steel, formed, drilled and countersunk for fastenings.

2.4 **DOOR ACCESSORIES**

- .1 Door louvres: Vee shaped sight tight, with double flat frames, with 40% minimum free area, of W25 galvanized steel sheet with manufacturer's standard shop primer finish in grey colour; Airvector "T20F", Kreuger "600A", K.N. Crowder "SDL-V90", or M.W. McGill "DG 2000".
 - .2 Fusible link door louvres: 1.6 mm (16 ga) cold rolled steel, fire actuated fusible link closure mechanism, minimum 25% free louvre area, baked enamel finish in colour selected by Consultant, listed and bearing the mark of ULC or Warnock Hersey. Accepted manufacturers: E. H. Price, Airflow, or K.N. Crowder.
 - .3 Screws: Tamperproof stainless steel screws with countersunk flat head.
 - .4 Door bumpers: In accordance with ANSI/BHMA A156.16, Type 6-180, grey neoprene.
 - .5 Hardware reinforcement: 3.4 mm thick (10 ga) steel.
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2.5 **HOLLOW METAL DOOR FRAMES**

- .1 Exterior Frames: Fabricated or hot-dip zinc coated steel that complies with ASTM A653/A653M, coating designation G90.
 - .1 Minimum 16-gauge thick steel sheet.
 - .2 Thermal break frames: Tested for thermal performance in accordance with NFRC 100 and resistance to air infiltration in accordance with ASTM E283. Where indicated provide thermally broken frame profiles for use in both masonry and drywall construction. Fabricate with 1/16" positive thermal break and integral vinyl weatherstripping.
- .2 Interior Frames: Fabricated from cold-rolled steel sheet complying with ASTM A1008/1008M.
 - .1 Minimum 16-gauge thick steel sheet.
 - .2 Fire rated frames: Fabricate frames in accordance with NFPA 80 listed and labeled by a qualified testing agency for fire protection ratings indicated.
 - .3 Frame jambs shall extend to surface of finish floor only. Provide frame jambs with 2-piece adjustable floor anchors.
 - .4 Hardware reinforcement: Fabricate with reinforcement plates from same material as frames.
 - .5 Conduit in hollow metal frames: To CSA C22.2 No. 83-M. EMT galvanized cold rolled steel tubing.
- .3 Frame Anchors
 - .1 Frames in masonry: Adjustable "T-strap" anchors and base anchor.
 - .2 Frames in precast (concrete): Countersunk galvanized expansion bolts complete with base anchors, and spacers behind hollow metal frame.
 - .3 Frames in steel channel sub-frames: Countersunk fluorocarbon coated self drilling screws complete with spacers behind hollow metal frame.
 - .4 Labeled frames: To conform to ULC or Warnock Hersey requirements.
 - .5 Frames in gypsum board partitions: Steel anchor clips and adjustable base anchors of suitable design securely welded inside each jamb.
 - .6 Floor anchors: Minimum 3.5 mm thick adjustable hot dip galvanized base anchors with two holes for bolting to floor.

2.6 **LIGHT OPENINGS AND GLAZING**

- .1 Refer to Section 08 80 00 for glazing types and applications.
 - .2 Stops and mouldings: Provide stops and mouldings around glazed lites where indicated. Form corners of stops and mouldings with butted or mitered hairline joints at fabricator's
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shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.

- .3 Mouldings for glazed lites in doors and loose stops for glazed lites in frames: Minimum 20 gauge, fabricated from same material as door face sheet in which they are installed.
- .4 Fixed frame mouldings: Formed integral with hollow metal frames, minimum 16 mm high unless otherwise indicated. Provide fixed frame mouldings and stops on outside of exterior and on secure side of interior doors and frames.
- .5 Preformed metal frames for light openings: Manufacturer's standard frame formed of cold rolled steel sheet with baked enamel or powder coated finish. Approved for use in doors of fire protection rating indicated. Match pre-finished door paint colour where applicable.

2.7

FABRICATION

- .1 Finish Work free from warp, open seams, buckles, weld and grind marks and other surface defects detrimental to attainment of a good paint finish in field. Form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.
- .2 Arc weld joints in accordance with CSA W59-M to produce a finished unit, square, true and free of distortion. Continuous weld joints unless specified otherwise. Execute welding by a firm fully approved by Canadian Welding Bureau to requirements of CSA W47.1.
- .3 Ream and remove burrs from cutouts and from drilled and punched holes.
- .4 Doors that do not require labels shall have label holes properly filled at the factory prior to shipping to Site.
- .5 Hollow Metal Doors and Transoms
 - .1 Doors: Flush swing type of sizes to details, schedules and reviewed Shop Drawings with cutouts for glass and grilles and reinforced to receive hardware fastenings.
 - .1 Blank, reinforce, drill and tap doors for mortised, template hardware. Where required, reinforce doors for surface-mounted hardware and door closers.
 - .2 Provide inverted, recessed, spot welded channels at top and bottom of doors. Provide PVC top caps on exterior doors.
 - .3 Provide cutouts with framing, glass stop mouldings and division bars where openings are required.
 - .4 Glass stops: Drill and countersink glass stops, secure with stainless steel tamper-proof flat head screws spaced at maximum 150 mm o.c. Provide stainless steel stops for stainless steel doors.
 - .5 Door seams:
 - .1 Laminated doors: Adhesive assisted lock seam.
 - .2 Steel stiffened doors: Continuous welded edges.

- .2 Exterior Insulated Doors:
 - .1 Vertical edges:
 - .1 Vertical edges to be mechanically interlocked with hairline seam, continuously welded, filled and ground smooth full height of door.
 - .2 Top and bottom edges:
 - .1 Reinforced tops and bottoms of doors with continuous steel channel minimum 16 gauge, extending full width of door and welded to face sheet.
 - .2 Doors with inverted top channel to include steel top cap welded in place with web of channel flush with face sheets of door.
 - .3 Plastic or composite fillers shall not be used.
 - .3 Transoms: Fabricate from same materials and construction and finish in same manner as doors.
 - .6 Frames and Screens
 - .1 Welded frames: Weld flush face joints continuously. Grind, fill, dress and make smooth, flush and invisible.
 - .1 Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping. Spreader bars are for bracing only and are not to be used to size the frame opening.
 - .2 Furnish exterior door frames with continuously welded integral steel weather drip at head of frame.
 - .2 Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 - .3 Floor anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 - .4 Where frames are set in masonry or concrete, supply adjustable anchors to trade installing frame.
 - .5 Fabricate frames for installation in gypsum board partitions with steel anchors. Minimum number of anchors for each jamb is as follows:
 - .1 4 anchors for frames up to 2285 mm.
 - .2 5 anchors for frames from 2285 mm to 2440 mm.
 - .3 5 anchors, plus one additional for each 600 mm over in height for frames over 2440 mm.
 - .6 Frames in previously placed concrete, masonry, precast or structural steel: Anchors located at maximum 150 mm from top and bottom of each jamb, and intermediate anchors at maximum 660 mm o.c.
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- .7 Prepare each door opening for single stud rubber door silencers. Three for single door openings located in strike jamb and two for double door openings located in head.
 - .7 Thermally broken door frames:
 - .1 For conditions where extreme temperature differences occur, use thermally broken commercial knocked-down or welded steel frames to decrease thermal conductivity.
 - .2 Manufactured from 16 gauge paintable galvalume steel.
 - .3 171.4 mm jamb depth.
 - .4 Where thermally broken welded frame is required, ensure welds do not cause thermal transfers between interior and exterior surfaces of frame sections.
 - .5 Fabricate interior and exterior sections of thermally broken frames with continuous PVC thermal break separation.
 - .6 Thermally broken sections shall not be assembled with screws, grommets or other fasteners.
 - .7 Closed sections (mullions and centre rails) of thermally broken frames to be factory insulated with 24 kg/m³ of loose batt type fiberglass material.
 - .8 Fire Rated Doors and Frames
 - .1 Fabricate doors and frames for hourly rating noted on door schedules in conformance with CAN4 S104-M and CAN4 S105-M. Furnish door and frames with the appropriate label of a testing organization accredited by Standard Council of Canada in conformance with the foregoing standards.
 - .2 Label the entire assembly of fire rated screens containing doors.
 - .3 Locate fire rating label on doors on hinged edge midway between top hinge and head of door. Locate fire rating label on frames in door rebate.
 - .4 Mortise, reinforce, drill and tap doors to receive template hardware and reinforce for surface mounted hardware, all as per requirements of foregoing standards.
 - .9 Temperature Rise Limit
 - .1 Where located in a firewall, fabricate doors to achieve the Temperature Rise Limit (TRL) indicated in the Ontario Building Code.
 - .2 Provide such doors with a combined fire rating/temperature rise limit label. Locate as previously specified.
 - .10 Insulated hollow metal transom panels: Same as for hollow metal door construction complete with drip flashings on exterior panels.
 - .11 Preparation for security system: Hollow metal doors will be monitored to a central security system as indicated on Drawings. Prepare frames and doors to accommodate concealed rotary switch hinge (C.R.S.) at the centre hinge point. Provide frame with metal mortar
-

guard at back side of hinge and with a 19 mm diameter rigid galvanized steel conduit from top of mortar guard to 300 mm above door head.

3 Execution

3.1 **INSTALLATION**

.1 Building-in of hollow metal frames in masonry is specified in Section 04 22 00 - Concrete Unit Masonry.

.2 Setting of hollow metal frames:

.1 Erect door frames, (glazed screen and borrowed light frames) plumb, square and level, maintaining widths and heights.

.2 Brace frames solidly in position while being built into masonry. Install temporary wood spreaders at mid-height of door frames, full width, until adjacent masonry Work is complete.

.3 Pack the door jamb and head voids which occur in exterior walls with specified insulation.

.4 Tap structural steel to coincide with fastener spacing on hollow metal door frame. Place spacer at each fastener location and install fastener.

.5 Tighten fastener, with head flush to frame. Apply metal filler to fastener head. Sand filler flush to frame and prepare for paint finish.

.3 Installation of doors and finish hardware is specified in Section 08 71 05 - Installation of Doors and Finish Hardware.

.4 Door Hardware and Painting

.1 Install door hardware supplied by Section 08 71 00 - Finish Hardware.

.2 Install door hardware in accordance with hardware templates and manufacturer's written instructions.

.3 Install louvres, glazing and silencers.

.4 Finish paint in accordance with Section 09 91 00 Painting.

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- | | | | |
|----|-----------------------|---|--|
| .1 | ASTM E152 | - | Methods of Fire Tests of Door Assemblies |
| .2 | CAN3-0188.1-M | - | Interior Mat Formed Wood Particleboard |
| .3 | CAN/CSA-0132.2 Series | - | Wood Flush Doors |
| .4 | CAN4-S104-M | - | Fire Tests of Door Assemblies |
| .5 | AODA | - | Accessibility for Ontarian with Disabilities Act |

1.3 **QUALITY ASSURANCE**

- .1 Except where more rigid requirements are specified, the current CAN/CSA-0132.2 series governs this section.

1.4 **SUBMITTALS**

.1 Submit Shop Drawings in accordance with Section 01 33 00.

- .1 Clearly show in detail, thicknesses, core construction, sizes, quantities, fastenings and finishes.

1.5 **DELIVERY, HANDLING AND STORAGE**

- .1 Wrap finished Products individually in protective wrapping for shipment and Site storage. Maintain a relative humidity of not less than 25% or not more than 55% in storage area.
- .2 Mark individual architectural door numbers in the top hinge cavity created by the machining of the hinges.
- .3 Deliver only after the building is enclosed and dry, heated and ventilated. Do not store in a damp area.
- .4 Handle to prevent damage thereto. Do not drag across each other or across other surfaces.
- .5 Pile delivered Products inside the building on 100 mm x 100 mm wood skids, with bottom face protected from air currents. Use three skids per pile.

1.6 **PROTECTION**

- .1 Protect the Work of this section from damage. Replace damaged Work which cannot be satisfactorily repaired, restored or cleaned. Store materials in a manner which will prevent damage thereto.
-

1.7 **WARRANTY**

- .1 Warrant the Work for the periods stated below. Further to requirements in the foregoing warranty, replace doors showing defects including warping, twisting, splitting, delamination, bubbling, sagging or showing core ghost lines, occurring within the warranty period.
- .2 Warranty periods as follows:
 - .1 Units with 448 kg/m³ core: Minimum three years.
 - .2 Units with 512 kg/m³ core: Life time of the doors.

2 Products

2.1 **ACCEPTABLE MANUFACTURERS**

- .1 Jeld-Wen
- .2 Masonite
- .3 Lambton Doors
- .4 Cambridge Door Ltd.
- .5 Or accepted equal

2.2 **MATERIALS**

- .1 Solid Core Door:
 - .1 Minimum 448 kg/m³ density, solid mat formed wood particleboard core conforming to CAN3-0188.1-M, or 512 kg/m³ particleboard conforming to ANSI A208.1 LD2.
 - .1 Door Style: Flush interior, 5-ply construction
 - .2 Door Finish: factory prime, painted to match existing.
 - .3 Perimeter Construction: solid lumber lock blocks, vertical stiles and top and bottom rails, bonded to core material.
 - .4 Glass stop: matching wood, flat bead types
 - .5 Stiles and rails shall be hardwood not less than 1 1/8" bonded to core where core is solid.
 - .6 Edge: to AWMAC Woodwork Standards, Type D - Solid Wood
 - .7 Thickness: 45 mm (1 ¾ inch)
 - .8 Size: 560 mm x 2135 mm
 - .9 Hardware: Refer to hardware schedule.
 - .10 Blocking: Provide blocking with screw holding capability for doors to receive surface mounted hardware.

- .3 Adhesive: Hot pressed, water resistant type conforming to glue line requirements of CAN/CSA 0132.2 series.
- .4 Sealer: Compatible with field applied finish. Coordinate with Section 09 91 00. In an unpainted condition, sealer to be visually recognizable for ease of inspection in the field
- .5 Door louvres: Vee shaped sight tight, with double flat frames, 25% minimum face area, of W25 galvanized steel with manufacturer's standard shop primer; Airvector "T20F", Kreuger "600A", K.N. Crowder "SDL-V90" or M.W. McGill "DG2000

2.3 **FRAMES**

- .1 Wood frame:
 - .1 Construct frames to AWS requirements for interior grade, standards and provide in sizes as indicated on Drawings.
 - .2 Plain sawn solid stock hardwood (in the same species as wood door face veneer) complying with premium grade requirements of AWMAC and matching the colour and graining of the door face veneer.
 - .3 Machining: Machine wood doors, paneling and frames, for hardware. Comply with final hardware schedules, shop drawings, and hardware template.
- .2 Hollow Metal Door Frames
 - .1 Steel: 1.5 mm thick (16 ga) steel.
 - .2 Hardware reinforcement: 3.4 mm thick (10 ga) steel.
 - .3 Channel door spreaders: 1.2 mm thick (18 ga) steel.
- .3 Frame Anchors
 - .1 Frames in masonry: Adjustable "T-strap" anchors and base anchor.
 - .2 Frames in precast (concrete): Countersunk galvanized expansion bolts complete with base anchors, and spacers behind hollow metal frame.
 - .3 Labeled frames: To conform to ULC or Warnock Hersey requirements.
- .4 Frames in gypsum board partitions: Steel anchor clips and adjustable base anchors of suitable design securely welded inside each jamb.

2.4 **VISION PANEL**

- .1 Glass for glazed wood doors shall be tempered and shall comply with Section 08 80 00.
- .2 Glass stops: Provide loose glazing stops as required for use under Section 08 80 00.
- .3 Wood glass stops: Solid hardwood, species to match face finish, and referenced quality standard.

2.5 **GENERAL FABRICATION**

- .1 Fabricate units under conditions which permit a balance control of the moisture content of all component parts to within range of 6% to 12%.
-

- .2 Fabricate doors with core specified, five-ply construction, with stiles and rails bonded to core.
- .3 Incorporate solid wood blocking at locations where finish hardware is installed.
- .4 Thoroughly sand back face of facing to provide a homogeneous bonding surface. Apply facing on cross banding to both faces of doors. Bond materials under pressure in accordance with the material manufacturer's printed specifications, to a perfectly smooth surface free from distortion, waves, ridges or core ghost lines.
- .5 Job application of door facing is not acceptable.
- .6 Fabricate transoms the same as doors; faces to match door face colour and pattern. Rebate transoms to door heads.

2.6 **FACTORY MACHINING**

- .1 Coordinate with allied trades and perform factory machining.
- .2 Undercut doors to accommodate carpet floor finish and bevel edges as required.
- .3 Accurately cut out openings to receive door louvres and glazing. Openings shall be square with internal corners slightly rounded. Install door louvres in doors, in accordance with door schedule.
- .4 Tack stops in place with countersunk head wood screws ready for final setting in the field.
- .5 Do preparation, accurately cut openings for and pre-fit mortise hardware in accordance with hardware manufacturer's templates and finish hardware schedule.
- .6 Wood Door Frames
 - .1 Construct frames to AWS requirements for interior grade, standards and provide in sizes as indicated on Drawings.
 - .2 Provide frames in single piece lengths of solid hardwood lumber.
 - .3 Machining: Machine wood doors, paneling and frames, for hardware. Comply with final hardware schedules, shop drawings, and hardware template.

2.7 **SEALING**

- .1 Completely seal all exposed wood edges and edges of cutouts before units are shipped from the manufacturer's mill or are placed in the open air or unheated storage areas at the mill which would result in a change in the specified moisture content of the wood. Apply sealer in accordance with sealer manufacturer's directions.

2.8 **PRIMING**

- .1 Shop prime doors for finish painting in the field.

3 Execution

3.1 **INSTALLATION**

- .1 Supply doors to Section 08 71 05 for installation.
- .2 Install doors plumb, rigid, square, clear of floor finishes and with correct rebate opening for door installation.

- .3 Reseal wood doors after fitting and trimming, particularly at top and bottom rails with wood door sealer and edge varnish.
- .4 Paint both lock and hinge side stiles with wood door paint and touch-up glazing stops as necessary.
- .5 Install hardware in accordance with hardware supplier's instructions.
- .6 Adjust fixed and operable hardware for correct clearances and function.

End of Section

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- 1 General
 - 1.1 **SUMMARY**
 - .1 Section Includes
 - .1 Labour, Products, equipment and services necessary to complete the Work of this section.
 - 1.2 **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 access door components and include product characteristics, performance criteria, physical size, finish and limitations.
 - .3 Shop Drawings:
 - .1 Submit catalogue details for each type of door illustrating profiles, dimensions and methods of assembly.
 - 1.3 **CLOSEOUT SUBMITTALS**
 - .1 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.
 - 1.4 **DELIVERY, STORAGE AND HANDLING**
 - .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .2 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 access doors from nicks, scratches, and blemishes.
 - .3 Apply temporary protective coating to finished surfaces. Remove coating after installation.
 - .1 Use coatings in accordance with manufacturer's written instructions that are easily removable.
 - .2 Leave protective coating in place until final cleaning of building.
 - .4 Replace defective or damaged materials with new.
- 2 Products
 - 2.1 **ACCESS DOORS**
 - .1 Non-rated Access Doors
 - .1 Door: 2.5 mm thick extruded aluminum alloy frame, screwed in gypsum board inlay complete with galvanized internal steel corner reinforcing. Door shall have a concealed hinge and be fully removable with a keyed cabinet lock. Door to be of type and fire rated to suit type of wall or ceiling construction in which they are installed. Finish: White powder coated.
 - .2 Frame: 2.5 mm thick extruded aluminum alloy frame, complete with galvanized internal steel corner reinforcing. Frame opening with perimeter EPDM gasket maintaining the STC of the gypsum board assembly.

- .3 Board: Access panel inlay shall equal the wall and ceiling specifications to maintain STC rating.
- .4 Hinge: Concealed, galvanized steel free pivot hinge to open doors 120 degrees. Access panel door shall be fully removable.
- .5 Locking devices: Key operated cylinder lock, two keys per lock, keyed alike.
- .6 Panel Size: 600 mm x 600 mm or 300 mm x 300 mm, unless indicated otherwise.
- .7 Acceptable Manufacturers
 - .1 Bauco "Softline" Clean Flush Access Door
 - .2 Acudor Access Door
 - .3 or accepted equal
- .2 Fire-rated Access Doors
 - .1 Door: 16 gauge steel, uninsulated fire-rated access door. Finish: White prime coated baked enamel finish
 - .2 Frame: 16 gauge steel flush to frame complete with galvanized reinforcing edges and taping bead flange.
 - .3 Hinge: concealed
 - .4 Latch: self-closing, self-latching bolt operated by knurled knob or flush key and inside turn release
 - .5 Locking devices: Key operated cylinder lock, two keys per lock, keyed alike.
 - .6 Fire Rating: UL 1-1/2 hour "B" label or ULC - 2 Hour "B" label.
 - .7 Panel Size: 305 mm x 305 mm, unless indicated otherwise.
 - .8 Acceptable Manufacturers
 - .1 "FB-5060" by Acudor Products Ltd.
 - .2 or accepted equal

2.2 **FABRICATION**

- .1 Manufacture each access panel assembly as a unit ready for installation on Site.
- .2 Furnish number of latches required to hold door flush for a uniform appearance when closed.
- .3 Provide installation instructions with each panel.
- .4 Rear of panel door leaf label indicating product model and size.

3 Execution

3.1 **EXAMINATION**

- .1 Examine areas to receive access doors. Notify Consultant if areas are not acceptable for installation. Do not begin installation until acceptable conditions have been met.

3.2 **INSTALLATION**

- .1 Follow manufacturer's instructions for installing access panels. Install access doors plumb, level and square.
- .2 Anchor frames securely in place.
- .3 Set frames to proper alignment with the wall or ceiling.

- .4 Position access panels for proper access to concealed equipment requiring access.

3.3 **CLEANING AND ADJUSTMENT**

- .1 Adjust panel after installation for proper operation. Remove drywall compound from hinge, frame and door leaf edge. Clean the frame and door with a damp cloth.
- .2 Remove and replace panels or frames that are warped, bowed or damaged.

3.4 **PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair or replace damage to adjacent materials caused by access door installation.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- | | | |
|-----|--------------------------|---|
| .1 | CAN/CGSB-12.8-M | - Insulating Glass Units |
| .2 | CAN/CGSB-12.3-M | - Flat, Clear Float Glass |
| .3 | CAN/CGSB-12.4-M | - Heat Absorbing Glass |
| .4 | CAN/CGSB-12.1-M | - Tempered or Laminated Safety Glass |
| .5 | CAN/CGSB-12.10-M | - Glass, Light and Heat Reflecting |
| .6 | CAN/CGSB-1.108-M | - Bituminous Solvent Type Paint |
| .7 | CAN/CSA G40.20/ G40.21-M | - Welded Structural Quality Steel/Structural Quality Steels |
| .8 | CAN/CGSB 19.24-M | - Multi-Component, Chemical-Curing Sealing Compound |
| .9 | ASTM A446/A446M | - Specification for Steel Sheet, Zinc Coated (Galvanized) by the Hop Dip Process, Structural (Physical) Quality |
| .10 | NAAMM AMP-505 | - The National Association of Architectural Metal Manufacturers, Applied Coatings |
| .11 | NAAMM AMP-501 | - The National Association of Architectural Metal Manufacturers, Finishes for Aluminum |
| .12 | AODA | - Accessibility for Ontarians with Disabilities Act |

1.3 **SUBMITTALS**

.1 Samples

- .1 Submit in accordance with Section 01 33 00.
- .2 Submit duplicate sample sections of all component parts of entrances, glass and spandrel panels, finished in specified colours. Sizes of samples as follows:
- | | |
|----|-----------------------------------|
| .1 | Extruded shapes: 300 mm |
| .2 | Each type of glass: 300 mm square |
-

.2 Shop Drawings

- .1 Submit in accordance with Section 01 33 00.
- .2 Show fabrication and erection details of all components and accessories. Prior to review by the Consultant, submit Shop Drawings and calculations to structural silicone sealant manufacturer for review and approval. Show the following on the Shop Drawings:
 - .1 Interface conditions with adjoining works.
 - .2 Sealant locations and joint detail including joint back-up.
 - .3 Interior structure and/or reinforcements.
 - .4 Extruded framing system for all members (plans and sections, in half full size, if not of the manufacture specified and drawn). Show thermal breaks and what material.
 - .5 Glazing and glass stop details, vinyl or neoprene mouldings (in half full size), and all anchorage and assembly fixings.
 - .6 Ventilator details showing hardware locations and a note confirming that operating hardware is accessible for unobstructed hand operation.
 - .7 List of materials used for every component.
- .3 Indicate how thermal expansion and contraction are to be accommodated and to what degree. Show connections to adjacent construction and provision made for structural deflections, contractions, expansion and other normal movement.

1.4 **GENERAL DESIGN**

- .1 Make thorough examination of all Drawings and details, check interfacing with Work of other Contracts and other factors influencing the engineering design and performance of the Work and be fully cognizant of requirements.
- .2 Drawings and Specifications do not intend to identify or solve the requirements of thermal, structural, vapour and air movement, methods of anchorage, flatness and other requirements. Be responsible for all of these aspects. Base design on the "rainscreen principle" as advocated by National Research Council of Canada (NRC).
- .3 Design to withstand without failure, the positive and negative forces imposed by wind, earthquake, temperature and shrinkage stress, deflections of the supporting or adjacent structures, all within deflection limitations governed by the design of the supporting structure. Calculate external pressure of suction due to wind on part or all of the surface of the units in accordance with the Ontario Building Code.
- .4 Design in such a way that completed installation is free from rattles, wind whistles and noise due to thermal and structural movement and air pressure.

1.5 **DESIGN REQUIREMENTS**

- .1 Be responsible for the design of components and accessories thereof and connections in accordance with the requirements of the Ontario Building Code.
 - .2 Design aluminum entrance system to accommodate following without detrimental effect:
-

- .1 Cyclic 40°C daily, thermal swing of components.
- .2 Cyclic, dynamic loading and release of loads such as wind loads.
- .3 13 mm vertical deflection in supporting structure and movement of supporting structure due to live, dead load, and creep or deflection, seismic load, sway displacement and similar item.
- .4 Restrict air infiltration/exfiltration, through alluminum assembly to 0.25 m³/h/m⁻¹ and doors to 2.79 m³/h/m⁻¹ at reference pressure differential of 75 Pa, when measured in accordance with ASTM E283.
- .3 No water infiltration when tested to ASTM E331 with pressure differential of 720 Pa (15.0 psf).
- .4 Design glass in accordance with CAN/CGSB-12.20-M. Perform stress analysis. Design units to accommodate live, dead, lateral, wind, seismic, handling, transportation, and erection loads.
- .5 Design and detail controlled drainage path to actively discharge water, which enters into or forms within curtain wall/window system, to exterior; design to prevent accumulation or storage of water within curtain wall, or window system. Prevent water from entering interior when tested in accordance with ASTM E331.
- .6 Design and detail air barrier, vapour retarder, insulation and rainscreen Products and assemblies into continuous and integrated curtain wall/window envelope. Optimize curtain wall/window design to align envelope layers and to minimize thermal bridges.
- .7 Prevent deflection and permanent or progressive glazing displacement. Restrict horizontal and vertical mullion deflection to less than L/175 (under uniformly distributed positive design wind load), and 10 mm maximum regardless of span.
- .8 Design anchorage inserts for installation as part of other sections of Work. Design anchorage assemblies to accommodate construction and installation tolerances.

1.6 **DELIVERY, HANDLING AND STORAGE**

- .1 Transport materials to the job site storage compound in such a manner as to prevent in-transit damage. These measures shall include, but not limited to, crating, polyethylene wrapping system, etc.
- .2 Store in a dry, protected area on site, in original undamaged containers with manufacturers labels and seals intact.
- .3 Provide interleaving protection between glass. Keep glass and interleaving dry and store cases in clean, cool, dry areas with temperatures above the dewpoint. Circulation of cool, dry air in storage areas is essential. Open cases and inspect units periodically for moisture accumulation. Do not store glass in direct sunlight without an opaque protective covering over same.
- .4 Remove damaged or unsatisfactory materials from the site and replace with new materials to the satisfaction of the Consultant at no cost to the Owner.

1.7 **QUALITY ASSURANCE**

- .1 Have a senior, qualified representative of the silicone sealant manufacturer present at the job site to supervise the butt glazing Work at all times.

1.8 **PROTECTION**

- .1 Protect the Work of this trade from damage. Protect Work of other trades resulting from the Work of this section.
- .2 Install at the factory, strippable coatings on all exposed surfaces of aluminum. Leave coating and protective wrappings on the surfaces through the period that other trades work proceed on the building. Remove on completion of the Work.
- .3 Comply with unpacking procedures as recommended by framing and glass manufacturers.
- .4 Make good all damaged Work caused by failure to provide adequate protection. Remove unsatisfactory Work and replace at no expense to the Owner.

1.9 **WARRANTY**

- .1 Warrant Work of this section against defects and deficiencies for the periods specified below from date Work is certified as substantially performed in accordance with the general conditions of the Contract.
- .2 Promptly make good defects and deficiencies which become apparent within the Warranty Period by replacing defective Work satisfactory to the Consultant and at no expense to the Owner.
- .3 Warrant the Work as follows:
 - .1 Work in general: Two-year warranty against defects and failure of system, and to remain completely weathertight and air and water leakproof within the tolerances and limits specified.
 - .2 Insulating units: Five-year warranty against breakage due to faulty workmanship or materials, loss of air seal and condensation.
 - .3 Tinted or reflective units: Ten-year warranty against peeling or becoming defective due to normal weather conditions.
 - .4 Anodized finish: Five-year warranty against fading, coating conversion and coating separation from metal.
 - .5 Fluoropolymer finish: Five-year warranty against peeling, checking, blistering or cracking, and be nonconvertible; fading shall be within ± 5 NBS.

2 **Products**

2.1 **MATERIALS**

- .1 Aluminum Extrusions: Alloy and temper recommended by aluminum-framed entrance door manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.090" wall thickness at any location for the main frame and door leaf members.
 - .2 Aluminum
 - .1 Extrusions: AA6063-T5 alloy, anodizing quality, conforming to ASTM B221.
 - .2 Plate and sheet: AA1100-H14 alloy, anodizing quality unless otherwise indicated minimum 3 mm thick, conforming to ASTM B209.
-

- .3 Exposed surfaces of aluminum shall be free of die marks, scratches, blisters, "leave-off marks", or other blemishes, whether left unfinished or finished.

2.2 **SYSTEM DESCRIPTION:**

- .1 Exterior Entrance: Thermally broken aluminum extrusions, factory anodized finish (or match existing), sealed insulated glass units with related flashings, hardware, anchorage, weatherstripping and attachment devices.
- .2 Interior Vestibules: aluminum extrusions, factory anodized finish (or match existing), sealed single pane tempered safety glass with related hardware, anchorage, and attachment devices. Extend vertical framing to underside of structural framing and provide required support.

2.3 **ALUMINUM ENTRANCE FRAMES**

.1 Non-thermally Broken, Single Glazed Systems

- .1 Extruded aluminum sections, 44 mm x 114 mm nominal dimension, flush glazing stops, internal drainage system.
- .2 Acceptable Manufacturer:
 - .1 "Tri Fab VG 450" by Kawneer
 - .2 "FlushGlaze 800 Series" by Alumaticor
 - .3 Or accepted equal

.2 Thermally Broken, Double Glazed Systems

- .1 Extruded aluminum sections, 44 mm x 114 mm nominal dimension, thermally broken, flush glazing stops, internal drainage system.
- .2 Acceptable Manufacturer:
 - .1 "Tri Fab VG 451T" by Kawneer
 - .2 "FlushGlaze BF 3400 Insulframe Series" by Alumaticor
 - .3 Or accepted equal

2.4 **DOORS (SINGLE GLAZING)**

- .1 Extruded aluminum sections, flush glazing stops, top rail and stiles, bottom and mid-rail or as indicated on Drawings.
 - .1 Narrow Stiles:
 - .1 "Narrow Stile 190" by Kawneer
 - .2 "Canadiana 100 Series" by Alumaticor
 - .3 Or accepted equal
 - .2 Medium Stiles:
 - .1 "Medium 350 Series" by Kawneer

- .2 "400 series" by Alumicor
- .3 Or accepted equal

2.5 **DOORS (DOUBLE GLAZING)**

- .1 Doors: Thermally broken exterior doors with insulated units with top rail and stiles, bottom and mid-rail or as indicated on Drawings. Weatherstripping, mechanically fastened and welded corner construction. Both the door and frame are thermally broken, and to accept most universal hardware.
 - .1 Narrow Stiles
 - .1 "Insulclad 260" by Kawneer
 - .2 "Institutional Insuldoor" by Alumicor
 - .3 Or accepted equal
 - .2 Medium Stiles
 - .1 "Insulclad 360" by Kawneer
 - .2 "Institutional Insuldoor 400A Series " by Alumicor
 - .3 Or accepted equal
- .2 Column covers and trim rings: Aluminum plate, roll formed curved 3 mm thick; two panels opposing; reveal (open) joints; columns with supports of Z275 galvanized support struts and clip assembly designed and engineered to hold the assembly in place.
- .3 Stools, sills and cover plates: Extruded aluminum and brake formed sheet stock.

2.6 **WINDOWS**

- .1 Aluminum Windows:
 - .1 Sliding windows compatible with Doors within this Section, 50 mm minimum nominal mullion depth frame. Make profiles of framing members as shown on Drawings.
 - .1 Acceptable Manufacturer:
 - .1 Kawneer
 - .2 Alumicor
 - .3 Or accepted equal
 - .2 Fixed Window type
 - .1 "516 or 518 Series" by Kawneer
 - .2 Truline 900 Series by Alumicor
 - .3 4100 Series by Oldcastle Building Material
 - .4 Or accepted equal

2.7 SPANDREL PANEL BACK-UP

- .1 Material: Minimum 0.76 mm thick (22 gauge) galvanized steel face sheet with rigid fibreglass insulation core of thickness shown bonded to same, supplemented by mechanical fasteners as applicable.

2.8 GLASS AND GLAZING MATERIALS

- .1 Glass Component Types
 - .1 Float glass, clear glazing quality, 6 mm thickness to CAN/CGSB-12.3-M.
 - .2 Tempered glass, clear glazing quality, 6 mm thickness, to CAN/CGSB-12.1-M, Type 2, Class B, Category II.
 - .3 Laminated safety glass at doors and sidelights: 6 mm thickness conforming to CAN/CGSB 12.1 M, Type 1, Class B with clear polyvinyl butyral interlay.
 - .4 Heat strengthened glass, glazing quality, 6 mm thickness, to U.S. Federal Spec. DD-G-1403, Type HS.
 - .5 Sandblasted Glass: tempered glass conforming to CAN/CGSB-12.1 M. Thickness: minimum 6 mm thick or as indicated on Drawings
 - .2 Double and Triple glazed insulating glass: Conforming to CAN/CGSB 12.8 M argon filled stainless steel spacers, grey sealant, as manufactured by Viracon, Guardian, LOF, PPG, AFGI, 6 mm thick clear outer pane and clear inner pane, with Low E coating on the #3 surface. All vision glass to have a minimum light transmittance of 66%. Glass to be float, tempered or heat strengthened in accordance with glass manufacturer's recommendations as substantiated by glass manufacturer's stress analysis for each glass location.
 - .3 Spandrel glass: Heat strengthened monolithic glass with water based silicone opaque white coating, submit sample for Consultant review. Opaci Coat 300 by Industrial Control Development or accepted equal.
 - .4 Glass for Vestibule Doors, Sidelites and Transoms
 - .1 Interior: 6 mm thick clear heat absorbing tempered glass as specified herein or as indicated on Drawings.
 - .2 Exterior: 6 mm thick tinted heat absorbing tempered glass as specified herein, tinted same as for insulating units or as indicated on Drawings.
 - .5 Glazing Materials
 - .1 Tape: Tremco "Polyshim II" or approved equivalent.
 - .2 Backer rod: Closed cell foam polyethylene rod, outsized minimum 25% larger than joint width and compatible with joint sealant.
 - .3 Neoprene or EPDM Setting Blocks: Durometer hardness of 85 \pm 5, Shore A.
 - .4 Silicone spacer blocks: Durometer hardness of 55 \pm 5 Shore A.
 - .5 Gaskets: Extruded EPDM.
-

- .6 Structural glazing sealant: One part structural silicone sealant, "SSG 4000 Ultraglaze" by GE Silicones or equal by Dow Corning. Confirm compatibility with glazing manufacturer's secondary sealant.

2.9 **DOOR FINISH HARDWARE**

- .1 As supplied by Building Finish Hardware Supplier.

2.10 **ACCESSORIES**

- .1 Perimeter sealant: One part silicone neutral cure low modulus sealant, GE Silicones "Silpruf SCS 2000" or equal by Dow Corning. Colour as selected by the Consultant from standard colour selection.
- .2 Screws, bolts and fasteners: Self tapping electrozinc plated or cadmium plated steel for aluminum to aluminum contact and stainless steel for aluminum to steel contact.
- .3 Steel reinforcements and anchors: Conforming to CAN/CSA-G40.20/G40.21-M, Grade 300W hot-dip galvanized to CSA G164-M requirements.
- .4 Isolation coating: Henry "410-02" bituminous paint or zinc chromate paint.
- .5 Thermal break material: Polyvinylchloride, of semi-rigid durometer hardness of 80, plus or minus 5, located on the external side of the glass pane.
- .6 Door weatherstripping: Heavy duty mohair pile material designed for easy removal and replacement when worn, complete with adjustable fixing to ensure a full "wipe" of the threshold below.
- .7 Compressible filler: Ceramar by W.R. Meadows or CPD Closed Cell Foam.
- .8 Airseal transition membrane: Soprema "Soprasolin" or W.R. Grace "Permabarrier", in width sufficient to properly bridge and seal joints around windows. Provide stainless fasteners and bars necessary to keep membrane in place.
- .9 Foamed-in-place air seals: Class 1, single component polyurethane foam conforming to CAN/ULC-S710.1, with flame spread rating of twenty or less and smoke developed of twenty-five or less. Density of 20.8 to 28.8 kg/m³, "Zerodraft Foam Sealant" by Canam Building Envelope Specialists Inc., or "Great Stuff Pro" by Dow Chemical Company, or "LEF" by Tremco, or approved alternative.
- .10 Backpan insulation: Semi-rigid glass fibre thermal insulation as follows:
 - .1 Owens Corning "AF530"
 - .2 Roxul "RXL 40"
 - .3 Fibrex Insulation, Inc. "Curtain Wall Type 4"
 - .4 Ottawa Fibre "OFI 48"
- .11 Loose insulation: Loose fibreglass or mineral wool.
- .12 Temporary strips: 25 mm wide, light reflecting, easily removable, pressure sensitive tape applied over all glass. Doors shall have two cross stripes at eye level, windows and curtain wall shall have corner to corner cross stripes from aluminum frames.

- .13 Safety decals: 25 mm wide pressure sensitive tape applied at eye level on the No. 4 surface of all glass lites in curtain wall at ground floor level. Design as selected by the Consultant.
- .14 Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum-framed entrance door members, trim hardware, anchors, and other components.
- .15 Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B633 for severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
 - .1 Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.
- .16 Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B456 for severe service conditions, or zinc-coated steel or iron complying with ASTM B633 for severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
 - .1 Weather Seals: Provide weather stripping with integral barrier fin or fins of semi-rigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.

2.11 **FABRICATION**

- .1 General
 - .1 Form all sections true to detail, free from defects impairing appearance, strength and durability.
 - .2 Fabricate frames with thermal breaks.
 - .3 Mullions and frames shall be tubular extruded shapes with sharp, well defined corners.
 - .4 Overall assembled profiles shall be as detailed on the Drawings. Curtain wall glazing shall be replaceable from the exterior while window glazing shall be replaceable from the interior.
 - .5 Make provision at all sealed horizontals to lead moisture accumulation to the exterior. Provide drainage leads in the pressure plates and horizontal snap-on covers for this purpose.
 - .6 Pressure plates shall be of extruded aluminum with integrally aligned sockets to receive and hold the latch bulbs of the snap-on face caps.
 - .7 Form continuous sills, stools and flashings with intermediate clips, anchorages and reinforcing and as much as possible, be shop assembled. Furnish all filler and closure pieces as required.
 - .8 Locate thermal break on the exterior side of the glazing and secure by snap-in methods without the use of any metallic fasteners which could reduce the effectiveness of the thermal barrier.
 - .9 Make provision in the Work for vertical and horizontal expansion and contraction and structural deflections.
-

- .10 Mitre and closely fit all corners of formed Work. Apply back-up sealants on the inside of joints. Provide drainage towards the exterior at the bottom of all glazing rebates.
- .11 Attach all anchorages to the warm side.
- .12 Carry out all welding with argon shielded electric arcs to ensure complete fusion of the metal.
- .2 **Doors**
 - .1 Aluminum doors shall have square snap-on glazing beads designed for EPDM glazing gaskets.
 - .2 Equip doors with full weatherstripping at perimeter. Install weatherstripping throughout the full length and width of the doors at jambs and heads.
 - .3 Fabricate doors and frames complete with all necessary internal reinforcements, cutouts, recesses, mortising or milling operations required for a rigid assembly and to accommodate finish hardware. All connections shall ensure adequate strength.
 - .4 Fabricate frames with joints accurately fitted and securely jointed together in a manner to ensure tightly fitting joints. Internally seal corners of frames and all joints exposed to water penetration using a material compatible to resist flow at the high surface summer temperatures to be experienced by the metal.
- .3 **Doors - Barrier Free Access**
 - .1 Prepare doors where indicated to accommodate power operators and pushbutton controls to allow barrier-free access. Provide a barrier-free logo above pushbutton.
 - .2 Coordinate as required for the satisfactory installation of finish hardware by Section 08 71 05.
- .4 **Insulated Spandrel Panel Back-Up**
 - .1 Form panels with offset edge flange to provide flush surface at edge of pan. Bond insulation to panel back-up with daubs of mastic adhesive.
 - .2 Provide integral reinforcing and stiffeners as required.
 - .3 Weld corners of panels and grind smooth or butter corner joints with butyl sealant.

2.12 **PROTECTION OF METALS**

- .1 Provide protection against galvanic action wherever dissimilar metals are in contact, either by painting the contact surfaces with a heavy coat of zinc chromate primer, or by the application of an appropriate sealant or tape.
 - .2 Protect aluminum which is to be in contact with cured concrete with zinc chromate primer or bituminous paint, and wherever crevices between the contact surfaces may entrap moisture or other corrosive elements.
-

3 Execution

3.1 **INSPECTION OF JOB CONDITIONS**

- .1 Inspect existing conditions upon which Work of this section is dependent. Report to the Consultant in writing any defects or discrepancies. Commencement of Work implies acceptance of existing conditions.

3.2 **INSTALLATION**

.1 Assembly and Anchorage

- .1 Anchor component parts securely in place by bolting, welding or other permanent mechanical attachment system, which will comply with performance requirements and permit movement as intended or necessary. Install slip-joint linings where required to ensure movement as per design.
- .2 Allow for complete adjustment in anchorage for levelling and positioning of units during installation.
- .3 Where welding is unavoidable for exposed non-ferrous Work during erection of curtain wall assembly, comply with CSA W59-M and recommendations of fully certified firm to CSA W47.1 for the particular metals and alloys being welded. Use methods and welding rods which will not distort members and will result in closest possible colour match. Grind exposed surfaces smooth, using wheels and compounds which are free of iron and other substances which would result in stains or discoloration of surfaces. Restore finishes after welding and grinding.

.2 Erection Tolerances

- .1 Limit variations from plumb, level or dimensioned angle to the following:
 - .1 3 mm maximum deviation in storey height, or in 3000 mm vertical run, or in 6000 mm horizontal run.
 - .2 6 mm maximum deviation in 12000 mm in any direction.
- .2 Limit variations from location (theoretical calculated positions in plan or evaluation based on established floor lines and column lines), including variations from plumb and level, to the following:
 - .1 9 mm total maximum deviation for member at any location.
 - .2 3 mm maximum change in deviation for member for 3000 mm run, any direction.
- .3 Limit offsets in end-to-end and edge-to-edge alignment of adjoining and consecutive members, which form planes, continuous runs and profiles, to the following:
 - .1 1.5 mm maximum offset in flush alignment, including those which are to be 12 mm or less out-of-flush, and including those which are separated 50 mm or less by a reveal or protrusion in plane of wall.

.3 Doors

- .1 Install doors plumb, square, level, free from warp, twist and superimposed loads.
-

- .2 Secure Work adequately and accurately to structure in the required position, in a manner not to restrict thermal movement.
- .3 Provide compressible filler over aluminum work at locations shown on Drawings.
- .4 Use aluminum or long-life coated steel screws, nuts, bolts, washers, rivets and all other fastening devices, colour to match doors and frames where exposed to view.

3.3 **GLAZING**

- .1 Use extruded gaskets for door and sidelight glazing.
- .2 Thoroughly wipe all surfaces receiving glazing materials with a cloth dampened in xylol to assure a clean surface.
- .3 Use glazing tape for glass and aluminum spandrel panels except at butt glazing, use structural silicone sealant and spacer blocks. Provide temporary pinning at butt glazed joints.
- .4 At horizontal mullions and frames secure lites with screw applied pressure plates into the main grid members. Mitre glazing tape at all end joints, corners and at junctions. Screw fasteners shall be 1/4-20 machine screws. Contain glazing tape on pressure plates with a rigid polyvinyl chloride spacer. Internal seal shall be bulb type silicone extrusions.
- .5 Place setting blocks at quarter points from each corner of glass. Centre glass in opening and press firmly against tape and combination of structural sealant and spacer blocks at butt glazed back-up vertical mullions. Provide isolation tape at edges of laminated glass to prevent staining of interply plastic from glazing materials. Roll-in inside resilient extrusion.

3.4 **JOINT SEALANT AND SEALS**

- .1 Pre-application conference: Arrange with the sealant manufacturer(s) for a visit to the job site by one of its technical representatives before beginning the sealing installation to discuss with the Contractor and the Consultant the procedures to be adopted, to analyze site conditions and inspect the surfaces and joints to be sealed, in order that recommendations may be made, should adverse conditions exist. Discuss the following items:
 - .1 Weather conditions under which Work will be done.
 - .2 Anticipated frequency and extent of joint movement.
 - .3 Joint design.
 - .4 Number of beads to be used in the sealing operation.
 - .5 Have manufacturer(s) send report to the Consultant.
- .2 Joint Sealant
 - .1 At interior and exterior joints between aluminum framing and adjacent Work of others execute the following Work:
 - .1 Install backer rod as required to provide sealant joints of proper form, thickness-to-width ratios, and to provide bond break at back side of

sealant. Where backer rod cannot be used, use bond breaker tape to back side of sealant joint substrate.

.2 Clean substrate surfaces to which sealant is to bond and apply sealant primers as recommended by sealant manufacturer.

.3 Seal joints continuous to produce weatherproof and visually acceptable joint installation.

.2 Install backer rod between butt glazed insulating and spandrel glass units, and between units to adjacent structures as shown. Seal joints continuous to produce weatherproof and visually acceptable joint installation.

.3 Seal all joints required for a weatherproof installation and against air/vapour leakage. Use materials in strict accordance with the manufacturer's printed instructions, and applied only by tradesmen specially trained or experienced in their use. Before applying sealants, completely remove all mortar, dirt, dust, moisture and other foreign matter from surfaces it will contact. Mask adjoining surfaces when required, to maintain a clean and neat appearance. Total sealing compounds to fill the joint and provide a smooth finished surface.

.4 Refer to and comply with workmanship requirements of Section 07 92 00.

.3 **Foamed-In-Place Air Seals**

.1 Prior to application, remove mortar, dirt, dust, moisture and other foreign matter from joints to be sealed.

.2 Apply seal in accordance with manufacturer's directions. Fill all joints. Trim off excess seal.

.4 **Airseal Transition Membrane**

.1 Apply primer and airseal transition membrane in accordance with membrane manufacturer's instructions. Use primer in conjunction with adhesive if part of system.

.2 Re-prime surfaces not covered with transition membrane during the same working day.

.3 Overlap airseal transition membrane 75 mm minimum. Lap in the direction of waterflow.

.4 Coordinate the airseal transition with adjacent parts of the Work.

3.5 CLEAN UP

.1 Maintain the units in a clean condition throughout construction period, so that they will be without deterioration or damage at time of Owner's acceptance. Select methods of cleaning which will promote achievement of uniform appearance and stabilized colours and textures for materials that weather or age with exposure.

.2 Immediately before time of Substantial Performance, wash glass thoroughly, inside and out.

.3 Do not use steel wool, wire brushes or steel scrapers on finished surfaces.

- .4 Daily during this Work, and on completion, remove from the job site, all rubbish, debris, broken glass, temporary safety markings and excess materials resulting from this Work.
- .5 Remove protective covering and coating from aluminum surfaces, inside and out, and clean all surfaces, remove all labels, temporary stripes and protective devices and polish all glass surfaces, immediately prior to final acceptance of the Work by the Consultant.

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.
- .2 Fire rated door and framing in complete systems for installation as vision lights in fire rated doors, full vision fire rated doors, sidelights, borrowed lights, windows, transoms in exterior and interior openings and fire rated partitions.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- .1 AAMA 501.1-2005 - Standard Test Method for Water Penetration of Windows, Curtain Walls, and Doors Using Dynamic Pressure
 - .2 AAMA 501.2-2003 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems
 - .3 AAMA 501.5-2005 - Test Method for Thermal Cycling of Exterior Walls
 - .4 AAMA 1503-1998: - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections
 - .5 AAMA 2603-2002 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels
 - .6 AAMA 2604-2005 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels
 - .7 ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low Alloy, and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2007.
 - .8 ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2006b
 - .9 ASTM E283-04 - Test Method for Determining the Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences across the Specimen
 - .10 ASTM E330-02 - Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference Procedure A
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| .11 | ASTM E331-04 | - Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference |
| .12 | ASTM E783-02 | - Test Method for Field Measurement of Air Leakage through Installed Exterior Windows and Doors |
| .13 | ASTM E1105-00 | - Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference |
| .14 | ASTM E90-04 | - Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements |
| .15 | ASTM E413-04 | - Standard Classification for Rating Sound Insulation |
| .16 | CAN-S101 | - Fire Endurance Tests of Building Construction and Materials |
| .17 | CAN4-S104 | - Fire Tests of Door Assemblies |
| .18 | CAN4-S106 | - Standard Method for Fire Tests of Window and Glass Block Assemblies |
| .19 | NFPA 80 | - Standard for Fire Doors and Fire Windows |
| .20 | NFPA 251 | - Standard Methods of Tests of Fire Endurance of Building Construction and Materials |
| .21 | NFPA 252 | - Standard Methods of Fire Tests of Door Assemblies |
| .22 | NFPA 257 | - Standard on Fire Test for Window and Glass Block Assemblies |

1.3 **SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 Submittal Procedures.
 - .2 Product Data: Submit latest edition of manufacturer's product data including product descriptions, technical data, ULC listings and installation instructions.
 - .3 Shop Drawings: Include plans, elevations and details of product showing component dimensions, including framed opening requirements, dimensions, tolerances and attachment to structure.
 - .4 Hardware Schedule: List of manufacturer-supplied hardware and verification of cylinder size complying the Section 08 71 00.
 - .5 Samples:
 - .1 Glass sample as provided by the manufacturer
 - .2 Sample of frame
 - .3 Verification of selected finish sample.
-

- .6 Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.
- .7 Certificate of compliance from glass and glazing manufacturers attesting that glass and glazing materials for project comply with the requirements and this Section.

1.4 **QUALITY ASSURANCE**

- .1 Installer qualifications: An installer who has completed a minimum of 5 glazing projects similar in material, design and extent to that of this Project in the last 2 years, and whose work has resulted in construction with a record of successful in-service performance.
- .2 Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are classified and labeled by ULC for fire ratings indicated. Assemblies must be factory welded or come complete with factory-installed mechanical joints and must not require job site fabrication.
- .3 Fire-Rated Window Assemblies: Assemblies complying with NFPA 80 that are classified and labeled by ULC, for fire ratings indicated. Assemblies must be factory-welded or come complete with factory-installed mechanical joints and must not require job site fabrication.

1.5 **DELIVERY, HANDLING AND STORAGE**

- .1 Deliver materials to the site in original crates and containers with the maker's name and brand distinctly marked thereon and with glass labeled as to types. Do not remove labels on glass until after Work is accepted by the Consultant.
- .2 Store materials within the building, in a clean, dry location. Fully protect materials from damage until ready for use.

1.6 **WARRANTY**

- .1 Warrant the following Work against defects and deficiencies for the 5 years from date Work is certified as substantially performed in accordance with the general conditions of the Contract:
- .2 Promptly make good defects and deficiencies which become apparent within the Warranty Period by replacing defective Work satisfactory to the Consultant and at no expense to the Owner.

2 **Products**

2.1 **MANUFACTURERS**

- .1 Fire Rated Door and Window Assembly:
 - .1 Glass Material: Fire-rated glass ceramic clear and wireless glazing material listed for use in non-impact safety rated locations with fire rating requirements from 20 to 90 minutes. "FireLite Plus" manufactured by Nippon Electric Glass Company, distributed by Technical Glass Products, equal by Safti-First or accepted equal.
 - .2 Frame System: Fire-rated brushed stainless steel (up to a 45-minute rating) frame system. "Fireframes Designer Series" by Technical Glass Products, equal by Safti-First or accepted equal.

2.2 **PERFORMANCE REQUIREMENTS**

- .1 Doors: Capable of providing a fire rating of 20, 45, 60 or 90 minutes.
- .2 Window Assembly: Capable of providing a fire rating of 20, 45, 60 or 90 minutes.
- .3 Openings: Applications in fire partitions or area separation walls and corridors where opening protection is specified. Capable of providing 20, 45, 60, or 90 minute rating.
- .4 Structural Performance:
 - .1 Design and size the system to withstand structural forces placed upon it without damage or permanent set when tested in accordance with ASTM E330 using load 1.5 times the design wind loads and of 10 seconds in duration.
 - .2 Positive wind load: as indicated on Drawings
 - .3 Negative wind load: as indicated on Drawings
 - .4 Member deflection: Limit deflection of the edge of the glass normal to the plane of the glass to 1/175 of the glass edge length or 3/4 inch, whichever is less of any framing member.
 - .5 Accommodate movement between storefront and adjoining systems.
- .5 Air infiltration: Provide systems that allow a maximum air leakage through fixed glazed openings of 0.06 cfm/sq. ft. of area when tested per ASTM E 283 at a static air differential of 6.24 lbf/sq ft.
- .6 Water Penetration:
 - .1 Under Static pressure, provide systems that do not show uncontrolled water leakage when tested according to ASTM E 331 under static pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
 - .2 Under Dynamic pressure, provide systems that do not show uncontrolled water leakage when tested according to AAMA 501.1 under static pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

2.3 **DESIGN REQUIREMENTS**

- .1 Dimensions – Door and Framing:
 - .1 Door framing face dimension: 1 15/16-inch
 - .2 Depth of door framing: 1 15/16-inch
 - .3 Door style face dimension: 3 1/8-inch
 - .4 Door cross rail (if applicable) face: 3 9/16-inch
 - .5 Depth of stile, header, sill and cross rail: 1 15/16-inch
 - .2 Dimensions – Window Assembly:
 - .1 Perimeter framing face dimension: 2 3/4-inch at head, sill and jamb
 - .2 Horizontal and/or vertical mullions: 3 9/16-inch on the face.
-

.3 Depth of perimeter and mullion: 1 15/16-inch

.3 Construction: Narrow-profile, roll-formed steel architectural grade specialty fire doors. Conventional break-shape type hollow metal steel fire-rated doors will not be considered an acceptable substitute for the doors specified in this section as they do not conform to the project design intent and/or aesthetic and quality standards.

.1 Knock down frames are not permitted.

2.4 **MATERIALS**

.1 Fire Rated Glazing:

.1 Thickness: 8 mm overall.

.2 Weight: 4 lbs./sq.ft.

.3 Approximate Visible Transmission: 85%.

.4 Approximate Visible Reflection: 9%

.5 Fire-Rating: 20 minutes to 3 hours for doors; 20 minutes to 90 minutes for other applications.

.6 Impact Safety Resistance: ANSI Z97.1 and CPSC 16CFR1201 (Cat. I and II).

.7 STC Rating: Approximately 38 dB.

.8 Surface Finish:

.1 Standard Grade is polished for a surface quality that is comparable to alternative fire-rated ceramics marketed as having a premium finish.

.2 Premium Grade is finish ground and polished on both surfaces to provide superior surface quality, improving overall clarity and providing a surface that is unmatched by alternative products.

.9 Positive Pressure Test: UL 10C; passes.

.10 Labeling: Permanently label each piece of glazing with the manufacturer's logo, cUL logo and fire rating in sizes up to 3,325 sq. in.

.11 Fire Rating: Fire rating classified and labeled by UL for fire rating scheduled at opening locations on drawings, when tested in accordance with ULC Standards CAN4 S-104 and CAN4 S-106.

.2 Glazing Compound for Fire-Rated Glazing Materials

.1 Glazing Tape: Closed cell PVC foam, maximum water absorption by volume of 2%. Glass panels exceeding 1,393 sq. inches for 90 minute ratings must be glazed with fire-rated glazing tape supplied by the manufacturer.

.2 Glazing Compound: DAP 33 putty.

.3 Silicone Sealant: One-part neutral curing silicone, medium modulus sealant, Type S, Grade NS, Class 25 with additional movement capability of 50% in both extension and compression (total 100%):

.1 "Dow Corning 795" by Dow Corning Corp.

- .2 "Silglaze-II 2800" by General Electric Co.
- .3 "Spectrum 2" by Tremco Inc.
- .4 Setting Blocks: Neoprene, EPDM or silicone, tested for compatibility with glazing compound, of 70 to 90 Shore A hardness.
- .5 Cleaners, Primers and Sealers: As recommended by glazing manufacturer.
- .3 Steel Frames and Doors
 - .1 Steel Framing System: 45 minute rated doors.
 - .1 Frame: Brushed stainless steel, up to 45 minute rating, profiled formed tubing.
 - .2 Fasteners: As recommended by the manufacturer.
 - .3 Glazing Accessories: Calcium silicate setting blocks.
 - .4 Glazing Compounds: FireLite Plus approved closed cell PVC tape or pure silicone sealant or accepted equal.

2.5 **FABRICATION**

- .1 Obtain accepted Shop Drawings prior to fabrication.
- .2 Fabricate glass and other glazing products in sizes required to glaze openings indicated, with edge and face clearances, edge and surface conditions, and bit complying with recommendations of product manufacturer and referenced glazing standards as required to comply with system performance requirements.
- .3 Furnish frame assemblies pre-welded. When necessary, splice frames too large for shop fabrication or shipping or to fit into available building openings and fit with suitable fasteners.
- .4 Furnish interior frame assemblies "K-D". When necessary, splice frames too large for shop fabrication or shipping or to fit in available building openings and fit with suitable fasteners.
- .5 Field glaze door and frame assemblies.
- .6 Factory prepare steel door assemblies and install all hardware.
- .7 Fabricate to fire-rated field dimensions.

2.6 **POWDERCOAT FINISHES**

- .1 Finish after fabrication.
 - .2 Powdercoat Finish: Polyester Super Durable powder coating which meets AAMA 2604 for chalking and fading. Apply manufacturer's standard powder coating finish system applied to factory-assembled frames before shipping, complying with manufacturer's recommended instructions for surface preparation including pretreatment, application and minimum dry film thickness.
 - .3 Colour and Gloss: As selected by the Consultant from the manufacturer's standard range.
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.4 Acceptable manufacturers:

.1 Tiger Drylac

.2 Or accepted equal and as compatible with the framing manufacturer.

2.7 **DOOR HARDWARE**

.1 Refer to Section 08 71 00 Door Hardware.

2.8 **ACCESSORY MATERIALS**

.1 Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30 mil thickness per coat.

3 Execution

3.1 **EXAMINATION**

.1 Examine substrates and members to which the Work of this section attaches or adjoins prior to frame installation.

.2 Provide openings plumb, square and within allowable tolerances. Provide 3/8 inch shim space at all walls.

.3 Notify the Consultant of any conditions which jeopardize the integrity of the proposed fire wall/fire door system. Do not proceed until such conditions are corrected.

.4 Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings that are not firmly bonded to substrates.

3.2 **INSTALLATION**

.1 Refer to the manufacturer's installation manual for framing installation.

.2 Protect glass from edge damage during handling and installation. Inspect glass during installation and discard pieces with edge damage that could affect glass performance.

.3 Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.

.4 Cut glazing tape to length and set against permanent stops, flush with sight lines to fit openings exactly, with stretch allowance during installation.

.5 Place setting blocks located at quarter points of glass with edge block no more than 150 mm from corners.

.6 Glaze vertically into labelled fire rated metal frames or partition walls with same fire rating as glass and push against tape for full contact at perimeter of pane or unit.

.7 Place glazing tape on free perimeter of glazing in same manner described above.

.8 Install removable stop and secure without displacement of tape.

.9 Install in vision panels in fire rated doors to requirements of NFPA 80.

.10 Install so that appropriate cUL and FireLite Plus markings remain permanently visible.

3.3 REPAIR AND TOUCH UP

- .1 Limited to minor repair of small scratches. Use only manufacturer's recommended products. Such repairs shall match original finish for quality or material and view.
- .2 Remove and replace glass that is broken, chipped, cracked, abraded or damaged.

3.4 ADJUSTING

- .1 Adjust door function and hardware for smooth operation. Coordinate with other hardware suppliers for function and use of any other attached hardware.

3.5 PROTECTION AND CLEANING

- .1 Protect glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
 - .1 Do not clean with astringent cleaners. Use a clean "grit-free" cloth and a small amount of mild soap and water or mild detergent.
 - .2 Do not use any cleaning products not recommended by the manufacturer.
 - .3 Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If contaminating substances do come into contact with the glass, remove them immediately as recommended by the glass manufacturer.
 - .4 Wash glass on both exposed surfaces in each area not more than four days before the date scheduled for inspections.

End of Section

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- 1 General
 - 1.1 **SUMMARY**
 - .1 Section Includes
 - .1 Labour, Products, equipment and services necessary to complete the Work of this section.
 - 1.2 **REFERENCE**
 - .1 AAMA 303-97
 - 1.3 **QUALITY ASSURANCE**
 - .1 Window fabrication and installation: To requirements of CAN/CSA-A440/A440.1.
 - .2 Window classification rating: CAN/CSA-A440/A440.1.
 - .1 Air tightness: A3.
 - .2 Water tightness: B5.
 - .3 Wind load resistance: C4.
 - .4 Condensation resistance: $I_g=56$, $I_r=65$.
 - 1.4 **SUBMITTALS**
 - .1 Shop Drawings: Clearly indicate each type of window and screen, the material being supplied, the wall thickness of parts and show all connections, attachments, reinforcing, anchorage and location of exposed fastenings, sealing and glazing.
 - .2 Maintenance data: On completion of Work of this section, supply three copies of maintenance and glazing instructions.
 - 1.5 **DELIVERY, STORAGE AND HANDLING**
 - .1 Provide adequate protection to windows to prevent damage to frames and glass during delivery, storage and handling.
 - 1.6 **WARRANTY**
 - .1 Submit a ten year warranty, commencing from date of Substantial Performance, against defects in the insulating glass units. Defects shall include but not necessarily limited to:
 - .1 Obstruction of vision as a result of dust or film formation on the internal glass surfaces and seal failure.
 - .2 Glass breakage, under design conditions, other than extrinsic glass breakage, but including breakage due to thermal shock and temperature differential due to inherent glass faults.
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2 Products

2.1 **MATERIALS**

- .1 Framing and sash members: UV resistant extruded virgin resin PVC with miter cut and fusion welded corners. Members to have multiple chambers that block heat or cold transmission. Provide integral galvanized steel reinforcing as required to resist wind loads.
- .2 Flashing: PVC, finished to match PVC framing members.
- .3 Weatherstripping: Bulb seal located around the perimeter of the window sash to form an effective barrier from wind and water when fully closed.
- .4 Sash operator: Roto gear operator and concealed sash locks in colour selected by the Consultant, with anti-corrosion coating. All hardware burglar resistant.
- .5 Bolts, screws and fasteners: Stainless steel or aluminum for aluminum connections; cadmium plated steel may be used at interior side of air/vapour barriers; galvanized steel elsewhere.
- .6 Sealants: CAN/CGSB-19.24, Dymeric 240 by Tremco Ltd., or accepted equal. Colours to match aluminum frames, as approved by the Consultant.
- .7 Joint backing: Non-absorbent, non-gassing, closed cell polyolefin foam, over sized 25%, Sof Rod by Tremco Ltd.
- .8 Isolation coating: Best grade, quick drying non-staining alkali resistant bituminous paint.
- .9 Packing Insulation: Semi-rigid batts composed of glass fibres and thermosetting resins, nominal density of 1.1 lb./cu.ft., AF110 by Owens Corning, or other approved equivalents.
- .10 Flexible air/vapour barrier seals: Neoprene or EPDM, designed to remain flexible at low temperatures.
- .11 Air/vapour barrier strip: Continuous, self adhering air/vapour barrier membrane, 150 mm wide, mechanically fastened to window frame, compatible with building air/vapour barrier, to allow for continuity of the air/vapour system. Fasten air/vapour barrier to window frame, in shop, with continuous aluminum fastening bar, and stainless steel fasteners.
- .12 Waterproofing sheet membrane: Sheet rubber, EPDM, minimum thickness 45 mils; adhesive, tapes and sealant for membrane: as manufactured by or recommended by the membrane manufacturer.
- .13 Insect screens: Anti-glare fibreglass cloth in extruded aluminum frame in colour to match window/doors.

2.2 **GLASS AND GLAZING**

- .1 Float glass: CAN/CGSB-12.3, annealed, glazing quality.
 - .2 Tempered safety glass: CAN/CGSB-12.1 Type 2, Class B, tong and roller marks free.
 - .3 Insulating glass units: CAN2-12.8 and composed of two lites of glass sealed around a warm edge spacer or as indicated on Drawings. All insulating glass units comply with the performance requirements of the IGMAC in accordance with either CAN/CGSB-12.8-97. Edges of glass shall be straight cut, free of nicks and other imperfections conducive to breakage.
-

- .4 Frosted glass: "Pinhead Morocco" tempered glass, 6 mm thick by Pilkington Glass Limited or accepted equal.
- .5 Shims, spacers and setting blocks: 45, 70 and 90 Durometer A hardness ± 5 respectively, neoprene rubber, resistant to oxidation and permanent deformation under load.
- .6 Glazing gaskets: Extruded neoprene or EPDM of approved profile, Durometer A hardness of 50 ± 5 , resistant to oxidation and permanent deformation under load.
- .7 Glazing tape: Preformed polyisobutylene tape with spacer, paper release, Polyshim tape by Tremco Ltd. or other approved equivalents.
- .8 Foam sealant: Icynene or Abisko Enerfoam.
- .9 Airseal transition membrane: Soprema "Soprasolin" or W.R. Grace "Permabarrier".

2.3 **FABRICATION**

- .1 Take field measurements prior to fabrication.
- .2 Shop-fabricate window frames to profiles and sizes shown. Design sections to accommodate expansion and contraction. Form accurate members with clean, straight, sharply defined profiles free from any defects.
- .3 Fabricate members to provide for design loads and allowable deflections.
- .4 Accurately form window corners and intersections to flush fused joints.
- .5 Make allowances for the deflection of the structure.
- .6 Include anchors, dowels and fastenings shown or specified or necessary to anchor the Work together or to the Work of the other sections. Supply items and inserts required to be built into the Work of respective sections. Provide instructions for proper location.
- .7 Nuts, bolts, screws, clips and other means of fastening shall be concealed in the finished Work except where exposed screws are shown or specified.
- .8 Means of anchoring the windows shall have sufficient adjustment to permit correct and accurate alignment.
- .9 No manufacturer's names, plates, labels or any other means of identification will be permitted on any of the finished units or hardware.

2.4 **FABRICATION - GLAZING**

- .1 Accurately size glass to fit openings allowing clearances following trade practices. Cut glass clean and carefully; nicks, damaged edge conditions will not be accepted. Replace all glass with nicked or damaged edges.
 - .2 Glass lites shall be float or tempered in accordance with requirements of glass manufacturer as substantiated by the glass manufacturer's stress analysis for each location required, unless otherwise indicated.
-

3 Execution

3.1 **INSTALLATION**

- .1 Prior to installation, apply heavy coat of isolation coating to concealed surfaces of aluminum in direct contact with structural steel, concrete or masonry.
- .2 Provide supplementary structural steel framing and supports required to support Work of this section unless indicated to be supplied under other sections.
- .3 Set Work of this section plumb, square, level, at correct elevation and in alignment with adjacent Work. Anchor securely. Brace Work rigidly for building-in.
- .4 Accurately fit frames to provide weathertight installation and provide clearances required due to expansion, contraction and deflection of building structure and frames.
- .5 Provide continuity of thermal and air/vapour barriers with adjacent thermal and air/vapour barrier systems.
- .6 Gun-apply a continuous bead of sealant to all joints and air/vapour barrier junctions with adjacent construction. Liberally butter screw fastenings with sealant.
- .7 Provide airseal transition membrane between Work of this section and adjacent construction, and at deflection and expansion connections with adhesive and retain with continuous aluminum or galvanized steel plates or bars and non-corrosive mechanical fasteners. Vulcanize or overlap joints to ensure a continuous seal.
- .8 Provide air-tight seals at penetrations in air/vapour barriers required for Work of this and other sections.
- .9 Install sills, drips, flashings, cover plates, weatherstripping and all other items, shown, specified, or necessary for a complete installation.
- .10 Provide foam insulation in voids between framing members and adjacent constructions and where detailed.
- .11 After adjustment the anchorage devices shall be rivetted, welded or positively locked to prevent movement once alignment is achieved.
- .12 Gun-apply three continuous beads of sealant under extruded aluminum thresholds. Make bead diameter sufficient to ensure a full width seal. Remove excess sealant.
- .13 Assume all responsibility for the design of the assembly, reinforcing and anchoring to suit each specific condition complying with the requirements specified herein and as shown on the reviewed Shop Drawings.

3.2 **INSTALLATION - GLAZING**

- .1 Free rabbets, stops and glass edges of dust, dirt, moisture, oil and other foreign matter detrimental to glazing material adhesion. Ensure drainage holes are not blocked.
 - .2 Place two setting blocks under each unit at quarter points. Place spacers on all edges of glass, located directly opposite each other when on both sides of the glass, located at maximum 600 mm24" centres and maximum 300 mm12" from corners and uniformly spaced.
-

- .3 Install glazing tapes and gaskets to ensure complete contact on surface of glass and stops. Make joints only at corners of sash or frame. Fit accurately with tight joints, free from tension, gaps, cracks and embedded foreign matter.
- .4 Set glass properly centered with uniform bite and face and edge clearance, free from twist, warp or other distortion likely to develop stress.
- .5 Ensure water and air tight seal for glass between glazed element and frame is flush with sight line.
- .6 Perform glazing only when the temperature is above 5°C (41°F).

3.3 **INSTALLATION - SEALANT**

- .1 Seal all joints between Work of this section and adjacent surfaces with sealant to provide a completely weathertight enclosure. Apply joint backing to achieve correct joint depth and shape in accordance with manufacturer's instructions.
- .2 Mix, apply and cure sealant in strict accordance with manufacturer's instructions. Apply sealant to clean, dry, grease and oil free surfaces.
- .3 Apply sealant in continuous full beads, using gun with proper size nozzle and sufficient pressure to fill voids and joints solid.
- .4 Form surfaces smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
- .5 Tool exposed surfaces to slightly concave shape.
- .6 Remove excess compound promptly as Work progresses and upon completion.

3.4 **ADJUST AND CLEAN**

- .1 Use soap and water, or water and approved solvents not injurious to aluminum, glass, glazing and sealant compounds. Do not use abrasive.
- .2 Adjust all operating devices and leave in perfect working order.

End of Section

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-
- 1 General
- 1.1 **SUMMARY**
- .1 Section Includes
- .1 Labour, Products, equipment and services necessary to complete the Work of this section.
- .2 Frameless interior sliding service windows as indicated in Drawings and sections.
- 1.2 **SUBMITTALS**
- .1 Shop Drawings
- .1 Submit in accordance with Section 01 33 00.
- .2 Clearly show in detail, relation to adjoining Work, assemblies, head and frame details and assembly details, fastenings, reinforcing, anchorage and finish.
- .2 Product Data: Submit Manufacturer's technical product data.
- 1.3 **DELIVERY, STORAGE AND HANDLING**
- .1 Deliver Work in sequence to meet installation schedule. Protect Work against damage during manufacture and delivery. Handle carefully to prevent distortion and wracking.
- .2 Deliver windows crated to provide protection during transit and job storage.
- .3 Inspect windows upon delivery for damage. Unless minor defects can be made to meet the requirements of this Section and to the satisfaction of the Owner, damaged parts should be removed and replaced.
- 1.4 **PROJECT CONDITIONS**
- .1 Field measurements: Check opening by accurate field measurements before fabrication. Show recorded measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work.
- 1.5 **WARRANTY**
- .1 All material and workmanship shall be warranted against defects for a period of one (1) year from date of Substantial Completion.
- 2 Products
- 2.1 **ACCEPTABLE MANUFACTURERS**
- .1 "Sharyn Series SHCX0A" by C.R Laurence Co., Inc.
- .2 Or accepted equal.
- 2.2 **MATERIALS**
- .1 Aluminum frame shall be constructed of 6063-T5 extruded aluminum. Overall frame sizes in accordance with the Drawings.
- .2 Finish: All aluminum to be satin anodized, or as selected by Consultant.
-

2.3 **PASS-THRU WINDOWS**

- .1 Pass Window Units: Factory fabricated, glazed unit; horizontal sliding type.
- .2 Header: Extruded aluminum.
- .3 Configuration: Horizontal Sliding
- .4 Window rolls on top-hung ball bearing rollers
- .5 Hardware: Manufacturer's standard double track header, rollers, guides, push button lock, fixed sidelite header insert, recessed bottom track.

2.4 **GLAZING**

- .1 Glazing is 6 mm thick Tempered glass. Refer to Section 08 80 00.

2.5 **JOINT SEALANT**

- .1 Sealant conforming to CAN/CGSB 19.13-M.

3 Execution

3.1 **PREPARATION**

- .1 Examine and verify substrate is suitability for product being installation.
- .2 Verify rough opening is properly sized and located.
- .3 Protect existing construction and completed work from damage.
- .4 Apply barrier coating to aluminum surfaces in contact with dissimilar metals and cementitious materials to minimum 0.7 mm (30 mils) dry film thickness.

3.2 **INSTALLATION**

- .1 Build-in and erect Work plumb, true, square, straight, level, and accurate to sizes detailed, free from distortion or defects detrimental to appearance or performance.
- .2 Install window in accordance with manufacturer's printed instructions and recommendations.
- .3 Provide field cutting or drilling required for proper installation and anchorage of the Work.

3.3 **CLEANING**

- .1 Clean frame and glazing surfaces after installation, complying with requirements contained in the manufacturer's instructions. Remove excess glazing sealant compounds, dirt or other substances.

3.4 **PROTECTION**

- .1 Protect frame and glass throughout the remainder of the construction period to ensure no damage is incurred other than normal weathering at the time of acceptance. Repair or replace damaged components.

End of Section

1 General

1.1 **FINISH HARDWARE**

- .1 Supply finish hardware for this Project, complete with templates, installation instructions, screws, expansion shields, anchors and other related accessories, and schedule delivery to avoid delaying the progress of the Work. Deliver hardware to the job site packaged, labelled and cross-referenced to the hardware schedule in such a manner that all items may be readily located to their scheduled location on the Work.
- .2 Hardware Schedule follows at the end of this Section.

1.2 **REQUIREMENTS OF REGULATORY AGENCIES**

- .1 Use ULC listed and/or Warnock Hersey International labelled hardware for doors in fire separations and exit doors.

1.3 **QUALITY ASSURANCE**

- .1 Standards: Comply with standards specified in this section.
- .2 Qualifications of manufacturers: Products supplied under this section shall be from manufacturers regularly engaged in manufacture of similar items and with history of successful production acceptable to the Consultant.

1.4 **SUBMITTALS**

- .1 Submit the following as Shop Drawings in accordance with Section 01 33 00:
 - .1 Three copies of a detailed finish hardware list reviewed by a qualified AHC member of American Society of Hardware Consultants. List all items proposed to be furnished and delivered under this section.
 - .2 Manufacturer's specifications, catalogue cuts and other data required to demonstrate compliance with specified requirements.
- .2 Following review, the Consultant will return two copies to the Contractor. If copies are marked "Revised as Noted - Do Not Resubmit" or "Reviewed as Submitted", make photocopies and distribute to the following:
 - .1 Section 08 11 13 - one copy
 - .2 Section 08 14 10 - one copy
 - .3 Section 08 40 00 - one copy
 - .4 Section 08 71 05 - one copy
- .3 Identify each hardware item by manufacturer, manufacturer's catalogue number, material, function, finish and location of item in Work.
- .4 Review of hardware list by Consultant shall not relieve Contractor from responsibility for furnishing all required finish hardware.

1.5 **SAMPLES**

- .1 Deliver physical samples of approved finish hardware items to Consultant within fifteen Calendar Days.
-

- .2 Identify each sample by label indicating applicable Specification paragraph or line number, brand name and number, finish and hardware package number.
- .3 Substitute new samples for those rejected by Consultant.
- .4 Consultant will retain samples until completion of Project, at which time, samples will be returned to Supplier.
- .5 Do not deliver any hardware to Site until all samples have been approved.

1.6 **PRODUCT HANDLING**

- .1 Packaging and marking: Individually package each unit of finish hardware, complete with proper fastenings and appurtenances, clearly marked on outside to indicate contents and specific locations in the Work.
- .2 Replacements: In the event of damage, immediately make all repairs and replacements necessary to approval of Consultant and at no additional cost to Owner.

1.7 **MAINTENANCE**

- .1 Maintenance data: Submit maintenance data, parts list and manufacturer's instructions for each type of door closer, lockset, latchset, door holders and fire exit hardware for incorporation into maintenance manual specified in Section 01 33 00.
- .2 Brief maintenance staff regarding proper care, cleaning and general maintenance.
- .3 Supply four sets of wrenches for door closers, locksets and fire exit hardware.

1.8 **DELIVERY AND STORAGE**

- .1 Store finish hardware in locked, clean and dry area on site.
- .2 Package each item of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.
- .3 Maintain inventory list with hardware schedule.

1.9 **HARDWARE LIST**

- .1 The Supplier shall thoroughly check the hardware list forming part of this section and shall bring to the attention of the Consultant any errors or omissions therein.
- .2 Confirm degrees of swing for door holders and closers.

1.10 **EXISTING HARDWARE**

- .1 All existing hardware that are noted on Drawings to be replaced shall be returned to the Owner.

1.11 **DOOR SCHEDULES**

- .1 The Supplier shall thoroughly check the door schedules and Working Drawings to ensure that hardware listed can be used as specified in accordance with building codes and function. Bring to attention of the Consultant any errors or omissions therein.
 - .2 Doors shown on Drawings and omitted from the schedules shall be included on the detailed finish hardware list.
-

1.12 **WARRANTY**

- .1 Warrant all exit devices for three years and door closers for ten years.

2 Products

2.1 **GENERAL**

- .1 Manufacturers: Products listed in the hardware schedule are from the first manufacturers listed below. Alternative Suppliers other than those listed will not be considered.

- | | | |
|----|-------------------------------|----------------------------|
| .1 | Hinges: | Hager Hinge Canada |
| .2 | Door closers: | LCN |
| .3 | Cylinders: | Schlage |
| .4 | Locksets/latchsets/deadlocks: | Schlage |
| .5 | Exit devices: | Von Duprin |
| .6 | Overhead door stops/stays: | Glynn-Johnson |
| .7 | Flatware: | Gallery Specialty Hardware |
| .8 | Weatherstrip/threshold: | Aluminum Door Supplier |

- .2 Fasteners: Furnish all finish hardware with all screws, bolts and other fasteners of suitable size and type necessary to anchor hardware in position for trouble-free service under heavy duty usage.

- .1 Furnish fastenings where necessary with expansion shields, toggle bolts and other anchors acceptable to Consultant, depending on material to which hardware is to be applied and recommendations of hardware manufacturer.
- .2 Fastenings shall harmonize with hardware as to material and finish.
- .3 Exposed screws for installing hardware shall have Phillips or Robertson heads.
- .4 Finishes: Hardware shall match finish of locksets. Take special care to coordinate all various manufactured items furnished under this section, to ensure an acceptable uniform finish.

2.2 **MATERIALS**

- .1 Full Mortise Hinges

- .1 Non-removable pins at outswinging exterior doors.
- .2 Ball bearing type "BB".

- .2 Exit Devices/Mullions

- .1 Exterior doors equipped with exit devices must have security deadlatching and cylindrical dogging.
- .2 All doors equipped with exit devices to have lever trim to match lock/latchsets.
-

.3 Locksets/Latchsets/Strikes

- .1 All mortise sets to come complete with three point anti-friction latchbolt, thru-bolted trim.
- .2 All mortise levers to be solid stainless steel or forged brass as specified.

.4 Door Closers

- .1 Use full through bolt fastening, "CTB". With "Top Jamb" application, supply arm through bolt fastening.
- .2 Spring power is to be of proper size to operate door efficiently. All door closers to be supplied as multi-sized. For exterior doors, supply closers multi-sized but pre-adjusted to size 4 for "Top Jamb" application, or size 5 for "Parallel Arm" application. For interior doors, supply closers multi-sized but pre-adjusted to size 3 for "Regular Mount" or "Top Jamb" application or size 4 for "Parallel Arm" application. It is the responsibility of Section 08 71 05 to make final adjustment on the door closers. This final adjustment is to include closing speed, latching speed and backcheck.
- .3 All door closers are to be supplied with full cover and are to be of a complementary design from one model type to the next. Door closers are to be of the same manufacturer throughout the Project.
- .4 Finish door closers supplied for all exterior door locations and for wet or damp interior door locations are to be with special rust inhibitor paint protection, "SRI".
- .5 Where specified for labelled wood fire doors, supply through bolts "CTB" for installing closers.
- .6 Supply screws for door closer arms/brackets of sufficient length to penetrate jamb head seals and still provide adequate securement to the frame surface.
- .7 Protect all door closers, except those having a built-in stop system such as "DS (Door Saver) or "CUSH" (Cushion Stop) models, with an auxiliary door stop. Such auxiliary stops shall be as specified, and may include either overhead, floor or wall mounted types.

.5 Automatic Entrance System

- .1 Complete system supplied by this section as specified in the hardware schedule.

.6 Overhead Door Stops/Stays

- .1 Where an overhead door holder is to be used in conjunction with a door closer, provide stop only, or stop with hold open as specified. Where a door closer is not required, use a friction type, non-friction type, or non-friction with hold open type device as specified.
 - .2 Supply screws for the jamb brackets for overhead door holders/stays of sufficient length to penetrate jamb head seals and still provide adequate securement to the frame surface.
 - .3 All surface mounted overhead door holders/stays are to be supplied with through bolts for the door attachment.
-

.7 Kickplates/Armour Plates

- .1 1.2 mm minimum thickness stainless steel, Type 304, #4 finish, rounded corners, free of rough or sharp edges; drill for countersunk fixing with stainless steel flat head screws flush with finished surface. Supply with 3M tape only where specified.
- .2 Where door pulls are scheduled on one side of door and push plates on other side issue installation instructions so that the pull is secured through door from reverse side and countersunk flush with door prior to installation of push plate.

.8 Wall Stops

- .1 Furnish wall stops of height to engage doors.
- .2 Where wall stops cannot be used, use overhead door stops and/or floor stops as specified. Adjust to proper degree of stop.

2.3 **KEYING**

- .1 All locksets, panic hardware and key switches will be supplied complete with Medeco high security, removable core cylinders, master keyed to a grand master key system. Supply cylinders less cores. Supply 50 temporary cores for use during the construction period which shall be master keyed and keyed differently.
- .2 Supply the following:
 - .1 Three keys for each permanent cylinder core
 - .2 Two keys for each construction (temporary core)
 - .3 Three construction master keys
 - .4 Twelve grand master keys
 - .5 Thirty-six sub master keys

2.4 **KEY CONTROL AND KEY CABINET**

- .1 Provide one only Moore Key Control System AWC 150S.
 - .2 Finishes - Description
 - .1 605 Polished Brass
 - .2 606 Satin Brass
 - .3 612 Satin Bronze
 - .4 613 Oil Rubbed Bronze
 - .5 618 Polished Nickel (on brass or bronze base metal)
 - .6 619 Satin Nickel (on brass or bronze base metal)
 - .7 622 Flat Black/Anodized Black (on brass or bronze base metal))
 - .8 625 Polished Chrome (on brass or bronze base metal)
-

.9	626	Satin Chrome (on brass or bronze base metal)
.10	628	Clear Anodized/Painted Aluminum
.11	629	Polished Stainless Steel
.12	630	Satin Stainless Steel
.13	631	Flat Black/Anodized Black Steel
.14	632	Polished Brass Steel
.15	633	Satin Brass Steel
.16	639	Satin Bronze Steel
.17	640	Oil Rubbed Bronze Steel
.18	645	Polished Nickel Steel
.19	646	Satin Nickel Steel
.20	651	Polished Chrome Steel
.21	652	Satin Chrome (on steel base metal)
.22	666	Polish Brass Aluminum
.23	667	Satin Brass Aluminum
.24	668	Satin Bronze Aluminum
.25	669	Polish Nickel Aluminum
.26	670	Satin Nickel Aluminum
.27	671	Flat Black/Anodized Black Aluminum
.28	672	Polish Chrome Aluminum
.29	677	Polish Brass (painted/powder coat)
.30	678	Satin Brass (painted/powder coat)
.31	680	Satin Bronze (painted/powder coat)
.32	689	Clear Anodized/Painted Aluminum
.33	693	Flat Black/Anodized Black (painted/powder coat)
.34	695	Oil Rubbed Bronze (painted/powder coat)
.35	702	Satin Chrome Aluminum
.36	703	Oil Rubbed Bronze Aluminum
.37	ALUM	Extruded Aluminum Mill Finish (thresholds)

3 Execution

3.1 **DELIVERY**

- .1 Stockpile all items sufficiently in advance to ensure their delivery to the site in a timely manner to ensure orderly progress of Work.

3.2 **INSTALLATION INSTRUCTIONS**

- .1 Furnish metal door and frame manufacturers with complete instructions and templates for preparation of their Work to receive hardware.
- .2 Furnish manufacturer's instructions for proper installation of each hardware component.
- .3 Fully adjust all non-sized or universal door closers in strict accordance with the manufacturer's printed instructions for spring power closing speed, latching speed and backcheck at the time of installation.

3.3 **EXAMINATION**

- .1 Confirm kickplate and threshold sizes before ordering.
- .2 Do not use wall stops on drywall, demountable or moveable partitions.

3.4 **KEY SECURITY**

- .1 Deliver to, and install all cylinders at the jobsite.
- .2 Key all doors to receive locks according to an approved key schedule.

3.5 **INSTALLATION**

- .1 Hardware installation is specified in Section 08 71 05 – Installation of Doors and Finish Hardware.

3.6 **ADJUSTMENT**

- .1 Coordinate with hardware installer and adjust all items of hardware to operate smoothly. If a manufacturer's representative has done this Work, forward written confirmation of same.
- .2 Prepare or replace any hardware found defective.

3.7 **HARDWARE SCHEDULE**

- .1 As per list following this Section. Hardware schedule was prepared by Spyder SC.
- End of Section

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DOOR HARDWARE

08 71 00

PROJECT:

**CITY OF TORONTO ACCESSIBILITY UPGRADES**

Police Marine Sub-Station No.1 – Bluffers Park
23 Bluffers Park/ 7 Brimley Rd S, Toronto, Ontario

ARCHITECT:

**IBI GROUP**

175 Galaxy Blvd, Unit 100
Toronto, Ontario

Prepared By: Alex Bekmansourov

Date: January 30, 2022

Revised:



Architectural Hardware Finishes

Steel	Stainless Steel	Brass/Bronze	Aluminum	Painted/Powder Coat	US/CAN#
Clear Anodized / Painted Aluminum					
			628	689	US28
Satin Nickel					
646		619	670		US15
Polished Nickel					
645		618	669		US14
Satin Stainless Steel					
	630				US32D
Polished Stainless Steel					
	629				US32
Satin Chrome					
652		626	702		US26D
Polished Chrome					
651		625	672		US26
Satin Brass					
633		606	667	678	US4
Polished Brass					
632		605	666	677	US5
Satin Bronze					
639		612	668	680	US10
Oil Rubbed Bronze					
640		613	703	695	US10B
Flat Black / Anodized Black					
631		622	671	693	US19

Door Types & Handing

Abbreviations

RH – Right Hand

RHA – Right Hand Active

SS- Single Slider

LH – Left Hand

LHA – Left Hand Active

BP – Bi-Parting Slider

RHR – Right Hand Reverse

RHRA/LHRA – Right & Left Hand Reverse Active

BP – Bi-Passing Slider

LHR – Left Hand Reverse

RHA/LHA – Right & Left Hand Active

BF – Bi-Folding Slider

RHRA – Right Hand Reverse Active

DA- Double Acting

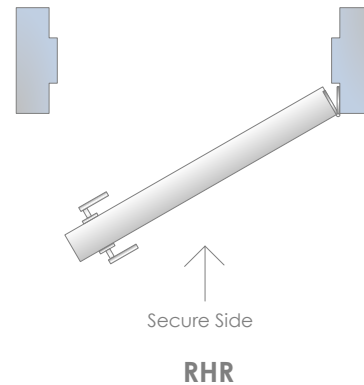
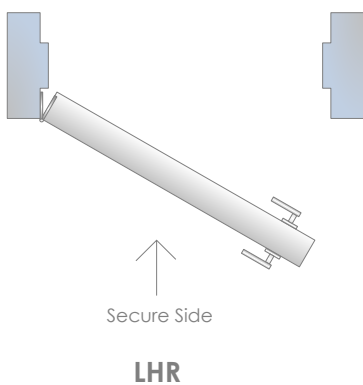
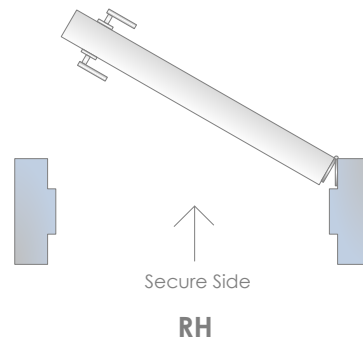
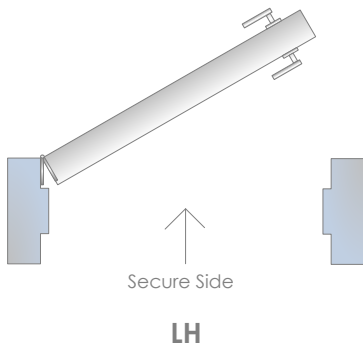
TS – Telescopic Slider

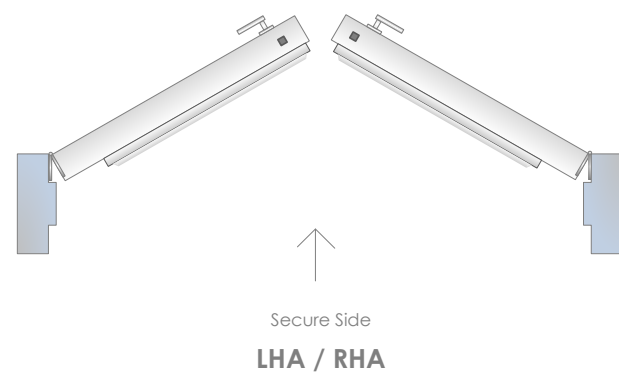
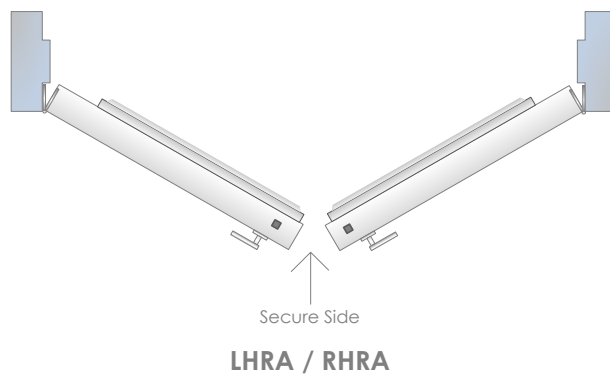
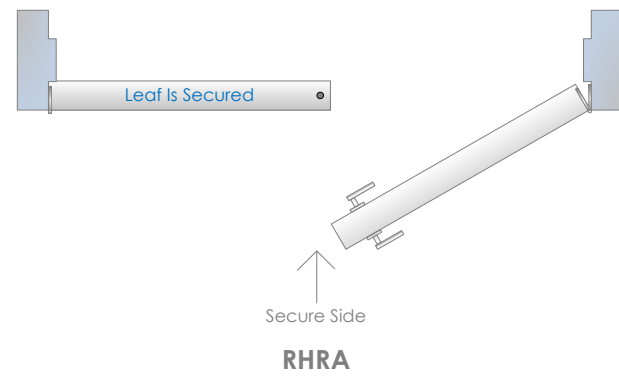
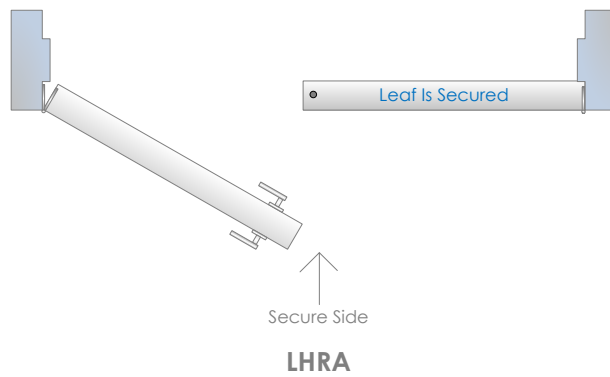
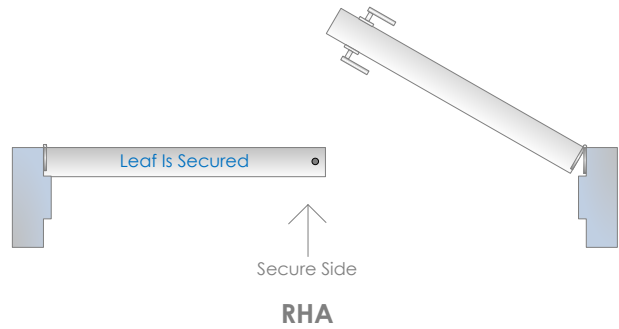
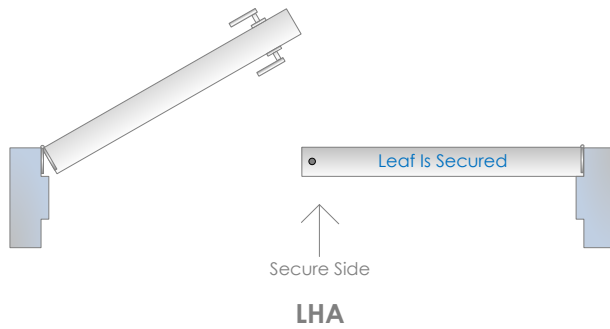
LHRA – Left Hand Reverse Active

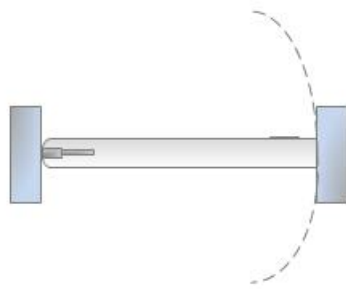
DE – Double Egress

PKT – Pocket Slider

Note: The handing on a swing door is determined by placing yourself on the secure side or keyed side of the door.







DA-DOUBLE
ACTING



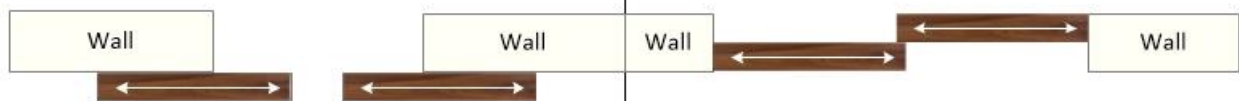
DE-DOUBLE
EGRESS



PKT - POCKET SLIDER



SS - SINGLE SLIDER or
BARN SLIDER



BP - BI-PARTING



BPS - BI-PASSING

Symbols



- Door has a fire rating and all associated hardware must have a fire label to suit. Must comply with local requirements.



- Door is automatic and is equipped with an auto operator. Door must meet local barrier free codes



- Door has an electrical requirement and requires power to be brought to the appropriate location above the door or to the latch, for either security or barrier free applications. Refer to security & electrical drawings for further information.



- Door requires security card access. Refer to security / electrical drawings for further information.

Abbreviations

Door:

HMD = Hollow Metal Door
IHMD = Insulated Hollow Metal Door
ALD = Aluminum Door
SCWD = Solid Core Wood Door
HCWD = Hollow Core Wood Door
FGD = Frameless Glass Door
FRP = Fiberglass Reinforced Plastic Door

Frame:

HMF = Hollow Metal Frame
ALF = Aluminum Frame
Cased Open HMF = Cased Open Hollow Metal Frame
WDF = Wood Frame
Cased Open WDF = Cased Open Wood Frame
Cased Open Drywall = Cased Open Drywall

Fire Ratings:

0 HR – Zero Hour Fire Rating / Smoke Barrier
20 MIN – 20 Minute Fire Rating
¾ HR – 45 Minute Fire rating
1 ½ HR – 90 Minute Fire Rating
2 HR – 120 Minute Fire Rating
3 HR – 180 Minute Fire Rating

Disclaimer

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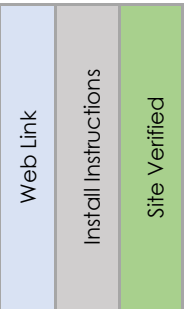
HARDWARE SCHEDULE

Heading# 1

Opening Information					
Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

2 Total Openings

1	Door#	NE-101	Location:	Exterior from Vestibule 101	Handing:
1	Door#	NE-108	Location:	Exterior from Corridor 102	Handing:



By Hardware Supplier

2	Storeroom Lockset	ND80BDC x RHO x 626	626	Schlage	<input checked="" type="checkbox"/>		
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By Locksmith

2	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco			<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.



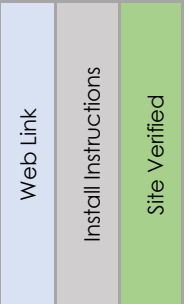
Heading# 2

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

2 Total Openings

1	Door#	NE-102	Location:	Vestibule 101 from Corridor 102	Handing:
1	Door#	NE-107	Location:	Corridor 102 to Storage & Elec 108	Handing:



By Hardware Supplier

2	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	<input checked="" type="checkbox"/>		
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By Locksmith

2	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco			<input type="checkbox"/>
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Heading# 3

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

3 Total Openings

1	Door#	NE-103	Location:	Corridor 102 to Office 103	Handing:
1	Door#	NE-105	Location:	Corridor 102 to Storage 104	Handing:
1	Door#	NE-106	Location:	Corridor 102 to Kitchen 105	Handing:

Web Link

Install Instructions

Site Verified

By Hardware Supplier

3	Passage Latchset	ND10S x RHO x 626	626	Schlage	X			
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*BALANCE OF EXITING HARDWARE TO REMAIN.

-----End of Heading-----



**Heading# 4**

Opening Information

Opening Type:	Pair	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1 **Door#** NE-104 **Location:** Corridor 102 from Mech.Room 109 **Handing:**

Web Link

Install Instructions

Site Verified

By Hardware Supplier

1	Classroom Lockset	ND70BDC x RHO x 626 x 14-042	626	Schlage	X			
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By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

-----End of Heading-----

END OF SCHEDULE



DOOR HARDWARE

08 71 00

PROJECT:

**CITY OF TORONTO ACCESSIBILITY UPGRADES**

FIRE HALL NO. 226

87 Main Street, Toronto, Ontario

ARCHITECT:

**IBI GROUP**

175 Galaxy Blvd, Unit 100

Toronto, Ontario

Prepared By: Alex Bekmansourov

Date: January 30, 2022

Revised: March 17, 2022





Architectural Hardware Finishes

Steel	Stainless Steel	Brass/Bronze	Aluminum	Painted/Powder Coat	US/CAN#
Clear Anodized / Painted Aluminum					
			628	689	US28
Satin Nickel					
646		619	670		US15
Polished Nickel					
645		618	669		US14
Satin Stainless Steel					
	630				US32D
Polished Stainless Steel					
	629				US32
Satin Chrome					
652		626	702		US26D
Polished Chrome					
651		625	672		US26
Satin Brass					
633		606	667	678	US4
Polished Brass					
632		605	666	677	US5
Satin Bronze					
639		612	668	680	US10
Oil Rubbed Bronze					
640		613	703	695	US10B
Flat Black / Anodized Black					
631		622	671	693	US19

Door Types & Handing

Abbreviations

RH – Right Hand

LH – Left Hand

RHR – Right Hand Reverse

LHR – Left Hand Reverse

RHRA – Right Hand Reverse Active

LHRA – Left Hand Reverse Active

RHA – Right Hand Active

LHA – Left Hand Active

RHRA/LHRA – Right & Left Hand Reverse Active

RHA/LHA – Right & Left Hand Active

DA- Double Acting

DE – Double Egress

SS- Single Slider

BP – Bi-Parting Slider

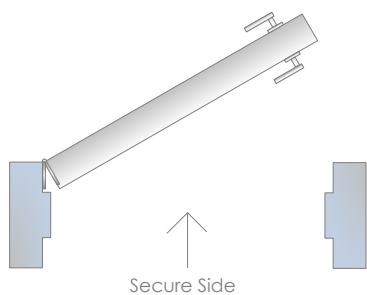
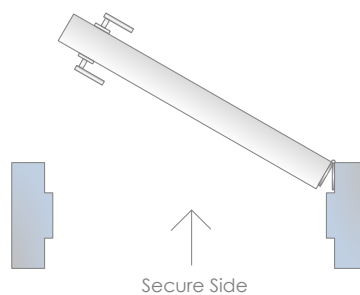
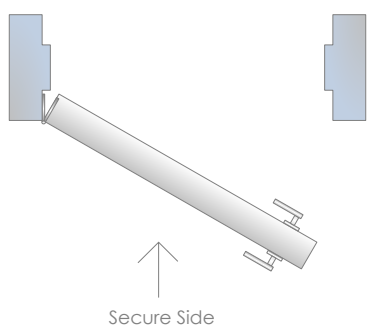
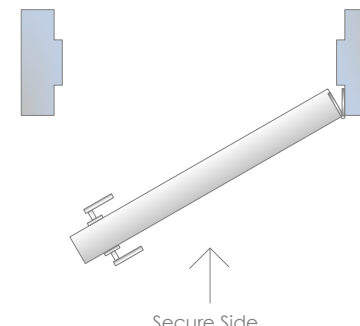
BP – Bi-Passing Slider

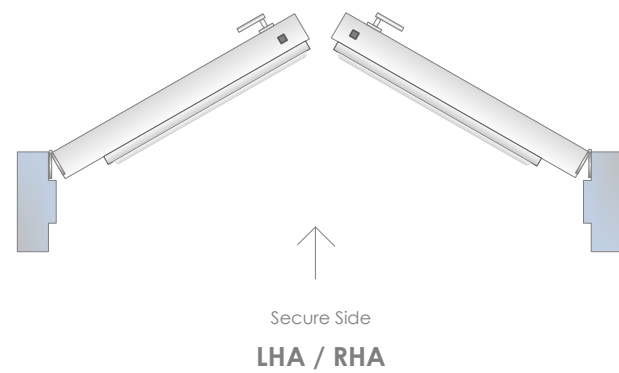
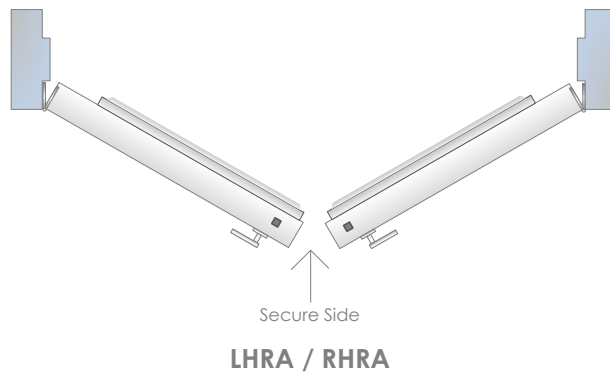
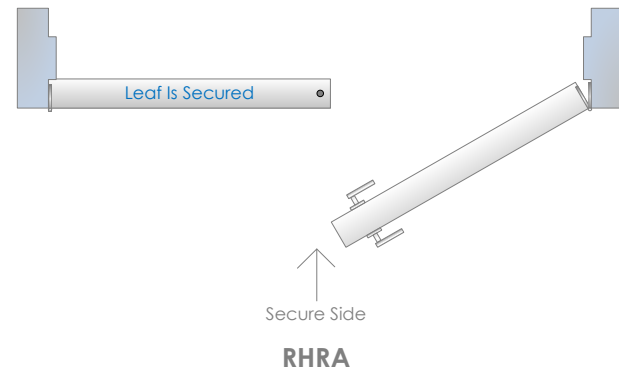
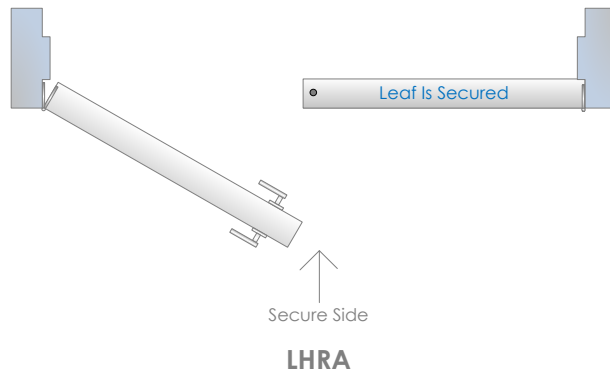
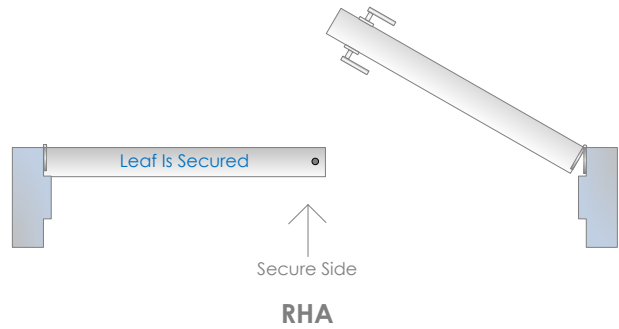
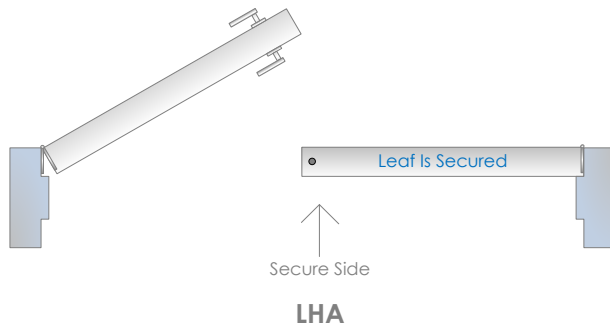
BF – Bi-Folding Slider

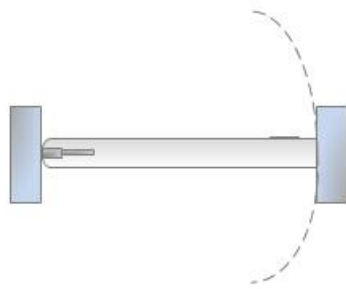
TS – Telescopic Slider

PKT – Pocket Slider

Note: The handing on a swing door is determined by placing yourself on the secure side or keyed side of the door.


LH

RH

LHR

RHR





DA-DOUBLE
ACTING



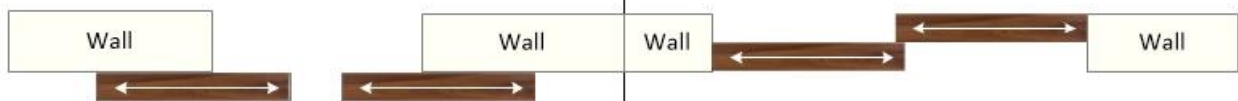
DE-DOUBLE
EGRESS



PKT - POCKET SLIDER



SS - SINGLE SLIDER or
BARN SLIDER



BP - BI-PARTING



BPS - BI-PASSING

Symbols



- Door has a fire rating and all associated hardware must have a fire label to suit. Must comply with local requirements.



- Door is automatic and is equipped with an auto operator. Door must meet local barrier free codes



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HARDWARE SCHEDULE



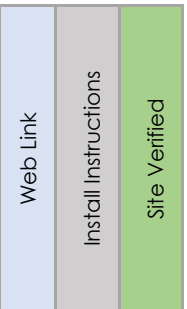
Heading# 1

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2150 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	None

1 Total Openings

1 **Door#** N-108 **Location:** Bunker Room to B/F Universal WR 215 **Handing:** LH



By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	630	Hager	X			<input type="checkbox"/>
1	Storeroom Lockset	ND80BDC x RHO x 626	626	Schlage	X			<input type="checkbox"/>
1	Electric Strike	1500C	630	HES	X	X		<input type="checkbox"/>
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – Door Screws	630	Gallery	X			<input type="checkbox"/>
2	Coat Hook	GSH 390	626	Gallery	X			<input type="checkbox"/>
1	Floor Stop	GSH 209	626	Gallery	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5500	BLK	KN Crowder	X			<input type="checkbox"/>
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X		<input type="checkbox"/>
1	Emergency Key Cabinet	EB-02	RD	Canropa	X			<input type="checkbox"/>

By Automatics Supplier – PACKAGE #5 – PUSH TO LOCK KIT UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)

1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount	628		X			<input type="checkbox"/>
1	Wave to Lock Kit	CX-WC16	630	Camden	X	X		<input type="checkbox"/>
1	Emergency Key Cabinet	EB-02	RD	Canropa	X			<input type="checkbox"/>

By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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Notes:

- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Refer to STC rating of the wall in Architectural layout G1002



- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

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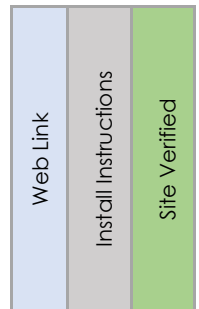
Heading# 2

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

8 Total Openings

1	Door#	NE-101	Location:	Apparatus Bay 101 to Lounge 107	Handing:
1	Door#	NE-103	Location:	Lounge 107 from Stairs A 106	Handing:
1	Door#	NE-105	Location:	Apparatus Bay 101 to Stairs A 106	Handing:
1	Door#	NE-201	Location:	Bedroom Area 206 to Bedroom 209	Handing:
1	Door#	NE-202	Location:	Bedroom Area 206 to Bedroom 207	Handing:
1	Door#	NE-203	Location:	Stair C 205 from Bedroom Area 206	Handing:
1	Door#	NE-204	Location:	Corridor 211 to Lavatory 212	Handing:
1	Door#	NE-205	Location:	Corridor 211 to Lounge RM	Handing:



By Hardware Supplier

8	Passage Latchset	ND10S x RHO x 626	626	Schlage	X			
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*BALANCE OF EXITING HARDWARE TO REMAIN.

-----End of Heading-----

**Heading# 3**

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1	Door#	NE-102	Location:	Exterior to Lounge 107	Handing:	RH
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Web Link

Install Instructions

Site Verified

By Hardware Supplier

1	Keypad Lockset	LR1021B-26D-41	630	Dormakaba	X			<input type="checkbox"/>
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By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

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.....End of Heading.....





Heading# 4

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

2 Total Openings

1	Door#	NE-104	Location:	Stair A from Stair	Handing:
1	Door#	NE-209	Location:	Stair A 201 to Bedroom 202	Handing:

Web Link

Install Instructions

Site Verified

By Hardware Supplier

2	Classroom Lockset	ND70BDC x RHO x 613	605	Schlage	X			
2	Wrap Around Plate	4CW	605	Don-Jo	X			

By Locksmith

2	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	605	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- Modify Existing Door for New Hardware

.....End of Heading.....





Heading# 5

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	None

1 Total Openings

1 **Door#** NE-106 **Location:** Bunker Room 102 from Hose Tower 104 **Handing:**

Web Link

Install Instructions

Site Verified

By Hardware Supplier

1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	X			
---	-------------------	---------------------	-----	---------	-------------------	--	--	--

By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

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-----End of Heading-----





Heading# 6

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1	Door#	NE-107	Location:	Exterior to Hose Tower 104	Handing:	LH
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Web Link

Install Instructions

Site Verified

By Hardware Supplier

1	Keypad Lockset	LL1021B-26D-41	630	Dormakaba	X			<input type="checkbox"/>
---	----------------	----------------	-----	-----------	-------------------	--	--	--------------------------

By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN. – Reuse Existing Latch.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

.....End of Heading.....



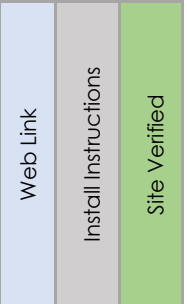
**Heading# 7A**

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1 **Door#** NE-206 **Location:** Corridor 211 to Washroom 214 **Handing:**



By Hardware Supplier

1	Passage Latchset	ND10S x RHO x 626	626	Schlage	X			
1	Wrap Around Plate	4CW	630	Don-Jo	X			

*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

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- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- Modify Existing Door for New Hardware

.....End of Heading.....



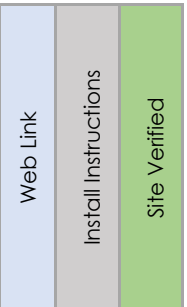
**Heading# 7B**

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1	Door#	NE-207	Location:	Bedroom 202 from Closet	Handing:
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By Hardware Supplier

1	Passage Latchset	ND10S x RHO x 626	605	Schlage	X			
1	Wrap Around Plate	4CW	605	Don-Jo	X			

*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

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- Modify Existing Door for New Hardware

.....End of Heading.....



Heading# 8

Opening Information				
Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating None
Door Material:	Existing	Frame Material:	Existing	Fire Rating None

1 Total Openings						Web Link	Install Instructions	Site Verified
1	Door#	NE-208	Location:	Bedroom 202 to Women's Washroom 203	Handing:			
By Hardware Supplier								
1	Privacy Latchset	ND40S x RHO x 626			626	Schlage	X	

*BALANCE OF EXITING HARDWARE TO REMAIN.

.....End of Heading.....



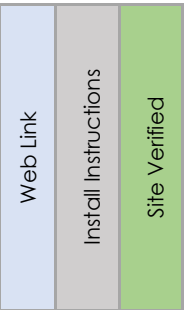
Heading# 9

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1 Door# NE-301 Location: Stair A 301 to Gym Room 302 Handing:



By Hardware Supplier

1	Classroom Lockset	ND70BDC x RHO x 613	606	Schlage	X			
1	Wrap Around Plate	4CW or 214CW or 200CW or 212CW	606	Don-Jo	X			

By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	606	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

***VERIFY DOOR THICKNESS PRIOR TO ORDERING HARDWARE.**

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- Modify Existing Door for New Hardware

.....End of Heading.....

END OF SCHEDULE





DOOR HARDWARE

08 71 00

PROJECT:



CITY OF TORONTO ACCESSIBILITY UPGRADES

FIRE HALL NO. 223

116 Dorset Rd, Toronto, Ontario

ARCHITECT:



IBI GROUP

175 Galaxy Blvd, Unit 100

Toronto, Ontario

Prepared By: Alex Bekmansourov

Date: January 29, 2022

Revised:





Architectural Hardware Finishes

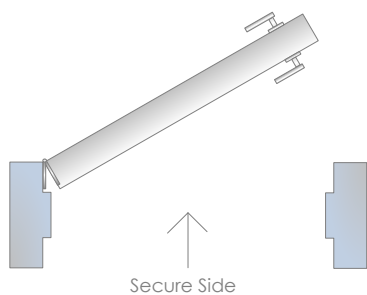
Steel	Stainless Steel	Brass/Bronze	Aluminum	Painted/Powder Coat	US/CAN#
Clear Anodized / Painted Aluminum					
			628	689	US28
Satin Nickel					
646		619	670		US15
Polished Nickel					
645		618	669		US14
Satin Stainless Steel					
	630				US32D
Polished Stainless Steel					
	629				US32
Satin Chrome					
652		626	702		US26D
Polished Chrome					
651		625	672		US26
Satin Brass					
633		606	667	678	US4
Polished Brass					
632		605	666	677	US5
Satin Bronze					
639		612	668	680	US10
Oil Rubbed Bronze					
640		613	703	695	US10B
Flat Black / Anodized Black					
631		622	671	693	US19

Door Types & Handing

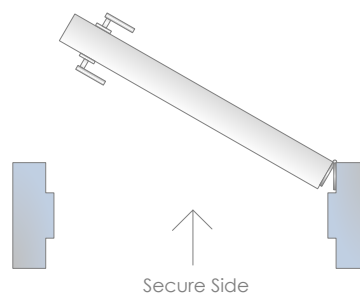
Abbreviations

RH – Right Hand	RHA – Right Hand Active	SS- Single Slider
LH – Left Hand	LHA – Left Hand Active	BP – Bi-Parting Slider
RHR – Right Hand Reverse	RHRA/LHRA – Right & Left Hand Reverse Active	BP – Bi-Passing Slider
LHR – Left Hand Reverse	RHA/LHA – Right & Left Hand Active	BF – Bi-Folding Slider
RHRA – Right Hand Reverse Active	DA- Double Acting	TS – Telescopic Slider
LHRA – Left Hand Reverse Active	DE – Double Egress	PKT – Pocket Slider

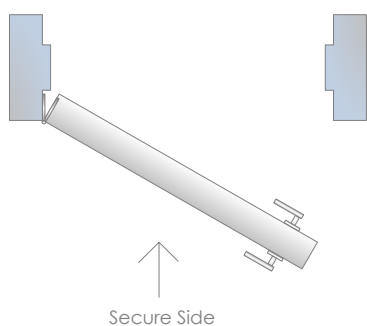
Note: The handing on a swing door is determined by placing yourself on the secure side or keyed side of the door.



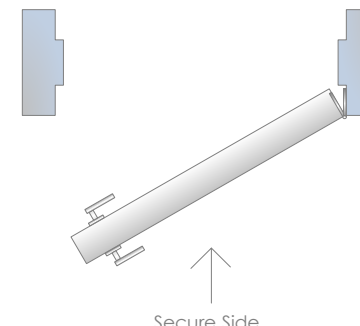
LH



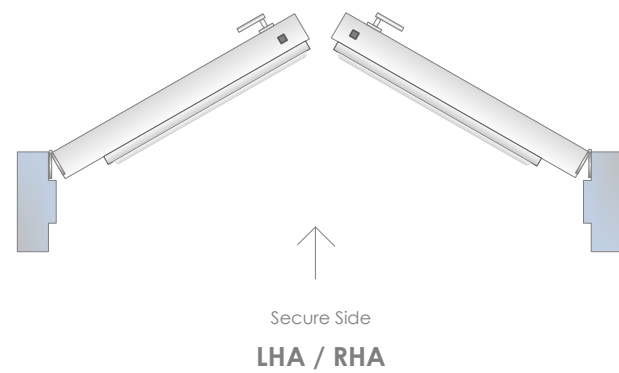
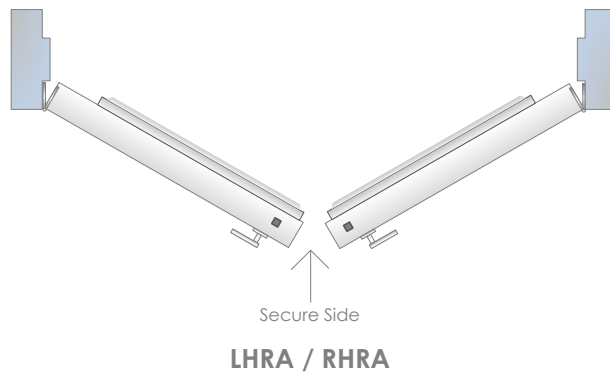
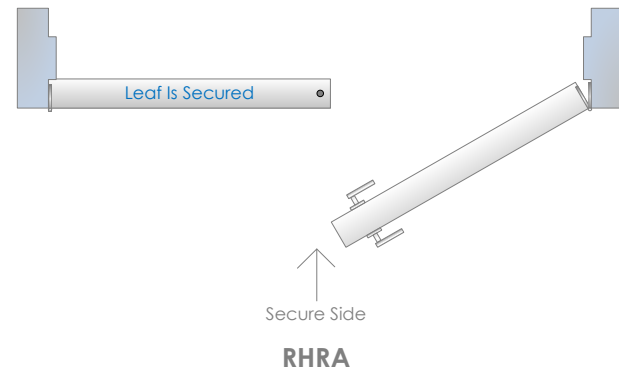
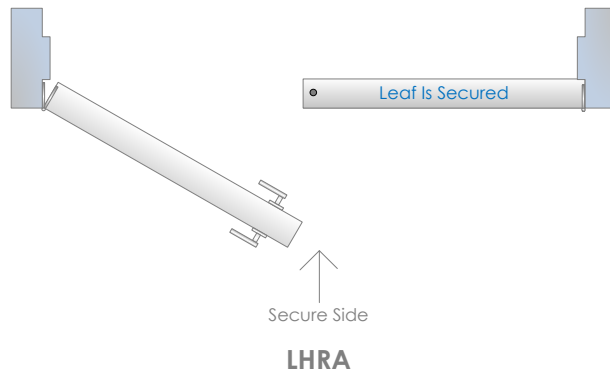
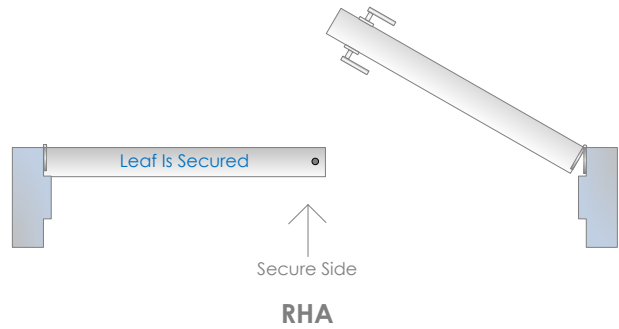
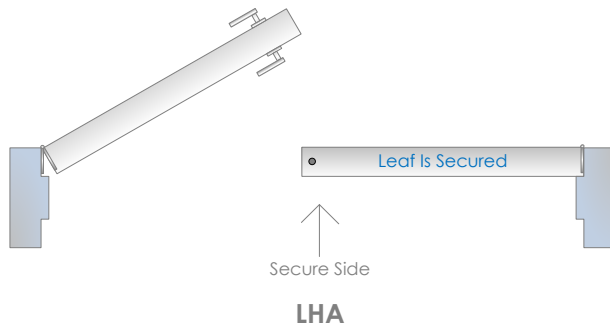
RH

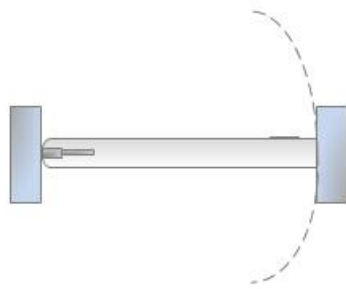


LHR



RHR





DA-DOUBLE
ACTING



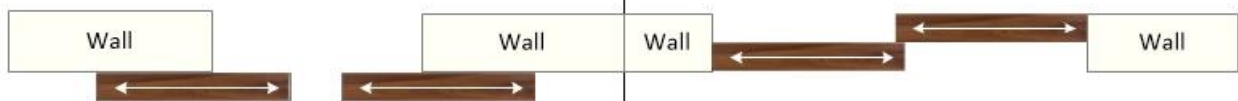
DE-DOUBLE
EGRESS



PKT - POCKET SLIDER



SS - SINGLE SLIDER or
BARN SLIDER



BP - BI-PARTING



BPS - BI-PASSING

Symbols



- Door has a fire rating and all associated hardware must have a fire label to suit. Must comply with local requirements.



- Door is automatic and is equipped with an auto operator. Door must meet local barrier free codes



- Door has an electrical requirement and requires power to be brought to the appropriate location above the door or to the latch, for either security or barrier free applications. Refer to security & electrical drawings for further information.



- Door requires security card access. Refer to security / electrical drawings for further information.

Abbreviations

Door:

HMD = Hollow Metal Door
IHMD = Insulated Hollow Metal Door
ALD = Aluminum Door
SCWD = Solid Core Wood Door
HCWD = Hollow Core Wood Door
FGD = Frameless Glass Door
FRP = Fiberglass Reinforced Plastic Door

Frame:

HMF = Hollow Metal Frame
ALF = Aluminum Frame
Cased Open HMF = Cased Open Hollow Metal Frame
WDF = Wood Frame
Cased Open WDF = Cased Open Wood Frame
Cased Open Drywall = Cased Open Drywall

Fire Ratings:

0 HR – Zero Hour Fire Rating / Smoke Barrier
20 MIN – 20 Minute Fire Rating
¾ HR – 45 Minute Fire rating
1 ½ HR – 90 Minute Fire Rating
2 HR – 120 Minute Fire Rating
3 HR – 180 Minute Fire Rating

Disclaimer

Installation Instructions:

Installation instructions have been provided for convenience only. Although we do our best to ensure these documents are accurate and up to date, it is ultimately the responsibility of the installer to ensure they are using the correct instructions for the product they are installing. Use of the installation instructions provided is done so at one's own risk and Spyder SC takes no responsibility to their accuracy.

Weblinks:

Weblinks do change from time to time as manufacturers move around their websites, please inform us if you have a none functioning weblink.



HARDWARE SCHEDULE

Heading# 1

Opening Information					
Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings					Web Link	Install Instructions	Site Verified			
1	Door#	NE-001	Location:	Corridor to Lockers 007				Handing:		
By Hardware Supplier										
1	Storeroom Lockset	ND80BDC x RHO x 626			626	Schlage	X			
By Locksmith										
1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.			626	Medeco				<input type="checkbox"/>

*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

.....End of Heading.....





Heading# 2

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

3 Total Openings

1	Door#	NE-101	Location:	Dormitory 111 from Bedroom 112	Handing:
1	Door#	NE-105	Location:	Loungwe 114 to Bedroom 116	Handing:
1	Door#	NE-108	Location:	Corridor 102 to Bedroom 104	Handing:

Web Link

Install Instructions

Site Verified

By Hardware Supplier

3	Passage Latchset	ND10S x RHO x 626	626	Schlage	X			
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*BALANCE OF EXITING HARDWARE TO REMAIN.

-----End of Heading-----





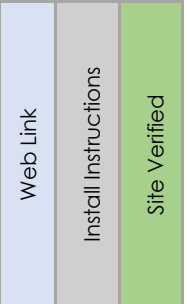
Heading# 3

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1 Door# NE-102 Location: Exterior from Apparatus Bay 106 Handing:



By Hardware Supplier

1	Keypad Lockset	LR1021B-26D-41	630	Dormakaba	X			<input type="checkbox"/>
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By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

.....End of Heading.....





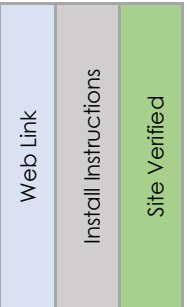
Heading# 4

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1 **Door#** NE-103 **Location:** Corridor to Bunker Room 110 **Handing:**



By Hardware Supplier

1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	X			
1	Wrap Around Plate	42CW	630	Don-Jo	X			

By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

.....End of Heading.....





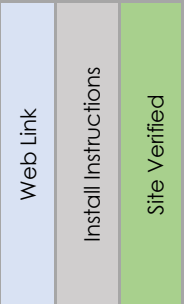
Heading# 5

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1 Door# NE-104 Location: Apparatus Bay 106 from Corridor Handing:



By Hardware Supplier

1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	<input checked="" type="checkbox"/>			
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By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

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- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

.....End of Heading.....





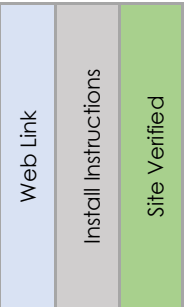
Heading# 6

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

2 Total Openings

1	Door#	NE-106	Location:	Apparatus Bay 106 to Office 117	Handing:
1	Door#	NE-109	Location:	Corridor 102 to Office 103	Handing:



By Hardware Supplier

2	Office Lockset	ND50BDC x RHO x 626	626	Schlage	X			
2	Wrap Around Plate	42CW	630	Don-Jo	X			

By Locksmith

2	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

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.....End of Heading.....



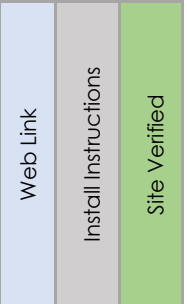
Heading# 7

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1 Door# NE-107 Location: Bedroom 104 from Washroom 105 Handing:



By Hardware Supplier

1	Privacy Latchset	ND40S x RHO x 626	626	Schlage	X			
1	Wrap Around Plate	42CW	630	Don-Jo	X			

*BALANCE OF EXITING HARDWARE TO REMAIN.

-----End of Heading-----



Heading# 8

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

2 Total Openings

1	Door#	NE-110	Location:	Corridor 102 to Bedroom 104	Handing:
1	Door#	NE-111	Location:	Bedroom 104 from Closet	Handing:

Web Link

Install Instructions

Site Verified

By Hardware Supplier

2	Passage Latchset	ND10S x RHO x 626	626	Schlage	X			
2	Wrap Around Plate	42CW	630	Don-Jo	X			

*BALANCE OF EXITING HARDWARE TO REMAIN.

.....End of Heading.....

END OF SCHEDULE



DOOR HARDWARE

08 71 00

PROJECT: 
CITY OF TORONTO ACCESSIBILITY UPGRADES
West Scarborough Community Centre
313 Pharmacy Ave, Toronto, Ontario

ARCHITECT: 
IBI GROUP
175 Galaxy Blvd, Unit 100
Toronto, Ontario

Prepared By: Alex Bekmansourov
Date: February 3, 2022
Revised: March 17, 2022



Architectural Hardware Finishes

Steel	Stainless Steel	Brass/Bronze	Aluminum	Painted/Powder Coat	US/CAN#
Clear Anodized / Painted Aluminum					
			628	689	US28
Satin Nickel					
646		619	670		US15
Polished Nickel					
645		618	669		US14
Satin Stainless Steel					
	630				US32D
Polished Stainless Steel					
	629				US32
Satin Chrome					
652		626	702		US26D
Polished Chrome					
651		625	672		US26
Satin Brass					
633		606	667	678	US4
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Satin Bronze					
639		612	668	680	US10
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640		613	703	695	US10B
Flat Black / Anodized Black					
631		622	671	693	US19

Door Types & Handing

Abbreviations

RH – Right Hand

LH – Left Hand

RHR – Right Hand Reverse

LHR – Left Hand Reverse

RHRA – Right Hand Reverse Active

LHRA – Left Hand Reverse Active

RHA – Right Hand Active

LHA – Left Hand Active

RHRA/LHRA – Right & Left Hand Reverse Active

RHA/LHA – Right & Left Hand Active

DA- Double Acting

DE – Double Egress

SS- Single Slider

BP – Bi-Parting Slider

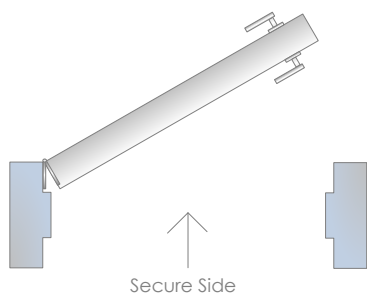
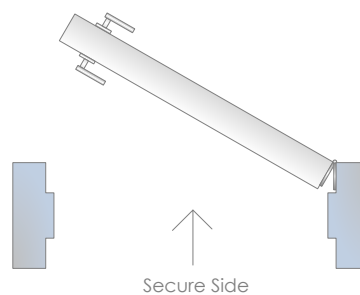
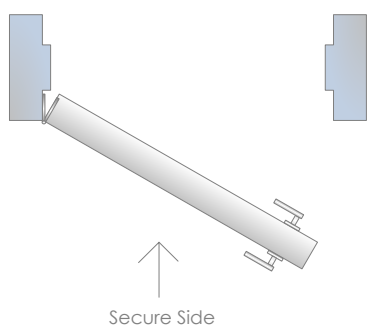
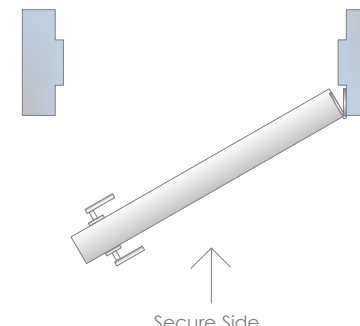
BP – Bi-Passing Slider

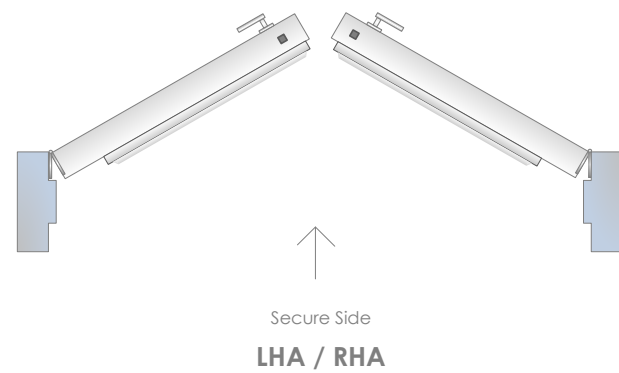
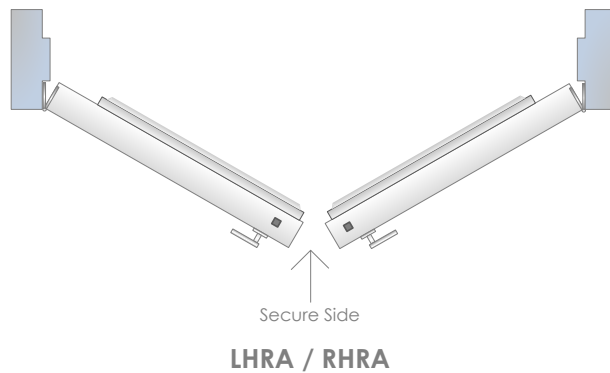
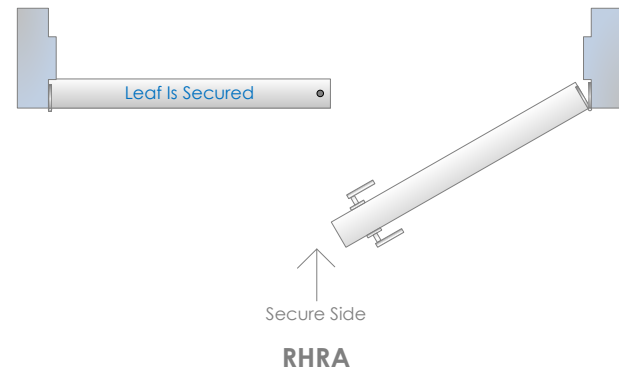
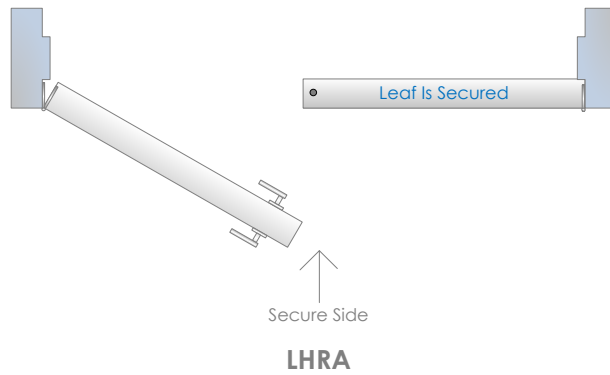
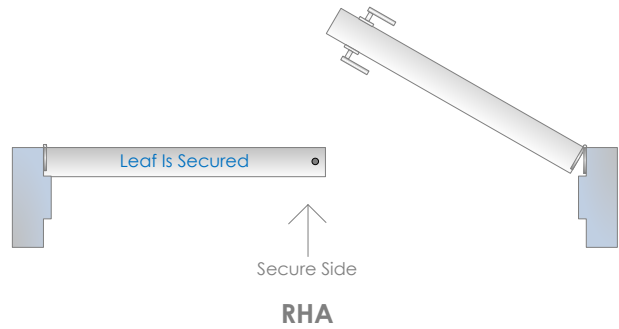
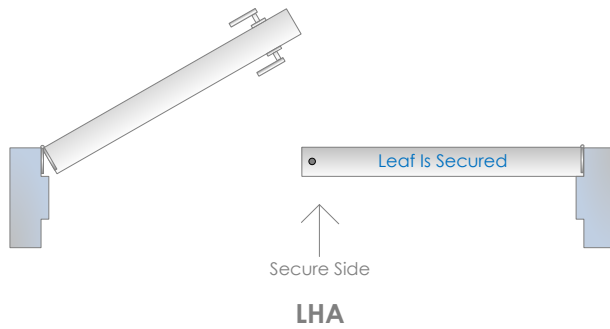
BF – Bi-Folding Slider

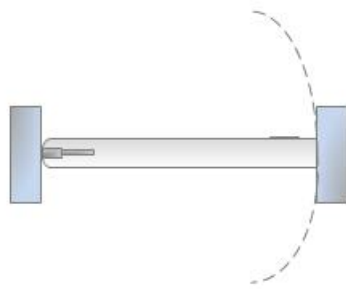
TS – Telescopic Slider

PKT – Pocket Slider

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LH

RH

LHR

RHR





DA-DOUBLE
ACTING



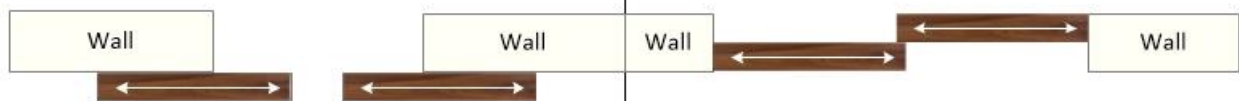
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EGRESS



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Disclaimer

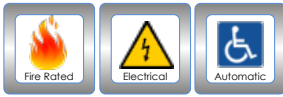
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Weblinks:

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HARDWARE SCHEDULE



Heading# 1

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	3/4 HR

1 Total Openings

1	Door#	N-003	Location:	Corridor 001 from Youth Lounge 003	Handing:	RHR
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By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4" NRP	652	Hager	X			<input type="checkbox"/>
1	Passage Latchset	ND10S x RHO x 626	626	Schlage	X			<input type="checkbox"/>
1	Electric Strike	1500C	630	HES	X	X		<input type="checkbox"/>
1	Overhead Stop	105S	630	Glynn Johnson	X	X		<input type="checkbox"/>
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – HM Door Screws	630	Gallery	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			<input type="checkbox"/>
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X		<input type="checkbox"/>

By Automatics Supplier – PACKAGE #3 – PUSH BUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)

1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount	628		X			<input type="checkbox"/>
2	Wave Buttons	CM-331/42SW-SGLR, Double Gang, SS Face Plate with LED Ring	630	Camden	X			<input type="checkbox"/>
2	Surface Mount Box	CM-43CBLA	630	Camden	X			<input type="checkbox"/>

Notes:

- Final commissioning of all access control items, such as but not limited to electric strikes, Rex sensors, Door contacts, Electrified Panics, Relays & Maglocks is the responsibility of the security provider
- Refer to STC rating of the wall in Architectural layout G1002
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Refer to STC rating of the wall in Architectural layout G1002



- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.

-----End of Heading-----



Heading# 2

Opening Information

Opening Type:	Pair	Opening Size:	2 x 915 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	3/4 HR

1 Total Openings

1	Door#	N-003b	Location:	Youth Lounge 003 from Sump Room 015	Handing:	RHRA
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Web Link	Install Instructions	Site Verified
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By Hardware Supplier

6	Hinge	BB1279 – 4 1/2" x 4"	652	Hager	X			<input type="checkbox"/>
1	Storeroom Lockset	ND80BDC x RHO x 626 x 14-042	626	Schlage	X			<input type="checkbox"/>
1	Semi-Auto Flush Bolts	F51P	626	Ives	X			<input type="checkbox"/>
1	Dust Proof Strike	DP2	626	Ives	X			<input type="checkbox"/>
1	Coordinator	COR52 x FL20	626	Ives	X			<input type="checkbox"/>
1	Mounting Bracket	MB2	626	Ives	X			<input type="checkbox"/>
1	Dust Proof Strike	DP2	626	Ives	X			<input type="checkbox"/>
2	Closer	1461 x Rw/PA	689	LCN	X	X		<input type="checkbox"/>
2	Drop Plate	1460-18	689	LCN	X	X		<input type="checkbox"/>
2	Overhead Stop	104S	630	Glynn Johnson	X	X		<input type="checkbox"/>
2	Kickplate	GSH 80A – 203 x 876 (Rounded Corners) – Door Screws	630	Gallery	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 6300	BLK	KN Crowder	X			<input type="checkbox"/>
2	Door Sweep	W-24S x 915	CA	KN Crowder	X			<input type="checkbox"/>
1	Astragal	By HM Door Supplier						<input type="checkbox"/>

By Locksmith

1	Permanent Core	Permanent Medeco Core Provided by City Locksmith	626	Medeco				<input type="checkbox"/>
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Notes:



- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

-----End of Heading-----



Heading# 3

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2050 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	3/4 HR

1 Total Openings

1	Door#	N-005	Location:	Corridor 004 to Office 005	Handing:	LH
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Web Link

Install Instructions

Site Verified

By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	652	Hager	X			<input type="checkbox"/>
1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	X			<input type="checkbox"/>
1	Mortise Cylinder	80-111	626	Schlage	X			<input type="checkbox"/>
1	Electric Strike	1500C	630	HES	X	X		<input type="checkbox"/>
1	Overhead Stop	105S	630	Glynn Johnson	X	X		<input type="checkbox"/>
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – HM Door Screws	630	Gallery	X			<input type="checkbox"/>
2	Coat Hook	GSH 390	626	Gallery	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			<input type="checkbox"/>
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X		<input type="checkbox"/>

By Automatics Supplier – PACKAGE #3 – PUSH BUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)

1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount	628		X			<input type="checkbox"/>
2	Wave Buttons	CM-331/42SW-SGLR, Double Gang, SS Face Plate with LED Ring	630	Camden	X			<input type="checkbox"/>
2	Surface Mount Box	CM-43CBLA	630	Camden	X			<input type="checkbox"/>
1	Key Switch	CM-2210 x 7224 LED	630	Camden	X			<input type="checkbox"/>
1	Cylinder	CM-CYL60-KA	630	Camden	X			<input type="checkbox"/>

By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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Notes:

- Final commissioning of all access control items, such as but not limited to electric strikes, Rex sensors, Door contacts, Electrified Panics, Relays & Maglocks is the responsibility of the security provider
- Refer to STC rating of the wall in Architectural layout G1002
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Option to have Operators manually turned off and room closed during non working hours using classroom function of lockset.
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.

-----End of Heading-----



Heading# 4

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2050 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	3/4 HR

1 Total Openings

1	Door#	N-010	Location:	Corridor 004 to Tech Room 010	Handing:	RH
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Web Link

Install Instructions

Site Verified

By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	652	Hager	X			<input type="checkbox"/>
1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	X			<input type="checkbox"/>
1	Mortise Cylinder	80-111	626	Schlage	X			<input type="checkbox"/>
1	Electric Strike	1500C	630	HES	X	X		<input type="checkbox"/>
1	Overhead Stop	105S	630	Glynn Johnson	X	X		<input type="checkbox"/>
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – HM Door Screws	630	Gallery	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			<input type="checkbox"/>
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X		<input type="checkbox"/>

By Automatics Supplier – **PACKAGE #3 – PUSH BUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)**



1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount	628		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	Wave Buttons	CM-331/42SW-SGLR, Double Gang, SS Face Plate with LED Ring	630	Camden	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	Surface Mount Box	CM-43CBLA	630	Camden	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	Key Switch	CM-2210 x 7224 LED	630	Camden	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	Cylinder	CM-CYL60-KA	630	Camden	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
By Locksmith									
1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Notes:

- Final commissioning of all access control items, such as but not limited to electric strikes, Rex sensors, Door contacts, Electrified Panics, Relays & Maglocks is the responsibility of the security provider
- Refer to STC rating of the wall in Architectural layout G1002
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Option to have Operators manually turned off and room closed during non working hours using classroom function of lockset.
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.

-----End of Heading-----





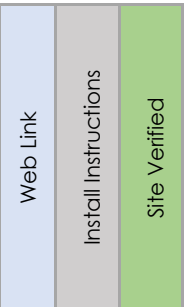
Heading# 5

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2050 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	None

1 Total Openings

1	Door#	N-012	Location:	Tech Room 010 from Office Space 012	Handing:	RHR
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By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	652	Hager	X			<input type="checkbox"/>
1	Office Lockset	ND50BDC x RHO x 626	626	Schlage	X			<input type="checkbox"/>
2	Coat Hook	GSH 390	626	Gallery	X			<input type="checkbox"/>
1	Overhead Stop	105S	630	Glynn Johnson	X	X		<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			<input type="checkbox"/>
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X		<input type="checkbox"/>

By Locksmith

1	Permanent Core	Permanent Medeco Core Provided by City Locksmith	626	Medeco				<input type="checkbox"/>
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Notes:

- Refer to STC rating of the wall in Architectural layout G1002
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

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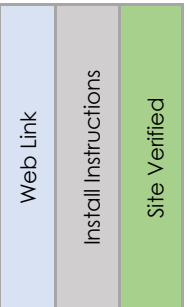
Heading# 6

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1	Door#	NE-001	Location:	Corridor 001 from Boiler Room 002	Handing:
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By Hardware Supplier

1	Storeroom Lockset	ND80BDC x RHO x 626	626	Schlage	X			
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By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

-----End of Heading-----





Heading# 7

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1	Door#	NE-006	Location:	Corridor 004 to Office 006	Handing:
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Web Link

Install Instructions

Site Verified

By Hardware Supplier

1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	X			
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By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

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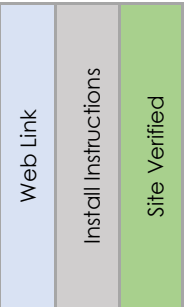
**Heading# 8**

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1 **Door#** NE-007 **Location:** Corridor 004 to Office 006 **Handing:**



By Hardware Supplier

1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	X			
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By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

.....End of Heading.....



Heading# 9

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1	Door#	NE-008	Location:	Corridor 004 to Gender Neutral W.S 008	Handing:
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Web Link	Install Instructions	Site Verified
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By Hardware Supplier

1	Privacy Latchset	ND40S x RHO x 626	626	Schlage	X			
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*BALANCE OF EXITING HARDWARE TO REMAIN.

-----End of Heading-----

Heading# 10

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1	Door#	NE-011	Location:	Corridor 004 to Janitor Room 011	Handing:
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Web Link	Install Instructions	Site Verified
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By Hardware Supplier

1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	X			
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By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.



Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

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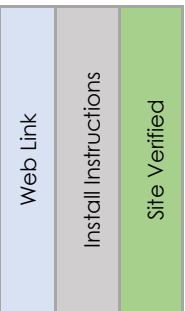
**Heading# 11**

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	None

1 Total Openings

1 **Door#** N-101A **Location:** Exterior from South Lounge 101 **Handing:** LHR

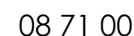


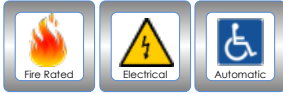
By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4" NRP	630	Hager	X			<input type="checkbox"/>
1	Exit Device	CD-98L x 996L-R/V x 06 x 626/630 – 4'0	630	Von Duprin	X	X		<input type="checkbox"/>
1	Rim Cylinder Housing	80-116	626	Schlage	X			<input type="checkbox"/>
1	Mortise Cylinder	80-110	626	Schlage	X			<input type="checkbox"/>
1	Mortise Cylinder	80-111	626	Schlage	X			<input type="checkbox"/>
1	Electric Strike	6300 x 12/24VCD	630	Von Duprin	X	X		<input type="checkbox"/>
1	Overhead Stop	105S	630	Glynn Johnson	X	X		<input type="checkbox"/>
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – Door Screws	630	Gallery	X			<input type="checkbox"/>
1	Weatherstrip	W-13 – 1 @ 1067 & 2 @ 2135	628	KN Crowder	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			<input type="checkbox"/>
1	Door Sweep	W-13S x 1067	BLK	KN Crowder	X			<input type="checkbox"/>
1	Threshold	CT-10 x 1067	628	KN Crowder	X			<input type="checkbox"/>

By Automatics Supplier – **PACKAGE #1 – PUSH BUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)**

1	Auto Operator (SNG)	BESAM SW200i – Push Side Mount	628		X			<input type="checkbox"/>
1	Push Button	CM60/4-WT	630	Camden	X			<input type="checkbox"/>





Heading# 12

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	3/4 HR

1 Total Openings

1 **Door#** N-103A **Location:** Kitchen 103 from Office Area 105 **Handing:** RHR

Web Link

Install Instructions

Site Verified

By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4" NRP	652	Hager	X			<input type="checkbox"/>
1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	X			<input type="checkbox"/>
1	Mortise Cylinder	80-111	626	Schlage	X			<input type="checkbox"/>
1	Electric Strike	1500C	630	HES	X	X		<input type="checkbox"/>
1	Overhead Stop	105S	630	Glynn Johnson	X	X		<input type="checkbox"/>
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – HM Door Screws	630	Gallery	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			<input type="checkbox"/>
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X		<input type="checkbox"/>

By Automatics Supplier – **PACKAGE #3 – PUSH BUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)**

1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount	628		X			<input type="checkbox"/>
2	Wave Buttons	CM-331/42SW-SGLR, Double Gang, SS Face Plate with LED Ring	630	Camden	X			<input type="checkbox"/>
2	Surface Mount Box	CM-43CBLA	630	Camden	X			<input type="checkbox"/>
1	Key Switch	CM-2210 x 7224 LED	630	Camden	X			<input type="checkbox"/>
1	Cylinder	CM-CYL60-KA	630	Camden	X			<input type="checkbox"/>

By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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Notes:

- Final commissioning of all access control items, such as but not limited to electric strikes, Rex sensors, Door contacts, Electrified Panics, Relays & Maglocks is the responsibility of the security provider
- Refer to STC rating of the wall in Architectural layout G1002
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)

- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Option to have Operators manually turned off and room closed during non working hours using classroom function of lockset.
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.

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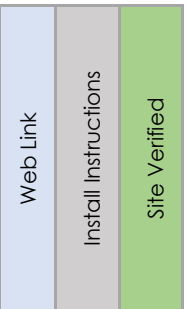
Heading# 13

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	3/4 HR

1 Total Openings

1 **Door#** N-103B **Location:** Corridor 102 to Kitchen 103 **Handing:** LH



By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	652	Hager	X			<input type="checkbox"/>
1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	X			<input type="checkbox"/>
1	Mortise Cylinder	80-111	626	Schlage	X			<input type="checkbox"/>
1	Electric Strike	1500C	630	HES	X	X		<input type="checkbox"/>
1	Overhead Stop	105S	630	Glynn Johnson	X	X		<input type="checkbox"/>
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – HM Door Screws	630	Gallery	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			<input type="checkbox"/>
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X		<input type="checkbox"/>

By Automatics Supplier – PACKAGE #3 – PUSH BUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)

1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount	628		X			<input type="checkbox"/>
2	Wave Buttons	CM-331/42SW-SGLR, Double Gang, SS Face Plate with LED Ring	630	Camden	X			<input type="checkbox"/>
2	Surface Mount Box	CM-43CBLA	630	Camden	X			<input type="checkbox"/>
1	Key Switch	CM-2210 x 7224 LED	630	Camden	X			<input type="checkbox"/>
1	Cylinder	CM-CYL60-KA	630	Camden	X			<input type="checkbox"/>



By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco					<input type="checkbox"/>
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Notes:

- Final commissioning of all access control items, such as but not limited to electric strikes, Rex sensors, Door contacts, Electrified Panics, Relays & Maglocks is the responsibility of the security provider
- Refer to STC rating of the wall in Architectural layout G1002
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Option to have Operators manually turned off and room closed during non working hours using classroom function of lockset.
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.

-----End of Heading-----



Heading# 14

Opening Information

Opening Type:	Single	Opening Size:	965 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	3/4 HR

1 Total Openings

1	Door#	N-110	Location:	Corridor 102 to B/F Washroom 110	Handing:	LH
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Web Link

Install Instructions

Site Verified

By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	630	Hager	X				<input type="checkbox"/>
1	Storeroom Lockset	ND80BDC x RHO x 626	626	Schlage	X				<input type="checkbox"/>
1	Electric Strike	1500C	630	HES	X	X			<input type="checkbox"/>
2	Kickplate	GSH 80A – 203 x 927 (Rounded Corners) – Door Screws	630	Gallery	X				<input type="checkbox"/>
2	Coat Hook	GSH 390	626	Gallery	X				<input type="checkbox"/>



1	Floor Stop	GSH 209	626	Gallery	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5500	BLK	KN Crowder	X			<input type="checkbox"/>
1	Auto Door Bottom	434APKL x 965	MIL	Pemko	X	X		<input type="checkbox"/>
By Automatics Supplier – PACKAGE #5 – PUSH TO LOCK KIT UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)								
1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount	628		X			<input type="checkbox"/>
1	Wave to Lock Kit	CX-WC16	630	Camden	X	X		<input type="checkbox"/>
1	Emergency Key Cabinet	EB-02	RD	Canropa	X			<input type="checkbox"/>
By Locksmith								
1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>

Notes:

- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Refer to STC rating of the wall in Architectural layout G1002
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

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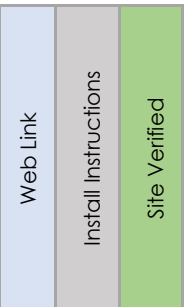
**Heading# 15**

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	None

1 Total Openings

1	Door#	N-113	Location:	Corridor 116 to Office 113	Handing:	LH
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By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 1/2" x 4"	652	Hager	X			<input type="checkbox"/>
1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	X			<input type="checkbox"/>



1	Mortise Cylinder	80-111	626	Schlage	X				
1	Electric Strike	1500C	630	HES	X	X			
1	Overhead Stop	105S	630	Glynn Johnson	X	X			
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – HM Door Screws	630	Gallery	X				
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X				
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X			
By Automatics Supplier – PACKAGE #3 – PUSH BUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)									
1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount	628		X				
2	Wave Buttons	CM-331/42SW-SGLR, Double Gang, SS Face Plate with LED Ring	630	Camden	X				
2	Surface Mount Box	CM-43CBLA	630	Camden	X				
1	Key Switch	CM-2210 x 7224 LED	630	Camden	X				
1	Cylinder	CM-CYL60-KA	630	Camden	X				
By Locksmith									
1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco					

Notes:

- Final commissioning of all access control items, such as but not limited to electric strikes, Rex sensors, Door contacts, Electrified Panics, Relays & Maglocks is the responsibility of the security provider
- Refer to STC rating of the wall in Architectural layout G1002
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Option to have Operators manually turned off and room closed during non working hours using classroom function of lockset.
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.

-----End of Heading-----





Heading# 16

Opening Information

Opening Type:	Pair	Opening Size:	1 x 1067 x 2135 x 45 – 1 x 763 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	None

1 Total Openings

1 **Door#** N-119A **Location:** Common Space 119 from Corridor 124 **Handing:** LHRA/RHRA

Web Link

Install Instructions

Site Verified

By Hardware Supplier

5	Heavy Weight Hinge	BB1168 – 4 ½" x 4" NRP	652	Hager	X			<input type="checkbox"/>
1	Electric Hinge	BB1168 – 4 ½" x 4" ETW NRP	652	Hager	X			<input type="checkbox"/>
1	Exit Device	LBL-RX-QEL-9847L-F x 996L x 06 x 4'0 x RHR	626	Von Duprin	X	X	X	<input type="checkbox"/>
1	Exit Device	LBL-9847L-Fx 996L x 06 x 3'0 x LHR	626	Von Duprin	X	X	X	<input type="checkbox"/>
2	Rim Cylinder Housing	80-116	626	Schlage	X			<input type="checkbox"/>
1	Mortise Cylinder	80-111	626	Schlage	X			<input type="checkbox"/>
1	Closer	4111-RH (LCN / ST 2779)	689	LCN	X	X		<input type="checkbox"/>
1	Overhead Stop	104S	630	Glynn Johnson	X	X		<input type="checkbox"/>
1	Overhead Stop	103S	630	Glynn Johnson	X	X		<input type="checkbox"/>
2	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – Door Screws	630	Gallery	X			<input type="checkbox"/>
2	Kickplate	GSH 80A – 203 x 725 (Rounded Corners) – Door Screws	630	Gallery	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 6500	BLK	KN Crowder	X			<input type="checkbox"/>
1	Door Sweep	W-24S x 1067	CA	KN Crowder	X			<input type="checkbox"/>
1	Door Sweep	W-24S x 763	CA	KN Crowder	X			<input type="checkbox"/>
1	Astragal	W-25 x 2135	CA	KN Crowder	X			<input type="checkbox"/>
1	Power Supply	PS904-4RL-FA	689	Von Duprin	X			<input type="checkbox"/>

By Automatics Supplier – PACKAGE #3 – PUSH BUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)

1	Auto Operator (SNG)	BESAM SW100 - Push Side Mount – LH	628		X			<input type="checkbox"/>
2	Wave Buttons	CM-331/42SW-SGLR, Double Gang, SS Face Plate with LED Ring	630	Camden	X			<input type="checkbox"/>
2	Surface Mount Box	CM-43CBLA	630	Camden	X			<input type="checkbox"/>
1	Logic Relay	CX-33		Camden	X			<input type="checkbox"/>
1	Key Switch	CM-2210 x 7224 LED	630	Camden	X			<input type="checkbox"/>
1	Cylinder	CM-CYL60-KA	630	Camden	X			<input type="checkbox"/>



By Locksmith

2	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco					<input type="checkbox"/>
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Notes:

- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Final commissioning of all access control items, such as but not limited to electric strikes, Rex sensors, Door contacts, Electrified Panics, Relays & Maglocks is the responsibility of the security provider
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- Operator must be manually tuned off prior to locking door with Classroom Lever Trim.

-----End of Heading-----



Heading# 17

Opening Information

Opening Type:	Pair	Opening Size:	1 x 1067 x 2135 x 45 – 1 x 763 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	None

1 Total Openings

1	Door#	N-119B	Location:	Common Space 119 from Corridor 123	Handing:	LHRA/RHRA
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Web Link

Install Instructions

Site Verified

By Hardware Supplier

5	Heavy Weight Hinge	BB1168 – 4 ½" x 4" NRP	652	Hager	X				<input type="checkbox"/>
1	Electric Hinge	BB1168 – 4 ½" x 4" ETW NRP	652	Hager	X				<input type="checkbox"/>
1	Exit Device	LBL-RX-QEL-9847L-F x 996L x 06 x 4'0 x LHR	626	Von Duprin	X	X	X		<input type="checkbox"/>
1	Exit Device	LBL-9847L x 996L-F x 06 x 3'0 x RHR	626	Von Duprin	X	X	X		<input type="checkbox"/>
2	Rim Cylinder Housing	80-116	626	Schlage	X				<input type="checkbox"/>
1	Mortise Cylinder	80-111	626	Schlage	X				<input type="checkbox"/>
1	Closer	4111-LH (LCN / ST 2779)	689	LCN	X	X			<input type="checkbox"/>



1	Overhead Stop	104S	630	Glynn Johnson	X	X		<input type="checkbox"/>
1	Overhead Stop	103S	630	Glynn Johnson	X	X		<input type="checkbox"/>
2	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – Door Screws	630	Gallery	X			<input type="checkbox"/>
2	Kickplate	GSH 80A – 203 x 725 (Rounded Corners) – Door Screws	630	Gallery	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 6500	BLK	KN Crowder	X			<input type="checkbox"/>
1	Door Sweep	W-24S x 1067	CA	KN Crowder	X			<input type="checkbox"/>
1	Door Sweep	W-24S x 763	CA	KN Crowder	X			<input type="checkbox"/>
1	Astragal	W-25 x 2135	CA	KN Crowder	X			<input type="checkbox"/>
1	Power Supply	PS904-4RL-FA	689	Von Duprin	X			<input type="checkbox"/>
By Automatics Supplier – PACKAGE #3 – PUSH BUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)								
1	Auto Operator (SNG)	BESAM SW100 - Push Side Mount – RH	628		X			<input type="checkbox"/>
2	Wave Buttons	CM-331/42SW-SGLR, Double Gang, SS Face Plate with LED Ring	630	Camden	X			<input type="checkbox"/>
2	Surface Mount Box	CM-43CBLA	630	Camden	X			<input type="checkbox"/>
1	Logic Relay	CX-33		Camden	X			<input type="checkbox"/>
1	Key Switch	CM-2210 x 7224 LED	630	Camden	X			<input type="checkbox"/>
1	Cylinder	CM-CYL60-KA	630	Camden	X			<input type="checkbox"/>
By Locksmith								
2	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>

Notes:

- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Final commissioning of all access control items, such as but not limited to electric strikes, Rex sensors, Door contacts, Electrified Panics, Relays & Maglocks is the responsibility of the security provider
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- Operator must be manually tuned off prior to locking door with Classroom Lever Trim.

-----End of Heading-----





Heading# 18

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	None

1 Total Openings

1	Door#	N-120	Location:	Corridor 102 to Activity Room 120	Handing:	RH
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Web Link

Install Instructions

Site Verified

By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	652	Hager	X			<input type="checkbox"/>
1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	X			<input type="checkbox"/>
1	Mortise Cylinder	80-111	626	Schlage	X			<input type="checkbox"/>
1	Electric Strike	1500C	630	HES	X	X		<input type="checkbox"/>
1	Overhead Stop	105S	630	Glynn Johnson	X	X		<input type="checkbox"/>
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – HM Door Screws	630	Gallery	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			<input type="checkbox"/>
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X		<input type="checkbox"/>

By Automatics Supplier – PACKAGE #3 – PUSH BUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)

1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount	628		X			<input type="checkbox"/>
2	Wave Buttons	CM-331/42SW-SGLR, Double Gang, SS Face Plate with LED Ring	630	Camden	X			<input type="checkbox"/>
2	Surface Mount Box	CM-43CBLA	630	Camden	X			<input type="checkbox"/>
1	Key Switch	CM-2210 x 7224 LED	630	Camden	X			<input type="checkbox"/>
1	Cylinder	CM-CYL60-KA	630	Camden	X			<input type="checkbox"/>

By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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Notes:

- Final commissioning of all access control items, such as but not limited to electric strikes, Rex sensors, Door contacts, Electrified Panics, Relays & Maglocks is the responsibility of the security provider
- Refer to STC rating of the wall in Architectural layout G1002
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)



- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Option to have Operators manually turned off and room closed during non working hours using classroom function of lockset.
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.

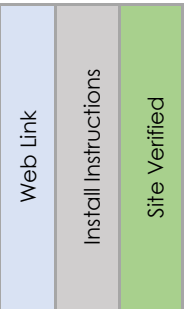
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Heading# 19**Opening Information**

Opening Type:	Single	Opening Size:	1067 x 2135 x 45	STC Rating	None
Door Material:	ALD	Frame Material:	ALF	Fire Rating	None

1 Total Openings

1 **Door#** N-120A **Location:** Exterior from Activity Room I 120 **Handing:** LHR

**By Hardware Supplier**

1	Continuous Hinge	112XY x 2108	628	Ives	X	X		<input type="checkbox"/>
1	Exit Device	CD-35A-NL-OP x 388NL x 4'0	626	Von Duprin	X	X		<input type="checkbox"/>
1	Rim Cylinder	80-116	626	Schlage				<input type="checkbox"/>
1	Mortise Cylinder	80-110	626	Schlage	X			<input type="checkbox"/>
1	Door Pull	GSH 165F x 1830 x #2 MTG	630	Gallery	X			<input type="checkbox"/>
1	Closer	4021-RH	628	LCN	X	X		<input type="checkbox"/>
1	Drop Plate	4020-18G	628	LCN	X	X		<input type="checkbox"/>
1	Overhead Stop	105S	630	Glynn Johnson	X	X		<input type="checkbox"/>
1	Weatherstrip	By Aluminum Door Supplier	628					<input type="checkbox"/>
1	Door Sweep	By Aluminum Door Supplier	628					<input type="checkbox"/>
1	Threshold	By Aluminum Door Supplier	628					<input type="checkbox"/>

By Security Supplier

1	Door Contact	To Suit Building System						<input type="checkbox"/>
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By Locksmith

2	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

-----End of Heading-----



Heading# 20

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	None

1 Total Openings

1 **Door#** N-121 **Location:** Corridor 102 to Activity Room II 121 **Handing:** RH

Web Link

Install Instructions

Site Verified

By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	652	Hager	X			<input type="checkbox"/>
1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	X			<input type="checkbox"/>
1	Mortise Cylinder	80-111	626	Schlage	X			<input type="checkbox"/>
1	Electric Strike	1500C	630	HES	X	X		<input type="checkbox"/>
1	Overhead Stop	105S	630	Glynn Johnson	X	X		<input type="checkbox"/>
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – HM Door Screws	630	Gallery	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			<input type="checkbox"/>
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X		<input type="checkbox"/>

By Automatics Supplier – PACKAGE #3 – PUSH BUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)

1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount	628		X			<input type="checkbox"/>
2	Wave Buttons	CM-331/42SW-SGLR, Double Gang, SS Face Plate with LED Ring	630	Camden	X			<input type="checkbox"/>
2	Surface Mount Box	CM-43CBLA	630	Camden	X			<input type="checkbox"/>
1	Key Switch	CM-2210 x 7224 LED	630	Camden	X			<input type="checkbox"/>
1	Cylinder	CM-CYL60-KA	630	Camden	X			<input type="checkbox"/>

By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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Notes:

- Final commissioning of all access control items, such as but not limited to electric strikes, Rex sensors, Door contacts, Electrified Panics, Relays & Maglocks is the responsibility of the security provider
- Refer to STC rating of the wall in Architectural layout G1002
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Option to have Operators manually turned off and room closed during non working hours using classroom function of lockset.
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.

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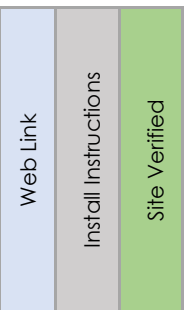
Heading# 21

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2135 x 45	STC Rating	None
Door Material:	ALD	Frame Material:	ALF	Fire Rating	None

1 Total Openings

1	Door#	N-121A	Location:	Exterior from Activity Room II121	Handing:	LHR
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By Hardware Supplier

1	Continuous Hinge	112XY x 2108	628	Ives	X	X	<input type="checkbox"/>
1	Exit Device	CD-35A-NL-OP x 388NL x 4'0	626	Von Duprin	X	X	<input type="checkbox"/>
1	Rim Cylinder	80-116	626	Schlage			<input type="checkbox"/>
1	Mortise Cylinder	80-110	626	Schlage	X		<input type="checkbox"/>
1	Door Pull	GSH 165F x 1830 x #2 MTG	630	Gallery	X		<input type="checkbox"/>
1	Closer	4021-RH	628	LCN	X	X	<input type="checkbox"/>
1	Drop Plate	4020-18G	628	LCN	X	X	<input type="checkbox"/>
1	Overhead Stop	105S	630	Glynn Johnson	X	X	<input type="checkbox"/>



1	Weatherstrip	By Aluminum Door Supplier	628					
1	Door Sweep	By Aluminum Door Supplier	628					
1	Threshold	By Aluminum Door Supplier	628					
By Security Supplier								
1	Door Contact	To Suit Building System						
By Locksmith								
2	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

-----End of Heading-----

Heading# 22

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2135 x 45	STC Rating	None
Door Material:	ALD	Frame Material:	ALF	Fire Rating	None

1 Total Openings

1	Door#	N-122	Location:	Exterior from Conference Room 122	Handing:	LHR
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Web Link

Install Instructions

Site Verified

By Hardware Supplier

1	Continuous Hinge	112XY x 2108	628	Ives	X	X		
1	Exit Device	CD-35A-NL-OP x 388NL x 4'0	626	Von Duprin	X	X		
1	Rim Cylinder	80-116	626	Schlage				
1	Mortise Cylinder	80-110	626	Schlage	X			
1	Door Pull	GSH 165F x 1830 x #2 MTG	630	Gallery	X			
1	Closer	4021-RH	628	LCN	X	X		
1	Drop Plate	4020-18G	628	LCN	X	X		
1	Overhead Stop	105S	630	Glynn Johnson	X	X		
1	Weatherstrip	By Aluminum Door Supplier	628					



1	Door Sweep	By Aluminum Door Supplier	628						<input type="checkbox"/>
1	Threshold	By Aluminum Door Supplier	628						<input type="checkbox"/>
By Security Supplier									
1	Door Contact	To Suit Building System							<input type="checkbox"/>
By Locksmith									
2	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco					<input type="checkbox"/>

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

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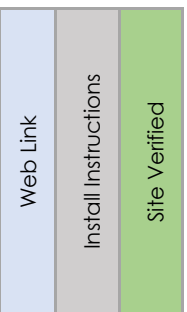
Heading# 23

Opening Information

Opening Type:	Pair	Opening Size:	2 x 950 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	3/4 HR

1 Total Openings

1 **Door#** N-123 **Location:** Corridor 123 from Gym 125 **Handing:** LHRA/RHRA



By Hardware Supplier

4	Heavy Weight Hinge	BB1168 – 4 ½" x 4" NRP	652	Hager	X				<input type="checkbox"/>
2	Electric Hinge	BB1168 – 4 ½" x 4" ETW NRP	652	Hager	X				<input type="checkbox"/>
1	Exit Device	LBL-RX-QEL-9847L-F x 996L x 06 x 4'0 x RHR	626	Von Duprin	X	X	X		<input type="checkbox"/>
1	Exit Device	LBL-RX-QEL-9847L-F x 996L x 06 x 4'0 x LHR	626	Von Duprin	X	X	X		<input type="checkbox"/>
2	Rim Cylinder Housing	80-116	626	Schlage	X				<input type="checkbox"/>
1	Mortise Cylinder	80-111	626	Schlage	X				<input type="checkbox"/>
2	Overhead Stop	104S	630	Glynn Johnson	X	X			<input type="checkbox"/>
4	Kickplate	GSH 80A – 203 x 912 (Rounded Corners) – Door Screws	630	Gallery	X				<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 6500	BLK	KN Crowder	X				<input type="checkbox"/>
1	Door Sweep	W-24S x 950	CA	KN Crowder	X				<input type="checkbox"/>



1	Door Sweep	W-24S x 950	CA	KN Crowder	X			<input type="checkbox"/>
1	Astragal	W-25 x 2135	CA	KN Crowder	X			<input type="checkbox"/>
1	Power Supply	PS904-4RL-FA	689	Von Duprin	X			<input type="checkbox"/>
By Automatics Supplier – PACKAGE #3C – PUSH BUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)								
1	Auto Operator (PAIR)	BESAM SW100 – Double Door - Pull Side Mount – RH/LH	628		X			<input type="checkbox"/>
2	Wave Buttons	CM-331/42SW-SGLR, Double Gang, SS Face Plate with LED Ring	630	Camden	X			<input type="checkbox"/>
2	Surface Mount Box	CM-43CBLA	630	Camden	X			<input type="checkbox"/>
1	Logic Relay	CX-33		Camden	X			<input type="checkbox"/>
1	Key Switch	CM-2210 x 7224 LED	630	Camden	X			<input type="checkbox"/>
1	Cylinder	CM-CYL60-KA	630	Camden	X			<input type="checkbox"/>
By Locksmith								
3	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>

Notes:

- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Final commissioning of all access control items, such as but not limited to electric strikes, Rex sensors, Door contacts, Electrified Panics, Relays & Maglocks is the responsibility of the security provider
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- Operator must be manually tuned off prior to locking door with Classroom Lever Trim.

-----End of Heading-----



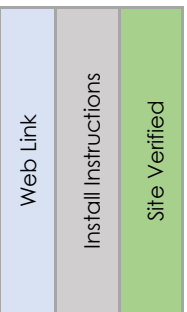

Heading# 24

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	3/4 HR

1 Total Openings

1	Door#	N-124	Location:	Corridor 124 from Pool	Handing:	LHR
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By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4" NRP	630	Hager	X			<input type="checkbox"/>
1	Exit Device	98L-F x 996L-R/V x 06 x 626/630 x 4'0	630	Von Duprin	X	X		<input type="checkbox"/>
1	Electric Strike	6300 x 12/24VCD	630	Von Duprin	X	X		<input type="checkbox"/>
1	Rim Cylinder Housing	80-116	626	Schlage	X			<input type="checkbox"/>
1	Mortise Cylinder	80-111	626	Schlage	X			<input type="checkbox"/>
1	Overhead Stop	105S	630	Glynn Johnson	X	X		<input type="checkbox"/>
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – HM Door Screws	630	Gallery	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			<input type="checkbox"/>
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X		<input type="checkbox"/>

By Automatics Supplier – PACKAGE #3 – PUSH BUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)

1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount	628		X			<input type="checkbox"/>
2	Wave Buttons	CM-331/42SW-SGLR, Double Gang, SS Face Plate with LED Ring	630	Camden	X			<input type="checkbox"/>
2	Surface Mount Box	CM-43CBLA	630	Camden	X			<input type="checkbox"/>
1	Key Switch	CM-2210 x 7224 LED	630	Camden	X			<input type="checkbox"/>
1	Cylinder	CM-CYL60-KA	630	Camden	X			<input type="checkbox"/>



By Locksmith

2	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco					<input type="checkbox"/>
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Notes:

- Final commissioning of all access control items, such as but not limited to electric strikes, Rex sensors, Door contacts, Electrified Panics, Relays & Maglocks is the responsibility of the security provider
- Refer to STC rating of the wall in Architectural layout G1002
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.
- Operator must be manually tuned off prior to locking door with Classroom Lever Trim.

-----End of Heading-----



Heading# 25

Opening Information

Opening Type:	Pair	Opening Size:	2 x 950 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	None

1 Total Openings

1	Door#	N-125A	Location:	Exterior from Gym 125	Handing:	LHRA/RHRA
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By Hardware Supplier

4	Heavy Weight Hinge	BB1168 – 4 ½" x 4" NRP	630	Hager	X				<input type="checkbox"/>
2	Electric Hinge	BB1168 – 4 ½" x 4" ETW NRP	630	Hager	X				<input type="checkbox"/>
1	Exit Device	RX-QEL-9847NL-OP-F x 110NL-MD x 4'0 x LHR	626	Von Duprin	X	X			<input type="checkbox"/>
1	Exit Device	RX-QEL-9847EO-F x 4'0 x RHR	626	Von Duprin	X	X			<input type="checkbox"/>
1	Rim Cylinder Housing	80-116	626	Schlage	X				<input type="checkbox"/>



1	Mortise Cylinder	80-111	626	Schlage	X				
2	Door Pull	GSH 165F x 1830 x #2 MTG	630	Gallery	X				
2	Overhead Stop	104S	630	Glynn Johnson	X	X			
4	Kickplate	GSH 80A – 203 x 912 (Rounded Corners) – Door Screws	630	Gallery	X				
1	Smoke / Sound Seal	W-66 x 6500	BLK	KN Crowder	X				
1	Weatherstrip	W-13 – 1 @ 1900 & 2 @ 2135	628	KN Crowder	X				
1	Smoke / Sound Seal	W-66 x 6600	BLK	KN Crowder	X				
2	Door Sweep	W-13S x 950	BLK	KN Crowder	X				
1	Astragal	W-25 x 2135	CA	KN Crowder	X				
1	Threshold	CT-10 x 1900	628	KN Crowder	X				
1	Power Supply	PS904-4RL-FA	689	Von Duprin	X				
By Automatics Supplier – PACKAGE #1C – INTERIOR PUSHBUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)									
1	Auto Operator (PAIR)	BESAM SW200i – Double Door - Push Side Mount – RH/LH	628		X				
1	Push Button	CM60/4-WT	630	Camden	X				
1	Surface Mount Box	CM-79	630	Camden	X				
1	Wave Buttons	CM-331/42SW-SGLR, Double Gang, SS Face Plate with LED Ring	630	Camden	X				
1	Surface Mount Box	CM-43CBLA	630	Camden	X				
1	Logic Relay	CX-33		Camden	X				
1	Key Switch	CM-2210 x 7224 LED	630	Camden	X				
1	Cylinder	CM-CYL60-KA	630	Camden	X				
By Security Supplier									
2	Door Contact	To Suit Building System							
By Locksmith									
3	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco					

Notes:

- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Final commissioning of all access control items, such as but not limited to electric strikes, Rex sensors, Door contacts, Electrified Panics, Relays & Maglocks is the responsibility of the security provider
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- Operator must be manually tuned off prior to locking door

-----End of Heading-----





Heading# 26

Opening Information

Opening Type:	Pair	Opening Size:	2 x 950 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	None

1 Total Openings

1	Door#	N-125B	Location:	Exterior from Gym 125	Handing:	LHRA/RHRA
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Web Link

Install Instructions

Site Verified

By Hardware Supplier

4	Heavy Weight Hinge	BB1168 – 4 ½" x 4" NRP	630	Hager	X			<input type="checkbox"/>
2	Electric Hinge	BB1168 – 4 ½" x 4" ETW NRP	630	Hager	X			<input type="checkbox"/>
1	Exit Device	RX-QEL-9847NL-OP-F x 110NL-MD x 4'0 x LHR	626	Von Duprin	X	X		<input type="checkbox"/>
1	Exit Device	RX-QEL-9847EO-F x 4'0 x RHR	626	Von Duprin	X	X		<input type="checkbox"/>
1	Rim Cylinder Housing	80-116	626	Schlage	X			<input type="checkbox"/>
1	Mortise Cylinder	80-111	626	Schlage	X			<input type="checkbox"/>
2	Door Pull	GSH 165F x 1830 x #2 MTG	630	Gallery	X			<input type="checkbox"/>
2	Overhead Stop	104S	630	Glynn Johnson	X	X		<input type="checkbox"/>
4	Kickplate	GSH 80A – 203 x 912 (Rounded Corners) – Door Screws	630	Gallery	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 6500	BLK	KN Crowder	X			<input type="checkbox"/>
1	Weatherstrip	W-13 – 1 @ 1900 & 2 @ 2135	628	KN Crowder	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 6600	BLK	KN Crowder	X			<input type="checkbox"/>
2	Door Sweep	W-13S x 950	BLK	KN Crowder	X			<input type="checkbox"/>
1	Astragal	W-25 x 2135	CA	KN Crowder	X			<input type="checkbox"/>
1	Threshold	CT-10 x 1900	628	KN Crowder	X			<input type="checkbox"/>
1	Power Supply	PS904-4RL-FA	689	Von Duprin	X			<input type="checkbox"/>

By Automatics Supplier – PACKAGE #1C – INTERIOR PUSHBUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)

1	Auto Operator (PAIR)	BESAM SW200i – Double Door - Push Side Mount – RH/LH	628		X			<input type="checkbox"/>
1	Push Button	CM60/4-WT	630	Camden	X			<input type="checkbox"/>
1	Surface Mount Box	CM-79	630	Camden	X			<input type="checkbox"/>
1	Wave Buttons	CM-331/42SW-SGLR, Double Gang, SS Face Plate with LED Ring	630	Camden	X			<input type="checkbox"/>



1	Surface Mount Box	CM-43CBLA	630	Camden	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	Logic Relay	CX-33		Camden	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	Key Switch	CM-2210 x 7224 LED	630	Camden	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	Cylinder	CM-CYL60-KA	630	Camden	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
By Security Supplier									
2	Door Contact	To Suit Building System			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
By Locksmith									
3	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Notes:

- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Final commissioning of all access control items, such as but not limited to electric strikes, Rex sensors, Door contacts, Electrified Panics, Relays & Maglocks is the responsibility of the security provider
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- Operator must be manually tuned off prior to locking door

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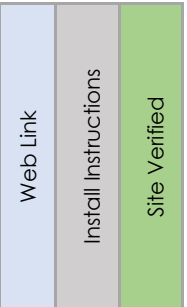
Heading# 27

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	3/4 HR

1 Total Openings

1	Door#	N-126A	Location:	Corridor 123 from B/F Washroom & Change Room 126	Handing:	LHR
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By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	630	Hager	X			<input type="checkbox"/>
1	Storeroom Lockset	ND80BDC x RHO x 626	626	Schlage	X			<input type="checkbox"/>
1	Electric Strike	1500C	630	HES	X	X		<input type="checkbox"/>
2	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – Door Screws	630	Gallery	X			<input type="checkbox"/>
2	Coat Hook	GSH 390	626	Gallery	X			<input type="checkbox"/>
1	Overhead Stop	105S	630	Glynn Johnson	X	X		<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5500	BLK	KN Crowder	X			<input type="checkbox"/>
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X		<input type="checkbox"/>

By Automatics Supplier – PACKAGE #5 – PUSH TO LOCK KIT UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)

1	Auto Operator (SNG)	BESAM SW100 – Push Side Mount	628		X			<input type="checkbox"/>
1	Logic Relay	CX-33		Camden	X			<input type="checkbox"/>
1	Wave to Lock Kit	CX-WC16	630	Camden	X	X		<input type="checkbox"/>
1	Emergency Call Kit	CX-WEC10K2	630	Camden	X	X		<input type="checkbox"/>
1	Emergency Key Cabinet	EB-02	RD	Canropa	X			<input type="checkbox"/>

By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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Notes:

- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Refer to STC rating of the wall in Architectural layout G1002

- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- Door to be sequenced with Door N-126B so when push to lock it is engaged on either door the other door's push to lock is activated.
- Emergency Call Kits to be Sequenced with Door N-126B

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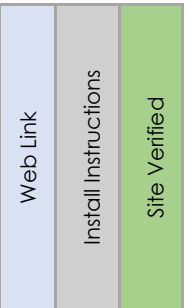
Heading# 28

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	3/4 HR

1 Total Openings

1 **Door#** N-126B **Location:** Pool to B/F Washroom & Change Room 126 **Handing:** RH



By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	630	Hager	X			<input type="checkbox"/>
1	Storeroom Lockset	ND80BDC x RHO x 626	626	Schlage	X			<input type="checkbox"/>
1	Electric Strike	1500C	630	HES	X	X		<input type="checkbox"/>
2	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – Door Screws	630	Gallery	X			<input type="checkbox"/>
2	Coat Hook	GSH 390	626	Gallery	X			<input type="checkbox"/>
1	Floor Stop	GSH 209	626	Gallery	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5500	BLK	KN Crowder	X			<input type="checkbox"/>
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X		<input type="checkbox"/>

By Automatics Supplier – PACKAGE #5 – PUSH TO LOCK KIT UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)

1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount	628		X			<input type="checkbox"/>
1	Logic Relay	CX-33		Camden	X			<input type="checkbox"/>
1	Wave to Lock Kit	CX-WC16	630	Camden	X	X		<input type="checkbox"/>
1	Emergency Call Kit	CX-WEC10K2 (Install push for assistance in Shower)	630	Camden	X	X		<input type="checkbox"/>



1	Emergency Key Cabinet	EB-02	RD	Canropa	X			<input type="checkbox"/>
By Locksmith								
1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>

Notes:

- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Refer to STC rating of the wall in Architectural layout G1002
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- Door to be sequenced with Door N-126A so when push to lock it is engaged on either door the other door's push to lock is activated.
- Emergency Call Kits to be Sequenced with Door N-126A

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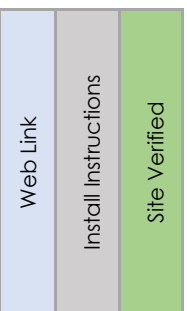
**Heading# 29**

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	3/4 HR

1 Total Openings

1	Door#	N-128A	Location:	Corridor 123 to Gender Neutral Change Room 128A	Handing:	LH
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By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	652	Hager	X			<input type="checkbox"/>
1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	X			<input type="checkbox"/>
1	Mortise Cylinder	80-111	626	Schlage	X			<input type="checkbox"/>
1	Electric Strike	1500C	630	HES	X	X		<input type="checkbox"/>
1	Overhead Stop	105S	630	Glynn Johnson	X	X		<input type="checkbox"/>
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – HM Door Screws	630	Gallery	X			<input type="checkbox"/>



1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			<input type="checkbox"/>
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X		<input type="checkbox"/>
By Automatics Supplier – PACKAGE #3 – PUSH BUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)								
1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount	628		X			<input type="checkbox"/>
2	Wave Buttons	CM-331/42SW-SGLR, Double Gang, SS Face Plate with LED Ring	630	Camden	X			<input type="checkbox"/>
2	Surface Mount Box	CM-43CBLA	630	Camden	X			<input type="checkbox"/>
1	Key Switch	CM-2210 x 7224 LED	630	Camden	X			<input type="checkbox"/>
1	Cylinder	CM-CYL60-KA	630	Camden	X			<input type="checkbox"/>
By Locksmith								
1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>

Notes:

- Final commissioning of all access control items, such as but not limited to electric strikes, Rex sensors, Door contacts, Electrified Panics, Relays & Maglocks is the responsibility of the security provider
- Refer to STC rating of the wall in Architectural layout G1002
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Option to have Operators manually turned off and room closed during non working hours using classroom function of lockset.
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.

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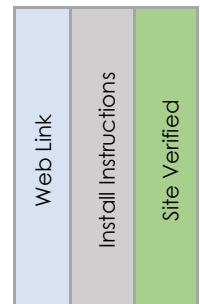
Heading# 30

Opening Information

Opening Type:	Single	Opening Size:	965 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	None

1 Total Openings

1	Door#	N-128D	Location:	Gender Neutral Change Room 128A to Washroom 1 128D	Handing:	RH
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By Hardware Supplier							
3	Hinge	BB1279 – 4 ½" x 4"	630	Hager	X		<input type="checkbox"/>
1	Privacy Latchset	ND40S x RHO x 626	626	Schlage	X		<input type="checkbox"/>
1	Coat Hook	GSH 390	626	Gallery	X		<input type="checkbox"/>
1	Kickplate	GSH 80A – 203 x 927 (Rounded Corners) – HM Door Screws	630	Gallery	X		<input type="checkbox"/>
1	Floor Stop	GSH 209	626	Gallery	X		<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X		<input type="checkbox"/>
1	Auto Door Bottom	434APKL x 965	MIL	Pemko	X	X	<input type="checkbox"/>

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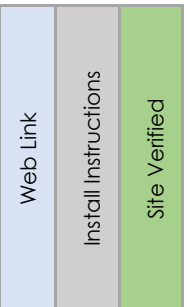
Heading# 31

Opening Information

Opening Type:	Single	Opening Size:	965 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	None

1 Total Openings

1	Door#	N-128E	Location:	Gender Neutral Change Room 128A to Washroom 2 128E	Handing:	RH
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By Hardware Supplier							
3	Hinge	BB1279 – 4 ½" x 4"	630	Hager	X		<input type="checkbox"/>
1	Privacy Latchset	ND40S x RHO x 626	626	Schlage	X		<input type="checkbox"/>
1	Coat Hook	GSH 390	626	Gallery	X		<input type="checkbox"/>
1	Kickplate	GSH 80A – 203 x 927 (Rounded Corners) – HM Door Screws	630	Gallery	X		<input type="checkbox"/>
1	Floor Stop	GSH 209	626	Gallery	X		<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X		<input type="checkbox"/>
1	Auto Door Bottom	434APKL x 965	MIL	Pemko	X	X	<input type="checkbox"/>

-----End of Heading-----



Heading# 32

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	None

1 Total Openings

1	Door#	N-128F	Location:	Gender Neutral Change Room 128A to Accessible Stall 128F	Handing:	RH
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Web Link	Install Instructions	Site Verified
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By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	630	Hager	X			<input type="checkbox"/>
1	Storeroom Lockset	ND80BDC x RHO x 626	626	Schlage	X			<input type="checkbox"/>
1	Electric Strike	1500C	630	HES	X	X		<input type="checkbox"/>
2	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – Door Screws	630	Gallery	X			<input type="checkbox"/>
2	Coat Hook	GSH 390	626	Gallery	X			<input type="checkbox"/>
1	Floor Stop	GSH 209	626	Gallery	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5500	BLK	KN Crowder	X			<input type="checkbox"/>
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X		<input type="checkbox"/>

By Automatics Supplier – PACKAGE #5 – PUSH TO LOCK KIT UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)

1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount	628		X			<input type="checkbox"/>
1	Wave to Lock Kit	CX-WC16	630	Camden	X	X		<input type="checkbox"/>
1	Emergency Key Cabinet	EB-02	RD	Canropa	X			<input type="checkbox"/>

By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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Notes:

- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Refer to STC rating of the wall in Architectural layout G1002



- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

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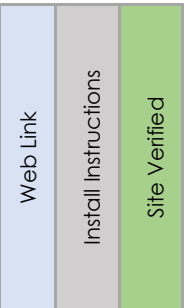
Heading# 33

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	None

1 Total Openings

1	Door#	N-128G	Location:	Gender Neutral Change Room 128A from Change Room Vestibule 128C	Handing:	LHR
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By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	630	Hager	X			<input type="checkbox"/>
1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	X			<input type="checkbox"/>
1	Mortise Cylinder	80-111	626	Schlage	X			<input type="checkbox"/>
1	Electric Strike	1500C	630	HES	X	X		<input type="checkbox"/>
1	Overhead Stop	105S	630	Glynn Johnson	X	X		<input type="checkbox"/>
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – HM Door Screws	630	Gallery	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			<input type="checkbox"/>
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X		<input type="checkbox"/>

By Automatics Supplier – PACKAGE #3 – PUSH BUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)

1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount	628		X			<input type="checkbox"/>
2	Wave Buttons	CM-331/42SW-SGLR, Double Gang, SS Face Plate with LED Ring	630	Camden	X			<input type="checkbox"/>
2	Surface Mount Box	CM-43CBLA	630	Camden	X			<input type="checkbox"/>
1	Key Switch	CM-2210 x 7224 LED	630	Camden	X			<input type="checkbox"/>
1	Cylinder	CM-CYL60-KA	630	Camden	X			<input type="checkbox"/>

By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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Notes:

- Final commissioning of all access control items, such as but not limited to electric strikes, Rex sensors, Door contacts, Electrified Panics, Relays & Maglocks is the responsibility of the security provider
- Refer to STC rating of the wall in Architectural layout G1002
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Option to have Operators manually turned off and room closed during non working hours using classroom function of lockset.
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.

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Heading# 34

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	None

1 Total Openings

1	Door#	N-128H	Location:	from Change Room Vestibule 128C to Gender Neutral Change Room 128B	Handing:	RH
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Web Link	Install Instructions	Site Verified
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By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	630	Hager	X			<input type="checkbox"/>
1	Deadbolt	L463BDC x 1-3/4	626	Schlage	X	X		<input type="checkbox"/>
1	Door Pull	GSH 167F x 610 x #5-2 MTL MTG	630	Gallery	X			<input type="checkbox"/>
1	Push Plate	GSH 80A – 150 x 610 (Rounded Corners) – 3M TAPE	630	Gallery	X			<input type="checkbox"/>
1	Closer	4011-RH	689	LCN	X	X		<input type="checkbox"/>
2	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – Door Screws	630	Gallery	X			<input type="checkbox"/>
1	Floor Stop	GSH 209	626	Gallery	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			<input type="checkbox"/>



1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X		X
By Locksmith								
2	Permanent Core	Permanent Medeco Core Provided by City Locksmith	626	Medeco				<input type="checkbox"/>

Notes:

- Refer to STC rating of the wall in Architectural layout G1002
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

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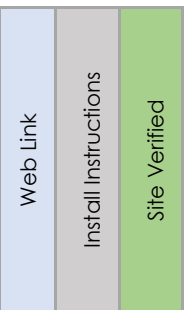
Heading# 35

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	None

1 Total Openings

1 **Door#** N-132 **Location:** Exterior from Corridor 132 **Handing:** RHR



By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4" NRP	630	Hager	X			<input type="checkbox"/>
1	Exit Device	CD-98L x 996L-R/V x 06 x 626/630 – 4'0	630	Von Duprin	X	X		<input type="checkbox"/>
1	Rim Cylinder Housing	80-116	626	Schlage	X			<input type="checkbox"/>
1	Mortise Cylinder	80-110	626	Schlage	X			<input type="checkbox"/>
1	Mortise Cylinder	80-111	626	Schlage	X			<input type="checkbox"/>
1	Electric Strike	6300 x 12/24VCD	630	Von Duprin	X	X		<input type="checkbox"/>
1	Overhead Stop	105S	630	Glynn Johnson	X	X		<input type="checkbox"/>
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – Door Screws	630	Gallery	X			<input type="checkbox"/>
1	Weatherstrip	W-13 – 1 @ 1067 & 2 @ 2135	628	KN Crowder	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			<input type="checkbox"/>
1	Door Sweep	W-13S x 1067	BLK	KN Crowder	X			<input type="checkbox"/>
1	Threshold	CT-10 x 1067	628	KN Crowder	X			<input type="checkbox"/>



By Automatics Supplier – PACKAGE #1 – PUSH BUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)							
1	Auto Operator (SNG)	BESAM SW200i – Push Side Mount	628		X		<input type="checkbox"/>
1	Push Button	CM60/4-WT	630	Camden	X		<input type="checkbox"/>
1	Surface Mount Box	CM-79	630	Camden	X		<input type="checkbox"/>
1	Wave Buttons	CM-331/42SW-SGLR, Double Gang, SS Face Plate with LED Ring	630	Camden	X		<input type="checkbox"/>
1	Surface Mount Box	CM-43CBLA	630	Camden	X		<input type="checkbox"/>
1	Logic Relay	CX-33		Camden	X		<input type="checkbox"/>
1	Key Switch	CM-2210 x 7224 LED	630	Camden	X		<input type="checkbox"/>
1	Cylinder	CM-CYL60-KA	630	Camden	X		<input type="checkbox"/>
By Security Supplier							
1	Door Contact	To Suit Building System					<input type="checkbox"/>
By Locksmith							
3	Permanent Core	Permanent Medeco Core Provided by City Locksmith	626	Medeco			<input type="checkbox"/>

Notes:

- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Final commissioning of all access control items, such as but not limited to electric strikes, Rex sensors, Door contacts, Electrified Panics, Relays & Maglocks is the responsibility of the security provider
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- Operator must be manually tuned off prior to locking door with Classroom Lever Trim.

-----End of Heading-----





Heading# 36

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	None

1 Total Openings

1 **Door#** N-133A **Location:** Exterior from Pool **Handing:** LHR

Web Link
Install Instructions
Site Verified

By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4" NRP	630	Hager	X			<input type="checkbox"/>
1	Exit Device	CD-98L x 996L-R/V x 06 x 626/630 – 4'0	630	Von Duprin	X	X		<input type="checkbox"/>
1	Rim Cylinder Housing	80-116	626	Schlage	X			<input type="checkbox"/>
1	Mortise Cylinder	80-110	626	Schlage	X			<input type="checkbox"/>
1	Mortise Cylinder	80-111	626	Schlage	X			<input type="checkbox"/>
1	Electric Strike	6300 x 12/24VCD	630	Von Duprin	X	X		<input type="checkbox"/>
1	Overhead Stop	105S	630	Glynn Johnson	X	X		<input type="checkbox"/>
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – Door Screws	630	Gallery	X			<input type="checkbox"/>
1	Weatherstrip	W-13 – 1 @ 1067 & 2 @ 2135	628	KN Crowder	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			<input type="checkbox"/>
1	Door Sweep	W-13S x 1067	BLK	KN Crowder	X			<input type="checkbox"/>
1	Threshold	CT-10 x 1067	628	KN Crowder	X			<input type="checkbox"/>

By Automatics Supplier – PACKAGE #1 – PUSH BUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)

1	Auto Operator (SNG)	BESAM SW200i – Push Side Mount	628		X			<input type="checkbox"/>
1	Push Button	CM60/4-WT	630	Camden	X			<input type="checkbox"/>
1	Surface Mount Box	CM-79	630	Camden	X			<input type="checkbox"/>
1	Wave Buttons	CM-331/42SW-SGLR, Double Gang, SS Face Plate with LED Ring	630	Camden	X			<input type="checkbox"/>
1	Surface Mount Box	CM-43CBLA	630	Camden	X			<input type="checkbox"/>
1	Logic Relay	CX-33		Camden	X			<input type="checkbox"/>
1	Key Switch	CM-2210 x 7224 LED	630	Camden	X			<input type="checkbox"/>

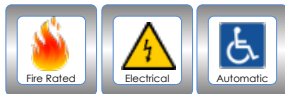


1	Cylinder	CM-CYL60-KA	630	Camden	X				<input type="checkbox"/>
By Security Supplier									
1	Door Contact	To Suit Building System							<input type="checkbox"/>
By Locksmith									
3	Permanent Core	Permanent Medeco Core Provided by City Locksmith	626	Medeco					<input type="checkbox"/>

Notes:

- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Final commissioning of all access control items, such as but not limited to electric strikes, Rex sensors, Door contacts, Electrified Panics, Relays & Maglocks is the responsibility of the security provider
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- Operator must be manually tuned off prior to locking door with Classroom Lever Trim.

-----End of Heading-----



Heading# 37

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	3/4 HR

1 Total Openings

1	Door#	N-133B	Location:	Pool from Change Room Vestibule 128C	Handing:	RHR
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Web Link

Install Instructions

Site Verified

By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4" NRP	630	Hager	X				<input type="checkbox"/>
1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	X				<input type="checkbox"/>
1	Mortise Cylinder	80-111	626	Schlage	X				<input type="checkbox"/>
1	Electric Strike	1500C	630	HES	X	X			<input type="checkbox"/>



1	Overhead Stop	105S	630	Glynn Johnson	X	X			
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – HM Door Screws	630	Gallery	X				
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X				
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X			
By Automatics Supplier – PACKAGE #3 – PUSH BUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)									
1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount	628		X				
2	Wave Buttons	CM-331/42SW-SGLR, Double Gang, SS Face Plate with LED Ring	630	Camden	X				
2	Surface Mount Box	CM-43CBLA	630	Camden	X				
1	Key Switch	CM-2210 x 7224 LED	630	Camden	X				
1	Cylinder	CM-CYL60-KA	630	Camden	X				
By Locksmith									
1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco					

Notes:

- Final commissioning of all access control items, such as but not limited to electric strikes, Rex sensors, Door contacts, Electrified Panics, Relays & Maglocks is the responsibility of the security provider
- Refer to STC rating of the wall in Architectural layout G1002
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Option to have Operators manually turned off and room closed during non working hours using classroom function of lockset.
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.

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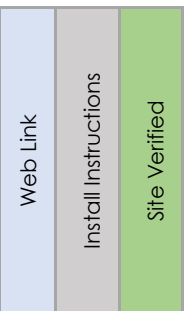
Heading# 38

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	3/4 HR

1 Total Openings

1 **Door#** N-133C **Location:** Corridor 132 from Pool **Handing:** RHR



By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4" NRP	630	Hager	X			<input type="checkbox"/>
1	Exit Device	98L-F x 996L-R/V x 06 x 626/630 x 4'0	630	Von Duprin	X	X		<input type="checkbox"/>
1	Electric Strike	6300 x 12/24VCD	630	Von Duprin	X	X		<input type="checkbox"/>
1	Rim Cylinder Housing	80-116	626	Schlage	X			<input type="checkbox"/>
1	Mortise Cylinder	80-111	626	Schlage	X			<input type="checkbox"/>
1	Overhead Stop	105S	630	Glynn Johnson	X	X		<input type="checkbox"/>
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – HM Door Screws	630	Gallery	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			<input type="checkbox"/>
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X		<input type="checkbox"/>

By Automatics Supplier – PACKAGE #3 – PUSH BUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)

1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount	628		X			<input type="checkbox"/>
2	Wave Buttons	CM-331/42SW-SGLR, Double Gang, SS Face Plate with LED Ring	630	Camden	X			<input type="checkbox"/>
2	Surface Mount Box	CM-43CBLA	630	Camden	X			<input type="checkbox"/>
1	Key Switch	CM-2210 x 7224 LED	630	Camden	X			<input type="checkbox"/>
1	Cylinder	CM-CYL60-KA	630	Camden	X			<input type="checkbox"/>

By Locksmith

2	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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Notes:



- Final commissioning of all access control items, such as but not limited to electric strikes, Rex sensors, Door contacts, Electrified Panics, Relays & Maglocks is the responsibility of the security provider
- Refer to STC rating of the wall in Architectural layout G1002
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.
- Operator must be manually tuned off prior to locking door with Classroom Lever Trim.

-----End of Heading-----

Heading# 39

Opening Information

Opening Type:	Pair	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1 **Door#** NE-101 **Location:** Corridor 102 to South Lounge 101 **Handing:**



By Hardware Supplier

1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	<input checked="" type="checkbox"/>			
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By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.



.....End of Heading.....

Heading# 40

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1	Door#	NE-105	Location:	Office Area 105 from Office 106	Handing:
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Web Link

Install Instructions

Site Verified

By Hardware Supplier

1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	X			
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By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

.....End of Heading.....





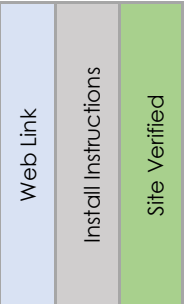
Heading# 41

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1 Door# NE-107 Location: Corridor 116 to Office 107 Handing:



By Hardware Supplier

1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	X			
By Locksmith								
1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>

*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

.....End of Heading.....



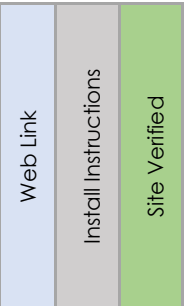
Heading# 42

Opening Information

Opening Type:	Pair	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1 Door# NE-108A Location: Corridor 102 from Print Room 108 Handing:



By Hardware Supplier

1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

.....End of Heading.....





Heading# 43

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1 Door# NE-108B Location: Corridor 116 to Print Room 108 Handing:

Web Link

Install Instructions

Site Verified

By Hardware Supplier

1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	<input checked="" type="checkbox"/>			
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By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

.....End of Heading.....



Heading# 44

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1 Door# NE-108C Location: Corridor 116 from Room Handing:

Web Link

Install Instructions

Site Verified

By Hardware Supplier

1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	X			
By Locksmith								
1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>

*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

.....End of Heading.....





Heading# 45

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1 **Door#** NE-111 **Location:** Print Room 108 to Janitor's Room 111 **Handing:**

Web Link

Install Instructions

Site Verified

By Hardware Supplier

1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	<input checked="" type="checkbox"/>			
By Locksmith								
1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>

*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

.....End of Heading.....





Heading# 46

Opening Information

Opening Type:	Pair	Opening Size:	Existing Doors x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1	Door#	NE-115A	Location:	Vestibule 115 from Corridor 116	Handing:	LHRA/RHRA
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Web Link

Install Instructions

Site Verified

By Hardware Supplier

BALANCE OF EXISTING HARDWARE TO REMAIN.

By Automatics Supplier – PACKAGE #1C – INTERIOR PUSHBUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)

1	Auto Operator (PAIR)	BESAM SW200i – Double Door - Push Side Mount – RH/LH	628		X			<input type="checkbox"/>
2	Wave Buttons	CM-330/42SW-SGLR, Double Gang, SS Face Plate with LED Ring	630	Camden	X			<input type="checkbox"/>
1	Wireless Receiver	CM-RX-90		Camden	X			<input type="checkbox"/>
2	Surface Mount Box	CM-43CBLA	630	Camden	X			<input type="checkbox"/>
1	Logic Relay	CX-33		Camden	X			<input type="checkbox"/>
1	Key Switch	CM-2210 x 7224 LED	630	Camden	X			<input type="checkbox"/>
1	Cylinder	CM-CYL60-KA	630	Camden	X			<input type="checkbox"/>

By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXISTING HARDWARE TO REMAIN.

Notes:

- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Final commissioning of all access control items, such as but not limited to electric strikes, Rex sensors, Door contacts, Electrified Panics, Relays & Maglocks is the responsibility of the security provider
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.
- *Existing Doors Must Be Dogged Down when Operator is Powered On.

-----End of Heading-----



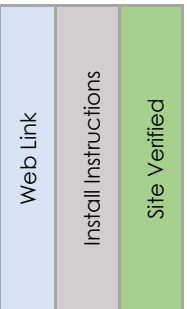
Heading# 47

Opening Information

Opening Type:	Pair	Opening Size:	Existing Doors x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1 **Door#** NE-115B **Location:** Exterior from Vestibule 115 **Handing:** LHRA/RHRA



By Hardware Supplier

BALANCE OF EXISTING HARDWARE TO REMAIN.

By Automatics Supplier – PACKAGE #1C – INTERIOR PUSHBUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)

1	Auto Operator (PAIR)	BESAM SW200i – Double Door - Push Side Mount – RH/LH	628		X			<input type="checkbox"/>
1	Push Button	CM60/4-WT	630	Camden	X			<input type="checkbox"/>
1	Surface Mount Box	CM-79	630	Camden	X			<input type="checkbox"/>
1	Wave Buttons	CM-330/42SW-SGLR, Double Gang, SS Face Plate with LED Ring	630	Camden	X			<input type="checkbox"/>
1	Wireless Receiver	CM-RX-90		Camden	X			<input type="checkbox"/>
1	Surface Mount Box	CM-43CBLA	630	Camden	X			<input type="checkbox"/>
1	Logic Relay	CX-33		Camden	X			<input type="checkbox"/>
1	Key Switch	CM-2210 x 7224 LED	630	Camden	X			<input type="checkbox"/>
1	Cylinder	CM-CYL60-KA	630	Camden	X			<input type="checkbox"/>

By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.



- Final commissioning of all access control items, such as but not limited to electric strikes, Rex sensors, Door contacts, Electrified Panics, Relays & Maglocks is the responsibility of the security provider
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.
- *Existing Doors Must Be Dogged Down when Operator is Powered On.

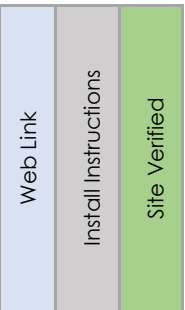
-----End of Heading-----

Heading# 48**Opening Information**

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1 **Door#** NE-127 **Location:** Corridor 123 to Janitor's Room 111 **Handing:**

**By Hardware Supplier**

1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	X			
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By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

-----End of Heading-----



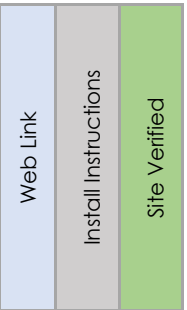
Heading# 49

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1 **Door#** NE-136 **Location:** Common Space 119 to Storage 136 **Handing:**



By Hardware Supplier

1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	X			
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By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

.....End of Heading.....





Heading# 50

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1 **Door#** C-14 **Location:** Corridor 215 from Storage C-14 **Handing:**

Web Link

Install Instructions

Site Verified

By Hardware Supplier

1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	X			
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By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

-----End of Heading-----



Heading# 51

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	None

1 Total Openings

1	Door#	N-201A	Location:	Corridor 201 from Storage 203	Handing:	RHR
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Web Link

Install Instructions

Site Verified

By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4" NRP	652	Hager	X			<input type="checkbox"/>
1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	X			<input type="checkbox"/>
2	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – HM Door Screws	630	Gallery	X			<input type="checkbox"/>
1	Overhead Stop	105S	630	Glynn Johnson	X	X		<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			<input type="checkbox"/>
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X		<input type="checkbox"/>

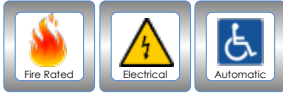
By Locksmith

1	Permanent Core	Permanent Medeco Core Provided by City Locksmith	626	Medeco				<input type="checkbox"/>
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Notes:

- Refer to STC rating of the wall in Architectural layout G1002
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

-----End of Heading-----



Heading# 52

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	3/4 HR

1 Total Openings

1 **Door#** N-201B **Location:** Corridor 201 from Pool Lockout **Handing:** LHR

Web Link

Install Instructions

Site Verified

By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4" NRP	630	Hager	X			<input type="checkbox"/>
1	Exit Device	98L-F x 996L-R/V x 06 x 626/630 x 4'0	630	Von Duprin	X	X		<input type="checkbox"/>
1	Electric Strike	6300 x 12/24VCD	630	Von Duprin	X	X		<input type="checkbox"/>
1	Rim Cylinder Housing	80-116	626	Schlage	X			<input type="checkbox"/>
1	Mortise Cylinder	80-111	626	Schlage	X			<input type="checkbox"/>
1	Overhead Stop	105S	630	Glynn Johnson	X	X		<input type="checkbox"/>
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – HM Door Screws	630	Gallery	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			<input type="checkbox"/>
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X		<input type="checkbox"/>

By Automatics Supplier – PACKAGE #3 – PUSH BUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)

1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount	628		X			<input type="checkbox"/>
2	Wave Buttons	CM-331/42SW-SGLR, Double Gang, SS Face Plate with LED Ring	630	Camden	X			<input type="checkbox"/>
2	Surface Mount Box	CM-43CBLA	630	Camden	X			<input type="checkbox"/>
1	Key Switch	CM-2210 x 7224 LED	630	Camden	X			<input type="checkbox"/>
1	Cylinder	CM-CYL60-KA	630	Camden	X			<input type="checkbox"/>

By Locksmith

2	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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Notes:

- Final commissioning of all access control items, such as but not limited to electric strikes, Rex sensors, Door contacts, Electrified Panics, Relays & Maglocks is the responsibility of the security provider
- Refer to STC rating of the wall in Architectural layout G1002



- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.
- Operator must be manually tuned off prior to locking door with Classroom Lever Trim.

-----End of Heading-----



Heading# 53

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	3/4 HR

1 Total Openings

1	Door#	N-202	Location:	Mezzanine to Elev.Closet 202	Handing:	RH
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Web Link	Install Instructions	Site Verified
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By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	630	Hager	X			<input type="checkbox"/>
1	Storeroom Lockset	ND80BDC x RHO x 626	626	Schlage	X			<input type="checkbox"/>
1	Closer	4011-RH (LCN/ST 1544)	689	LCN	X	X		<input type="checkbox"/>
1	Drop Plate	4020-18	689	LCN				<input type="checkbox"/>
2	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – Door Screws	630	Gallery	X			<input type="checkbox"/>
1	Overhead Stop	105S	630	Glynn Johnson	X	X		<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5500	BLK	KN Crowder	X			<input type="checkbox"/>
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X		<input type="checkbox"/>

By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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Notes:



- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

-----End of Heading-----

**Heading# 54**

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	3/4 HR

1 Total Openings

1 **Door#** N-205A **Location:** Corridor 201 from Corridor 205 **Handing:** RHR

Web Link

Install Instructions

Site Verified

By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4" NRP	630	Hager	X			<input type="checkbox"/>
1	Exit Device	98L-F x 996L-R/V x 06 x 626/630 x 4'0	630	Von Duprin	X	X		<input type="checkbox"/>
1	Electric Strike	6300 x 12/24VCD	630	Von Duprin	X	X		<input type="checkbox"/>
1	Rim Cylinder Housing	80-116	626	Schlage	X			<input type="checkbox"/>
1	Mortise Cylinder	80-111	626	Schlage	X			<input type="checkbox"/>
1	Overhead Stop	105S	630	Glynn Johnson	X	X		<input type="checkbox"/>
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – HM Door Screws	630	Gallery	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			<input type="checkbox"/>
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X		<input type="checkbox"/>

By Automatics Supplier – **PACKAGE #3 – PUSH BUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)**

1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount	628		X			<input type="checkbox"/>
2	Wave Buttons	CM-331/42SW-SGLR, Double Gang, SS Face Plate with LED Ring	630	Camden	X			<input type="checkbox"/>
2	Surface Mount Box	CM-43CBLA	630	Camden	X			<input type="checkbox"/>
1	Key Switch	CM-2210 x 7224 LED	630	Camden	X			<input type="checkbox"/>
1	Cylinder	CM-CYL60-KA	630	Camden	X			<input type="checkbox"/>

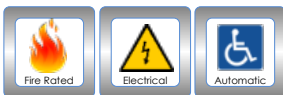
By Locksmith

2	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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Notes:

- Final commissioning of all access control items, such as but not limited to electric strikes, Rex sensors, Door contacts, Electrified Panics, Relays & Maglocks is the responsibility of the security provider
- Refer to STC rating of the wall in Architectural layout G1002
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.
- Operator must be manually tuned off prior to locking door with Classroom Lever Trim.

-----End of Heading-----



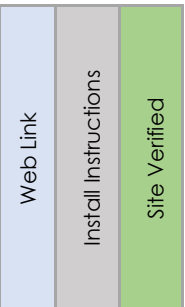
Heading# 55

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	3/4 HR

1 Total Openings

1	Door#	N-205B	Location:	Corridor 215 from Corridor 205	Handing:	LHR
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By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4" NRP	630	Hager	X			<input type="checkbox"/>
1	Exit Device	98L-F x 996L-R/V x 06 x 626/630 x 4'0	630	Von Duprin	X	X		<input type="checkbox"/>
1	Electric Strike	6300 x 12/24VCD	630	Von Duprin	X	X		<input type="checkbox"/>
1	Rim Cylinder Housing	80-116	626	Schlage	X			<input type="checkbox"/>
1	Mortise Cylinder	80-111	626	Schlage	X			<input type="checkbox"/>
1	Overhead Stop	105S	630	Glynn Johnson	X	X		<input type="checkbox"/>
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – HM Door Screws	630	Gallery	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			<input type="checkbox"/>



1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X		<input type="checkbox"/>
By Automatics Supplier – PACKAGE #3 – PUSH BUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)								
1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount	628		X			<input type="checkbox"/>
2	Wave Buttons	CM-331/42SW-SGLR, Double Gang, SS Face Plate with LED Ring	630	Camden	X			<input type="checkbox"/>
2	Surface Mount Box	CM-43CBLA	630	Camden	X			<input type="checkbox"/>
1	Key Switch	CM-2210 x 7224 LED	630	Camden	X			<input type="checkbox"/>
1	Cylinder	CM-CYL60-KA	630	Camden	X			<input type="checkbox"/>
By Locksmith								
2	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>

Notes:

- Final commissioning of all access control items, such as but not limited to electric strikes, Rex sensors, Door contacts, Electrified Panics, Relays & Maglocks is the responsibility of the security provider
- Refer to STC rating of the wall in Architectural layout G1002
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.
- Operator must be manually tuned off prior to locking door with Classroom Lever Trim.

-----End of Heading-----





Heading# 56

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	3/4 HR

1 Total Openings

1	Door#	N-206	Location:	Corridor 205 to Playcare Room 206	Handing:	LH
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Web Link

Install Instructions

Site Verified

By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	652	Hager	X			<input type="checkbox"/>
1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	X			<input type="checkbox"/>
1	Mortise Cylinder	80-111	626	Schlage	X			<input type="checkbox"/>
1	Electric Strike	1500C	630	HES	X	X		<input type="checkbox"/>
1	Overhead Stop	105S	630	Glynn Johnson	X	X		<input type="checkbox"/>
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – HM Door Screws	630	Gallery	X			<input type="checkbox"/>
2	Coat Hook	GSH 390	626	Gallery	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			<input type="checkbox"/>
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X		<input type="checkbox"/>

By Automatics Supplier – PACKAGE #3 – PUSH BUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)

1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount	628		X			<input type="checkbox"/>
2	Wave Buttons	CM-331/42SW-SGLR, Double Gang, SS Face Plate with LED Ring	630	Camden	X			<input type="checkbox"/>
2	Surface Mount Box	CM-43CBLA	630	Camden	X			<input type="checkbox"/>
1	Key Switch	CM-2210 x 7224 LED	630	Camden	X			<input type="checkbox"/>
1	Cylinder	CM-CYL60-KA	630	Camden	X			<input type="checkbox"/>
1	Safety Sensor	To Suit Application						

By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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Notes:

- Final commissioning of all access control items, such as but not limited to electric strikes, Rex sensors, Door contacts, Electrified Panics, Relays & Maglocks is the responsibility of the security provider
- Refer to STC rating of the wall in Architectural layout G1002
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Option to have Operators manually turned off and room closed during non working hours using classroom function of lockset.
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.

-----End of Heading-----



Heading# 57

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	3/4 HR

1 Total Openings

1	Door#	N-207	Location:	Corridor 205 to Office 207	Handing:	LH
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By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	652	Hager	X			<input type="checkbox"/>
1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	X			<input type="checkbox"/>
1	Mortise Cylinder	80-111	626	Schlage	X			<input type="checkbox"/>
1	Electric Strike	1500C	630	HES	X	X		<input type="checkbox"/>
1	Overhead Stop	105S	630	Glynn Johnson	X	X		<input type="checkbox"/>
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – HM Door Screws	630	Gallery	X			<input type="checkbox"/>
2	Coat Hook	GSH 390	626	Gallery	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			<input type="checkbox"/>
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X		<input type="checkbox"/>

By Automatics Supplier – PACKAGE #3 – PUSH BUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)

1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount	628		X			<input type="checkbox"/>
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2	Wave Buttons	CM-331/42SW-SGLR, Double Gang, SS Face Plate with LED Ring	630	Camden	X				<input type="checkbox"/>
2	Surface Mount Box	CM-43CBLA	630	Camden	X				<input type="checkbox"/>
1	Key Switch	CM-2210 x 7224 LED	630	Camden	X				<input type="checkbox"/>
1	Cylinder	CM-CYL60-KA	630	Camden	X				<input type="checkbox"/>
1	Safety Sensor	To Suit Application							
By Locksmith									
1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco					<input type="checkbox"/>

Notes:

- Final commissioning of all access control items, such as but not limited to electric strikes, Rex sensors, Door contacts, Electrified Panics, Relays & Maglocks is the responsibility of the security provider
- Refer to STC rating of the wall in Architectural layout G1002
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Option to have Operators manually turned off and room closed during non working hours using classroom function of lockset.
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.

.....End of Heading.....

Heading# 58

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1	Door#	NE-204	Location:	Corridor 205 to Office 204	Handing:
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Web Link

Install Instructions

Site Verified

By Hardware Supplier

1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	X				
By Locksmith									



1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

.....End of Heading.....

Heading# 59

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1 **Door#** NE-208 **Location:** Corridor 205 to Office 208 **Handing:**

Web Link

Install Instructions

Site Verified

By Hardware Supplier

1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	<input checked="" type="checkbox"/>			
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By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

.....End of Heading.....



Heading# 60

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1 **Door#** NE-209 **Location:** Corridor 205 to Office 209 **Handing:**

Web Link

Install Instructions

Site Verified

By Hardware Supplier

1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	X			
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By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

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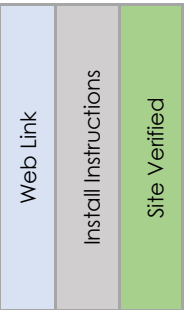
**Heading# 61**

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1	Door#	NE-210	Location:	Corridor 205 to Office Area 210	Handing:
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By Hardware Supplier

1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	X			
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By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

-----End of Heading-----





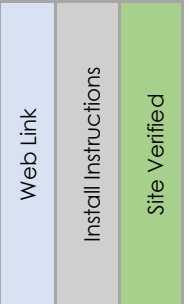
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Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1 **Door#** NE-211 **Location:** Corridor 205 to Office 211 **Handing:**



By Hardware Supplier

1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	<input checked="" type="checkbox"/>			
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By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

.....End of Heading.....





Heading# 63

Opening Information										
Opening Type:		Single	Opening Size:		Existing Door x Existing Frame			STC Rating	None	
Door Material:		Existing	Frame Material:		Existing			Fire Rating	None	
1 Total Openings								Web Link	Install Instructions	Site Verified
1	Door#	NE-213	Location:	Corridor 205 to Women's Washroom 213			Handing:			
By Hardware Supplier										
1	Privacy Latchset		ND40S x RHO x 626			626	Schlage	X		

*BALANCE OF EXITING HARDWARE TO REMAIN.

End of Heading

Heading# 64

Opening Information										
Opening Type:		Single	Opening Size:		Existing Door x Existing Frame			STC Rating	None	
Door Material:		Existing	Frame Material:		Existing			Fire Rating	None	
1 Total Openings								Web Link	Install Instructions	Site Verified
1	Door#	NE-214	Location:		Corridor 205 to Office Aera 214					
By Hardware Supplier										
1	Classroom Lockset		ND70BDC x RHO x 626			626	Schlage	X		
By Locksmith										
1	Permanent Core/Cylinder		Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.			626	Medeco		<input type="checkbox"/>	



*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

-----End of Heading-----

END OF SCHEDULE





DOOR HARDWARE

08 71 00

PROJECT:



CITY OF TORONTO ACCESSIBILITY UPGRADES

FIRE MUSEUM – FIRE PREVENTION OFFICE

351 Birchmount Road, Toronto, Ontario

ARCHITECT:



IBI GROUP

175 Galaxy Blvd, Unit 100

Toronto, Ontario

Prepared By: Alex Bekmansourov

Date: January 30, 2022

Revised: March 17, 2022





Architectural Hardware Finishes

Steel	Stainless Steel	Brass/Bronze	Aluminum	Painted/Powder Coat	US/CAN#
Clear Anodized / Painted Aluminum					
			628	689	US28
Satin Nickel					
646		619	670		US15
Polished Nickel					
645		618	669		US14
Satin Stainless Steel					
	630				US32D
Polished Stainless Steel					
	629				US32
Satin Chrome					
652		626	702		US26D
Polished Chrome					
651		625	672		US26
Satin Brass					
633		606	667	678	US4
Polished Brass					
632		605	666	677	US5
Satin Bronze					
639		612	668	680	US10
Oil Rubbed Bronze					
640		613	703	695	US10B
Flat Black / Anodized Black					
631		622	671	693	US19



Door Types & Handing

Abbreviations

RH – Right Hand

LH – Left Hand

RHR – Right Hand Reverse

LHR – Left Hand Reverse

RHRA – Right Hand Reverse Active

LHRA – Left Hand Reverse Active

RHA – Right Hand Active

LHA – Left Hand Active

RHRA/LHRA – Right & Left Hand Reverse Active

RHA/LHA – Right & Left Hand Active

DA- Double Acting

DE – Double Egress

SS- Single Slider

BP – Bi-Parting Slider

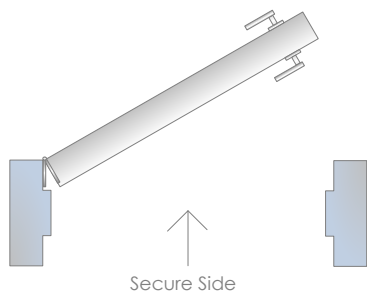
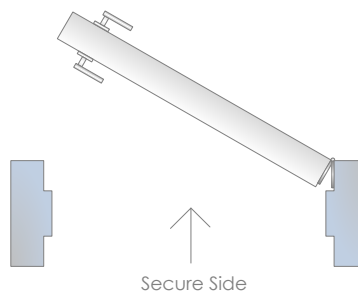
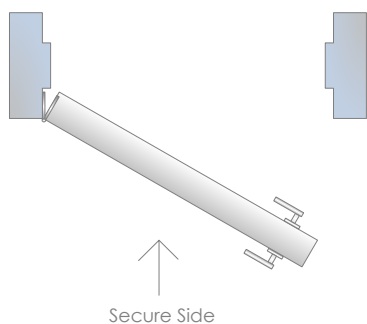
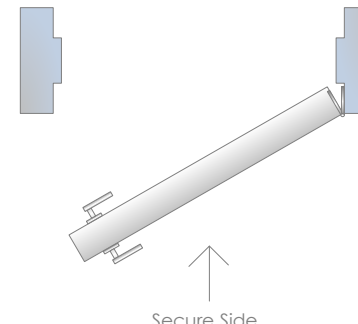
BP – Bi-Passing Slider

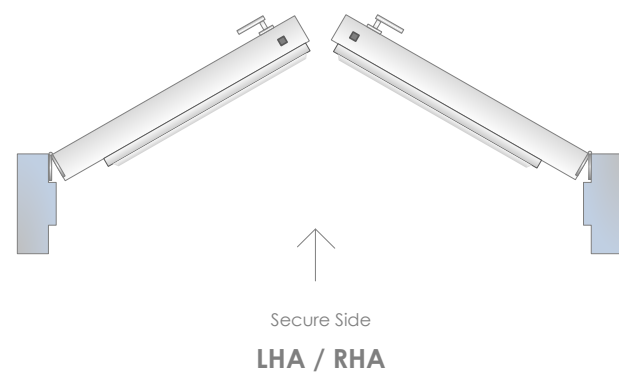
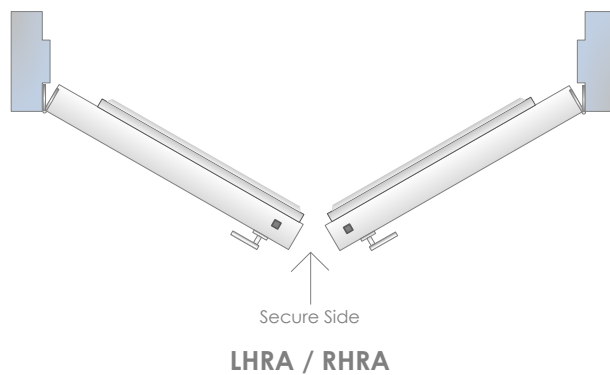
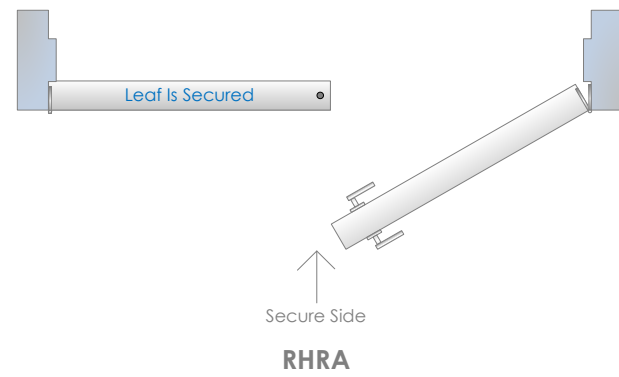
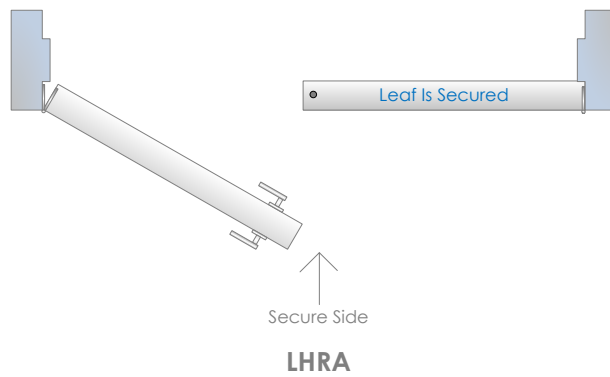
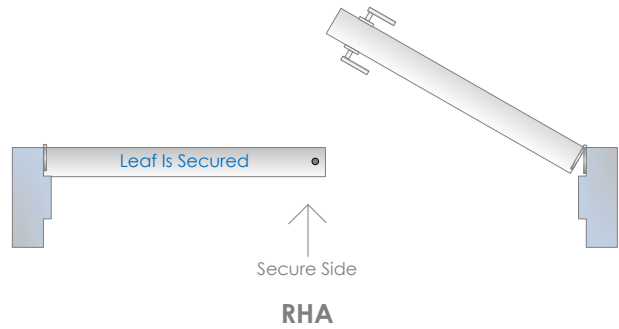
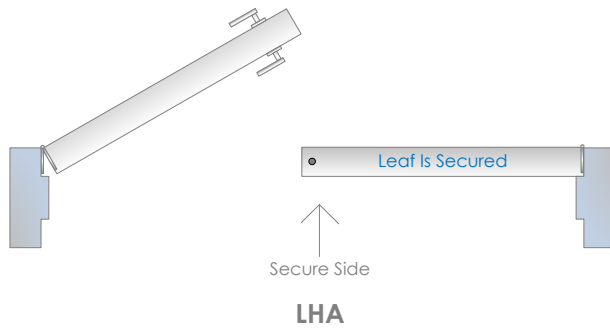
BF – Bi-Folding Slider

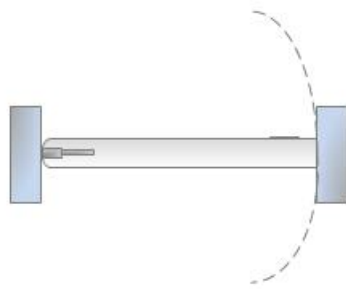
TS – Telescopic Slider

PKT – Pocket Slider

Note: The handing on a swing door is determined by placing yourself on the secure side or keyed side of the door.


LH

RH

LHR

RHR





DA-DOUBLE
ACTING



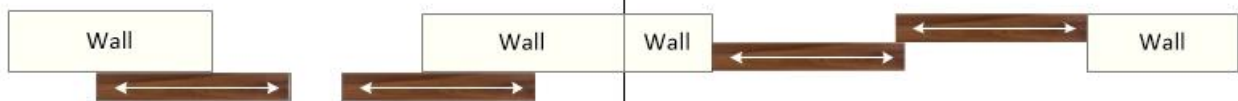
DE-DOUBLE
EGRESS



PKT - POCKET SLIDER



SS - SINGLE SLIDER or
BARN SLIDER



BP - BI-PARTING



BPS - BI-PASSING

Symbols



- Door has a fire rating and all associated hardware must have a fire label to suit. Must comply with local requirements.



- Door is automatic and is equipped with an auto operator. Door must meet local barrier free codes



- Door has an electrical requirement and requires power to be brought to the appropriate location above the door or to the latch, for either security or barrier free applications. Refer to security & electrical drawings for further information.



- Door requires security card access. Refer to security / electrical drawings for further information.

Abbreviations

Door:

HMD = Hollow Metal Door
IHMD = Insulated Hollow Metal Door
ALD = Aluminum Door
SCWD = Solid Core Wood Door
HCWD = Hollow Core Wood Door
FGD = Frameless Glass Door
FRP = Fiberglass Reinforced Plastic Door

Frame:

HMF = Hollow Metal Frame
ALF = Aluminum Frame
Cased Open HMF = Cased Open Hollow Metal Frame
WDF = Wood Frame
Cased Open WDF = Cased Open Wood Frame
Cased Open Drywall = Cased Open Drywall

Fire Ratings:

0 HR – Zero Hour Fire Rating / Smoke Barrier
20 MIN – 20 Minute Fire Rating
¾ HR – 45 Minute Fire rating
1 ½ HR – 90 Minute Fire Rating
2 HR – 120 Minute Fire Rating
3 HR – 180 Minute Fire Rating

Disclaimer

Installation Instructions:

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Weblinks:

Weblinks do change from time to time as manufacturers move around their websites, please inform us if you have a none functioning weblink.



HARDWARE SCHEDULE

Heading# 1

Opening Information					
Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	None

1 Total Openings					Web Link	Install Instructions	Site Verified
1	Door#	NE-001	Location:	Change Room 003 to Mech./Elec 002	Handing:		

By Hardware Supplier							
1	Classroom Lockset	ND70BDC x SPA x 626	626	Schlage	X		
By Locksmith							
1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco			<input type="checkbox"/>

*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

-----End of Heading-----





Heading# 2

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

2 Total Openings

1	Door#	NE-002	Location:	Change Room 003 to Washroom 005	Handing:
1	Door#	NE-003	Location:	Change Room 003 to Washroom 006	Handing:

Web Link

Install Instructions

Site Verified

By Hardware Supplier

2	Privacy Latchset	ND40S x SPA x 626	626	Schlage	X			
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*BALANCE OF EXITING HARDWARE TO REMAIN.

-----End of Heading-----



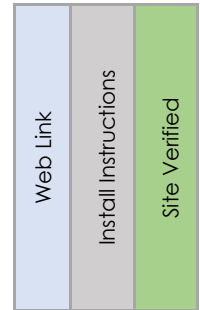
**Heading# 3**

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

9 Total Openings

1	Door#	NE-101	Location:	Apparatus Bay 101 to Office 102	Handing:
1	Door#	NE-102	Location:	Office 102 to Office 103	Handing:
1	Door#	NE-103	Location:	Apparatus Bay 101 to Office 103	Handing:
1	Door#	NE-103B	Location:	Office 103 from Closet	Handing:
1	Door#	NE-105	Location:	Corridor 105 from Apparatus Bay 101	Handing:
1	Door#	NE-107	Location:	Stair B 110 to Office 106	Handing:
1	Door#	NE-108	Location:	Stair A 109 to Office 106	Handing:
1	Door#	NE-109	Location:	Apparatus Bay 101 to Storage 107	Handing:
1	Door#	NE-110	Location:	Apparatus Bay 101 from Hose Tower 108	Handing:



By Hardware Supplier

9	Passage Latchset	ND10S x SPA x 605	605	Schlage	X			
9	Wrap Around Plate	42CW	605	Don-Jo	X			

*BALANCE OF EXITING HARDWARE TO REMAIN.

- Modify Existing Door for New Hardware

-----End of Heading-----



Heading# 4

Opening Information				
Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating: None
Door Material:	Existing	Frame Material:	Existing	Fire Rating: None

1 Total Openings

1	Door#	NE-104	Location:	Apparatus Bay 101 to Kitchen 104	Handing:
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Web Link

Install Instructions

Site Verified

By Hardware Supplier						
1	Passage Latchset	ND10S x SPA x 626	626	Schlage	X	

*BALANCE OF EXITING HARDWARE TO REMAIN.

- Modify Existing Door for New Hardware

.....End of Heading.....

**Heading# 5**

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1	Door#	NE-106	Location:	Exterior to Corridor 105	Handing:	RH
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Web Link

Install Instructions

Site Verified

By Hardware Supplier

1	Keypad Lockset	LR1021B-26D-41	630	Dormakaba	X			<input type="checkbox"/>
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By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

-----End of Heading-----

END OF SCHEDULE

DOOR HARDWARE

08 71 00

PROJECT:

**CITY OF TORONTO ACCESSIBILITY UPGRADES**

FIRE HALL NO. 224

1313 Woodbine Ave, Toronto, Ontario

ARCHITECT:

**IBI GROUP**

175 Galaxy Blvd, Unit 100

Toronto, Ontario

Prepared By: Alex Bekmansourov

Date: January 29, 2022

Revised:



Architectural Hardware Finishes

Steel	Stainless Steel	Brass/Bronze	Aluminum	Painted/Powder Coat	US/CAN#
Clear Anodized / Painted Aluminum					
			628	689	US28
Satin Nickel					
646		619	670		US15
Polished Nickel					
645		618	669		US14
Satin Stainless Steel					
	630				US32D
Polished Stainless Steel					
	629				US32
Satin Chrome					
652		626	702		US26D
Polished Chrome					
651		625	672		US26
Satin Brass					
633		606	667	678	US4
Polished Brass					
632		605	666	677	US5
Satin Bronze					
639		612	668	680	US10
Oil Rubbed Bronze					
640		613	703	695	US10B
Flat Black / Anodized Black					
631		622	671	693	US19

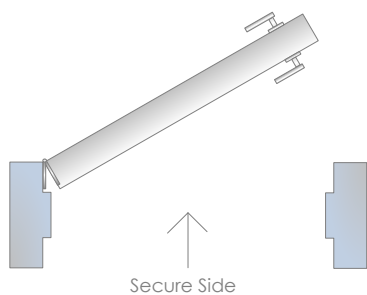


Door Types & Handing

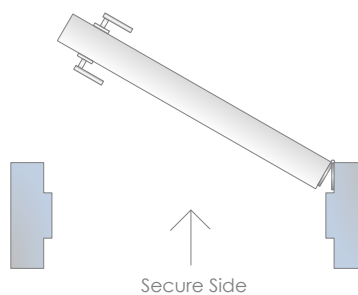
Abbreviations

RH – Right Hand	RHA – Right Hand Active	SS- Single Slider
LH – Left Hand	LHA – Left Hand Active	BP – Bi-Parting Slider
RHR – Right Hand Reverse	RHRA/LHRA – Right & Left Hand Reverse Active	BP – Bi-Passing Slider
LHR – Left Hand Reverse	RHA/LHA – Right & Left Hand Active	BF – Bi-Folding Slider
RHRA – Right Hand Reverse Active	DA- Double Acting	TS – Telescopic Slider
LHRA – Left Hand Reverse Active	DE – Double Egress	PKT – Pocket Slider

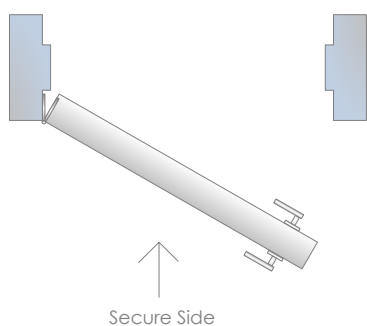
Note: The handing on a swing door is determined by placing yourself on the secure side or keyed side of the door.



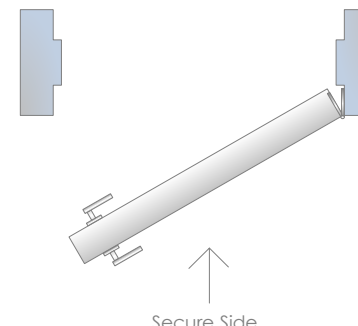
LH



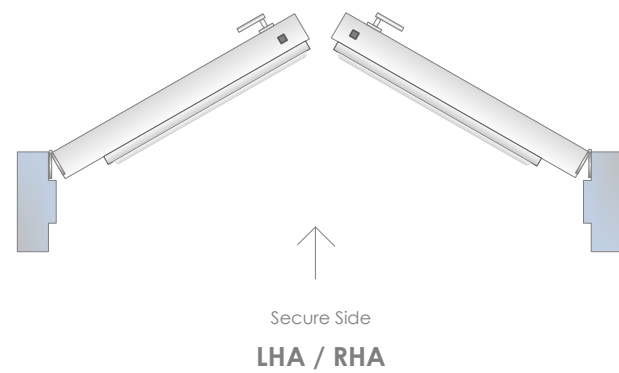
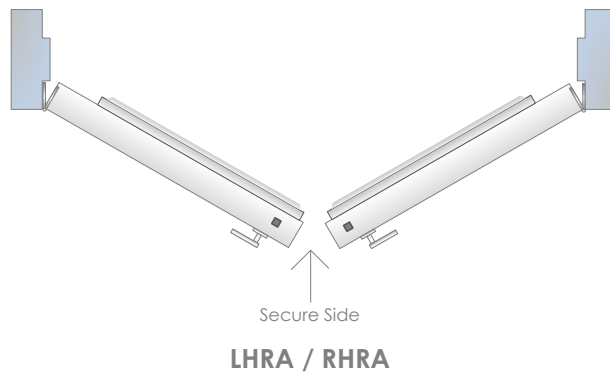
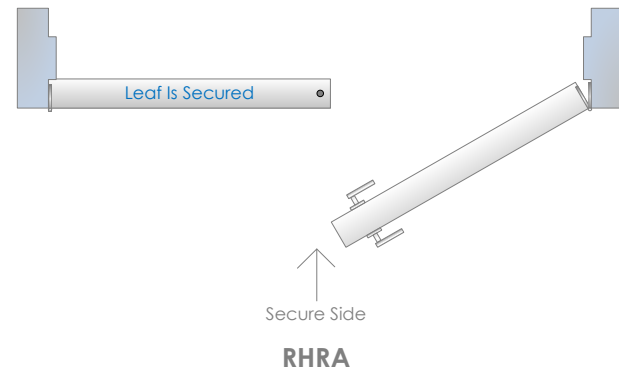
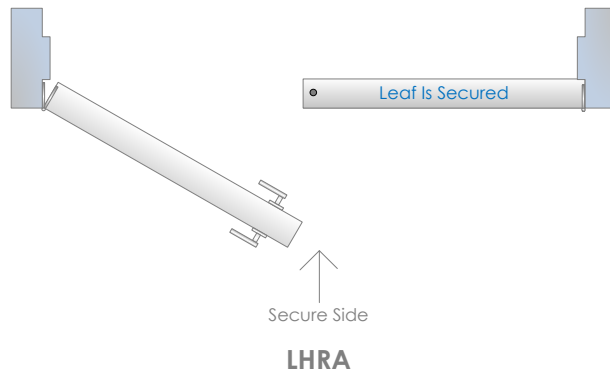
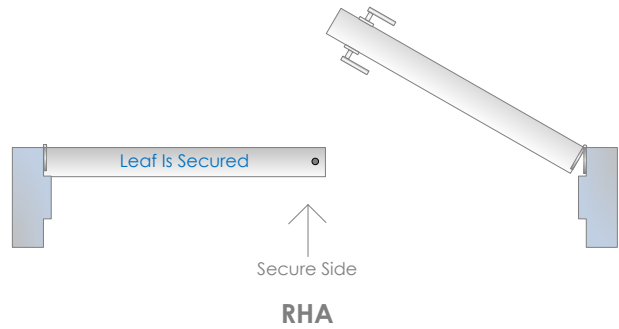
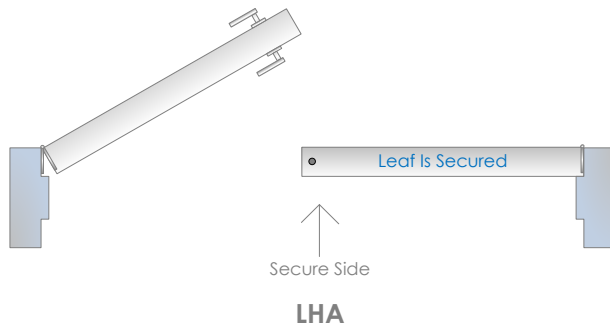
RH

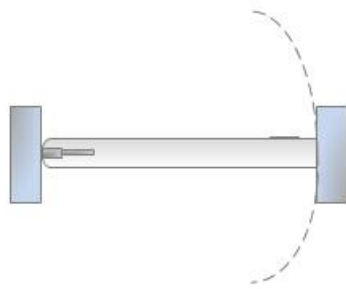


LHR



RHR





DA-DOUBLE
ACTING



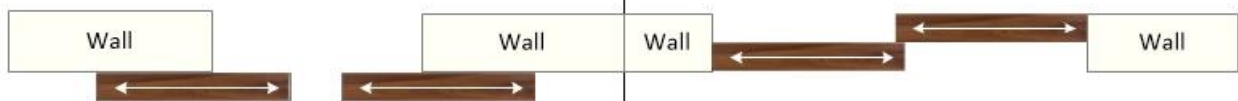
DE-DOUBLE
EGRESS



PKT - POCKET SLIDER



SS - SINGLE SLIDER or
BARN SLIDER



BP - BI-PARTING



BPS - BI-PASSING

Symbols



- Door has a fire rating and all associated hardware must have a fire label to suit. Must comply with local requirements.



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Cased Open WDF = Cased Open Wood Frame
Cased Open Drywall = Cased Open Drywall

Fire Ratings:

0 HR – Zero Hour Fire Rating / Smoke Barrier
20 MIN – 20 Minute Fire Rating
¾ HR – 45 Minute Fire rating
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2 HR – 120 Minute Fire Rating
3 HR – 180 Minute Fire Rating

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HARDWARE SCHEDULE

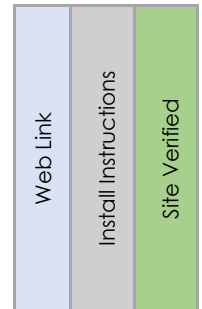
Heading# 1

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	None

7 Total Openings

1	Door#	NE-001	Location:	Open Space 001 to Storage 003	Handing:
1	Door#	NE-002	Location:	Open Space 001 to Equipment 004	Handing:
1	Door#	NE-004	Location:	Open Space 001 to Electrical Room 009	Handing:
1	Door#	NE-102	Location:	Corridor 104 from Storage 103	Handing:
1	Door#	NE-105	Location:	Apparatus Bay 101 to Dispatch 107	Handing:
1	Door#	NE-201	Location:	Kitchen Room from Lounge Room 207	Handing:
1	Door#	NE-206	Location:	Kitchen Corridor from Closet 202	Handing:



By Hardware Supplier

7	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	X			
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By Locksmith

7	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.



Heading# 2

Opening Information					
Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	None

1 Total Openings						Web Link	Install Instructions	Site Verified
1	Door#	NE-003	Location:	Open Space 001 from Storage 005	Handing:			
By Hardware Supplier								
		EXISTING HARDWARE TO REMAIN						

*BALANCE OF EXITING HARDWARE TO REMAIN.



Heading# 3

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2135 x 45	STC Rating	None
Door Material:	SCWD	Frame Material:	WDF	Fire Rating	None

1 Total Openings

1 **Door#** N-106 **Location:** Apparatus Bay 101 to B/F Universal WR **Handing:** LH

Web Link

Install Instructions

Site Verified

By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	630	Hager	X			<input type="checkbox"/>
1	Storeroom Lockset	ND80BDC x RHO x 626	626	Schlage	X			<input type="checkbox"/>
1	Electric Strike	1500C	630	HES	X	X		<input type="checkbox"/>
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – Door Screws	630	Gallery	X			<input type="checkbox"/>
2	Coat Hook	GSH 390	626	Gallery	X			<input type="checkbox"/>
1	Floor Stop	GSH 209	626	Gallery	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5500	BLK	KN Crowder	X			<input type="checkbox"/>
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X		<input type="checkbox"/>
1	Emergency Key Cabinet	EB-02	RD	Canropa	X			<input type="checkbox"/>

By Automatics Supplier – PACKAGE #5 – PUSH TO LOCK KIT UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)

1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount	628		X			<input type="checkbox"/>
1	Wave to Lock Kit	CX-WC16	630	Camden	X	X		<input type="checkbox"/>
1	Emergency Call Kit	CX-WEC10K2	630	Camden	X	X		<input type="checkbox"/>

By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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Notes:

- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Refer to STC rating of the wall in Architectural layout G1002
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.



- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

-----End of Heading-----

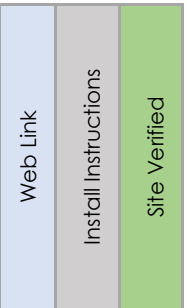
Heading# 4

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1 **Door#** NE-101 **Location:** Storage 103 from Workshop 102 **Handing:**



By Hardware Supplier							
1	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	X		
1	Wrap Around Plate	42CW	630	Don-Jo	X		
By Locksmith							
1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco			<input type="checkbox"/>

*BALANCE OF EXITING HARDWARE TO REMAIN.

*EXISTING HARDWARE TO BE CONFIRMED PRIOR TO ORDERING.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- Modify Existing Door for New Hardware

-----End of Heading-----



Heading# 5

Opening Information				
Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating None
Door Material:	Existing	Frame Material:	Existing	Fire Rating None

2	Total Openings				
1	Door#	NE-103	Location:	Corridor 104 to Office 106	Handing:
1	Door#	NE-104	Location:	Dispatch 107 to Office 106	Handing:

Web Link

Install Instructions

Site Verified

By Hardware Supplier						
2	Passage Latchset	ND10S x RHO x 626	626	Schlage	X	

*BALANCE OF EXITING HARDWARE TO REMAIN.

-----End of Heading-----



Heading# 6

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1	Door#	NE-202	Location:	Corridor to Women's WR 204	Handing:
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Web Link

Install Instructions

Site Verified

By Hardware Supplier						
1	Privacy Latchset	ND40S x RHO x 626	626	Schlage	X	

*BALANCE OF EXITING HARDWARE TO REMAIN.

-----End of Heading-----



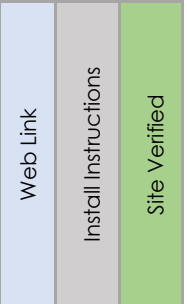
Heading# 7

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

2 Total Openings

1	Door#	NE-204	Location:	Corridor to Captain's Quarters 201	Handing:
1	Door#	NE-207	Location:	Corridor to Chiefs Room 203	Handing:



By Hardware Supplier

2	Office Lockset	ND50BDC x RHO x 626	626	Schlage	<input checked="" type="checkbox"/>			
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By Locksmith

2	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
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- Modify Existing Door for New Hardware

.....End of Heading.....



Heading# 8

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1 **Door#** NE-205 **Location:** Exterior from Kitchen Corridor **Handing:**

Web Link

Install Instructions

Site Verified

By Hardware Supplier

1	Keypad Lockset	LR1021B-26D-41	630	Dormakaba	X			<input type="checkbox"/>
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By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

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.....End of Heading.....

END OF SCHEDULE





DOOR HARDWARE

08 71 00

PROJECT:



CITY OF TORONTO ACCESSIBILITY UPGRADES

Scarborough Arts Council

1859 Kingston Road, Toronto, Ontario

ARCHITECT:



IBI GROUP

175 Galaxy Blvd, Unit 100

Toronto, Ontario

Prepared By: Alex Bekmansourov

Date: February 5, 2022

Revised: March 17, 2022





Architectural Hardware Finishes

Steel	Stainless Steel	Brass/Bronze	Aluminum	Painted/Powder Coat	US/CAN#
Clear Anodized / Painted Aluminum					
			628	689	US28
Satin Nickel					
646		619	670		US15
Polished Nickel					
645		618	669		US14
Satin Stainless Steel					
	630				US32D
Polished Stainless Steel					
	629				US32
Satin Chrome					
652		626	702		US26D
Polished Chrome					
651		625	672		US26
Satin Brass					
633		606	667	678	US4
Polished Brass					
632		605	666	677	US5
Satin Bronze					
639		612	668	680	US10
Oil Rubbed Bronze					
640		613	703	695	US10B
Flat Black / Anodized Black					
631		622	671	693	US19

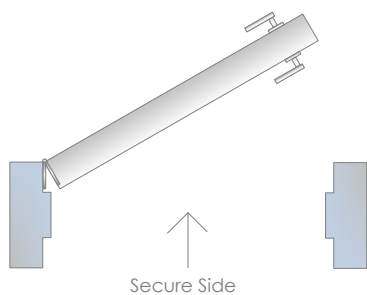


Door Types & Handing

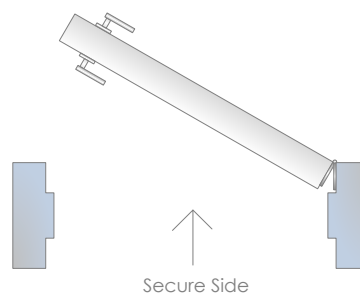
Abbreviations

RH – Right Hand	RHA – Right Hand Active	SS- Single Slider
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LHRA – Left Hand Reverse Active	DE – Double Egress	PKT – Pocket Slider

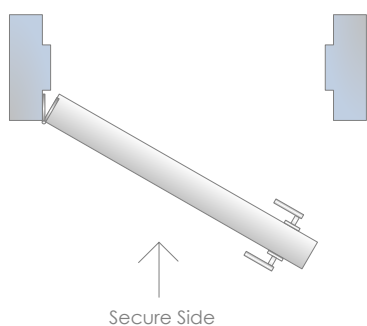
Note: The handing on a swing door is determined by placing yourself on the secure side or keyed side of the door.



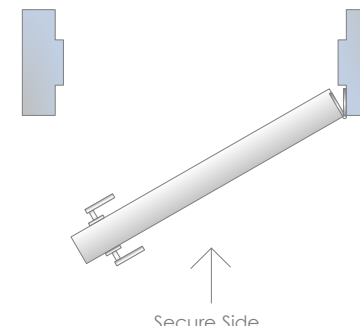
LH



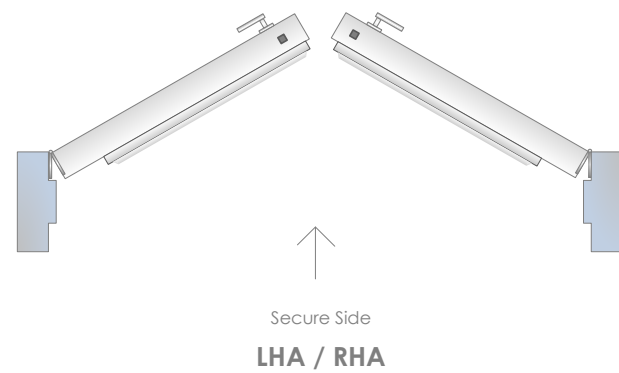
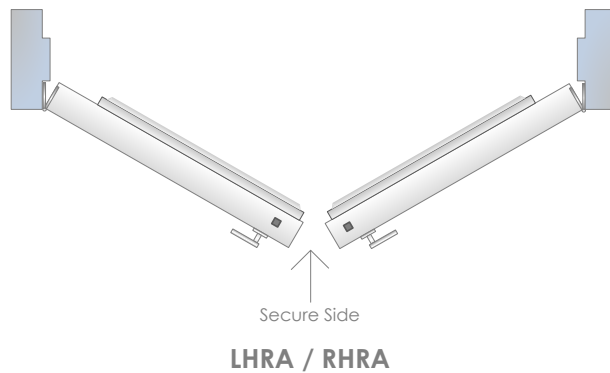
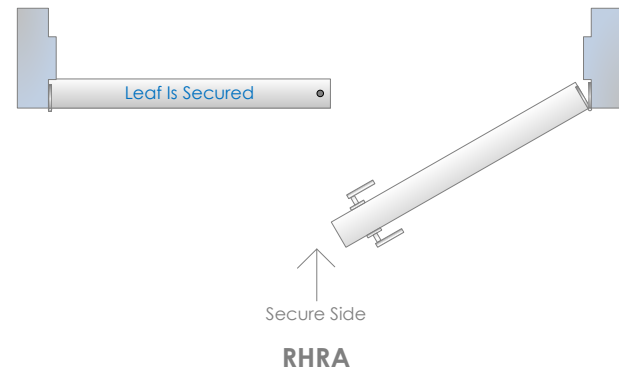
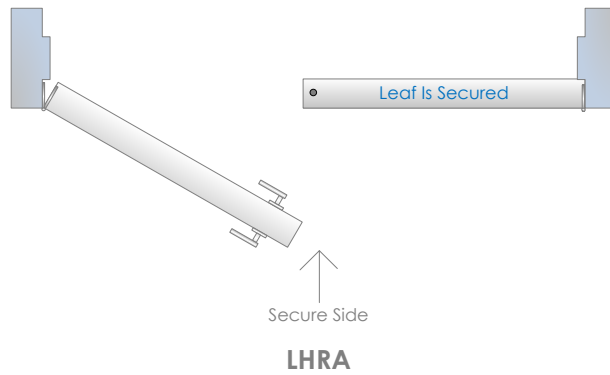
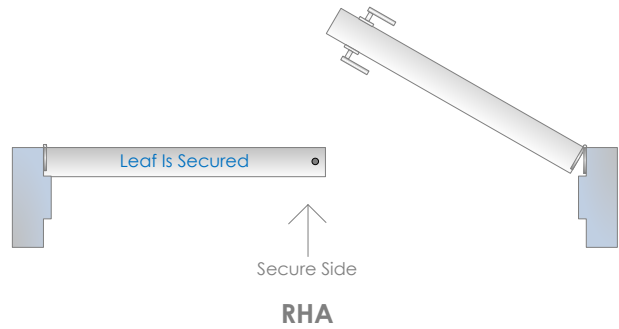
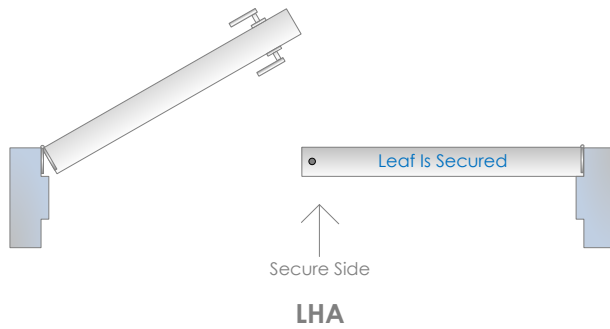
RH

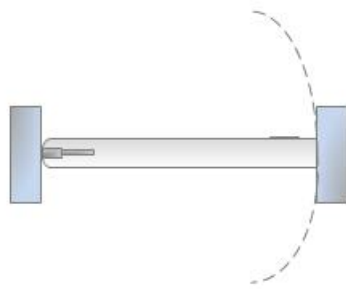


LHR



RHR





DA-DOUBLE
ACTING



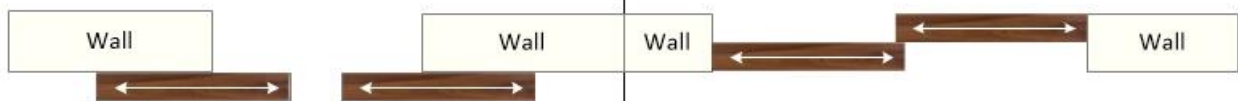
DE-DOUBLE
EGRESS



PKT - POCKET SLIDER



SS - SINGLE SLIDER or
BARN SLIDER



BP - BI-PARTING



BPS - BI-PASSING

Symbols



- Door has a fire rating and all associated hardware must have a fire label to suit. Must comply with local requirements.



- Door is automatic and is equipped with an auto operator. Door must meet local barrier free codes



- Door has an electrical requirement and requires power to be brought to the appropriate location above the door or to the latch, for either security or barrier free applications. Refer to security & electrical drawings for further information.



- Door requires security card access. Refer to security / electrical drawings for further information.

Abbreviations

Door:

HMD = Hollow Metal Door
IHMD = Insulated Hollow Metal Door
ALD = Aluminum Door
SCWD = Solid Core Wood Door
HCWD = Hollow Core Wood Door
FGD = Frameless Glass Door
FRP = Fiberglass Reinforced Plastic Door

Frame:

HMF = Hollow Metal Frame
ALF = Aluminum Frame
Cased Open HMF = Cased Open Hollow Metal Frame
WDF = Wood Frame
Cased Open WDF = Cased Open Wood Frame
Cased Open Drywall = Cased Open Drywall

Fire Ratings:

0 HR – Zero Hour Fire Rating / Smoke Barrier
20 MIN – 20 Minute Fire Rating
¾ HR – 45 Minute Fire rating
1 ½ HR – 90 Minute Fire Rating
2 HR – 120 Minute Fire Rating
3 HR – 180 Minute Fire Rating

Disclaimer

Installation Instructions:

Installation instructions have been provided for convenience only. Although we do our best to ensure these documents are accurate and up to date, it is ultimately the responsibility of the installer to ensure they are using the correct instructions for the product they are installing. Use of the installation instructions provided is done so at one's own risk and Spyder SC takes no responsibility to their accuracy.

Weblinks:

Weblinks do change from time to time as manufacturers move around their websites, please inform us if you have a none functioning weblink.



HARDWARE SCHEDULE



Heading# 1

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2090 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	None

1 Total Openings

1 **Door#** N-001 **Location:** Exterior from Corridor 001 **Handing:** LHR

Web Link

Install Instructions

Site Verified

By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4" NRP	630	Hager	X			<input type="checkbox"/>
1	Exit Device	CD-98L x 996L-R/V x 17 x 626/630 – 4'0	630	Von Duprin	X	X		<input type="checkbox"/>
1	Rim Cylinder Housing	80-116	626	Schlage	X			<input type="checkbox"/>
1	Mortise Cylinder	80-110	626	Schlage	X			<input type="checkbox"/>
1	Mortise Cylinder	80-111	626	Schlage	X			<input type="checkbox"/>
1	Electric Strike	6300 x 12/24VCD	630	Von Duprin	X	X		<input type="checkbox"/>
1	Overhead Stop	105S	630	Glynn Johnson	X	X		<input type="checkbox"/>
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – Door Screws	630	Gallery	X			<input type="checkbox"/>
1	Weatherstrip	W-13 – 1 @ 1067 & 2 @ 2135	628	KN Crowder	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			<input type="checkbox"/>
1	Door Sweep	W-13S x 1067	BLK	KN Crowder	X			<input type="checkbox"/>
1	Threshold	CT-10 x 1067	628	KN Crowder	X			<input type="checkbox"/>

By Automatics Supplier – PACKAGE #1 – PUSH BUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)

1	Auto Operator (SNG)	BESAM SW200i – Push Side Mount	628		X			<input type="checkbox"/>
1	Push Button	CM60/4-WT	630	Camden	X			<input type="checkbox"/>
1	Surface Mount Box	CM-79	630	Camden	X			<input type="checkbox"/>
1	Wave Buttons	CM-331/42SW-SGLR, Double Gang, SS Face Plate with LED Ring	630	Camden	X			<input type="checkbox"/>
1	Surface Mount Box	CM-43CBLA	630	Camden	X			<input type="checkbox"/>
1	Logic Relay	CX-33		Camden	X			<input type="checkbox"/>
1	Key Switch	CM-2210 x 7224 LED	630	Camden	X			<input type="checkbox"/>
1	Cylinder	CM-CYL60-KA	630	Camden	X			<input type="checkbox"/>



By Security Supplier									
1	Door Contact	To Suit Building System							<input type="checkbox"/>
By Locksmith									
3	Permanent Core	Permanent Medeco Core Provided by City Locksmith			626	Medeco			<input type="checkbox"/>

Notes:

- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Final commissioning of all access control items, such as but not limited to electric strikes, Rex sensors, Door contacts, Electrified Panics, Relays & Maglocks is the responsibility of the security provider
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- Operator must be manually tuned off prior to locking door with Classroom Lever Trim.

-----End of Heading-----

**Heading# 2**

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2050 x 45	STC Rating	None
Door Material:	SCWD	Frame Material:	WDF	Fire Rating	None

1 Total Openings

1	Door#	N-006	Location:	Corridor 001 to Corridor 006	Handing:	LH
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Web Link

Install Instructions

Site Verified

By Hardware Supplier									
3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"			652	Hager	X		<input type="checkbox"/>
1	Classroom Lockset	ND70BDC x SPA x 626			626	Schlage	X		<input type="checkbox"/>
1	Wrap Around Plate	42CW			630	Don-Jo	X		
1	Mortise Cylinder	80-111			626	Schlage	X		<input type="checkbox"/>
1	Electric Strike	1500C			630	HES	X	X	<input type="checkbox"/>
1	Overhead Stop	105S			630	Glynn Johnson	X	X	<input type="checkbox"/>



1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – HM Door Screws	630	Gallery	X					
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X					
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X				
By Automatics Supplier – PACKAGE #3 – PUSH BUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)										
1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount	628		X					
2	Wave Buttons	CM-331/42SW-SGLR, Double Gang, SS Face Plate with LED Ring	630	Camden	X					
2	Surface Mount Box	CM-43CBLA	630	Camden	X					
1	Key Switch	CM-2210 x 7224 LED	630	Camden	X					
1	Cylinder	CM-CYL60-KA	630	Camden	X					
By Locksmith										
1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco						

Notes:

- Final commissioning of all access control items, such as but not limited to electric strikes, Rex sensors, Door contacts, Electrified Panics, Relays & Maglocks is the responsibility of the security provider
- Refer to STC rating of the wall in Architectural layout G1002
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Option to have Operators manually turned off and room closed during non working hours using classroom function of lockset.
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.

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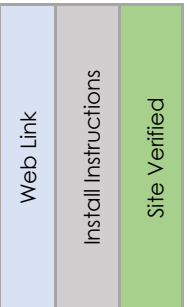
**Heading# 4**

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1	Door#	NE-002	Location:	Corridor 002 to Office Area 002	Handing:
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By Hardware Supplier

1	Passage Latchset	ND10S x SPA x 626	626	Schlage	X			
1	Wrap Around Plate	42CW	630	Don-Jo	X			

*BALANCE OF EXITING HARDWARE TO REMAIN.

- Modify Existing Door for New Hardware

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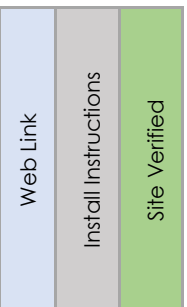
Heading# 5

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

2 Total Openings

1	Door#	NE-005	Location:	Corridor 006 to Storage Rooms 005A & 005B	Handing:
1	Door#	NE-007	Location:	Garage/Storage Space 007 to Corridor 006	Handing:



By Hardware Supplier

2	Classroom Lockset	ND70BDC x SPA x 626	626	Schlage	X			
2	Wrap Around Plate	42CW	630	Don-Jo	X			

By Locksmith



2	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

-----End of Heading-----

Heading# 6

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1 **Door#** NE-008 **Location:** Corridor 001 to Washroom 008 **Handing:**

Web Link

Install Instructions

Site Verified

By Hardware Supplier

1	Privacy Latchset	ND40S x SPA x 626	626	Schlage	X			
1	Wrap Around Plate	42CW	630	Don-Jo	X			

*BALANCE OF EXITING HARDWARE TO REMAIN.

-----End of Heading-----



Heading# 7

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2050 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	None

1 Total Openings

1 **Door#** N-101A **Location:** Exterior from Vestibule 101 **Handing:** LHR

Web Link

Install Instructions

Site Verified

By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4" NRP	605	Hager	X			<input type="checkbox"/>
1	Classroom Lockset	ND70BDC x SPA x 605	605	Schlage	X			<input type="checkbox"/>
1	Mortise Cylinder	80-111	605	Schlage	X			<input type="checkbox"/>
1	Electric Strike	1500C	605	HES	X	X		<input type="checkbox"/>
1	Overhead Stop	105S	605	Glynn Johnson	X	X		<input type="checkbox"/>
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – Door Screws	605	Gallery	X			<input type="checkbox"/>
1	Weatherstrip	W-13 – 1 @ 1067 & 2 @ 2135	BRZ	KN Crowder	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			<input type="checkbox"/>
1	Door Sweep	W-13S x 1067	BRZ	KN Crowder	X			<input type="checkbox"/>
1	Threshold	CT-10 x 1067	605	KN Crowder	X			<input type="checkbox"/>

By Automatics Supplier – PACKAGE #1 – PUSH BUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)

1	Auto Operator (SNG)	BESAM SW200i – Push Side Mount	605		X			<input type="checkbox"/>
1	Push Button	CM60/4-WT	630	Camden	X			<input type="checkbox"/>
1	Surface Mount Box	CM-79	630	Camden	X			<input type="checkbox"/>
1	Wave Buttons	CM-331/42SW-SGLR, Double Gang, SS Face Plate with LED Ring	630	Camden	X			<input type="checkbox"/>
1	Surface Mount Box	CM-43CBLA	630	Camden	X			<input type="checkbox"/>
1	Logic Relay	CX-33		Camden	X			<input type="checkbox"/>
1	Key Switch	CM-2210 x 7224 LED	605	Camden	X			<input type="checkbox"/>
1	Cylinder	CM-CYL60-KA	605	Camden	X			<input type="checkbox"/>

By Security Supplier

1	Door Contact	To Suit Building System						<input type="checkbox"/>
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By Locksmith

3	Permanent Core	Permanent Medeco Core Provided by City Locksmith	605	Medeco				<input type="checkbox"/>
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Notes:

- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Final commissioning of all access control items, such as but not limited to electric strikes, Rex sensors, Door contacts, Electrified Panics, Relays & Maglocks is the responsibility of the security provider
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- Operator must be manually tuned off prior to locking door with Classroom Lever Trim.

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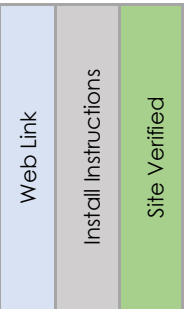
Heading# 8

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2050 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	None

1 Total Openings

1 **Door#** N-101B **Location:** Vestibule 101 from Corridor 111 **Handing:** LHR



By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	605	Hager	X			<input type="checkbox"/>
1	Door Pull Set	GSH 167F x 167F x 1700 x #5MTG (Back to Back)	605	Gallery	X			<input type="checkbox"/>
1	Overhead Stop	105S	605	Glynn Johnson	X	X		<input type="checkbox"/>
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – Door Screws	605	Gallery	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			<input type="checkbox"/>
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X		<input type="checkbox"/>

By Automatics Supplier – PACKAGE #3 – PUSH BUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)

1	Auto Operator (SNG)	BESAM SW100 – Push Side Mount - LH	605		X			<input type="checkbox"/>
2	Wave Buttons	CM-331/42SW-SGLR, Double Gang, SS Face Plate with LED Ring	630	Camden	X			<input type="checkbox"/>



2	Surface Mount Box	CM-43CBLA	630	Camden	X			<input type="checkbox"/>
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Notes:

- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Final commissioning of all access control items, such as but not limited to electric strikes, Rex sensors, Door contacts, Electrified Panics, Relays & Maglocks is the responsibility of the security provider
- Refer to STC rating of the wall in Architectural layout G1002
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.

-----End of Heading-----



Heading# 9

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2050 x 45	STC Rating	None
Door Material:	SCWD	Frame Material:	WDF	Fire Rating	None

1 Total Openings

1	Door#	N-102	Location:	Corridor 106 to B/F Universal Washroom 102	Handing:	LH
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Web Link

Install Instructions

Site Verified

By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	630	Hager	X			<input type="checkbox"/>
1	Storeroom Lockset	ND80BDC x SPA x 626	626	Schlage	X			<input type="checkbox"/>
1	Wrap Around Plate	42CW	630	Don-Jo	X			
1	Electric Strike	1500C	630	HES	X	X		<input type="checkbox"/>
2	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – Door Screws	630	Gallery	X			<input type="checkbox"/>
2	Coat Hook	GSH 390	626	Gallery	X			<input type="checkbox"/>
1	Floor Stop	GSH 209	626	Gallery	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5500	BLK	KN Crowder	X			<input type="checkbox"/>
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X		<input type="checkbox"/>

By Automatics Supplier – PACKAGE #5 – PUSH TO LOCK KIT UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)

1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount	628		X			<input type="checkbox"/>
1	Wave to Lock Kit	CX-WC16	630	Camden	X	X		<input type="checkbox"/>
1	Emergency Call Kit	CX-WEC10K2	630	Camden	X	X		<input type="checkbox"/>



By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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Notes:

- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Refer to STC rating of the wall in Architectural layout G1002
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

-----End of Heading-----

Heading# 10

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2050 x 45	STC Rating	None
Door Material:	SCWD	Frame Material:	WDF	Fire Rating	None

1 Total Openings

1	Door#	N-106	Location:	Corridor 106 from Stair A A1	Handing:	LHR
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Web Link	Install Instructions	Site Verified
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By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	652	Hager	X			<input type="checkbox"/>
1	Classroom Lockset	ND70BDC x SPA x 626	626	Schlage	X			<input type="checkbox"/>
1	Wrap Around Plate	42CW	630	Don-Jo	X			
1	Closer	4011-RH (LCN/ST 1544)	689	LCN	X	X		<input type="checkbox"/>
1	Drop Plate	4020-18	689	LCN				<input type="checkbox"/>
1	Overhead Stop	105H	630	Glynn Johnson	X	X		<input type="checkbox"/>
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – HM Door Screws	630	Gallery	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			<input type="checkbox"/>
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X		<input type="checkbox"/>



By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco					<input type="checkbox"/>
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Notes:

- Refer to STC rating of the wall in Architectural layout G1002
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

-----End of Heading-----

Heading# 11

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2050 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	None

1 Total Openings

1	Door#	N-110	Location:	Corridor 111 to Office 109	Handing:	LH
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Web Link

Install Instructions

Site Verified

By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	652	Hager	X				<input type="checkbox"/>
1	Classroom Lockset	ND70BDC x SPA x 626	626	Schlage	X				<input type="checkbox"/>
1	Wrap Around Plate	42CW	630	Don-Jo	X				
1	Overhead Stop	105S	630	Glynn Johnson	X	X			<input type="checkbox"/>
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – HM Door Screws	630	Gallery	X				<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X				<input type="checkbox"/>
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X			<input type="checkbox"/>

By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco					<input type="checkbox"/>
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Notes:

- Refer to STC rating of the wall in Architectural layout G1002
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)



- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

-----End of Heading-----

Heading# 12

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

2 Total Openings

1	Door#	NE-108A	Location:	Corridor 111 to Office 108	Handing:	
1	Door#	NE-109	Location:	Office 108 from Closet	Handing:	

Web Link	Install Instructions	Site Verified
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By Hardware Supplier

2	Passage Latchset	ND10S x SPA x 626	626	Schlage	X			
2	Wrap Around Plate	42CW	630	Don-Jo	X			

*BALANCE OF EXITING HARDWARE TO REMAIN.

- Modify Existing Door for New Hardware

-----End of Heading-----

Heading# 13

Opening Information



Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1	Door#	NE-108B	Location:	Office 108 from Closet	Handing:
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Web Link

Install Instructions

Site Verified

By Hardware Supplier

1	Passage Latchset	ND10S x SPA x 626	605	Schlage	X			
1	Wrap Around Plate	42CW	605	Don-Jo	X			

*BALANCE OF EXITING HARDWARE TO REMAIN.

- Modify Existing Door for New Hardware

-----End of Heading-----

Heading# 14

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

2 Total Openings

1	Door#	NE-202	Location:	Corridor 201 to Office 202	Handing:
1	Door#	NE-206	Location:	Corridor 201 to Office 206	Handing:

Web Link

Install Instructions

Site Verified

By Hardware Supplier

2	Classroom Lockset	ND70BDC x SPA x 626	626	Schlage	X			<input type="checkbox"/>
2	Wrap Around Plate	42CW	630	Don-Jo	X			

By Locksmith

2	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:



- Refer to STC rating of the wall in Architectural layout G1002
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security
- Modify Existing Door for New Hardware

-----End of Heading-----

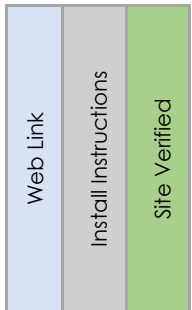
Heading# 15

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

4 Total Openings

1	Door#	NE-203	Location:	Office 202 from Storage 203	Handing:
1	Door#	NE-204	Location:	Storage 203 to Storage 204	Handing:
1	Door#	NE-207	Location:	Office 206 from Storage 207	Handing:
1	Door#	NE-208	Location:	Storage 207 to Storage 208	Handing:



By Hardware Supplier

4	Passage Latchset	ND10S x SPA x 626	605	Schlage	X			
4	Wrap Around Plate	42CW	605	Don-Jo	X			

*BALANCE OF EXITING HARDWARE TO REMAIN.

- Modify Existing Door for New Hardware

-----End of Heading-----

Heading# 16

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None





1 Total Openings

1 Door# NE-205 Location: Corridor 201 to Washroom 205 Handing:

Web Link

Install Instructions

Site Verified

By Hardware Supplier							
1	Privacy Latchset	ND40S x SPA x 626	626	Schlage	X		
1	Wrap Around Plate	42CW	630	Don-Jo	X		

*BALANCE OF EXITING HARDWARE TO REMAIN.

-----End of Heading-----

END OF SCHEDULE

DOOR HARDWARE

08 71 00

PROJECT:

**CITY OF TORONTO ACCESSIBILITY UPGRADES**

FIRE HALL NO. 227

1904 Queen St East, Toronto, Ontario

ARCHITECT:

**IBI GROUP**

175 Galaxy Blvd, Unit 100

Toronto, Ontario

Prepared By: Alex Bekmansourov

Date: January 29, 2022

Revised: March 17, 2022



Architectural Hardware Finishes

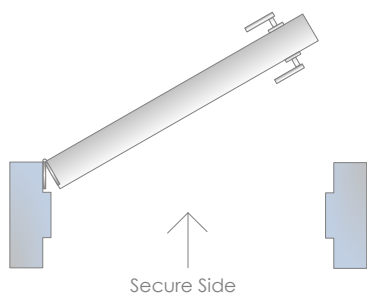
Steel	Stainless Steel	Brass/Bronze	Aluminum	Painted/Powder Coat	US/CAN#
Clear Anodized / Painted Aluminum					
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Satin Nickel					
646		619	670		US15
Polished Nickel					
645		618	669		US14
Satin Stainless Steel					
	630				US32D
Polished Stainless Steel					
	629				US32
Satin Chrome					
652		626	702		US26D
Polished Chrome					
651		625	672		US26
Satin Brass					
633		606	667	678	US4
Polished Brass					
632		605	666	677	US5
Satin Bronze					
639		612	668	680	US10
Oil Rubbed Bronze					
640		613	703	695	US10B
Flat Black / Anodized Black					
631		622	671	693	US19

Door Types & Handing

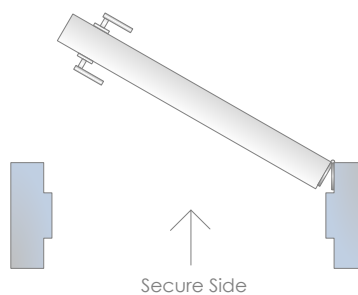
Abbreviations

RH – Right Hand	RHA – Right Hand Active	SS- Single Slider
LH – Left Hand	LHA – Left Hand Active	BP – Bi-Parting Slider
RHR – Right Hand Reverse	RHRA/LHRA – Right & Left Hand Reverse Active	BP – Bi-Passing Slider
LHR – Left Hand Reverse	RHA/LHA – Right & Left Hand Active	BF – Bi-Folding Slider
RHRA – Right Hand Reverse Active	DA- Double Acting	TS – Telescopic Slider
LHRA – Left Hand Reverse Active	DE – Double Egress	PKT – Pocket Slider

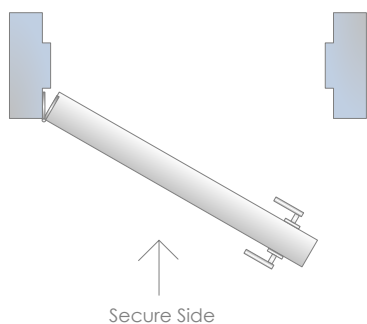
Note: The handing on a swing door is determined by placing yourself on the secure side or keyed side of the door.



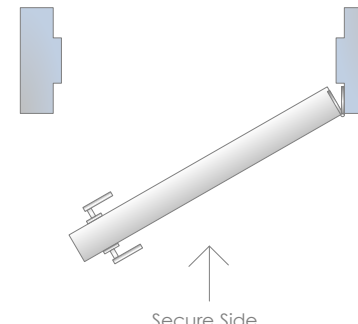
LH



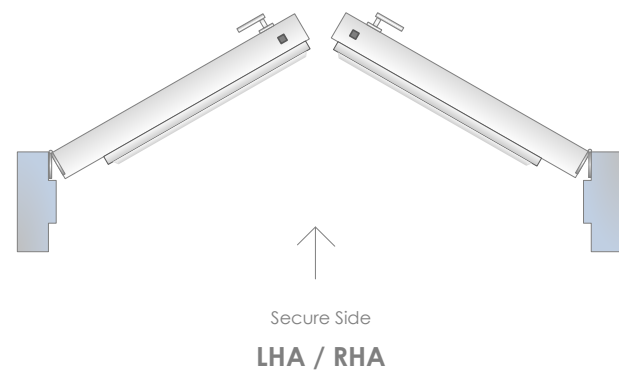
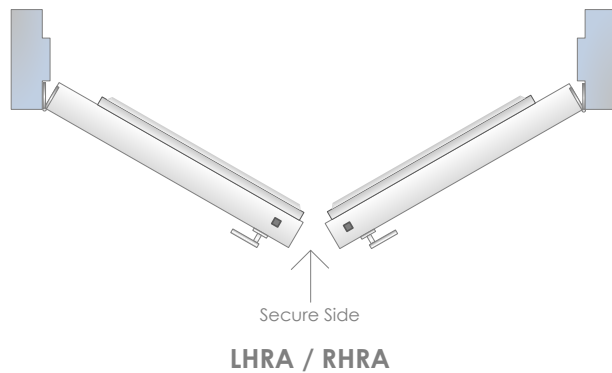
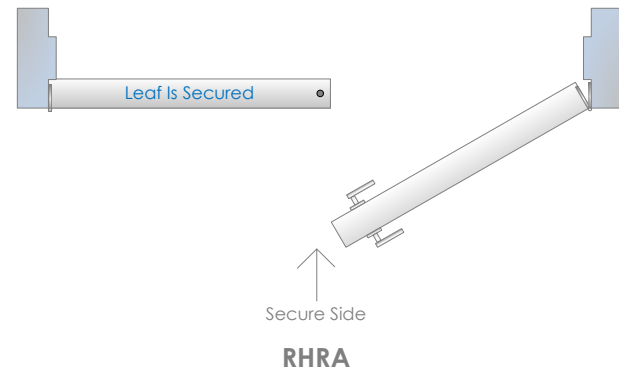
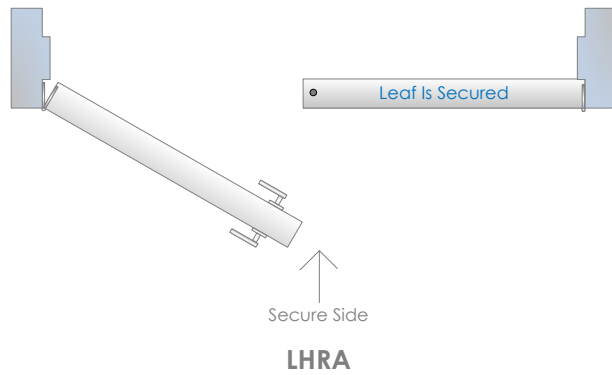
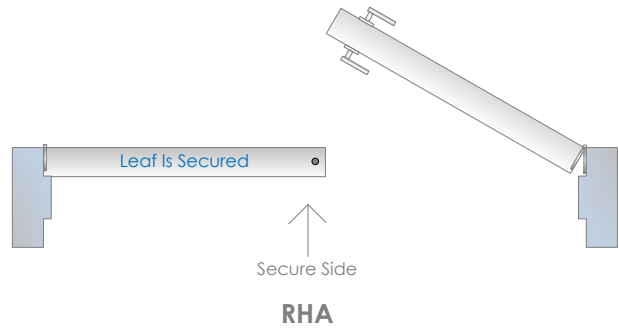
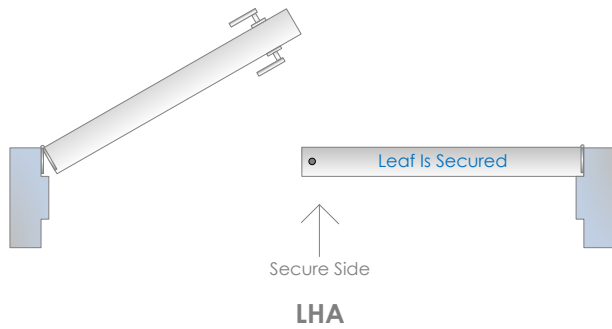
RH

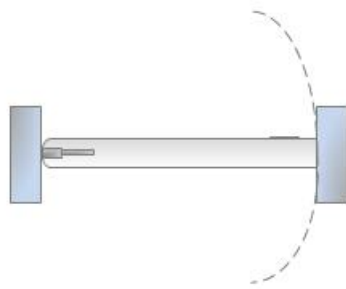


LHR



RHR





DA-DOUBLE
ACTING



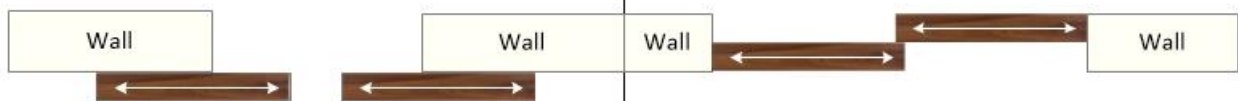
DE-DOUBLE
EGRESS



PKT - POCKET SLIDER



SS - SINGLE SLIDER or
BARN SLIDER



BP - BI-PARTING



BPS - BI-PASSING

Symbols



- Door has a fire rating and all associated hardware must have a fire label to suit. Must comply with local requirements.



- Door is automatic and is equipped with an auto operator. Door must meet local barrier free codes



- Door has an electrical requirement and requires power to be brought to the appropriate location above the door or to the latch, for either security or barrier free applications. Refer to security & electrical drawings for further information.



- Door requires security card access. Refer to security / electrical drawings for further information.

Abbreviations

Door:

HMD = Hollow Metal Door
IHMD = Insulated Hollow Metal Door
ALD = Aluminum Door
SCWD = Solid Core Wood Door
HCWD = Hollow Core Wood Door
FGD = Frameless Glass Door
FRP = Fiberglass Reinforced Plastic Door

Frame:

HMF = Hollow Metal Frame
ALF = Aluminum Frame
Cased Open HMF = Cased Open Hollow Metal Frame
WDF = Wood Frame
Cased Open WDF = Cased Open Wood Frame
Cased Open Drywall = Cased Open Drywall

Fire Ratings:

0 HR – Zero Hour Fire Rating / Smoke Barrier
20 MIN – 20 Minute Fire Rating
¾ HR – 45 Minute Fire rating
1 ½ HR – 90 Minute Fire Rating
2 HR – 120 Minute Fire Rating
3 HR – 180 Minute Fire Rating

Disclaimer

Installation Instructions:

Installation instructions have been provided for convenience only. Although we do our best to ensure these documents are accurate and up to date, it is ultimately the responsibility of the installer to ensure they are using the correct instructions for the product they are installing. Use of the installation instructions provided is done so at one's own risk and Spyder SC takes no responsibility to their accuracy.

Weblinks:

Weblinks do change from time to time as manufacturers move around their websites, please inform us if you have a none functioning weblink.

HARDWARE SCHEDULE



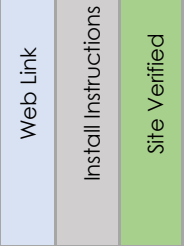
Heading# 1

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2135 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	None

1 Total Openings

1	Door#	N-111	Location:	Apparatus Bay 101 to B/F Universal WR 111	Handing:	LH
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By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	630	Hager	X			<input type="checkbox"/>
1	Storeroom Lockset	ND80BDC x RHO x 626	626	Schlage	X			<input type="checkbox"/>
1	Electric Strike	1500C	630	HES	X	X		<input type="checkbox"/>
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – Door Screws	630	Gallery	X			<input type="checkbox"/>
2	Coat Hook	GSH 390	626	Gallery	X			<input type="checkbox"/>
1	Floor Stop	GSH 209	626	Gallery	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5500	BLK	KN Crowder	X			<input type="checkbox"/>
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X		<input type="checkbox"/>
1	Emergency Key Cabinet	EB-02	RD	Canropa	X			<input type="checkbox"/>

By Automatics Supplier – PACKAGE #5 – PUSH TO LOCK KIT UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)

1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount	628		X			<input type="checkbox"/>
1	Wave to Lock Kit	CX-WC16	630	Camden	X	X		<input type="checkbox"/>

By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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Notes:

- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Refer to STC rating of the wall in Architectural layout G1002
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.



- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

-----End of Heading-----

Heading# 2

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1	Door#	NE-101	Location:	Exterior to Bunker Area 103	Handing:	LH
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Web Link

Install Instructions

Site Verified

By Hardware Supplier

1	Keypad Lockset	LL1021B-26D-41	630	Dormakaba	X			<input type="checkbox"/>
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By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

-----End of Heading-----

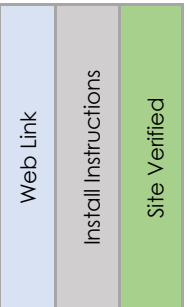
**Heading# 3**

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	None

4 Total Openings

1	Door#	NE-102	Location:	Bunker Area 103 from Stairs B104	Handing:
1	Door#	NE-107	Location:	Bunker Area 103 to Lounge Room 108	Handing:
1	Door#	NE-108	Location:	Bunker Area 103 to Mechanical Room 109	Handing:
1	Door#	NE-207	Location:	Corridor from Hose Tower Room 212	Handing:



By Hardware Supplier

4	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	X			
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By Locksmith

4	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

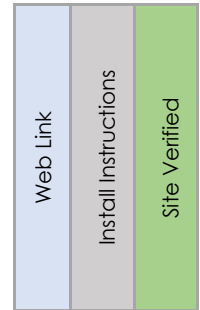
**Heading# 4**

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

5 Total Openings

1	Door#	NE-103	Location:	Corridor 106 from Kitchen 105	Handing:
1	Door#	NE-105	Location:	Corridor 106 to Lounge Room 108	Handing:
1	Door#	NE-201	Location:	Corridor 202 to Storage 204	Handing:
1	Door#	NE-204	Location:	Corridor to Bedroom 209	Handing:
1	Door#	NE-205	Location:	Bedroom 209 from Closet	Handing:



By Hardware Supplier

5	Passage Latchset	ND10S x RHO x 626	626	Schlage	X			
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*BALANCE OF EXITING HARDWARE TO REMAIN.

-----End of Heading-----

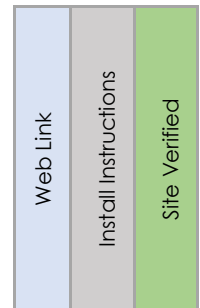
Heading# 5

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

2 Total Openings

1	Door#	NE-104	Location:	Corridor 106 from Washroom 107	Handing:
1	Door#	NE-203	Location:	Corridor 106 from Women's Washroom 208	Handing:



By Hardware Supplier

2	Privacy Latchset	ND40S x RHO x 626	626	Schlage	X			
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*BALANCE OF EXITING HARDWARE TO REMAIN.

-----End of Heading-----



Heading# 6

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1	Door#	NE-106	Location:	Bunker Area 103 from Stair A 110	Handing:	RHR
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Web Link

Install Instructions

Site Verified

By Hardware Supplier

1	Keypad Lockset	LR1021B-26D-41	630	Dormakaba	X			<input type="checkbox"/>
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By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

.....End of Heading.....





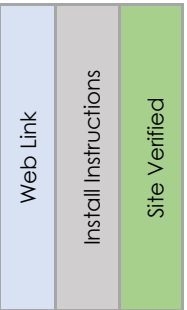
Heading# 7

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	None

2 Total Openings

1	Door#	NE-202	Location:	Corridor 220 to Bedroom 203	Handing:
1	Door#	NE-206	Location:	Corridor 220 to Bedroom 210	Handing:



By Hardware Supplier

2	Entrance Lockset	ND53BDC x RHO x 626	626	Schlage	X			
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By Locksmith

2	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.



Heading# 8

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

2 Total Openings

1	Door#	NE-301	Location:	Gym 302 to Storage 304	Handing:	
1	Door#	NE-302	Location:	Hose Tower 303 to Gym 302	Handing:	

Web Link

Install Instructions

Site Verified

By Hardware Supplier

2	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	X			
2	Wrap Around Plate	42CW	630	Don-Jo	X			

By Locksmith

2	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

*EXISTING HARDWARE TO BE CONFIRMED PRIOR TO ORDERING.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.
- Modify Existing Door for New Hardware

.....End of Heading.....

END OF SCHEDULE



DOOR HARDWARE

08 71 00

PROJECT:

**CITY OF TORONTO ACCESSIBILITY UPGRADES**

FIRE HALL NO. 225

3600 Danforth Ave, Toronto, Ontario

ARCHITECT:

**IBI GROUP**

175 Galaxy Blvd, Unit 100

Toronto, Ontario

Prepared By: Alex Bekmansourov

Date: January 30, 2022

Revised: March 17, 2022





Architectural Hardware Finishes

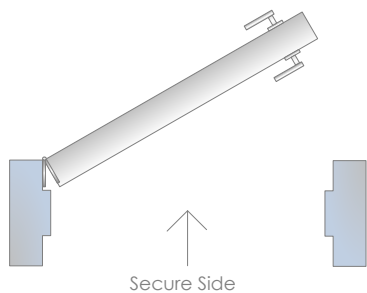
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Clear Anodized / Painted Aluminum					
			628	689	US28
Satin Nickel					
646		619	670		US15
Polished Nickel					
645		618	669		US14
Satin Stainless Steel					
	630				US32D
Polished Stainless Steel					
	629				US32
Satin Chrome					
652		626	702		US26D
Polished Chrome					
651		625	672		US26
Satin Brass					
633		606	667	678	US4
Polished Brass					
632		605	666	677	US5
Satin Bronze					
639		612	668	680	US10
Oil Rubbed Bronze					
640		613	703	695	US10B
Flat Black / Anodized Black					
631		622	671	693	US19

Door Types & Handing

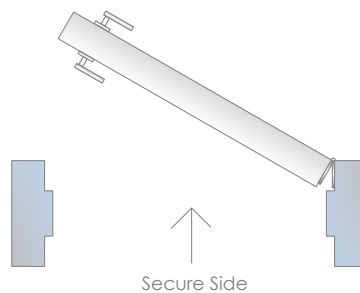
Abbreviations

RH – Right Hand	RHA – Right Hand Active	SS- Single Slider
LH – Left Hand	LHA – Left Hand Active	BP – Bi-Parting Slider
RHR – Right Hand Reverse	RHRA/LHRA – Right & Left Hand Reverse Active	BP – Bi-Passing Slider
LHR – Left Hand Reverse	RHA/LHA – Right & Left Hand Active	BF – Bi-Folding Slider
RHRA – Right Hand Reverse Active	DA- Double Acting	TS – Telescopic Slider
LHRA – Left Hand Reverse Active	DE – Double Egress	PKT – Pocket Slider

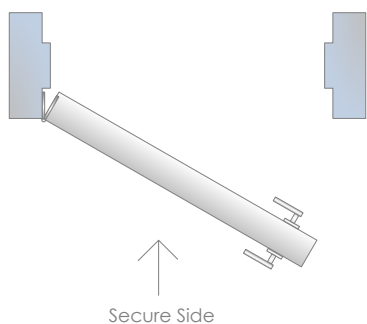
Note: The handing on a swing door is determined by placing yourself on the secure side or keyed side of the door.



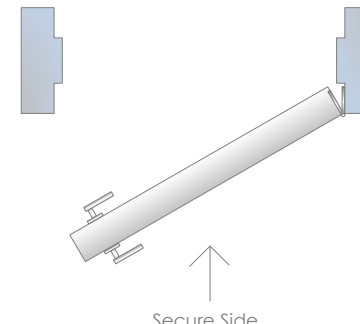
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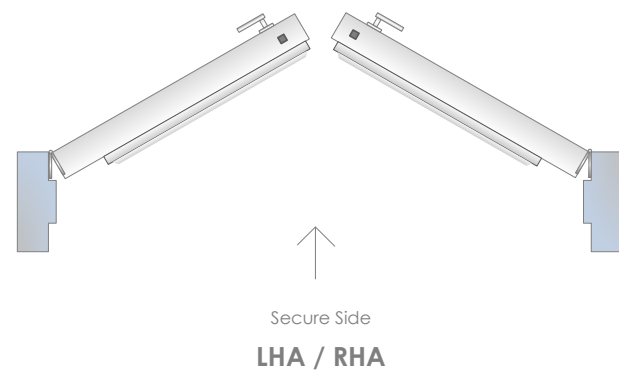
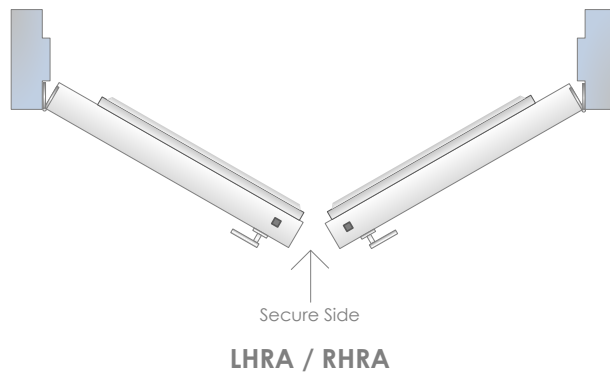
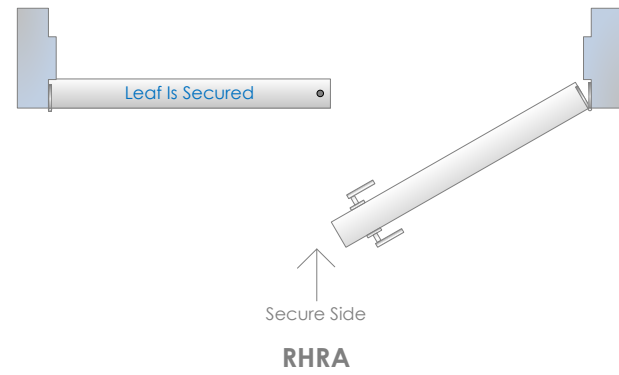
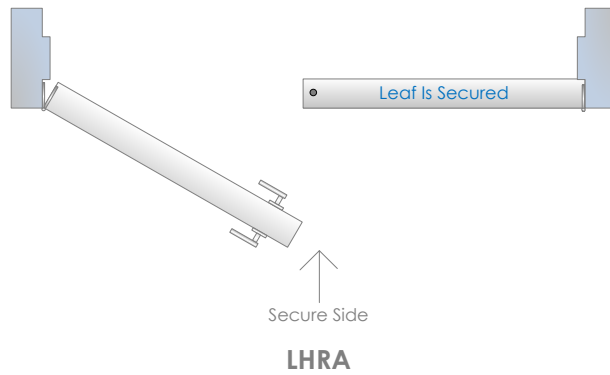
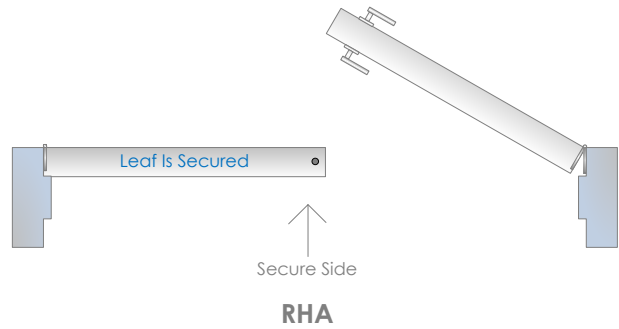
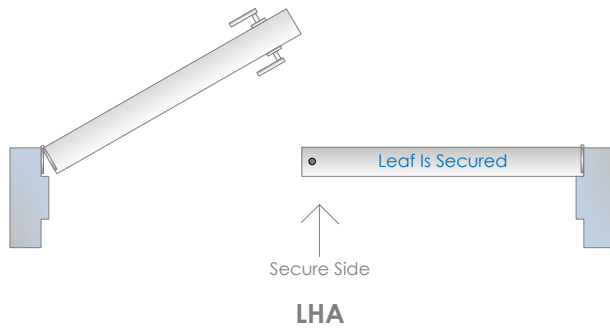
RH

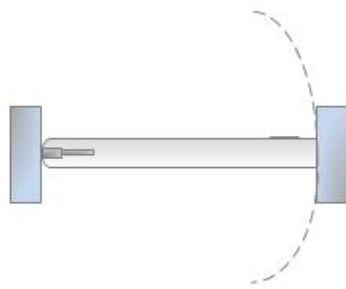


LHR



RHR





DA-DOUBLE
ACTING



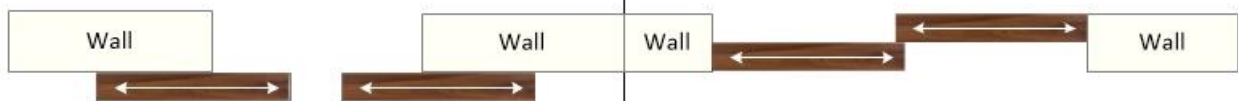
DE-DOUBLE
EGRESS



PKT - POCKET SLIDER



SS - SINGLE SLIDER or
BARN SLIDER



BP - BI-PARTING



BPS - BI-PASSING

Symbols



- Door has a fire rating and all associated hardware must have a fire label to suit. Must comply with local requirements.



- Door is automatic and is equipped with an auto operator. Door must meet local barrier free codes



- Door has an electrical requirement and requires power to be brought to the appropriate location above the door or to the latch, for either security or barrier free applications. Refer to security & electrical drawings for further information.



- Door requires security card access. Refer to security / electrical drawings for further information.

Abbreviations

Door:

HMD = Hollow Metal Door
IHMD = Insulated Hollow Metal Door
ALD = Aluminum Door
SCWD = Solid Core Wood Door
HCWD = Hollow Core Wood Door
FGD = Frameless Glass Door
FRP = Fiberglass Reinforced Plastic Door

Frame:

HMF = Hollow Metal Frame
ALF = Aluminum Frame
Cased Open HMF = Cased Open Hollow Metal Frame
WDF = Wood Frame
Cased Open WDF = Cased Open Wood Frame
Cased Open Drywall = Cased Open Drywall

Fire Ratings:

0 HR – Zero Hour Fire Rating / Smoke Barrier
20 MIN – 20 Minute Fire Rating
¾ HR – 45 Minute Fire rating
1 ½ HR – 90 Minute Fire Rating
2 HR – 120 Minute Fire Rating
3 HR – 180 Minute Fire Rating

Disclaimer

Installation Instructions:

Installation instructions have been provided for convenience only. Although we do our best to ensure these documents are accurate and up to date, it is ultimately the responsibility of the installer to ensure they are using the correct instructions for the product they are installing. Use of the installation instructions provided is done so at one's own risk and Spyder SC takes no responsibility to their accuracy.

Weblinks:

Weblinks do change from time to time as manufacturers move around their websites, please inform us if you have a none functioning weblink.



HARDWARE SCHEDULE



Heading# 1

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2050 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	None

1 Total Openings

1 **Door#** N-102 **Location:** Lobby 02 to B/F Universal WR 08 **Handing:** LH

Web Link

Install Instructions

Site Verified

By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 1/2" x 4"	630	Hager	X			<input type="checkbox"/>
1	Storeroom Lockset	ND80BDC x RHO x 626	626	Schlage	X			<input type="checkbox"/>
1	Electric Strike	1500C	630	HES	X	X		<input type="checkbox"/>
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – Door Screws	630	Gallery	X			<input type="checkbox"/>
2	Coat Hook	GSH 390	626	Gallery	X			<input type="checkbox"/>
1	Floor Stop	GSH 209	626	Gallery	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5500	BLK	KN Crowder	X			<input type="checkbox"/>
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X		<input type="checkbox"/>
1	Emergency Key Cabinet	EB-02	RD	Canropa	X			<input type="checkbox"/>

By Automatics Supplier – PACKAGE #5 – PUSH TO LOCK KIT UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)

1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount	628		X			<input type="checkbox"/>
1	Wave to Lock Kit	CX-WC16	630	Camden	X	X		<input type="checkbox"/>

By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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Notes:

- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Refer to STC rating of the wall in Architectural layout G1002



- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

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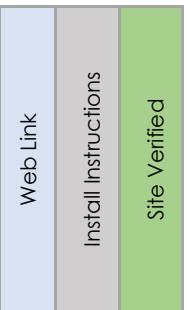
Heading# 2

Opening Information

Opening Type:	Single	Opening Size:	1067 x 2050 x 45	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	None

1 Total Openings

1 **Door#** N-111 **Location:** Vestibule 101 from Lobby 02 **Handing:** RHR



By Hardware Supplier

3	Heavy Weight Hinge	BB1168 – 4 ½" x 4" NRP	652	Hager	X			<input type="checkbox"/>
1	Keypad Lockset	LR1021B-26D-41	630	Dormakaba	X			<input type="checkbox"/>
1	Electric Strike	1500C	630	HES	X	X		<input type="checkbox"/>
1	Overhead Stop	105S	630	Glynn Johnson	X	X		<input type="checkbox"/>
2	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – Door Screws	630	Gallery	X			<input type="checkbox"/>
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			<input type="checkbox"/>
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X		<input type="checkbox"/>

By Automatics Supplier – PACKAGE #3 – PUSH BUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)

1	Auto Operator (SNG)	BESAM SW100 – Push Side Mount	628		X			<input type="checkbox"/>
2	Wave Buttons	CM-331/42SW-SGLR, Double Gang, SS Face Plate with LED Ring	630	Camden	X			<input type="checkbox"/>
2	Surface Mount Box	CM-43CBLA	630	Camden	X			<input type="checkbox"/>
1	Logic Relay	CX-33		Camden	X			<input type="checkbox"/>

By Security Supplier

1	Card Reader/Keypad	To Suit Building System (12V)	BLK					<input type="checkbox"/>
1	Door Contact	To Suit Building System						<input type="checkbox"/>
1	Rex Sensor	To Suit Building System						<input type="checkbox"/>



1	Access Controller	To Suit Building System							
1	Power Supply	Located in nearest IT Closet – By Security Provider							
By Locksmith									
1	Permanent Core	Permanent Medeco Core Provided by City Locksmith	626	Medeco					

Notes:

- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Final commissioning of all access control items, such as but not limited to electric strikes, Rex sensors, Door contacts, Electrified Panics, Relays & Maglocks is the responsibility of the security provider
- Refer to STC rating of the wall in Architectural layout G1002
- Operators Push/Pull Side Location indicated above is based on visually preferred location, however if on-site conditions prevent the installation of the operators on the side indicated above the installer must mount the operator on the side which does not impede with the door opening at least 90 degrees.
- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

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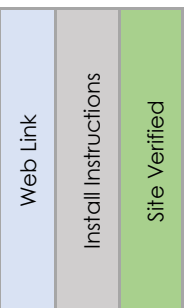
Heading# 3

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1 **Door#** NE-101 **Location:** Exterior from Mech. 27 **Handing:**



By Hardware Supplier

1	Storeroom Lockset	ND80BDC x RHO x 626	626	Schlage	X				
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By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco					
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

-----End of Heading-----

Heading# 4

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

2 Total Openings

1	Door#	NE-102	Location:	Corridor 23 from Closet	Handing:
1	Door#	NE-103	Location:	Corridor 23 from Closet	Handing:

Web Link

Install Instructions

Site Verified

By Hardware Supplier

4	Single Dummy	ND170 x RHO x 626	626	Schlage	X		
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*BALANCE OF EXITING HARDWARE TO REMAIN.

-----End of Heading-----

**Heading# 5**

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1	Door#	NE-104	Location:	Exterior from Vestibule 22	Handing:	RHR
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Web Link

Install Instructions

Site Verified

By Hardware Supplier

1	Keypad Lockset	LR1021B-26D-41	630	Dormakaba	X			<input type="checkbox"/>
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By Locksmith

1	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

-----End of Heading-----



Heading# 6

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

2 Total Openings

1	Door#	NE-105	Location:	Corridor from Chair Storage 21	Handing:
1	Door#	NE-108	Location:	Lobby 02 to Captain's Office 04	Handing:

Web Link

Install Instructions

Site Verified

By Hardware Supplier						
2	Passage Latchset	ND10S x RHO x 626	626	Schlage	X	

*BALANCE OF EXITING HARDWARE TO REMAIN.

-----End of Heading-----



Heading# 7

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	None

3 Total Openings

1	Door#	NE-106	Location:	Apparatus Bay 29 to Mech./Elec 09	Handing:
1	Door#	NE-109	Location:	Captain's Office 04 to Captain's Dorm 06	Handing:
1	Door#	NE-110	Location:	Captain's Office 04 to Captain's Dorm 05	Handing:

Web Link

Install Instructions

Site Verified

By Hardware Supplier

3	Classroom Lockset	ND70BDC x RHO x 626	626	Schlage	X			
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By Locksmith

3	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

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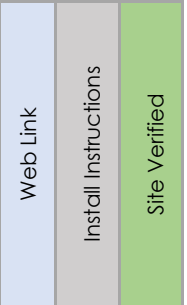
**Heading# 8**

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1 **Door#** NE-112 **Location:** Exterior from Vestibule 01 **Handing:** LHR



By Hardware Supplier

EXISTING HARDWARE TO REMAIN

By Automatics Supplier – **PACKAGE #1A – PUSH BUTTONS UPGRADED TO TOUCHLESS WAVE (UPGRADE EXTRA)**

1	Auto Operator (SNG)	BESAM SW200i – Push Side Mount	628		X			<input type="checkbox"/>
1	Push Button	CM60/4-WT	630	Camden	X			<input type="checkbox"/>
1	Surface Mount Box	CM-79	630	Camden	X			<input type="checkbox"/>
1	Wave Buttons	CM-331/42SW-SGLR, Double Gang, SS Face Plate with LED Ring	630	Camden	X			<input type="checkbox"/>
1	Surface Mount Box	CM-43CBLA	630	Camden	X			<input type="checkbox"/>
1	Key Switch	CM-2210 x 7224 LED	630	Camden	X			<input type="checkbox"/>
1	Cylinder	CM-CYL60-KA	630	Camden	X			<input type="checkbox"/>

By Locksmith

1	Permanent Cylinder	Permanent Medeco Cylinder Provided by City Locksmith	626	Medeco				<input type="checkbox"/>
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- 120VAC is required at the head of the door for all handicap door operators, 15A dedicated circuit. Wall/Frame must be reinforced for automatic operator mounting, all conduit and back boxes with pull cords are to be provided by the electrical contractor.
- Electrician to confirm wire locations with auto door operator supplier prior to pulling wires.
- Final commissioning of all access control items, such as but not limited to electric strikes, Rex sensors, Door contacts, Electrified Panics, Relays & Maglocks is the responsibility of the security provider

.....End of Heading.....



Heading# 9

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	Existing	Frame Material:	Existing	Fire Rating	None

1 Total Openings

1	Door#	NE-113	Location:	Vestibule 15 to Women's Lav. 14	Handing:
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Web Link

Install Instructions

Site Verified

By Hardware Supplier

1	Privacy Latchset	ND40S x RHO x 626	626	Schlage	X			
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*BALANCE OF EXITING HARDWARE TO REMAIN.

End of Heading

Heading# 10

Opening Information

Opening Type:	Single	Opening Size:	Existing Door x Existing Frame	STC Rating	None
Door Material:	HMD	Frame Material:	HMF	Fire Rating	None

3 Total Openings

1	Door#	NE-114	Location:	Vestibule 15 from Dormitory16	Handing:
1	Door#	NE-115	Location:	Dormitory17 to Dormitory16	Handing:
1	Door#	NE-116	Location:	Dormitory18 to Dormitory17	Handing:

Web Link

Install Instructions

Site Verified

By Hardware Supplier

3	Entrance Lockset	ND53BDC x RHO x 626	626	Schlage	X			
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By Locksmith



3	Permanent Core/Cylinder	Permanent Medeco Core/Cylinder Provided by City Locksmith Listed Below.	626	Medeco					
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*BALANCE OF EXITING HARDWARE TO REMAIN.

Notes:

- Lever Replacement Locks specified above all come with SFIC System with a plastic construction core for the facility/city locksmith to replace with permanent cores after construction. (Existing Key System should still be verified with facility prior to ordering Locks to ensure compatibility)
- Permanent Cores & Cylinders to be Provided by Approved City Locksmiths: Reillys Lock & Security Systems and/or ABC Security Access Systems.

-----End of Heading-----

END OF SCHEDULE

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section, including but not limited to the following:
 - .1 Receive and install hollow metal doors and plastic laminate doors (and transoms).
 - .2 Receive and install finish hardware in all doors listed in finish hardware schedule appended to Section 08 71 00. Receive templates from finish hardware Supplier.
 - .3 Final adjustment on door closers including closing speed, latching speed and backcheck.
- .2 Obtain up-to-date finish hardware schedule and keep a copy in a three-ring binder at the jobsite. Make schedule available to the Consultant upon request. Record any changes made to hardware schedule at the site.
- .3 Keep a copy of all reviewed catalogue cuts and samples, if any, and have same readily available to the Consultant upon request.

1.1 **REFERENCE**

- .1 Conform to the latest edition of the following:
 - .1 AODA - Accessibility for Ontarians with Disabilities Act

1.2 **QUALITY ASSURANCE**

- .1 The Subcontractor performing the Work of this section shall be a firm specializing in the installation of commercial doors and high quality building finish hardware, both electrified and non-electrified.
- .2 Give assistance at the place of the Works to organize hardware storeroom and supply qualified staff to correctly categorize, mark, and arrange each item in groups to enable efficient dispensing in specified hardware groups for each door to installation trades.
- .3 Provide qualified staff at the place of the Works promptly to assist installation trades subsequent to being requested and to ensure that hardware is being correctly installed.

1.3 **DELIVERY, STORAGE AND HANDLING**

- .1 Receive and store doors and finish hardware. It must be noted that hollow metal doors are in two types, namely standard hollow metal with stiffened/insulated core, and fire rated hollow metal. Likewise, solid core wood doors come in both standard and fire rated assemblies. Ensure that such units are identified accordingly to ensure installation at their intended points of usage.
 - .2 Jointly make an inventory of finish hardware with the hardware Supplier.
 - .3 Handle, store and protect doors and finish hardware in accordance with requirements specified in Section 08 11 13 and Section 08 14 10.
-

1.4 **PRE-INSTALLATION MEETING**

- .1 Prior to start of hardware installation, arrange for a Project site meeting of all parties associated with Work of this section. Presided by Consultant, meeting to include General Contractor, Hardware Consultant, Hardware Supplier, Hardware Installer and Security System Supplier/Installer.
- .2 In the meeting, review Specifications for Work included under this section and determine a complete understanding of requirements and responsibilities relative to Work included, storage and handling of materials, installation of materials, latest installation techniques, sequence and quality control, interfacing with Division 26, and other matters affecting the installation, so as to permit compliance with the intent of this section.

1.5 **WARRANTY AND MAINTENANCE DOCUMENTS**

- .1 Collect warranty and maintenance documents from finish hardware Supplier as specified in Section 08 71 00. Submit the foregoing documents upon Substantial Performance in accordance with Section 01 33 00.

2 Products

2.1 **MATERIALS**

- .1 (Not used)

3 Execution

3.1 **DOORS**

- .1 Install doors to swing shut with minimum clearances of 1.6 mm at heads, 2 mm at jambs and 6 mm over finished floor surfaces. Check with door schedule for conditions requiring greater clearance from floor for air movement.
- .2 Install doors to swing freely but not loosely on their hinges, to close tightly and evenly on their frames without binding or rattling in the latched position.
- .3 Do not install warped, twisted or other defective doors.
- .4 Field trimming or cutting of wood doors is not permitted. All cutouts for mortise hardware, grilles and glass, and all bevelling and prefitting shall have been done in the door manufacturer's plant.
- .5 Secure plastic laminate transoms with concealed pins at head and clips at bottom corners.

3.2 **FINISH HARDWARE**

- .1 Install building finish hardware in accordance with finish hardware schedule appended to Section 08 71 00. Carefully examine Section 08 71 00 for installation requirements specific to this Section.
 - .2 Consider hardware manufacturers recommended mounting heights as a general guide unless conditions such as intermediate rails, line of glass light, etc. dictate otherwise. Installer must carefully check manufacturers' installation instructions packed with hardware Products. In particular, the installation heights when using mullions and/or vertical rod devices may be predetermined by certain manufacturers.
-

- .3 Hardware Location:
 - .1 Hardware location dimension shall be as follows; measured from finish floor to centre line of hardware unless indicated otherwise:
 - .1 Locksets/latchsets centre line of strike: 1034 mm
 - .2 Deadlocks/mortise night latch: 1524 mm
 - .3 Exit devices (centre line of strike): 1000 mm
 - .4 Push plates: 1000 mm
 - .5 Door pulls: 1000 mm
 - .2 Hardware locations are to pre-determined standard industry recommendations. On custom doors, mount hardware across intermediate rail to meet architectural design considerations.
- .4 Protect installed hardware from damage.
- .5 Install kickplates on four sides with continuous pressure-sensitive two-sided adhesive tape supplied with hardware.
- .6 Thresholds: Site measure openings before cutting. Set thresholds on two continuous beads of sealant conforming to Section 07 92 00.
- .7 Door closers and holders: Install door closers in such a manner that door opening is unaffected and that maximum swing is permitted. Prior to installing closer to the door, it is the responsibility of the installer to:
 - .1 Index the arm attachment so as to properly position the arm to the closer.
 - .2 Adjust the back check positioning valve in order to maintain an effective backcheck range.
- .8 Weatherstripping of Doors
 - .1 Install weatherstripping effectively to tightly seal entire perimeter of doors. Secure in place with non-ferrous "Tec" screws, in accurate alignment.
 - .2 Maintain integrity of weatherseal at head of doors fitted with closers. Adapt weatherstripping as required to achieve specified performance and provide any necessary accessories.

3.3 **ELECTRIFIED HARDWARE**

- .1 Install electrified hardware and associated devices in accordance with manufacturers recommendations.
 - .2 Provide interconnecting wiring to power operators and controls back to panel in door framing for power connection by electrical division.
 - .3 All wiring will be supplied and installed by electrical division including conduit, boxes and other electrical appurtenances, including connections and terminations.
 - .4 Be responsible for ensuring that all wiring work is done in accordance with the Suppliers wiring diagrams and directions.
-

- .5 Arrange for testing and commissioning of system by the distributor of the system.

3.4 **INSPECTION**

- .1 Coordinate with finish hardware Supplier who provides inspection service during hardware installation and upon completion.
- .2 Adjust or rectify finish hardware items found to be improperly installed. Remove defective materials and replace with new materials supplied by the finish hardware Supplier at no cost to the Owner.

3.5 **CLEANING**

- .1 Wipe clean doors and frames of dust created from the door and hardware installation process.
- .2 Clean and polish all items of hardware and leave free from disfigurement.

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- .1 ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror
- .2 CAN/CGSB-12.1-M - Tempered or Laminated Safety Glass
- .3 CAN/CGSB-12.3-M - Flat, Clear Float Glass
- .4 CAN/CGSB-12.8-M - Insulating Glass Units
- .5 CAN/CGSB-12.11-M - Wired Safety Glass
- .6 CAN/CGSB-19.2-M - Glazing Compound, Non-Hardening, Modified Oil Type
- .7 AODA - Accessibility for Ontarians with Disabilities Act

1.3 **SUBMITTALS**

- .1 Shop Drawings: Submit Shop Drawings in accordance with Section 01 33 00 Submittals, for fabrication and erection of glazing elements indicating materials, thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details and accessories.

.2 Samples:

- .1 Submit one 300 x 300 mm sample of each type of glass in accordance with Section 01 33 00.

.3 Certificates: Submit manufacturer's certification that glass and glazing materials are compatible.

- .1 Submit compatibility and adhesion test reports from sealant manufacturer indicating that glazing materials were tested for compatibility and adhesion with glazing sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed for adhesion.

- .2 Compatibility test report from manufacturer of insulating glass edge sealant, indicating that glass edge sealants were tested for compatibility with other glazing materials including sealants, setting blocks, edge blocks and any other material that contacts or can affect the edge seal.

1.4 **DELIVERY, HANDLING AND STORAGE**

- .1 Deliver materials to the site in original crates and containers with the maker's name and brand distinctly marked thereon and with glass labeled as to types. Do not remove labels on glass until after Work is accepted by the Consultant.

- .2 Store materials within the building, in a clean, dry location. Fully protect materials from damage until ready for use.

2 Products

2.1 MATERIALS

- .1 Georgian Wired Glass: conforming to CAN/CGSB 12.11 M, Type 1, Style 3, polished wired glass with wires straight and true vertically and horizontally.
 - .1 Reinforced by a steel wire mesh in the form of squares or hexagons.
 - .2 Thickness: minimum 6 mm or as indicated on Drawings.
 - .3 Finish: clear polish glass
- .2 Tempered Glass: conforming to CAN/CGSB-12.1-M, Type 2, Class B, clear float glass fully tempered horizontally to achieve net strength of not less than 4 to 5 times greater than regular annealed glass. Free from roller and tong marks.
 - .1 Thickness: 6 mm or 12 mm or as indicated on Drawings
 - .2 Finish: Clear, Low iron
- .3 Laminated Tempered Glass: conforming to CAN/CGSB-12.1-M, Type 1, Class B, Consisting of two layers 6 mm thick, with 1.5 mm clear polyvinyl butyral interlayer, overall thickness 13 mm.
 - .1 Thickness: minimum 13 mm or as indicated on Drawings
- .4 Fire-rated Glass: Refer to Section 08 41 23
- .5 Float Glass: conforming to CAN/CGSB-12.3-M, glazing quality.
 - .1 Finish: polish
 - .2 Thickness: minimum 6 mm or as indicated on Drawings
- .6 Sandblasted Glass: tempered glass conforming to CAN/CGSB-12.1-M.
 - .1 Thickness: minimum 6 mm thick or as indicated on Drawings
- .7 Obscure Glass: frosted obscure tempered glass conforming to CAN/CGSB-12.1-M, Type 2, Class B (Moroccan Pinhead Obscure).
- .8 Translucent Glass: 6 mm thick frosted by the acid-etching process to provide a satin finish with optimum light and complete privacy.
 - .1 Thickness: minimum 6 mm thick or as indicated on Drawings
- .9 Plastic glazing: Clear "Lexan" by GE Canada, 6 mm thick.
- .10 Insulating glass: Factory sealed double glazed units conforming to CAN/CGSB-12.8-M as manufactured. Both panes to consist of clear float glass conforming to CAN/CGSB-12.3-M. (Panels to be float glass conforming to CAN/CGSB-12.3-M; tinted (grey) (bronze) exterior and clear interior, both 6 mm¹/₄" thick). The insulating unit panes shall be joined with a metal edge spacer along all edges ensuring a dehydrated air space with argon gas, and hermetically sealed at the periphery with a factory applied continuous flexible sealer.

- .1 Manufacturer: PPG Canada Inc., AFG Glass Inc., Guardian Glass, Cardinal Glass, Versalux Glass or accepted equal.
- .11 Soundproof / Acoustic Glass: Factory sealed double glazed unit consisting of laminated glass bonded together with clear PVB interlayers. Glass to have 50 STC rating. "LamiGlass" as manufactured by Guardian Glass or accepted equal.
 - .1 Outer pane (8.5 mm): 4 mm clear laminated glass, 0.76 mm inner layer consisting of multilayer PVB and 4 mm clear laminated glass.
 - .2 Cavity: 14.3 mm air gap consisting of 100% air,
 - .3 Inner pane (20.5 mm): 10 mm clear laminated glass, 0.76 mm multilayer PVB inner layer and 10 mm clear laminated glass.
- .12 Mirrors: Conforming to ASTM C1503, normal use (high humidity use) 6 mm¹/₄" thick float glass with process deposit of five silver coats, three copper coats and final protective seal, and with ground and polished round edges:
 - .1 Cushion: PVC pressure sensitive foam tape, 6 mm¹/₄" thick with adhesive one side.
 - .2 Concealed clips: Type 302 stainless steel, vandal-proof.
 - .3 Adhesive: "Mirror Mastic" by Palmer Products Corporation or accepted equal.
- .13 One way glass: 6 mm thick regular clear tempered glass with applied chrome alloy coating. Glass shall be transparent for one-way vision.
- .14 Desk Screens:
 - .1 Laminated tempered glass: 5 mm clear monolithic annealed laminated tempered glass on interior and exterior panes and 1.5 mm polyvinyl butyral (PVB) interlayer, with 19 mm U-channel, clear anodized, no-draft speak through grilles and pass through, polished chromed T-shaped "sleeve over" glass clamp.
 - .2 10 mm clear tempered glass (plexiglass when required), with 19 mm U-channel, clear anodized, no-draft speak through grilles and pass through, polished chromed T-shaped "sleeve over" glass clamp. Manufactured by Oxford or accepted equal.

2.2 ACCESSORIES

- .1 Sliding glass pass-throughs: tempered plate glass with "Roll-Ezy" steel track assembly No. 992 by Knape and Vogt, consisting of No. 993 upper channel, No. 995 shoe, No. 997 ballbearing carrier, No. 999 lower track, edge bumpers and Corbin lock No. 02289. Thickness as indicated on Drawings.
 - .2 Speak-Through/Voice Port: 6" diameter stainless steel voice port complete with bullet resistant plate/cover, speaker face with threaded holes, 5" diameter mounting hole required. Glazing thickness: 3/4" -1-7/16".
 - .1 "TSS MK-1" by Total Security Solutions
 - .2 Or accepted equal
-

- .3 Base Shoe: heavy duty square base shoe for 12.7 mm thick glass, 6063 aluminum alloy T52, 6096 mm long. Use gasket retention groove to secure the top rubber gasket in the base shoe.
 - .1 "CRL B5S20F" by CR Laurence Co.
 - .2 Or accepted equal
- .4 Glazing compound (fire doors): Putty.
- .5 Glazing tape: 440 polyisobutylene-butyl tape by Tremco Ltd.
- .6 Spacer shims and setting blocks: Neoprene, Shore "A" Durometer hardness 70-90, 100 mm long, wide enough to extend from fixed stop to opposite face of glass and of height suitable to provide adequate glazing "bite" for setting blocks. Neoprene, Shore "A" 40 to 50 Durometer hardness, of adequate thickness to provide correct glass to face clearance of at least 3 mm for spacer shims. For glass in fire rated doors (screens) use ULC approved fire-resistant setting blocks and spacer shims.
- .7 Glazing channel (for interior glazing): Black extruded neoprene or PVC channel gaskets, of size to suit glazing.
- .8 Glazing compound: One-part clear silicone. GE Canada "Silpruf SCS 2000", Dow Corning "795" or Tremco "Spectrum 2".
- .9 Window Films/Vision Barriers: Refer to Section 08 87 00 Glazing Surface Films

3 Execution

3.1 **INSPECTION OF JOB CONDITIONS**

- .1 Inspect openings and frames prepared by other trades into which glass is to be installed. Notify the Consultant in writing, of any conditions which will preclude proper installation. Do not glaze unsatisfactory locations until such conditions have been made good. Commencement of Work implies acceptance of existing conditions.
- .2 Obtain glass dimensions on the job site. Glass shall be 4 mm less than the rebate size in either dimension, with allowance for edge spacers, shims and setting blocks.
- .3 Free rabbets, stops and glass edges of dirt, moisture, oil and other foreign matter detrimental to or obstructing glazing material.

3.2 **GLASS INSTALLATION**

- .1 Check that all openings and stops to be painted are primed before commencing Work.
- .2 At completion of the Work, replace at own expense, glass provided under this section which is broken due to loose setting, binding in the frame, pinched by glazing clips, inadequate or improper use of setting blocks, improper workmanship or other causes.

3.3 **INTERIOR GLAZING**

- .1 Standard hollow metal doors: Install glass with continuous glazing channels on glass edges. Set glass and secure in place with stops butted tight to glazing channels. Screw stops to door with countersunk fluorocarbon coated oval head screws.

- .2 Standard wood doors: Install glass with continuous glazing channels on glass edges. Set glass and secure in place with stops butted tight to glazing channels. Secure stops to door with screws provided, with heads slightly below glass stop surface.
- .3 Standard hollow metal frames for screens and borrowed lights: Place setting blocks and spacers as required to support glass. Use a minimum of two setting blocks, locate at one-quarter points. Locate spacers at jamb edges of glass, uniformly spaced at 600 mm o.c. maximum, and 300 mm maximum from top and bottom.
- .4 Fire rated hollow metal doors: Set glass on continuous setting block with 6 mm gap between glazing stops and embed in putty in accordance with NFPA 80 requirements. All exposed joints between the metal and glass shall be struck and pointed.

3.4 **EXTERIOR GLAZING**

- .1 Apply setting blocks at quarter points on all four sides of openings.
- .2 Cut glazing tape to proper length and set against permanent stops approximately 0.8 mm below sightline. Install horizontal strips first, extend over entire width of opening before applying vertical strips. Weld corners together by butting tape and dabbling with sealant.
- .3 Remove backing paper from tape prior to setting glass.
- .4 Apply continuous heel bead between glass and sash.
- .5 Place glass in opening, press tightly and evenly against glazing tape.
- .6 Apply continuous glazing tape on removable stop. Place and screw stop in place with fluorocarbon coated oval head screws. Apply elastomeric sealant cap bead over top between glass and removable stop.

3.5 **MIRROR INSTALLATION**

- .1 Install with concealed, tamperproof clips, or 100% adhesive method. If clips are used, install cushion tape completely around perimeter of mirror back, set in concealed location within 25 mm of edge. Apply adhesive in strict accordance with manufacturer's printed instructions.
- .2 Where inset in ceramic tile, maintain a mirror-to-tile joint width of not more than 2 mm all around. Otherwise, remove mirror and replace same to satisfy the joint requirement, all at no cost to the Owner.

3.6 **IDENTIFICATION OF GLAZING**

- .1 Provide on one side of all glass lites, temporary, easily removable, large safety decals, immediately after glass installation. Maintain safety markings until final clean-up. Remove all markings at time of final clean-up.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **SUBMITTALS**

- .1 Samples: Submit one 500 x 500 mm sample of each type of film specified.
- .2 Product Data: Submit Manufacturer's data sheets on each type of film including:
 - .1 Adhesive
 - .2 Typical installation methods, maintenance data, storage and handling.
 - .3 Technical characteristics and criteria.

1.3 **DELIVERY, HANDLING AND STORAGE**

- .1 Store materials within the building, in a clean, dry location. Fully protect materials from damage until ready for use.
- .2 Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

2 Products

2.1 **MATERIALS**

- .1 Vision Strip:
 - .1 Vinyl with pressure-sensitive acrylic adhesive, 50 mm wide, two stripes spaced 280 mm apart or as indicated on Drawings.
 - .1 Refer to Drawings for mounting height.
 - .2 Colour: Translucent white
 - .1 Acceptable Manufacturer: 3M or accepted equal
- .2 Window Films
 - .1 Frosted Window Film:
 - .1 Polyester film with pressure sensitive adhesive. Film to provide "Etched/Frosted" appearance.
 - .2 Visible light transmittance: 60%
 - .3 Acceptable Manufacturer:
 - .1 "Fasara Regular - Glace" by 3M
 - .2 "Etchmark" by Avery Dennison
 - .3 "Fasara - Transparent Frosted Glass" by 3M

.2 Decorative Window Films

.1 Polyester film with pressure sensitive adhesive. Film to provide "dot" appearance.

.2 Visible light transmittance: 39%

.3 Acceptable Manufacturer:

.1 "Fasara Dot and Prism" by 3M

.2 or accepted equal

.3 Safety and Security Window Film

.1 Film thickness: 356 µm

.2 Visible light transmittance: 85%

.3 Acceptable Product:

.1 "Safety & Security Window Film - Series S140" by 3M

.2 Or accepted equal

2.2 **EXECUTION**

2.3 **EXAMINATION**

.1 Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's written recommendations.

.1 Examine glass surfaces to receive the new film and verify that they are free from defects and imperfections that will affect the final appearance.

.2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

.2 Start of glazing surface film installation indicates installer's acceptance of substrate conditions.

2.4 **PREPARATION**

.1 Comply with manufacturers recommendations for surface preparation.

.2 Clean glass of dust, dirt, paint, oil, grease, mildew, mold, and other contaminants that would inhibit adhesion.

.3 Immediately prior to applying film, thoroughly wash glass with neutral cleaning solution.

.4 Protect adjacent surfaces.

2.5 **INSTALLATION**

.1 Apply glazing surface films in accordance with manufacturer's written recommendations.

.2 General Film Installation:

.1 Accurately cut film with straight edges to required sizes

- .2 Remove release liner immediately prior to adhering film to glass.
- .3 Apply mounting solution to film and glass.
- .4 Apply film to glass and removed air bubbles, wrinkles, and other defects using a squeegee. Three to five complete passes are required to completely remove mounting solution from between film and glass.

2.6 **FIELD QUALITY CONTROL**

- .1 After installation, view film from a distance of 10 feet (3 meters) against a light colored background. Ensure appearance is uniform without streaks, bands, thin spots, and pinholes in accordance with the IWFA Visual Quality Standard for Applied Window Film.
- .2 If installed film does not meet these requirements removed and replaced with new film.

2.7 **CLEANING AND PROTECTION**

- .1 Clean glass following installation.
- .2 Remove excess sealants and other glazing materials from adjacent finished surfaces.
- .3 Remove labels and protective covers.
- .4 Protect films for damage during construction. Repair damaged to adjacent materials caused by glazing surface film installation.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- | | | |
|----|--------------------------|--|
| .1 | CISC/CPMA | - Canadian Institute of Steel Construction/
Canadian Paint Manufacturers Association |
| .2 | CSA A82.22-M | - Gypsum Plasters |
| .3 | CSA A82.57-M | - Inorganic Aggregates for Use in Interior
Plaster |
| .4 | CAN/CSA-G40.20/ G40.21-M | - General Requirements for Rolled or Welded
Structural Quality Steel/Structural Quality
Steels |
| .5 | SSPC | - Steel Structures Painting Council |
| .6 | AODA | - Accessibility for Ontarians with Disabilities
Act |

1.3 **QUALITY ASSURANCE**

- .1 Use only skilled tradesmen in accordance with CSA A82.30.

1.4 **SUBMITTALS**

- .1 Submit a Shop Drawing showing control joint arrangement in accordance with Section 01 33 00.

1.5 **DELIVERY, HANDLING AND STORAGE**

- .1 Deliver manufactured materials in original packages and containers bearing brand and manufacturer's name.
- .2 Protect this Work and the work of other trades from damage at all times. Make good or replace any damaged Work caused by the execution of the work of this trade at no additional cost to the Owner.
- .3 Store plaster materials off-ground, and away from any damp surface until ready for use. Remove damaged or deteriorated materials from the site and replace at no additional cost to the Owner.

1.6 **COORDINATION**

- .1 Coordinate with mechanical, electrical and other trades to accommodate fixtures, fittings and any other Work in furred, lathed and plastered areas.
-

1.7 **SCAFFOLDING**

- .1 Furnish scaffolding, hoisting equipment, etc., required for completion of the Work. Erect scaffolding so as not to interfere with the work of other trades. Promptly remove as soon as the various parts of the Work are concluded. Scaffolding shall be supported only from the floor and shall be inspected by the Consultant prior to the start of all Work.

1.8 **ENVIRONMENTAL CONDITIONS**

- .1 Provide adequate controlled ventilation during application and drying of plaster. Take precautions to prevent too rapid or uneven drying.

2 Products

2.1 **MATERIALS**

- .1 Running and furring channels: 38 mm x 19 mm and 19 mm x 19 mm galvanized steel as required and as shown.
- .2 Metal lath: Galvanized expanded diamond lath, weighing 1.8 kg/m², self furring where placed against a flat surface.
- .3 Gypsum lath: 9.5 mm x 400 mm x 1200 mm long conforming to CSA A82.24, latest edition.
- .4 Tie wire: 1.3 mm (16 gauge) annealed galvanized steel wire.
- .5 Furring rods, brackets: Mild steel, sized as required.
- .6 Casing beads (plaster stops): Square nose and round nose 0.5 mm (26 gauge) galvanized steel with keys or expanded mesh flanges for plaster, sized to accept plaster thickness specified.
- .7 Corner reinforcing beads: 75 mm wide reinforcing strip of metal lath bent to form 38 mm flanges on adjoining corners. Use at plaster interior corners.

AND/OR

- .8 Corner reinforcing beads (heavy duty): 0.5 mm (26 gauge) galvanized steel with expanded wing keys for all exterior plaster corners.

2.2 **CEMENT PLASTER**

- .1 Cement plaster: One part Type 10 Portland cement to three to four parts sand by volume with 15% to 25% lime putty.
- .2 Sand: Washed, free from earth and other harmful materials conforming to the following sieve analysis:

Sieve Size	Percent by Weight Passing Sieve	
No. 4	100	-
No. 8	80	98
No. 16	60	90
No. 30	35	70
No. 50	10	30
No. 100	No more than 10	

- .3 Finish coat: White silica sand, graded to pass a 20 mesh sieve.
- .4 Water: Clean and free from injurious amounts of oil, acid, alkali, organic matter.

2.3 **GYPSUM PLASTER**

- .1 Basecoat plaster: Gypsum neat plaster (hardwall) conforming to CSA A82.22-M.
- .2 Finishing plaster: Hydrated finishing lime and gypsum gauging plaster to CSA A82.22-M, latest editions.
- .3 Sand: Conforming to CSA A82.57-M.
- .4 Bonding plaster (on masonry walls): Specially formulated for use as scratch coat and brown coat as supplied by manufacturer of basecoat plaster.
- .5 Bonding agent (on concrete walls): Compatible with basecoat plaster, as supplied by manufacturer of plaster used. Submit test data and performance record to the Consultant.
- .6 Dense plaster: Plaster of density and thickness to minimum weight of 48 kg/m².
- .7 Isolating hangers: Domtar "Sound Insulation Saddles", or approved equal.

2.4 **FIREPROOFING PLASTER**

- .1 Fireproofing plaster: Gypsum plaster conforming to CSA A82.22-M with integrally mixed perlite aggregate conforming to CSA A82.57-M.
- .2 Metal lath and tie wire: As specified for cement plaster, but self furring.
- .3 Finishing plaster: Hydrated finishing lime and gypsum gauging plaster conforming to CSA A82.22-M, latest edition.

3 Execution

3.1 **SUSPENSION SYSTEM AND LATH INSTALLATION**

- .1 Install ceiling suspension system. Provide supplementary steel supports as required for support of plaster ceilings including mechanical and electrical components in ceiling. Do NOT hang suspension system from metal deck.
- .2 Install metal lath on supports for ceiling in accordance with manufacturer's directions.
- .3 Butt gypsum lath together to moderate contact. Neatly cut around outlets, pipes and openings.

3.2 **PLASTER PREPARATION**

- .1 Clean surfaces to be plastered free of dust, loose particles and other foreign matter which may be detrimental to the bond of the plaster and the surface being plastered. Prepare surfaces to receive plaster.
 - .2 Frame for openings and built-in equipment. Install square end expanded wing casing beads around openings, frames, and at edges of plaster, junctions with drywall and unplastered walls, etc. Ensure that they are installed straight, solid and true to line.
 - .3 Ensure that all lath and grounds are properly in place before commencing plastering operations.
-

- .4 Ensure that all conduits, pipes, cables and outlets are properly plugged, capped or covered and all wall sleeves are installed before commencing Work.
- .5 Mask or cover abutting Work with at least 760 mm wide continuous band of heavy building paper to afford protection to same work against droppings, etc. Remove on completion of Work.
- .6 Subdivide ceiling and provide control joints, centred at columns in accordance with reviewed control joint layout.
- .7 The following points shall also be isolated with control joints:
 - .1 At juncture of plaster ceiling with vertical surfaces (walls, columns, beams, etc.).
 - .2 Where plastered masonry walls abut plastered concrete.
 - .3 Where control joints occur in base wall or partition.
 - .4 At jambs of door openings.
 - .5 At construction changes within the plans of the partition or ceiling.

3.3 **MIXING**

- .1 Mix plaster in accordance with plaster manufacturer's printed directions.
- .2 Use watertight containers for mixing. Keep equipment clean and free from set and hardened materials. Clean equipment after each batch. Use only freshly mixed materials. Mix only as much plaster as can be used in one hour. Protect mixes from frost, dust and evaporation.

3.4 **APPLICATION**

- .1 Plaster shall be three-coat work, 19 mm overall thickness.
 - .2 Discard partly set, frozen, caked or lumpy material.
 - .3 Make plaster work straight, true, flush with grounds and provide a surface free from defects detrimental to appearance or performance.
 - .4 Completely isolate plaster ceilings from unplastered works, taking care to avoid splashing and marring adjoining Work.
 - .5 Terminate plaster at movement and control joint sides, with the plaster edge encased in plaster stops.
 - .6 Basecoat plaster: Apply to a minimum thickness of 16 mm measured from face of lath.
 - .7 Apply scratch coat using sufficient material and pressure to form full keys on plaster base. Scratch to a rough surface and allow to set.
 - .8 Apply brown coat over dampened scratch coat to a total thickness of 16 mm for basecoats. Bring flush with grounds, rod and darby to a true surface and leave rough, ready to receive finish coat. Rod base coat with a long straight edge to prevent surface variations exceeding 3 mm in 3000 mm. (Damp cure for at least seventy-two hours using a fine fog spray. Apply only as much water as can be readily absorbed.)
-

- .9 Where plaster finish is flush with door and window frames, cut base coats free to allow for movement. Groove back finish coat at intersections with frames to prevent chipping. Cut plaster free of electrical outlets and other openings.
- .10 The first and second coat over metal lath shall consist of hardwall plaster and sand proportioned in accordance with manufacturer's recommendations.
- .11 The base coats to receive the finish coat shall be brought to a true and even plane, ready to receive the finish coat.
- .12 Apply first coat of three coat work and cross scratch to form key. Apply second coat after first coat has hardened on metal lath. Rod plaster to a true surface with rod and darby and clean out angles. Roughen surface to receive putty finish.
- .13 Apply 13 mm parging, straightened and trowelled smooth where wall carpet is scheduled. Putty finish not required on parging.
- .14 Apply wire lath, furring channels and (perlite) plaster fireproofing to columns where indicated on the Drawings.
- .15 Finish coat: Apply after seven days, sand float cement plaster finish to dampened base coat. Apply from corner to corner in one operation, to a true, even surface. Trowel during set to provide smooth, dense surfaces, free of irregularities and blemishes.
- .16 Prepare lime putty by mixing lime with water and allow mixture to soak for twenty-four hours.
- .17 Prepare finish by mixing with gauging plaster in the required proportions.
- .18 If base coat is dry and suction irregular or excessive, spray surface lightly with water. Avoid excessive wetting.
- .19 Apply gypsum-lime putty trowel finish over base coat by scratching in thoroughly. Lay on well, double back and fill out to a true, even surface 1.5 mm to 3 mm thick. Allow finish to dry a few minutes then trowel well with water to a smooth, polished finish, free from any blemishes or irregularities.

3.5 **FIREPROOFING PLASTER**

- .1 Install lath and apply fireproofing plaster in thickness to obtain the specified fire ratings, all in accordance with ULC requirements. Trowel to a smooth finish.
- .2 Provide corner beads for fireproofed structural members.

3.6 **CLEANING UP**

- .1 Daily, as the Work proceeds and on completion, remove surplus materials completely, leaving floors, heating units, pipes, etc. and the premises generally in good condition. Remove all rubbish of this trade to an off-site disposal.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- | | | |
|----|--------------------------|--|
| .1 | ASTM A653/653M | - Standard Specification for Sheet Steel, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot Dip Process |
| .2 | ASTM A568/A568M | - Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for |
| .3 | ASTM C1396/C1396M | - Standard Specification for Gypsum Board |
| .4 | ASTM C475/C475M | - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board |
| .5 | ASTM C645 | - Standard Specification for Nonstructural Steel Framing Members |
| .6 | ASTM C1002 | - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs |
| .7 | CAN/CSA-G40.20/ G40.21-M | - General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels |
| .8 | SSPC | - The Society for Protective Coatings, "Steel Structures Painting Manual, Vol. 2" |
| .9 | AODA | - Accessibility for Ontarians with Disabilities Act |

1.3 **QUALITY ASSURANCE**

- .1 Retain workmen skilled in gypsum board work to perform Work of this section in accordance with this Specification and the latest printed directions of the manufacturer.

1.4 **DELIVERY, STORAGE AND HANDLING**

- .1 Deliver materials in original packages, containers and bundles bearing brand and manufacturer's name. Handle materials with care to prevent damage thereto. Store in a covered area off the ground, on flat, smooth, dry surfaces.
- .2 Protect this Work against damage at all times. Protect from moisture until ready for use.
-

1.5 **PROJECT/SITE CONDITIONS**

- .1 In cold weather and during period of gypsum board application and joint finishing, maintain temperatures within the building uniformly within the range of 13°C to 21°C (55°F to 70°F). Also provide adequate ventilation to eliminate excessive moisture within the building during this same period.

2 Products

2.1 **STEEL FRAMING SYSTEM**

- .1 Manufacturer:
 - .1 Bailey Metal Products Limited
 - .2 Canadian Gypsum Co. Limited (CGC)
 - .3 Or accepted equal
- .2 Main runner channels: 38 mm x 19 mm, cold rolled galvanized steel channels, weighing not less than 0.8 kg/m conforming to ASTM A568/568M and ASTM A653/653M.
- .3 Metal furring channels: 22 mm winged flange type, cold rolled galvanized steel channels conforming to ASTM A568/568M and ASTM A653/653M.
- .4 Metal studs: Standard gypsum board screw-on stud system complete with floor and ceiling runners conforming to ASTM A568/568M, ASTM C645 and ASTM A653/653M. Size: 32 mm wide x depths shown on Drawings. Use 20 gauge for abuse-resistant board.
- .5 Shaftwall framing: "C-H" studs complete with "J" runners and "E" studs as required, all hot-dip galvanized.
- .6 Accessories:
 - .1 Hangers: 5 mm diameter pencil rods or 32 mm x 3 mm galvanized steel flat bars to CSA A82.30-M.
 - .2 Tie wire: Not less than No. 18 gauge galvanized wire.
 - .3 Screw fasteners: in accordance with ASTM C1002, Type S, corrosion resistant.
- .7 Wall Reinforcement for miscellaneous fixtures, equipment and accessories: Provide fire retardant treated wood blocking and minimum 18 gauge sheet steel secured to stud to support manufactured components and accessories. Provide wall reinforcement to support future adult change table designed for a minimum load of 1.33 kN.

2.2 **GYPSUM BOARD**

- .1 Standard Gypsum Board
 - .1 12.7 mm, 15.9 mm thick or as indicated on Drawings, with tapered and rounded edge for joint filling, and in 1200 mm wide sheets of maximum practical lengths to minimize end joints, in accordance with ASTM C1396/C1396M.
 - .2 Acceptable Manufacturer
 - .1 "ToughRock" by Georgia Pacific Canada (GP)

- .2 "Sheetrock" by CGC
 - .3 "ProRoc Regular Gypsum Board" by CertainTeed
 - .4 Or accepted equal
 - .2 Fire rated Gypsum Board
 - .1 Gypsum board shall conform to the flame spread rating requirements of the Ontario Building Code.
 - .2 For fire rated assemblies, conforming to ASTM C1396/C1396M
 - .3 Size: 12.7 mm, 15.9 mm, 19.1 mm or 25.4 mm thick, unless indicated otherwise, Type "X" or "C"
 - .4 Acceptable Manufacturer
 - .1 Sheetrock Firecode Core Type C by CGC Inc
 - .2 ToughRock Fireguard Type X or C by Georgia Pacific Canada
 - .3 AirRenew Essential Type X LAQ Gypsum Board by CertainTeed Gypsum Inc.
 - .4 Or accepted equal
 - .3 Soundproof Gypsum Panels
 - .1 Mould-resistant type, impact resistant, STC 52 - 74, Type X
 - .2 Size: 15.9 mm thick, 1220 x 2440 mm sheets, unless indicated otherwise
 - .3 Acceptable Manufacturer
 - .1 QuietRock 530 by CertainTeed
 - .2 Or accepted equal
 - .4 Interior Ceiling Board
 - .1 In accordance with ASTM C1396 and CAN/CSA-A82.27
 - .2 Size: 12.7 mm thick, 1220 x 2440 mm sheets, unless indicated otherwise
 - .3 Acceptable Manufacturer
 - .1 "Easi-Lit Lightweight Drywall" by CertainTeed Gypsum Inc.
 - .2 "Sheetrock Interior Ceiling Board" by CGC Inc.
 - .3 "ToughRock CD Ceiling Board" by Georgia Pacific Canada
 - .4 Or accepted equal
 - .5 Moisture and Mould-Resistant Gypsum Board
 - .1 To ASTM C1396M, score of 10 with moisture and mould resistant core and paper surfaces.
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- .2 12.7 mm or 15.9 mm thick and of maximum practical lengths to minimize end joints, unless indicated otherwise.
 - .3 Acceptable Manufacturer
 - .1 M2Tech Moisture and Mold Resistant Type X Gypsum Board by CertainTeed
 - .2 Sheetrock Mould Tough Type X Interior Panel by CGC Inc.
 - .3 DensArmor Plus High Performance Interior Panel or ToughRock Mold-Guard by Georgia Pacific Canada.
 - .4 ProRock Moisture Resistant Gypsum Board by CertainTeed
 - .5 Or accepted equal
 - .6 Tile Backer Gypsum Board for Showers
 - .1 In accordance with ASTM C1178/C1178M and ASTM C1658/C1658M
 - .2 Size: 12.7 mm thick, or as indicated on Drawings
 - .3 Acceptable Manufacturer
 - .1 "Diamondback Tile Backer" or "Diamondback Type X Tile Backer" by CertainTeed
 - .2 "Sheetrock Mould Tough Fibreglass Interior Panel" or "Sheetrock Mould Tough Fibreglass Type X Interior Panel" by CGC Inc.
 - .3 "DensShield Tile Backer" or "DensShield Tile Backer Type X" by Georgia Pacific (GP)
 - .4 Or accepted equal
 - .7 Cement Board
 - .1 In accordance with ASTM C1396/C1396M
 - .2 Size: 12.7 mm thick, or as indicated on Drawings
 - .3 Acceptable Manufacturer
 - .1 "Durock Cement Board" by CGC Inc
 - .2 "Permabase" by Unifix Inc distributed by CertainTeed Gypsum Inc or National Gypsum.
 - .3 Or accepted equal
 - .8 Exterior Soffit Board
 - .1 Sag resistant, conforming to ASTM C1396.
 - .2 Acceptable Manufacturer
 - .1 "Exterior Ceiling Panel" by CGC Inc.
 - .2 "ToughRock Soffit Board" by Georgia Pacific Canada (GP)
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- .3 CertainTeed Soffit Board
 - .4 Or accepted equal
 - .9 Exterior Sheathing
 - .1 In accordance with ASTM C79, Type X
 - .2 Size: 12.7 mm thick or as indicated on Drawings
 - .1 "Dens Deck" or "ToughRock Sheathing" by Georgia Pacific Canada (GP)
 - .2 "ProRoc Sheathing Treated Core" by CertainTeed
 - .3 "Gyplap Sheathing" by CGC
 - .4 Or accepted equal
 - .10 Abuse Resistant Gypsum Fibre Panels
 - .1 Size: 16 mm thick or as indicated on Drawings
 - .2 Acceptable Manufacturer
 - .1 "Abuse-Resistant Gypsum Board Panels" with tapered edges by CGC
 - .2 "ToughRock Abuse-Resistant Gypsum Board", by Georgia Pacific Canada (GP)
 - .3 Etrene Impact by CertainTeed
 - .4 Or accepted equal
 - .11 Shaft Liner
 - .1 Mould and moisture resistant panels, double bevelled edge, conforming to ASTM C1396.
 - .2 Size: 25.4 mm thick or as indicated on Drawings
 - .3 Acceptable Manufacturer
 - .1 "Shaftwall Linerpanel" by CGC
 - .2 "Toughwall Fireguard Shaftliner" by Georgia Pacific (GP)
 - .3 M2Tech Shaft Liner by CertainTeed
 - .4 Or accepted equal
 - .12 Accessories
 - .1 External corner reinforcement: Domtar "Metal Corner Bead", CGC "Dur-A-Bead", CertainTeed "AquaBead Corner Reinforcement" or GP equal.
 - .2 Casing beads: 0.56 mm (25 gauge) galvanized steel designed to accept the specified thickness of gypsum board.
 - .3 Joint reinforcement tape (gypsum board): Domtar "Joint Tape" CGC "Perf-A-Tape", CertainTeed "FibaTape" or GP equal, conforming to ASTM C475.
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- .4 Joint reinforcement tape (backer board): Glass mesh.
 - .5 Joint filler, topping cement: For gypsum board, use manufacturer's high grade premixed compound. For composite and cementitious backer board, use board manufacturer's high grade premixed compound for waterproof exposure.
 - .6 Control joint strip: Roll formed zinc coated metal with a tape protected void, 6 mm wide throat x 11 mm deep with flanges for embedding in joint compound.
 - .13 Floor Underlayments: "Levelrock 25000 by CGC or accepted equal.
 - .14 Acoustic insulation: QuietZone Acoustic Batt by Owens Corning, "Sustainable Insulation Noise Reducer" by Certainteed, "Thermafiber Sound Attenuation Fire Blanket" by Thermafiber Inc., "SAFB" by Fibrex Insulations, Inc. or "AFB" by Rockwool. Size as indicated on Drawings.
 - .15 Acoustic sealant and spray: Tremco "Acoustical Sealant", PRC "PR181", U.S.E.-Hickson "Kop●R●100" or Wilrep "SilenSeal" (water based), "CP 506 Smoke and Acoustic Sealant" or "CP 572 Smoke and Acoustic Spray" by Hilti Canada, or accepted equal. Covering bead at exposed applications shall be a material compatible with acoustic sealant, suitable for painting, as supplied by acoustic sealant manufacturer.
 - .16 Shower Waterproofing Membrane
 - .1 Refer and coordinate requirements with Section 09 30 00 Tiling.
 - .2 Shower Waterproofing membrane is to be provided on shower walls and to transition to shower pan.
 - .17 Column covers: Non-combustible glass fibre-reinforced high density gypsum (GRG) conforming to ASTM E-84, fabricated in two vertically divided sections attached with screws and with field finished joint. All fasteners are to be concealed. Provide all support structures. Formglas Inc. or DecoForm Inc. or accepted equal.
 - .18 Screws and Nails:
 - .1 Backer board screws: "Hi-Lo" bugle head Type S point concrete backer board screws, corrosion resistant.
 - .2 Gypsum board screws: 5 mm x 25 mm (No. 6 gauge) x 1" long for metal furring application and 5 mm x 32 mm (No. 6 gauge) x 1-1/4" long for metal stud application. Screws shall be self-drilling, case hardened, with socket countersunk heads to ASTM C1002, Type S.
 - .3 Screws for gypsum board on wood studs: 5 mm (No. 6 gauge) x length to penetrate minimum 16 mm into wood. Screws shall conform to ASTM C1002, Type W.
 - .4 Nails for exterior gypsum board sheathing on wood framing: Roofing type, galvanized.
 - .19 Inserts for concrete slabs
 - .1 Ceiling Wire X-CW or Ceiling Clip X-CC by Hilti Canada, Tie wire anchors, Red Head TW-1614 by ITW Canada Inc., Parabolt Wire Hanger distributed by Acrow-Richmond Ltd., T-14 Eyebolt by Ramset Ltd. or Tie Wire Drive TW-932 by Isometric Ltd or accepted equal.
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- .20 Adhesive
 - .1 Adhesive for gypsum board on rigid insulation: 3M No. 2166 or ICI Devoe D.W.24.
 - .2 Adhesive for gypsum board on masonry or concrete walls: Joint filler mixed with water in accordance with manufacturer's directions.
- .21 Supplementary steel supports: Steel conforming to Section 05 50 00 of this Specification.
- .22 Metal deck flute closure: Moulded to deck profile; moulded cellular neoprene or rubber closure pieces at non-rated locations and fire rated closed cell neoprene conforming to ASTM D1056 or D2056 at fire rated locations.
- .23 Access doors: Refer to Section 08 31 00 Access Doors and Panels.

2.3 **FRAMING SYSTEMS**

- .1 Acceptable products: Model CFS-TTS "Firestop Top Track Seal" by Hilti Canada or approved equal.
- .2 Slip-type head joints: Deflection track.
- .3 Firestop top track seal: One-piece, pre-formed, polyurethane foam based, firestop seal for use with standard head-joint top tracks and bottom-joint tracks, and slip-type head joints in fire-rated construction at top of bottom of partition to maintain continuity of the fire resistance rated assembly. Provide in width and configuration required to accommodate depth and installation of studs and designed to saddle over the top track or under the bottom track.
 - .1 Track seal shall be UL 2079 tested for specific fire rated construction conditions conforming to construction assembly type, space requirements and fire-rating required for each application.
 - .2 Performance Requirements:
 - .1 Movement: +/- 50%
 - .2 Surface burning characteristics in accordance with CAN/ULC S102-10:
 - .1 Flame spread: 15
 - .2 Smoke developed: 35
 - .3 Mold-mildew performance in accordance with ASTM G21-96, Class 0.
 - .4 VOC content: 0.16 lb/gallon

3 Execution

3.1 **SUSPENSION SYSTEM**

- .1 Locate anchorage points in reinforced concrete floor slab underside (35 MPa (others) compressive strength) in accordance with gypsum board manufacturers' suspension requirements. Drill holes with carbide-tipped drill bits conforming to ANSI B94.12-M. Install anchors; minimum installation depth and method of expansion as recommended by anchor manufacturer.

- .2 DO NOT secure hangers to metal deck or mechanical ducts. Hang grillage for suspended gypsum board ceilings independent of walls, pipes, ducts. Securely anchor to the building structural framing (slab).
 - .1 Space hangers at 1200 mm maximum centres along the carrying channels, and not more than 150 mm from ends.
 - .2 Place supplementary steel supports as required to maintain hanger spacing and to keep metal deck and mechanical ducts free from hangers being secured to.
 - .3 Space carrying channels at maximum 1200 mm centres and not less than 25 mm nor more than 150 mm from boundary walls.
 - .1 Run the channels transverse to structural framing members.
 - .2 Where splices are necessary, lap members at least 200 mm and wire each end with two loops.
 - .3 Avoid clustering or lining up splices. Attach to rod hangers by bending hanger sharply under bottom flange of runner and securely wire in place with a saddle tie.
 - .4 Note: All stems on precast concrete double tee deck have 13 mm diameter holes, at 1200 mm o.c. and are available to ALL trades for attachments and hangers. Not all holes will therefore be used for gypsum board suspension alone. Provide supplementary steel as required and attach to holes that are available.
 - .5 Install furring channels transverse across carrying channels or other supports.
 - .1 Space at 400 mm centres and not less than 25 mm nor more than 150 mm from boundary walls, openings, interruptions in ceiling continuity and change in direction.
 - .2 Secure to each support with clips or equivalent attachment.
 - .3 Splice joints by nesting and tying channels together or with custom splicers.
 - .4 Level to a maximum tolerance of 3 mm over 3600 mm.
 - .5 Reinforce wherever necessary for the proper support of luminaires, access hatches, ceiling grilles, outlet boxes, ventilating outlets and all other openings.
 - .6 Provide special furring as required at recessed lights.
 - .6 Provide expansion/control joints in ceilings, furring and panelling where stresses are likely to develop, such as at the following locations:
 - .1 At abutting structural elements
 - .2 At dissimilar walls and ceilings
 - .3 At dissimilar backup interface at structural expansion and control joints
 - .4 At wings of "L", "U" and "T" shaped ceiling areas
 - .5 At 9000 mm maximum spacing in continuous runs
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- .7 Form control joints using continuous furring channels along each side of joint locations, and filling control joint space with specified joint strip, secured in place, making straight joints. Temporarily tape control joint "V" grooves in preparation for joint filling.

3.2 **STEEL STUDS AND FURRING**

- .1 Install tracks at floors, ceilings and underside of deck over, align accurately and secure to structure at 600 mm centres maximum. Avoid piercing metal deck.
 - .2 Close opening between top track and steel deck flutes on all full height partitions and bulkheads with specified deck flute closure. Install carefully and compress into place to close flute openings.
 - .3 Close opening between track and concrete deck on all full height partitions. Where partitions are at right angles to stems on precast concrete double tee deck, extend studs above bottom of stems as required to support gypsum board. Cut and fit top track between stems.
 - .4 On full height partitions at coffered ceilings, stop studs at ceiling level, install studs from top of ceilings to concrete deck. Cut and fit top track between stems as required.
 - .5 Place studs vertically at 400 mm o.c. and not more than 50 mm from abutting walls, openings and each side of corners. Install studs and secure to tracks.
 - .6 Arrange for mechanical and electrical horizontal runs within walls to be installed simultaneously with partitions.
 - .7 Provide freedom for deflection under beams and deck to prevent transmission of structural loads to studs, or install 50 mm deep telescoping top tracks.
 - .8 At openings, install horizontal track to accommodate intermediate studs. Cut out flanges at each end of track, turn up webs and screw to studs. Install intermediate studs above and below openings at same spacing as wall studs.
 - .9 Provide double studs at all hollow metal door jambs. Secure at top and bottom and brace back to adjacent studs at mid-point.
 - .10 Provide control joints in gypsum board partitions where stresses are likely to develop, such as at the following locations:
 - .1 At abutting structural elements
 - .2 At dissimilar backup interface
 - .3 At dissimilar walls and ceilings
 - .4 At structural expansion and control joints
 - .5 At door and other openings
 - .6 At 9000 mm maximum spacing in continuous runs
 - .11 Form control joints using double studs back to back on each side of joint locations, and filling control joint space with specified joint strip secured in place, making straight joints. Temporarily tape control joint "V" grooves in preparation for joint filling.
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- .12 Wall reinforcement for miscellaneous fixtures, equipment and accessories:
 - .1 Fixture and cabinet support: Verify location of supports within gypsum board assemblies to support wall mounted fitments, cabinets, and other items. Cooperate and coordinate with carpentry trade and provide information in ample time to ensure supports are provided in the correct locations.
 - .2 Ensure rigid and secure installation capable of offering resistance to minimum 227 kg (500 lbs) pull force. Provide galvanize stud reinforcements in moist areas. Do not use wood blocking for this purpose. Provide minimum 18 gauge sheet steel of additional reinforcing framing studs or furring channels secured between studs for attachment and support without limitations for the following:
 - .1 Washroom accessories
 - .2 Adult and baby change table
 - .3 Fire hose cabinets
 - .4 Access panels
 - .5 Architectural woodwork
 - .6 Miscellaneous specialties
 - .7 Fitments and fixtures
 - .8 Equipment

3.3 **GYPSUM BOARD ON METAL SUSPENSION, STEEL STUDS AND FURRING**

- .1 Erect gypsum boards vertically or horizontally, whichever results in fewer end joints. Locate edge or end joints over supporting members. Stagger vertical joints over different studs on opposite sides of partitions.
 - .2 Locate vertical joints at least 300 mm from the jamb lines of openings.
 - .3 Do not install imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1.6 mm open space between boards. Do not force into place.
 - .4 Position boards so that both tapered edge joints abut, and mill-cut or field-cut where end joints abut. Do not place tapered edges against cut edges or ends.
 - .5 Attach gypsum board to framing (and blocking) as required for additional support at openings and cutouts.
 - .6 Do not locate joints within 200 mm of corners or openings, except where control joints are shown at jamb lines or where openings occur adjacent to corners in the partition/wall layout. Where necessary, place a single vertical joint over the centre of wide openings.
 - .7 Where feasible, and where recommended by manufacturer, install gypsum board with "floating" corner construction, unless isolation of the intersecting boards is indicated or unless control or expansion joints are indicated.
 - .8 Drive screws with a power screw-gun and set with the countersunk head slightly below the surface of the board.
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- .9 In the case of double layers of gypsum board, screw first layer to studs and furring, laminate second layer to first using joint filler as an adhesive. Stagger joints between first and second layers. Brace face layer until adhesive has dried.
- .10 Install fire rated gypsum board to provide the fire ratings shown. Conform to applicable ULC/Warnock-Hersey designs and to manufacturer's specifications. Provide corner beads on all external corners.
- .11 Receive access panels from mechanical division and install in gypsum board assemblies. Coordinate locations with mechanical division.

3.4 **ACOUSTIC INSULATION**

- .1 Install sound attenuation blankets to full height and full width of partitions where indicated. Fit carefully behind electrical outlets and other Work which penetrates partitions.

3.5 **INSTALLATION OF SHAFTWALL**

- .1 Install runners at floors and underside of deck over, align accurately and secure to structure at 600 mm centres maximum with short leg toward finish side of wall.
- .2 Close opening between top track and steel deck flutes on all full height partitions and bulkheads with specified deck flute closure. Install carefully and compress into place to close flute openings.
- .3 Cut liner panel 25 mm less than floor to ceiling height and erect vertically between J-runners. If wall exceeds maximum panel length, position panel and joints within upper and lower third points of wall. Stagger joints top and bottom in adjacent panels and reinforce joints with horizontal C-H studs. Screw-attach studs or runners on walls over 4800 mm high.
- .4 Install studs to within 10 mm of floor to ceiling height, between liner panel, with panel edge inserted into stud groove. Install full length steel E-studs or J-runners vertically at intersections, corners, and columns. Frame openings to maintain structural support for wall.
- .5 Install gypsum panels on finish side to studs with 25 mm type S screws at 300 mm maximum.
- .6 Provide freedom for deflection under deck to prevent transmission of structural loads to studs.
- .7 Install horizontal shaftwall using C-H studs at 600 mm o.c. unless shown otherwise. Use J-runner to connect system to wall studs. Screw fasten gypsum board to J-runners.
- .8 Provide control joints where stresses are likely to develop, such as at the following locations:
 - .1 At abutting structural elements
 - .2 At dissimilar backup interface
 - .3 At dissimilar walls and ceilings
 - .4 At structural expansion and control joints, openings
 - .5 At 9200 mm maximum spacing in continuous runs

- .9 Form control joints using J-runners or E-studs back to back on each side of joint locations, and filling control joint space with specified joint strip secured in place, making straight joints.
- .10 Install firestopping and sealant along perimeter edge, top and penetrations in fire rated assembly.

3.6 **GYPSUM BOARD ON RIGID INSULATION**

- .1 Apply gypsum board by mechanical screwing and adhesive to insulation and to channels impaled in insulation. Channels are vertical, at 400 mm (600 mm) o.c.
- .2 Apply adhesive to foil face of insulation or back of wallboard with 3 mm continuous beads at 200 mm o.c.
- .3 Erect gypsum board vertically or horizontally, whichever results in fewer end joints. Press to firm contact with adhesive.
- .4 Screw to all channels at 300 mm o.c. using power screw-gun. Set screws with countersunk heads slightly below board surface.

3.7 **ACCESSORIES**

- .1 Erect plumb, or level, with minimum joints.
- .2 Corner reinforcing bead: Install along all external angles. Secure with screws at 225 mm o.c. Apply filler over flanges flush with nose of the bead and extending at least 75 mm onto surface of board each side of corner. When filler dries, apply a thin coat of topping cement and blend onto adjoining surfaces.
- .3 Casing beads: Install where wallboard butts against a surface having no trim concealing the juncture. Secure with screws at 300 mm o.c. Apply filler over flange flush with nose of the bead and extending at least 75 mm onto surface of board. When dry, apply a thin coat of topping cement and blend onto adjoining surfaces.
- .4 Recess channels and trim: Secure recess channels and special metal trim to substrate. Provide casing beads full height on wallboard edges at recess channels and metal trim.

3.8 **JOINT TAPING, FINISHING**

- .1 Apply a coat of joint filler over board each side of joint and embed reinforcing tape. Cover edges of embedded tape with a thin coat of joint filler and complete joint with a final coat of topping cement feathered at least 200 mm each side of joint and cambered to a maximum thickness of 1.6 mm.
 - .2 Fill any gaps between boards at internal corners with joint filler, allow to dry. Apply thin coat of joint filler over board 50 mm on each side of corner. Embed angularly creased reinforcing tape and cover edges of tape with a thin coat. Apply second coat over tape on one side of corner and allow to dry before covering tape on other side. Apply finish coat of topping cement.
 - .3 Fill screw holes and depressions over each screw and nail head with joint filler/topping cement.
 - .4 After topping cement has dried, sand surface lightly with No. 00 sandpaper and leave smooth, ready for painting. Apply second coat of filler if required.
 - .5 Finish work smooth, seamless, plumb, true, flush and with square, plumb, neat corners.
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- .6 Remove control joint "V" groove tape.

3.9 **CEMENT BOARD**

- .1 Fabricate and pre-cut cement board to required sizes and with necessary cut-outs.
- .2 Install cement board with edges centred on steel framing and joints staggered in adjacent rows. Fit ends and edges closely but do not force together.
- .3 Install cement board fasteners at 150 mm o.c. with perimeter fasteners between 10 mm to 16 mm from ends and edges.
- .4 Install cement board joint filler in accordance with the cement board manufacturer's directions to produce watertight, filled joints without voids, cracks and excess joint filler.

3.10 **JOINT TREATMENT OF BACKER BOARD - TILED AREAS**

- .1 Pre-fill joints of board with thin-set mortar and embed glassfibre tape. Press to a smooth finish. Allow to cure.
- .2 Provide control joint around ceiling perimeter, in addition to locations outlined earlier in this section.

3.11 **JOINT TREATMENT AND FINISHING OF BACKER BOARD - UNTILED**

- .1 Apply 50 mm glassfibre tape uniformly over joints and corners in a bed of joint compound. Cover fasteners with joint compound. Apply in accordance with manufacturer's directions.
- .2 Apply board manufacturer-recommended base coat uniformly on surface of board.
- .3 Apply 2.4 mm thick uniform water resistant skim coat as recommended by board manufacturer, finish smooth similar to that of gypsum board, ready to receive coating.
- .4 Provide control joint around ceiling perimeter, in addition to locations outlined earlier in this section.

3.12 **FINISHING**

- .1 Finishing shall conform to the following ASTM C840 finish levels:
 - .1 Level 0: For temporary construction.
 - .1 No taping, finishing or corner beads required.
 - .2 Level 1: Gypsum board in areas above ceilings, concealed spaces, service corridors and other areas not open to public view, and in areas where sound and smoke control is required.
 - .1 All joints and angles shall have tape embedded in joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable.
 - .3 Level 2: Where water resistant gypsum backing board (ASTM C630) is used as tile substrate, in warehouse storage or similar areas where surface appearance is not a primary concern.
 - .1 All joints and angles shall have tape embedded in joint compound and have one separate coat or joint compound wiped with joint knife and

leaving a thin coating over the tape and fastener heads. Cover accessories by one coat of joint compound. Surface shall be free of excess joint compound. Tool marks and ridges shall be acceptable.

- .4 Level 3: Gypsum board in areas to receive heavy or medium texture finishes before final painting or where heavy grade wall coverings are to be applied as the final decoration. Do not use where smooth painted surfaces or light to medium wall coverings are specified.
 - .1 All joints and angles shall have tape embedded in joint compound and two separate applications of joint compound over all joints, angles and fastener heads. Cove accessories with two separate coats of joint compound. Joint compounds shall be smooth and free of tool marks and ridges. Cover the prepared surface with a drywall primer prior to the application of the final decoration.
- .5 Level 4: Gypsum board in areas where flat paints, light textures (or backed wall coverings) are to be applied. Adequately conceal joints and fasteners if wall covering material is lightweight, contains limited pattern, has a gloss finish or combination of these finishes.
 - .1 All joints and angles shall have tape embedded in joint compound and have three separate coats of joint compound over all joints, angles and fastener heads. Cover accessories with three separate coats of joint compound. All joint compounds shall be free of tool marks and ridges. Cover the prepared surface with a drywall primer prior to the application of the final decoration, and repair if required.
- .6 Level 5: Where gloss, semi-gloss or non-textured flat paints are specified.
 - .1 Equal to level 4 and, in addition, apply a skim coat. Immediately shear off excess material leaving a film covering the paper. Cover the prepared surface with a drywall primer prior to the application of the final decoration.

3.13 **ACOUSTICAL CAULKING**

- .1 Apply acoustic sealant as the installation of acoustically insulated partitions proceed to ensure concealment of sealant. Work includes sealing perimeter of partitions, and openings and penetrations through partitions to achieve STC rating (required) shown on Drawings, in accordance with sealant manufacturer's printed directions.
- .2 Seal as follows
 - .1 At partitions, provide continuous, two 6 mm concealed beads of acoustical sealant under tracks and runners, behind steel studs at perimeter, and wherever Work abuts dissimilar materials.
 - .2 At ceilings, provide continuous, two 6 mm concealed beads of acoustical sealant wherever Work abuts dissimilar materials.
 - .3 Provide double seal at laminated partition faces. Install face layer with 6 mm edge clearance at terminations of Work, and install continuous bead of acoustical sealant all around.

- .4 At openings and cutouts, fill open spaces between edges of gypsum board and fixtures, cabinets, ducts and other flush or penetrating items, with continuous bead of acoustical sealant.
- .5 Seal sides and backs of electrical boxes to completely close up openings and joints with a bead of acoustical sealant.
- .6 Where sound-rated partitions intersect non-rated walls or partitions, extend sound-rated construction to completely close sound flanking paths through non-rated construction. Seal joints between face layers at vertical interior angles of intersecting partitions.
- .7 Ceiling plenums: Where sound-rated partitions extend through non-sound rated ceilings to structural substrates above, extend the same treatment to that portion of the partition above the ceiling as specified for portion below the ceiling.
- .8 For double-layer partition applications, install base layer only above ceilings.
- .3 Note: Where acoustic sealant is applied at exposed joints, apply a covering bead of topping sealant finish to a smooth, shallow concave surface.
- .4 Remove any excess sealant and smears as Work progresses and leave the Work in a clean condition to Consultant's satisfaction.

3.14 **CUTTING, DRILLING AND PATCHING**

- .1 Cut, drill and patch gypsum board as may be necessary to accommodate the work of other trades.

3.15 **PROTECTION BOARD**

- .1 Neatly cut boards in straight line. Position in place and butt together in moderate contact with 3 mm gap between boards.
- .2 Predrill and screw in place keeping a fastener distance of 19 mm from edge of board, and in accordance with manufacturer's directions.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- .1 ASTM C920 - Standard Specification for Elastomeric Joint Sealants
- .2 TTMAC - Terrazzo, Tile and Marble Association of Canada
- .3 AODA - Accessibility for Ontarians with Disabilities Act

1.3 **QUALITY ASSURANCE**

- .1 Retain a Subcontractor regularly engaged in installing ceramic tile for a minimum of five years, and whom has had a minimum of three successful installations of the type called for in this section, each at least three years old. Likewise Subcontractor shall be a member in good standing of the Terrazzo, Tile and Marble Association of Canada (TTMAC).
- .2 Submit upon Consultant's request, documented evidence of compliance with the foregoing.

1.4 **SUBMITTALS**

.1 Submit in accordance with Section 01 33 00.

.2 Samples

- .1 Submit sample panels of each type, colour, texture, size and pattern of tile.
- .2 Submit grout samples for approval by Consultant. Grout samples to match each tile colour, unless otherwise specified.
- .3 Approved samples shall be used as minimum standard for all Work under this section and installed Work must match samples in every respect.

.3 Certification: Submit certification for each type of floor tile as follows:

- .1 Provide tile products manufactured and tested in accordance with ANSI A137.1 as appropriate to the Basis-of-Design Materials listed in this Section and on the Drawings.
 - .2 Slip Resistance: Provide materials having a minimum Dynamic Coefficient of Friction (DCOF) of 0.42 dry and, wet in accordance with ANSI A137.1 when tested using BOT 3000 Digital Tribometer or minimum 0.45 dry and wet in accordance with DIN 51130 with minimum R9 Class Slip Resistance.
 - .3 Certification shall have been conducted by a nationally recognized independent testing laboratory acceptable to the Consultant.
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1.5 **DELIVERY, STORAGE AND HANDLING**

- .1 Deliver materials in adequate crates or containers with manufacturer's name and Product description clearly marked thereon.
- .2 Handle and store tiles in a manner to avoid chipping, breakage or the intrusion of foreign matter. Take precautions to protect the mortar and grout admixtures from freezing or from excessive heat.

1.6 **MAINTENANCE**

- .1 Upon completion of Work, deliver maintenance tiles in quantities equivalent to 5% (to nearest full carton) of each tiled area (wall and floor), including fittings, as required for Owner's future maintenance purposes.
- .2 Obtain maintenance tiles and fittings from the same production run as tiles and fittings installed. Put in heavy duty boxes and clearly label.

1.7 **MAINTENANCE GUIDE**

- .1 Submit four copies of TTMAC Maintenance Guide latest edition, for inclusion in the Owner's Maintenance Manual in accordance with Section 01 33 00. Give specific warning of any maintenance practice or materials which may disfigure the finished Work.

1.8 **WARRANTY**

- .1 Warrant Work of this section against defects and deficiencies for a period of two years from date Work is certified as substantially performed in accordance with the general conditions of the Contract.
- .2 Promptly make good defects and deficiencies which become apparent within the Warranty Period by replacing defective Work satisfactory to the Consultant and at no expense to the Owner.
- .3 Defects shall include but not limited to loss of bond, loosening, cracking, splitting, warping and deformations.

2 Products

2.1 **MATERIALS**

- .1 Material and colour schedule: Refer to finish schedule on Drawings. It must be noted that the finish schedule is for the purpose of establishing minimum standards for material types and/or colours for this Project. Except where specified otherwise, other Products are acceptable provided that the quality and/or colour represented in the schedule are fully matched to the approval of the Consultant.
- .2 Floor Tiles:
 - .1 Porcelain ceramic tiles complete with trim fittings including bullnosed tiles for floors at doors where tile meets other finishes thinner than the porcelain tile, and 100 mm coved base units to match tiles. Types as follows:
 - .1 Floors (PFT-1):
 - .1 Through body unglazed porcelain tile.
 - .2 Colour: Mica, Matte Finish.

- .3 Size: 300 mm x 600 mm.
 - .4 Slip Resistance: Slip Resistance: DCOF- 0.42 min. dry/wet in accordance with ANSI A137.1, when tested to BOT 3000 Digital Tribometer.
 - .5 Approved manufacturers: Emotion by D9 or accepted equal
 - .2 Shower Floors (PFT-2):
 - .1 Through body unglazed porcelain tile.
 - .2 Colour: Mid grey or as indicated on Drawings.
 - .3 Sizes: 48 mm x 48 mm.
 - .4 Slip Resistance: DCOF- 0.42 min. dry/wet in accordance with ANSI A137.1, when tested to BOT 3000 Digital Tribometer.
 - .5 Approved manufacturers: STI Mosaic by Stone-tile or accepted equal
 - .3 3600 Danforth Ave - Corridor Adjacent to Barrier-Free Washroom (PFT-2)
 - .1 Through body unglazed porcelain tile.
 - .2 Colour: beige (dark ivory) or as indicated on Drawings.
 - .3 Sizes: 300 mm x 300 mm.
 - .4 Slip Resistance: wet >0.60, dry> 0.87 in accordance with ASTM C1028 or DIN 51130: R9.
 - .5 Approved manufacturers: Architecture Series by Stone-tile or accepted equal
 - .4 Floor Tiles (PFT-4)
 - .1 Through body unglazed porcelain tile.
 - .2 Colour: Cool porcelain white (200), Smooth (V)
 - .3 Size: match existing tile size (300 mm x 450 mm)
 - .4 Slip Resistance: R10 in accordance with DIN 51130.
 - .5 Approved manufacturers: Core Collection Terra by Mosa Tile or accepted equal
 - .3 Wall Tiles:
 - .1 Glazed ceramic wall tiles in 100 mm x 400mm size complete with trim fittings including integral coves, sanitary caps and beads. Types as follows:
 - .1 Washroom / Shower Walls (CWT-1):
 - .1 Collection: Colour & Dimension.
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- .2 Colour: Arctic White Matte.
 - .3 Manufacturer: Olympia Tile or accepted equal.
- .2 Washroom / Shower Accent:
 - .1 Collection: Colour & Dimension.
 - .2 Colour: Taupe, Matte (CWT-3); Dark Grey, Matte (CWT-4)
 - .3 Manufacturer: Olympia Tile or accepted equal.
- .4 Kitchen Countertop and Backsplash (Q-1): Refer to Section 066116 Quartz Surface Fabrications
- .5 Levelling coat: Latex liquid and factory mixed cement/powder.
 - .1 Daltile "Laticrete 3701/226"
 - .2 Mapei "Kerabond/Keralastic"
 - .3 Kiesel "Servoflex-Trio-Supertech": Flexible full transfer thinset and medium bed mortar
 - .4 Or accepted equal
- .6 Waterproof membrane: Meeting ANSI 118.10 Specification for load bearing, bonded, waterproof membranes for thin-set ceramic tile and dimension stone installation.
 - .1 Mapei "Mapelastic" with Mapei reinforcing mesh
 - .2 Laticrete "9235"
 - .3 Kiesel "DMS-1K Schnell SuperTech": Fast setting, one component, cement based waterproofing and sealing sleeves and strips
 - .4 Or accepted equal
- .7 Crack suppressant membrane: Fabric or mesh reinforced, meeting TTMAC requirements.
 - .1 Mapei "Mapelastic"
 - .2 Laticrete "9235"
 - .3 Kiesel "DMS-1K Schnell SuperTech": Fast setting, one component, cement based waterproofing with sealing sleeves and strips
 - .4 Or accepted equal
- .8 Setting Bed and Thin-set:
 - .1 Thin set liquid latex-portland cement mortar: Field mixed, high strength thin bed mixture of latex-additive portland cement-filler powder.
 - .1 For tiles 200 mm x 200 mm or less in size:
 - .1 Mapei "Kerabond/Keralastic"
 - .2 Laticrete "4237/211"

- .3 Flextile "41/silica sand and cement"
 - .4 Kiesel "Servoflex-Trio-Supertech": Flexible full transfer thinset and medium bed mortar
 - .5 Or accepted equal
 - .2 For tiles over 200 mm x 200 mm up to 300 mm x 300 mm in size:
 - .1 Mapei "Kerabond / Keralastic"
 - .2 Laticrete "4237 / 211"
 - .3 Flextile "53 / 44"
 - .4 Kiesel "Servoflex-Trio-Supertech": Flexible full transfer thinset and medium bed mortar
 - .5 Or accepted equal
 - .3 For 330 mm x 330 mm tiles, use a full contact thin set mortar:
 - .1 Mapei "Ultracontact"
 - .2 Kiesel "Servoflex-Trio-Supertech": Flexible full transfer thinset and medium bed mortar
 - .3 Or accepted equal
 - .2 Polymer modified portland cement grout: Field mixed, high strength polymer modified portland cement/sand for floors; unsanded for wall applications. Colour to match tiles.
 - .1 Grout line width greater than 5 mm
 - .1 Mapei "Ultracolor Plus"
 - .2 Laticrete "Floor grout with 1776 additive"
 - .3 Flextile "PM 600 Grout"
 - .4 Kiesel "Servoflex F": Universal flexible, water and stain repellent grout
 - .5 Or accepted equal
 - .2 Grout line width between 1.5 mm to 3 mm
 - .1 Mapei "Ultracolor Plus"
 - .2 Laticrete "Wall grout with 1776 additive"
 - .3 Flextile "PM 500 Grout"
 - .4 Kiesel "Servoperl": Water and stain repellent grout.
 - .5 Or accepted equal
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- .3 Epoxy grout: Meeting ANSI 118.3 requirements:
 - .1 Mapei "Kerapoxy"
 - .2 Daltile "Laticrete Latapoxy SP-100"
 - .3 Flextile "Flex-Epoxy 100"
 - .4 Kiesel equal
 - .9 Uncoupling Membrane
 - .1 3 mm thick, orange, high-density polyethylene membrane incorporating a grid structure of 12 mm x 12 mm square cavities cut back in dovetail configuration. Polypropylene fleece laminated to its underside of HDPE layer. Provide waterproofing seaming membrane for seams and corners: 0.1 mm thick, orange polyethylene membrane, with polypropylene fleece laminated on both sides.
 - .1 Accepted manufacturer: Schluter "Ditra" or accepted equal.
 - .10 Edge Protection and Transition Strips:
 - .1 Transitions
 - .1 (TH-4a): Anodized aluminum profile with textured, sloped exposed surface, tapered leading edge and integrated grout joint spacer. Transition strips shall form a smooth transition where tile abuts another flooring surface.
 - .1 Material and Finish: Satin Anodized Aluminum
 - .2 Height: 12.5 mm
 - .3 Ramp length: 64 mm.
 - .4 Accepted manufacturer: Schluter "RENO-RAMP-K" or accepted equal.
 - .2 (TH-5a): Ball-and-socket hinged profile with sloped exposed surface, tapered leading edge, integrated trapezoid-perforated anchoring leg and integrated grout joint spacer. Transition strips shall form a smooth transition where tile abuts another flooring surface.
 - .1 Material and Finish: Satin Anodized Aluminum
 - .2 Height: as required to coordinate with tile selection and setting system selected.
 - .3 Ramp length: as required.
 - .4 Accepted manufacturer: Schluter "RENO-V" or accepted equal.
 - .3 Transition for same-height, hard-surface floor coverings, installed in the existing joint cavity, overlapping adjoining surface materials. To be used in existing floors on both sides of the transition. Example: ceramic tile to ceramic tile, ceramic tile to VCT, etc.
 - .1 Material and Finish: Stainless Steel
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- .2 Accepted manufacturer: Schluter "RENO-T" or accepted equal.
 - .4 Transition for existing floors with different heights and installed adjacent to the existing floor coverings without disturbing existing floors.
 - .1 Material and Finish: Stainless Steel
 - .2 Height: as required to coordinate with existing tile.
 - .3 Ramp length: as required to fit on existing flooring.
 - .4 Accepted manufacturer: Schluter "RENO-RAMP-K" or accepted equal
 - .2 Tile Edge Protection
 - .1 For outside corners and edges of walls: aluminum, L-shaped profile, integrated trapezoid perforated anchoring leg and integrated grout joint space. Finish: Anodized aluminum.
 - .1 Accepted manufacturer "Jolly" by Schluter as supplied by Centura or accepted equal
 - .2 For floors (where indicated on Drawings): stainless steel, L shaped profile with 3.2 mm wide top edge visible surface, integrated trapezoid perforated anchoring leg, and integrated grout joint spacer.
 - .1 Accepted manufacturer: "SCHIENE by Schluter" or accepted equal
 - .11 Floor sealer and protective coating: Compatible with tiles installed as recommended by tile manufacturer, to protect tile from yellowing, powdering, scuffing, acid, alkalis, calcium chloride and detergent dulling.
 - .12 Prefabricated control and expansion joints: Provide "Movement Joint Profiles" by Schluter or accepted equal in styles and sizes to suit application and as approved by Consultant.
- 3 Execution
- 3.1 **PREPARATION OF SURFACES**
- .1 Ensure surfaces are thoroughly clean, dry and sound. Remove oil, wax, grease, dirt, paint, form release agent, and other foreign material that may impair proper tile bond to wall and floor surfaces. Use mechanical methods such as sanding for walls or bead blasting for floors.
 - .2 On surfaces to be waterproofed, prepare concrete substrate in accordance with waterproofing manufacturer's preparation standards.
 - .3 Ensure substrates are structurally sound, level and plumb, within a maximum tolerance of 3 mm in 2.4 m for vertical surfaces, and horizontal surfaces within a maximum tolerance of 6 mm in 3 m from finished levels of the surface, or better.
 - .4 Trowel apply a levelling coat on uneven surfaces, or surfaces which do not guarantee a plumb or level finish to the tile, at a minimum of 6 mm thick.
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- .5 Do not set tile on surfaces containing frost. Maintain temperature to a minimum of 10°C (50°F) during installation. Maintain temperature above freezing until mortar and grout have properly cured. The lower the temperature, the longer tile curing will take.

3.2 FLOOR CONTROL JOINTS

- .1 Clean control joints occurring in slab areas to receive tile and blow clean with compressed air. Use a vacuum to avoid spreading dust in areas to be tiled. Grout flush to slab with cement compound using same materials as specified for levelling coat.

3.3 TILE LAYOUT

- .1 Lay out Work to produce a symmetrical pattern with minimum amount of cutting. Ensure cut tile at room perimeter is not less than one-half full size.

3.4 WATERPROOFING MEMBRANE

- .1 Prepare substrate for waterproofing in accordance with waterproofing manufacturer's directions.
- .2 Apply with a trowel on prepared substrate to a total dry film thickness of 635 microns (25 mils) in accordance with manufacturer's directions. Extend system over curbs and minimum 150 mm up walls.
- .3 Ensure full, complete, and permanent bond. Build up system where necessary to ensure positive slope to drain.
- .4 Reinforce intersections, projections, openings, and other locations as required, with fine glass fibre mesh reinforcing.
- .5 Terminate membrane in reglets wherever possible, except for control joints and grout joints.
- .6 In the case of reinforcing mesh or fabric, embed mesh or fabric while the first coat is fresh and apply a second coat on the mesh or fabric in accordance with manufacturer's written directions.

3.5 INSTALLATION

- .1 Mix thin set mortar and grout components to proportions and methods specified by mortar and grout manufacturer, to achieve maximum bond strength within the capacity of the mortar or grout.
- .2 Use mortar and grout within their pot life as specified by manufacturer.
- .3 For Tiles Less Than 200 x 200 mm In Size
 - .1 Apply mortar with a notched trowel using a scraping motion to work the material into good contact with surface to be covered. A trowel having notches approximately 4 x 4 x 4 mm is recommended. Back of tiles must have 95% mortar coverage.
 - .2 Apply only as much thin set mortar that can be covered within twenty minutes or while surface of thin set mortar is still fresh. Discard thin set mortar that has skinned over and apply fresh thin set mortar. Set tiles in place and beat with a small beating block as necessary to ensure a proper contact of the thin set mortar to the back of the tile and also to level the tiled surface. Align tile to show uniform joints and then allow to set until firm, refer to thin set mortar

manufacturer's written instructions. Clean excess thin set mortar from surface of tile with a damp cloth or sponge while the thin set mortar is fresh.

- .4 For Tiles 200 mm x 200 mm or Larger
 - .1 Apply thin set mortar with the flat side of a notched trowel using a scraping motion to key in the mortar into good contact with surface to be covered. A trowel notches approximately 8 mm x 8 mm x 8 mm is recommended, comb in one direction. Back of tiles must have 95% mortar coverage.
 - .2 Install with back-buttering to achieve good adhesion.
 - .5 Lay out Work so that fields are centred on areas, with no tiles of less than half-size used at room perimeter.
 - .6 Maintain heights of panels in full courses to nearest indicated dimension.
 - .7 Align joints of wall tile with floor tile.
 - .8 Make joints between tile uniform, plumb, straight, true, even and with adjacent tile flush.
 - .9 Provide fittings (base, wall caps and wall corner units) to complement tile system. Install edge protection at external vertical corners.
 - .10 Installation Methods
 - .1 Tile on concrete floor slab: Install tile floor, base fittings with thin set mortar in accordance with TTMAC Installation Manual, Detail 311F, latest edition.
 - .2 Tile on cementitious board ceilings in dry areas: Install tile with thin set mortar in accordance with TTMAC Installation Manual, Detail 315C, latest edition.
 - .3 Tile on cementitious board walls in wet areas: Install tile and fittings with thin set mortar in accordance with TTMAC Installation Manual, Detail 305W, latest edition.
 - .4 Tile on concrete or masonry walls: Install tile and fittings with thin set mortar in accordance with TTMAC Installation Manual, Detail 303W, latest edition. Install wall tile full height unless shown otherwise.
 - .5 Tile on gypsum board walls in dry areas: Install tile and fittings with thin set mortar in accordance with TTMAC Installation Manual, Detail 304W, latest edition.
 - .6 Tile on stairs: Install tile, fittings, and risers with thin set mortar in accordance with TTMAC Installation Manual, Detail 318S, latest edition.
 - .7 Tile on wood subfloor in dry area: Install tile, fittings, and risers with thin set mortar in accordance with TTMAC Installation Manual, Detail 313F, latest edition.
 - .11 Tile control joints: Provide 6 mm wide control joints in tiled floors where shown and directly over control joints in floor slab or masonry walls, in accordance with TTMAC Installation Manual, Detail 301MJ, latest edition. Apply sealant as specified.
 - .12 Cut and fit tile neatly to piping, fittings, projections and around recesses for recessed washroom accessories. Where surface mounted equipment and accessories are to be
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installed on tiled surfaces, extend tile over surfaces. Make cut edges smooth, even and free from chipping. Chipped and broken edges are not acceptable.

- .13 Cut circular cutouts for pipe and drain penetrations by core drilling only.
- .14 If existing tiles, those to remain, are damaged during demolition and removal Work, provide new tiles to match existing tiles. Prepare substrate and install new tiles as specified for new Work of this Section.

3.6 **GROUTING**

- .1 Do not proceed with grouting until at least forty-eight hours after tile has set to prevent displacement of tiles.
- .2 Ensure grout is applied to the full thickness of the tile.
- .3 Force grout into joints in accordance with grout manufacturer's directions to produce watertight, filled joints without voids, cracks and excess grout. Finish flush to edge thickness of tile.
- .4 Do not grout internal corner intersections of wall tile.
- .5 Protect grouted work from traffic for minimum forty-eight hours. Epoxy grout will achieve chemical and stain resistance after ten days therefore protect Work against spills until curing period has lapsed.

3.7 **SEALANT**

- .1 Apply sealant around piping and fittings extending through tiled surfaces.
- .2 Apply sealant in tile control joints and in internal tile to tile joints.
- .3 Tool to a smooth, flush surface, free from air bubbles and contamination. Provide backer rod only where required to control depth of sealant.

3.8 **UNCOUPLING MEMBRANE**

- .1 Leveling of the subfloor must be done prior to installing uncoupling membrane.
 - .2 Install uncoupling membrane to wood subfloor, concrete or vinyl floor in accordance with manufacturer's written instructions.
 - .1 For wood substrates, verify that subfloor panels are properly fastened to framing members
 - .2 For vinyl substrates, ensure that the structure is sound and adequate and well adhered. Remove wax and clean surface. For vinyl over wood structures, nail off floor with ring shank flooring nails every 4" (102 mm) o.c. Fasteners must pass through entire thickness of assembly with minimal penetration into joists.
 - .3 For concrete substrates, mechanically remove any waxy or oily films and curing compounds if present.
 - .3 Install membrane in full bedding of thin set mortar. Roll membrane to ensure full and continuous adhesion to structure.
 - .4 Movement Joints: construct expansion joints and control joints in accordance with TTMAC Detail 301MJ.
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3.9 **CLEANING**

- .1 Clean off excess grout with soft burlap or sponge moistened with clean water.
- .2 After grouting has cured, clean and polish floor and wall tile. Clean in accordance with TTMAC recommendations for treating new work as specified in its "Maintenance Guide". Do not use acid for cleaning.
- .3 Apply two coats of sealer to unglazed ceramic floor in accordance with sealer manufacturer's printed directions.
- .4 Re-point joints after cleaning as required to eliminate imperfections. Avoid scratching tile surfaces.

3.10 **PROTECTION ON COMPLETION**

- .1 After completion, close tiled areas to traffic for a minimum period of seventy-two hours.
- .2 Cover Work temporarily with building paper properly lapped and taped at joints, or other protection, until the Work is accepted by Consultant.

End of Section

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1 General

1.1 **WORK INCLUDED**

.1 Provide Work of this section in accordance with the Contract Documents including but not limited to, the following:

.1 Swimming pool deck:

- .1 Removal of deck tile and setting materials, including mortar bed.
- .2 Remove existing grab rails and store, for reinstallation at projects completion.
- .3 Provide porcelain tile at pool deck. Provide porcelain tile base at pool deck where it meets masonry wall. Deck markings to comply with Ontario Building Code requirements.
- .4 Installation of AODA porcelain tactile markings around the perimeter of the Pool, as per AODA requirements.
- .5 Installation of new deck marking, including Depth, Shallow End, and Deep End markers.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- .1 ASTM C920 - Standard Specification for Elastomeric Joint Sealants
- .2 TTMAC - Terrazzo, Tile and Marble Association of Canada

1.3 **QUALITY ASSURANCE**

- .1 Retain a Subcontractor regularly engaged in installing porcelain tiles for a minimum of five years, and has had a minimum of three successful installations of the type called for in this section, each at least three years old. Likewise Subcontractor shall be a member in good standing of the Terrazzo, Tile and Marble Association of Canada (TTMAC).
- .2 Submit upon Consultant's request, documented evidence of compliance with the foregoing.

1.4 **SAMPLES**

- .1 Submit in accordance with Section 01 33 00.
- .2 Submit one representative sample plate of tile material specified. Mount tiles on 400 mm x 400 mm plywood using specified thin set mortar, grout and sealer. Identify with Project name and number, date, tile type and manufacturer's name, and Subcontractor's name.
- .3 Approved samples shall be used as minimum standard for all work under this section and installed Work must match samples in every respect.
- .4 Submit list of materials to constitute the integrated system specified.

1.5 **DELIVERY, STORAGE AND HANDLING**

- .1 Deliver materials in adequate crates or containers with manufacturer's name and Product description clearly marked thereon.
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- .2 Handle and store tiles in a manner to avoid chipping, breakage or the intrusion of foreign matter. Take precautions to protect the mortar and grout admixtures from freezing or from excessive heat.

1.6 **EXTRA STOCK**

- .1 Upon completion of Work, deliver maintenance tiles in quantities equivalent to 5% (to nearest full carton) of each tiled area, including fittings, as required for Owner's future maintenance purposes.
- .2 Obtain maintenance tiles and fittings from the same production run as tiles and fittings installed. Put in heavy duty boxes and clearly label.

1.7 **MAINTENANCE GUIDE**

- .1 Submit four copies of TTMAC Maintenance Guide latest edition, for inclusion in the Owner's Maintenance Manual in accordance with Section 01 33 00. Give specific warning of any maintenance practice or materials which may damage or disfigure the finished Work.

1.8 **WARRANTY**

- .1 Warrant Work of this section against defects and deficiencies for a period of two years from date Work is certified as substantially performed in accordance with the general conditions of the Contract.
- .2 Promptly make good defects and deficiencies which become apparent within the Warranty Period by replacing defective Work satisfactory to the Consultant and at no expense to the Owner.
- .3 Defects shall include but not limited to loss of bond, loosening, cracking, splitting, warping and deformations.
- .4 The manufacturer of the specified tile setting materials shall extend to the Owner a ten year written warranty on finishing materials, labour and installation.

1.9 **PERFORMANCE REQUIREMENTS**

- .1 Slip resistance: Provide materials having minimum DCOF 0.42 dry/wet in accordance with ASTM A137.1.

2 **Products**

2.1 **MANUFACTURER**

- .1 Basis of Design:
 - .1 "Acepool" by Gres Aragon as distributed by Holten Impex International. Contact Shamanna Kelamangalam at shamanna@holtenimpex.com, (905) 726 - 9669 Extension 214 or (416) 709 - 0584.
 - .2 or accepted equal.

2.2 **MATERIALS**

- .1 Floor Tiles: Porcelain Mosaic tile, Anti slip
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- .1 Size: 317 mm x 317 mm x 5 mm thick; 25 mm x 25 mm x 5 thick (Individual mosaic piece)
- .2 Collection: Public Recreational and Private Pool
- .3 Colour:
 - .1 (PFT-5): White (901899 - Mosaico Blanco)
 - .2 (PFT-6): Dark Blue (902994 - Mosaico Azul oscuro)
- .2 Wall Base: Porcelain wall base tile, Anti slip (PWB-1)
 - .1 Size: 244 mm x 119 mm x 8 mm thick
 - .2 Collection: Sports Pool Bases
 - .3 Colour: Dark Blue (904006 - Azul oscuro)
- .3 Special Pieces
 - .1 Provide cove base tile work include complete trim fittings, corners, surface cap, and trims.
 - .2 Collection: Sports Pool
 - .1 Internal Radial Angle
 - .1 Size: 244 mm x 42 mm
 - .2 Colours:
 - .1 (IRA-1): Dark Blue (905547 - Azul oscuro)
 - .2 (IRA-2): White (905603 - Blanco)
 - .2 External Radial Angle
 - .1 Size: 244 mm x 42 mm
 - .2 Colours:
 - .1 (ERA-1): Dark Blue (905578 - Azul oscuro)
 - .2 (ERA-2): White (905494 - Blanco)
 - .3 Internal Mitre (IM-1)
 - .1 Size: 75 mm x 75 mm
 - .2 Colour: Dark Blue (905729 - Azul oscuro)
 - .4 External Mitre (EM-1)
 - .1 Size: 75 mm x 75 mm
 - .2 Colour: Dark Blue (905744 - Azul oscuro)

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- .5 Round Interior Mitre (RIM-1)
 - .1 Size: R33 radius
 - .2 Colour: Dark Blue (905610- Azul oscuro)
 - .6 Round External Mitre (REM-1)
 - .1 Size: R42 radius
 - .2 Colour: Dark Blue (905624- Azul oscuro)
 - .4 Tile installation materials:
 - .1 Levelling coat and mortar:
 - .1 Laticrete 226 mortar mix gauged with Laticrete 3701 Mortar Admix
 - .2 Mapei "Kerabond T/Keralastic"
 - .3 or accepted equal.
 - .2 Waterproofing membrane:
 - .1 Laticrete 9235
 - .2 Mapei "Mapelastic" with Mapei reinforcing mesh
 - .3 or accepted equal
 - .3 Grout: Epoxy adhesive to be chemical resistant, water cleanable tile-grouting epoxy shall meet the requirements of the manufacturer.
 - .1 Colour to match tile colour. (Dark blue for mosaic and cover base; white for white mosaic). Provide samples for selection by the Consultant.
 - .1 Laticrete SpectraLock PRO Grout
 - .2 Mapei Kerapoxy CQ
 - .3 or accepted equal
 - .4 Sealant: as recommended by the tile manufacturer.
 - .5 Porcelain Tactile Markings:
 - .1 Refer to Section 10 14 75 Tactile Warning Systems.
 - .2 Colour: Cultured Grey
- 3 Execution
- 3.1 **PREPARATION OF SURFACES**
- .1 Prepare surfaces in accordance with tile manufacturer recommendations.
 - .2 Ensure surfaces are thoroughly clean, dry and sound. Remove oil, wax, grease, dirt, paint, form release agent, and other foreign material which may impair proper tile bond to tile contact surfaces. Use mechanical methods such as sanding for walls or bead blasting for floors.
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- .3 Ensure substrates are structurally sound, level and plumb, within a maximum tolerance of 3 mm in 2.4 m for vertical surfaces, and horizontal surfaces within a maximum tolerance of 6 mm in 3 m from finished levels of the surface, or better.
- .4 Apply leveling coat to substrates as required to ensure surfaces are plumb, level and even. Note that thickness of leveling coat will vary depending upon accuracy of substrate surface, etc. Measure pool accurately prior to application of leveling coat. Review all areas with Consultant where leveling coat is to be less than 20 mm thick or thicker than 40 mm thick.
- .5 Do not set tile on surfaces containing frost. Maintain temperature to a minimum of 10°C (50°F) during installation. Maintain temperature above freezing until mortar and grout have properly cured. The lower the temperature, the longer tile curing will take.

3.2 **CONTROL JOINTS**

- .1 Provide control joints 6 mm wide at maximum 6 m spacing and at junction of pool tile and deck tile.
- .2 Fill control joints with specified sealant as recommended by manufacturer.

3.3 **WATERPROOFING MEMBRANE**

- .1 Prepare concrete substrate in accordance with waterproofing manufacturer's directions.
- .2 Apply with a trowel on prepared substrate to a total dry film thickness of 635 microns (25 mils) in accordance with manufacturer's directions.
- .3 Ensure all area's to be waterproofed has manufacturer's recommended moisture content prior to application.
- .4 Remove all form scale, oil, form release agents and any other foreign materials likely to affect bond, penetration and performance of the waterproofing.
- .5 Allow membrane to cure fully (typically seven (7) days at 70°F/21°C) before flood testing; flood test prior to applying tile.
- .6 Protect from traffic or water until fully cured.

3.4 **TILE LAYOUT**

- .1 Lay out Work to produce a symmetrical pattern with minimum amount of cutting. Ensure tile at perimeter is cut not less than one-half full size.

3.5 **INSTALLATION**

- .1 Mix mortar and grout components to proportions and methods specified by mortar and grout manufacturer, to achieve maximum bond strength within the capacity of the mortar or grout.
 - .2 Use mortar and grout within their pot life as specified by manufacturer.
 - .3 Make joints between tile uniform, plumb, straight, true, even and with adjacent tile flush.
 - .4 Provide coved bases throughout installation and manufactured tile trim pieces as required to complement tile system.
 - .5 Sound tiles after setting and replace hollow sounding units to obtain full bond.
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.6 Installation Methods

.1 Install tile and fittings on thick mortar bed in accordance with TTMAC Installation Manual.

.7 Cut and fit tile neatly to piping, fittings, projections, drains, etc. Where surface mounted equipment and accessories are to be installed on tiled surfaces, extend tile over surfaces. Make cut edges smooth, even and free from chipping. Chipped and broken edges are not acceptable.

.8 Cut circular cutouts for pipe and drain penetrations by core drilling only.

3.6 **GROUTING**

.1 Do not proceed with grouting until at least forty-eight hours after tile has set to prevent displacement of tiles.

.2 Ensure grout is applied to the full thickness of the tile.

.3 Force grout into joints in accordance with grout manufacturer's directions to produce watertight, filled joints without voids, cracks and excess grout. Finish flush to edge thickness of tile.

.4 Protect grouted Work from traffic for minimum forty-eight hours.

3.7 **SEALANT**

.1 Apply sealant around penetrations through tiled surfaces.

.2 Apply sealant in tile control joints and in other areas.

.3 Tool to a smooth, flush surface, free from air bubbles and contamination. Provide backer rod only where required to control depth of sealant.

3.8 **CLEANING**

.1 Clean off excess grout with soft burlap or sponge moistened with clean water.

.2 After grouting has cured, clean and polish ceramic tile. Clean in accordance with TTMAC recommendations for treating new Work as specified in its "Maintenance Guide". Do not use acid for cleaning.

.3 Re-point joints after cleaning as required to eliminate imperfections. Avoid scratching tile surfaces.

3.9 **PROTECTION ON COMPLETION**

.1 After completion, close tiled areas to traffic for a minimum period of seventy-two hours.

.2 Cover Work temporarily with building paper properly lapped and taped at joints, or other protection, until the Work is accepted by Consultant.

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- | | | | |
|----|--------------------|---|--|
| .1 | CAN/ULC-S102 | - | Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies |
| .2 | ASTM E84 | - | Standard Testing Method for Surface Burning Characteristics of Building Materials |
| .3 | ASTM E580 | - | Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions (for Seismic) |
| .4 | ASTM E1264 | - | Standard Classification for Acoustical Ceiling Products – acoustical testing (classification of tile) |
| .5 | Indoor Air Quality | - | GreenGuard |
| .6 | ASTM C635/C635M | - | Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings |
| .7 | ASTM C636/C636M | - | Standard Practice for Installation on Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels |
| .8 | AODA | - | Accessibility for Ontarians with Disabilities Act |

1.3 **SUBMITTALS**

.1 Submit in accordance with Section 01 33 00.

.2 Shop Drawings: Show/include the following:

- .1 Suspension system layout; conditions at abutting, intersecting and penetrating construction; dimensional locations of lighting fixtures, diffusers, sprinkler heads, other items that pierce the ceiling plane, and suspension hangers.
- .2 Locations of accessible openings in acoustic tile ceilings.
- .3 Product data on ceiling grid system, acoustic units, clearly indicating the specific items proposed for use if manufacturer's catalogs are submitted.

.3 Samples: Submit the following:

- .1 300 mm long samples of suspension system parts, including trim.
- .2 300 mm x 300 mm samples of acoustic units.
-

- .4 Certificates: Submit certificate attesting that installed acoustical ceiling systems meet the fire-resistance ratings required for this Project.
- .5 Maintenance data: Submit maintenance instructions for recommended cleaning materials and methods for acoustic units and trim. Include precautions for use of and composition of cleaning materials detrimental to acoustic units and trim.

1.4 **DELIVERY, STORAGE AND HANDLING**

- .1 Deliver materials in original packages, containers and bundles, bearing brand and manufacturer's name and ULC/Warnock Hersey labels.
- .2 Store materials in a covered area, off-ground, on flat, smooth, dry surfaces. Protect from moisture. Remove damaged or deteriorated materials from site.
- .3 Comply with acoustic unit manufacturer's recommendations regarding temperature and humidity conditions before, during and after ceiling installation.

1.5 **PROJECT CONDITIONS**

- .1 Environmental requirements: Continuously maintain rooms or areas scheduled to receive acoustical treatment at not less than 21°C (70°F), and at occupancy humidity, at least three days prior to installation and three days after this Work is completed. Schedule the Work to eliminate the risk of damage to these materials due to adverse environmental conditions in rooms or areas when and after this Work is installed.

1.6 **MAINTENANCE**

- .1 Extra stock: Leave spare acoustic units and full-size plenum barrier boards in quantity equivalent to 2% (to nearest box) of each type of acoustic ceiling. Obtain spare units from same production run as installed units. Product to be packaged with protective covering for storage and identified with labels describing contents.

2 **Products**

2.1 **MATERIALS**

- .1 Exposed or concealed grid system: 38 mm leg x 24 mm flange zinc coated cold rolled steel per ASTM C635, factory finished satin white:
 - .1 Chicago Metallic "200 Snap Grid"
 - .2 CGC Interiors "DX Fast-Loc"
 - .3 Bailey Metal Products Limited "Standard B.E. Safe-T-Lock"
 - .4 Armstrong "Prelude ML"
- .2 Exposed or concealed grid system: 9/16"
 - .1 Chicago Metallic "4000 Tempra"
 - .2 CGC Interiors "Centricitee DXT"
 - .3 Certainteed "Elite Narrow Stab System"
 - .4 Armstrong "Suprafine XL"

- .3 SEISMIC GRID SYSTEM:
 - .1 Chicago Metallic "200 Snap Grid", heavy duty
 - .4 Exposed grid system: Double web, aluminum, white finish, non-corrosive for high humidity exposure.
 - .1 Chicago Metallic "830 All Aluminum"
 - .2 CGC Interiors "AX All Aluminum"
 - .3 Armstrong "Prelude Plus XL Aluminum"
 - .5 Fire rated exposed grid system: Intermediate duty zinc coated cold rolled steel with double-web tees, rated to achieve fire rating required for Project. Finish in factory applied satin white.
 - .1 Chicago Metallic "1250 F/R"
 - .2 CGC Interiors "DXL Fire-Rated Systems"
 - .3 Certainteed "15/16" FireSecure Stab System"
 - .4 Armstrong "Prelude XL FireGuard"
 - .1 Acoustic lay-in panels: 610 mm x 1200 mm x 16 mm or 610 mm x 610 mm x 16 mm or match existing condition. Incombustible mineral fiber, square [reveal] edge, white factory-painted exposed surface. Minimum NRC rating of 0.70.
 - .1 Rockfon "Alaska" or "Artic"
 - .2 CGC Interiors "Mars"
 - .3 Certainteed "Symphony M"
 - .4 Armstrong "Ultima"
 - .2 Moisture resistant lay-in panels: 600 mm x 1200 mm x 16 mm, or 610 mm x 610 mm x 16 mm or match existing condition. Incombustible mineral fiber, square edge, with white vinyl facing, non-perforated:
 - .1 Armstrong "Clean Room VL".
 - .3 High humidity-resistant acoustic lay-in panels: 610 mm x 1200 mm x 16 mm or 610 mm x 610 mm x 16 mm or match existing condition. Incombustible mineral fiber, square edge, white medium texture surface:
 - .1 Rockfon "Koral"
 - .2 CGC Interiors "Radar Ceramic ClimaPlus 56645"
 - .3 Armstrong Minaboard "Ceramaguard Fine Fissured No. 608"
 - .4 Plenum Barrier Board Insulation: Stone wool insulation, 610 mm x 1220 mm x 38 mm thick, aluminum foil faced with fibre reinforcement, Class A, conforming to CAN/ULC-S102.
 - .1 Warning Label: Printed in black ink on the facing shall be warning labels 100 mm high by 100 mm wide spaced 300 mm in both directions with the words "Noise
-

Barrier. Do not remove barrier or damage foil facing.". Warning labels shall be oriented in all four directions in ninety-degree increments so legible from any edge of the board.

.1 "Plenum Barrier Board" by Rockfon.

.2 Or accepted equal.

.5 Hangers: Soft-annealed, zinc coated steel wire minimum 2.64 mm (12 gauge), meeting "heavy-duty" classification of ASTM C635.

.6 Edge mouldings: By Rockfon, CGC Interiors, Certainteed or Armstrong to complement ceiling grid, and installed around ceiling perimeters, in factory finished satin white on zinc coated cold rolled steel. Conform to manufacturer's requirements.

.7 Metal closures and trim: Bonderized and with factory-applied white baked enamel finish in white. If coloured, coordinate with ceiling tile colour and manufacturer's colour selection. Use anchors standard with manufacturer. Corrosion-resistant factory finished units. Provide anchors as standard with manufacturer.

.8 Panel hold-down clips: Standard of grid manufacturer.

.9 Supplementary splines: Hard fiber or steel splines as standard with grid manufacturer.

.10 Supplementary steel supports: Steel conforming to Section 05 50 00.

3 Execution

3.1 EXAMINATION

.1 Inspect substrates and previously placed Work to determine suitability and completeness. Start of this Work constitutes an acceptance of existing conditions. Correct failure of this Work due to unsatisfactory existing conditions at no increase in Contract Price. Similarly, if the Work needs to be removed to correct defects in substrates or previously placed Work, perform both removal and replacement at no increase in Contract Price.

3.2 EXPOSED GRID LAY-IN PANEL CEILINGS

.1 Install main tees, cross tees, and wall moldings so bottom flanges are in flat, level plane at finish ceiling elevations. Arrange grid so opposite wall edge panels are of equal width but not less than one-half panel width, and lay out and erect grid system to provide panel pattern shown.

.2 Install exposed ceiling grid per ASTM C636, reviewed Shop Drawings, and specified herein. Place secondary steel framing to span structural steel as required.

.3 Erect main beams parallel to main wall and to each other; space uniformly at centres specified.

.4 In ceilings having recessed lighting fixtures, modify grid framing to provide main beams along and parallel to both long sides of lighting fixtures.

.5 Support main beams with hangers along each run, spaced at not more than 1200 mm centers; except in areas of steel framing, Provide hangers at each intersection of main beam and framing.

- .6 If ductwork or equipment located in ceiling plenum area interferes with hanger spacing, Provide a trapeze or other arrangement reviewed by Consultant to support main beams at proper spacing.
 - .7 Do not secure hangers to metal roof deck, ductwork, conduit, piping, equipment, or support system for any of these. Provide additional hangers at each diffuser, grille and other points of extra loading.
 - .8 Secure hangers to main beams to develop full strength of hangers and per manufacturer's published directions. Secure hangers to construction above per ASTM C636 and following requirements:
 - .1 Exposed concrete slab: Use anchors, cast-in hanger wires or inserts, specifically designed for hanger use.
 - .2 Steel beams: Use beam clips.
 - .3 Steel joists: Wrap hanger wire around lower chord member.
 - .4 Permanent metal forms and cellular floor deck: Tabs, holes or slots specifically provided for hanger attachment; prevent hanger twisting or turning by cross tying.
 - .9 Install primary cross tees at right angles to main beam tees and space uniformly at centers specified. Join ends of cross tees to web of main beams with a positive interlock; except at light fixtures, secure members together with concealed steel clips and bolts. Install tees to produce fine-line joints between flanges of abutting members.
 - .10 Install secondary cross tees at right angles to primary tees and space uniformly at centers specified, and secure in a manner similar to primary tees.
 - .11 At locations where ceilings abut walls, columns and other vertical surfaces, install continuous wall molding to trim ceiling edges.
 - .1 Install molding with bottom horizontal leg at elevation required to support acoustic panel and to be flush with bottom flange of grid members [for concealed, flush with the bottom of tile, and with vertical leg concealed, as per manufacturer's instructions.
 - .2 Bolt moldings to supporting construction at 600 mm on centre and within 150 mm of end of each molding piece.
 - .3 Butt joints in moulding inconspicuously if several pieces are required in any one run.
 - .12 At recessed-grid system for reveal-edge lay-in panels, install "W" shaped wall molding, of profile specified, to retain recessed detail at ceiling perimeters.
 - .13 Install acoustic lay-in panels in grid system openings supported by bottom flanges of members in accordance with manufacturer's instructions.
 - .14 Where within 6000 mm of exterior doors, secure each lay-in panel into grid opening with concealed hold-down clips.
 - .15 Install reveal-edge panels with angled or square edges resting on bottom flanges of members, with panel surface extending below bottom flanges.
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3.3 FIRE-RESISTANCE RATED CEILINGS

- .1 Provide fire-resistance rated ceilings where required, including proper construction of framing and furring and proper thickness and weight of acoustic units, to produce hourly fire-resistance ratings called for.
- .2 Requirements for materials, methods of erection and application specified under appropriate headings of this section apply except where more stringent requirements are defined for particular fire-resistance rating by Underwriters' Laboratories of Canada or Warnock-Hersey.

3.4 PLENUM BARRIER BOARD

- .1 Install plenum barrier board insulation to form contiguous sound barrier above demising walls or under raised floors according to manufacturer's instructions.

3.5 ADJUSTING AND CLEANING

- .1 After interior finishing Work has been substantially completed, or when directed by Consultant, inspect acoustical treatment Work. Replace broken, chipped or damaged Work, reset loose units or units out of place, and touch up marred surfaces with matching paint. Upon completion of the Project, clean acoustical surfaces free from dirt and other markings and in good condition acceptable to Consultant.

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.
- .2 This section specifies testing of concrete floor slabs to guarantee a suitable substrate to receive the floor finishes specified in Division 9. Perform and pay for the following:
 - .1 Moisture tests using calcium chloride quantitative test method
 - .2 Humidity tests
 - .3 Dew point tests
 - .4 pH tests
 - .5 Verify 28-day curing of concrete
 - .6 Coordinate HVAC requirements for testing purposes
 - .7 Notify all parties of test results

1.1 **REFERENCE**

- .1 Conform to the latest edition of the following:
 - .1 AODA - Accessibility for Ontarians with Disabilities Act

1.2 **QUALITY ASSURANCE**

- .1 Technicians: Individuals from a company engaged in the business of performing construction testing and inspection services of the type required by this section, for a minimum of two years within the past five years. Tasks involved include the following:
 - .1 Testing in accordance with specified ASTM testing standards.
 - .2 Keeping a record of testing inspection details.
 - .3 Coordination with floor finishes trades.
 - .4 Electronic reporting of test results to Consultant.

1.3 **APPLICABLE TESTING STANDARDS**

- .1 Perform tests in accordance with the latest edition of the following standards:
 - .1 ACI 302.2R-06 - Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials
 - .2 ASTM D4262 - Standard Test Method for pH of Chemically Cleaned or Etched Concrete
 - .3 ASTM D4263 - Standard Test Method for Indicating Moisture in Concrete by Plastic Sheet Method

- | | | |
|----|--------------------------|---|
| .4 | ASTM F710 | - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring |
| .5 | ASTM F1869 | - Standard Test Method for Measuring Moisture Vapour Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride |
| .6 | ASTM F2170 | - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In Situ Probes |
| .7 | ASTM F2420 | - Standard Test Method for Determining Relative Humidity on the Surface of Concrete Floor Slabs Using Relative Humidity Probe Measurements and Insulated Hood |
| .8 | CSA A23.1/A23.2 | - Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete |
| .9 | ICRI Guideline No. 03732 | - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings and Polymer Overlays |

1.4 **SUBMITTALS**

- .1 Technicians' qualifications: Submit the following in accordance with Section 01 33 00:
 - .1 Confirmation of technicians' qualifications as specified.
 - .2 Confirmation of test method to be used.
- .2 Test Reports
 - .1 Submit to the Consultant, summary of tests leading to satisfactory results, prior to floor finish installation. Report to follow specified contents and format. No floor finish installation shall proceed without satisfactory test results reported to, and acknowledged by, the Consultant.

2 Products

2.1 **MATERIALS**

- .1 Not applicable

3 Execution

3.1 **FLOOR FINISHES SCHEDULE COORDINATION**

- .1 Coordinate testing with the schedule of floor finishes operations. Installation of finishes is predicated upon a concrete substrate that is suitable for installation of finishes as proven by satisfactory test results.

3.2 **SITE MEETING**

- .1 Prior to start of Work, attend a site meeting with the Construction Manager and Consultant, Contractor and Floor Finishes Subcontractors. Purpose of the meeting is to ensure familiarity with the requirements of the Work, common understandings reached, methodologies, relationships and protection of work criteria are understood.

3.3 **TESTING**

- .1 An appropriate environment is required during testing. Coordinate provision of HVAC during test periods.
- .2 Remove curing compound and/or sealer at test locations using hand-held grinders.
- .3 Perform moisture testing in accordance with ASTM F1869 methods. No alternative test methods accepted.
- .4 Follow ASTM standards for number and frequency of tests. At any rate, satisfactory test results must be representative of the total floor.
- .5 Perform relative humidity tests in accordance with ASTM F2170.
- .6 Perform pH testing in accordance with ASTM D4262 and ASTM F710.

3.4 **REPORTING**

- .1 All reports shall be prepared by the technician conducting the test, who shall affix his/her signature to the reports. The reports shall confirm compliance of the Work with the Contract Documents and be signed by the technician.
- .2 Report format shall be columnar, containing the information listed below, and, where applicable, contain notations of the specified standard or other reference covering the items to be tested.
- .3 Information required in the reports:
 - .1 Test location.
 - .2 Test method used (indicate passing result).
 - .3 Confirm surface for testing has been prepared.
 - .4 Start time and date of placing calcium chloride test.
 - .5 Relative humidity (RH) at start time.
 - .6 Ambient temperature (AT) at start time.
 - .7 Results after test period.
 - .8 Relative humidity (RH) at end of test.
 - .9 Ambient temperature (AT) at end of test.
 - .10 Satisfactory or unsatisfactory results. Repeat tests if results not satisfactory. Coordinate results with floor finishes trades.
 - .11 Observations or comments.
 - .12 Name and signature of technician; date report sent to Consultant.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.
- .2 Wood flooring at Scarborough Arts Council (1859 Kingston Road).

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- .1 AODA - Accessibility for Ontarians with Disabilities Act
- .2 FSC - Forest Stewardship Council: FSC Chain-of-Custody certification.

1.3 **SUBMITTALS**

.1 Samples

- .1 Submit in accordance with Section 01 33 00.
- .2 Submit three samples, minimum 150 mm square representing actual product, colour and patterns.
- .3 Identify samples with Project name, job number, date, colour, manufacturer's name and Contractor's name.

.2 Shop Drawings: Submit adhesive Product data confirming specified requirement.

.3 Maintenance instructions: Submit three copies of Product maintenance manual to Consultant prior to completion of the Work. Manual to contain specific maintenance recommendations and specific warning of any maintenance practice or materials which may damage or disfigure the flooring.

1.4 **DELIVERY, STORAGE AND HANDLING**

- .1 Deliver and store materials undamaged in original wrappings or containers, with manufacturer's labels and seals intact. Store materials in a warm, dry area.
- .2 Prevent damage to materials during handling and storage. Stack material not over two cartons in height, nor in excess of allowable floor loading. Store materials on smooth surfaces only, in an area designated by Consultant.
- .3 Protect this Work and the work of other trades at all times.

1.5 **QUALITY ASSURANCE**

- .1 Manufacturer shall be a company specializing in the products specified in this Section with a minimum five years documented experience.
 - .2 Installer shall specialize in performing Work of this section with a minimum of two years documented experience with projects of similar scope and complexity.
-

- .3 Construct a mock-up with actual materials for review by the Owner. Locate mock-up as acceptable to the Owner and provide temporary foundations and support. If deemed acceptable, the mock-up may form part of the Work.

1.6 **PROJECT CONDITIONS**

- .1 Maintain temperature of rooms and materials within limits acceptable by the manufacturer. Avoid high humidity and cold drafts.

1.7 **MAINTENANCE**

- .1 Extra stock: Leave maintenance tiles in quantity equivalent to 5% (to nearest full carton) of (each) installed tiles for Owner's future use. Label cartons as to contents and indicate areas where tiles were used.

2 Products

2.1 **MATERIALS**

- .1 Engineered Hardwood Flooring (EWF-1): Prefinished engineered narrow plank hardwood flooring, dry sawn hardwood bonded to 9-ply cross grain plantation hardwood:
 - .1 Grade: select and better.
 - .2 Finish: factory finish polyurethane
 - .3 Edging: Tongue and groove, beveled on 4 sides.
 - .4 Thickness: 19 mm
 - .5 Width: 82.5 mm
 - .6 Colour: Mesa - EE13304
 - .7 Acceptable product:
 - .1 "SuperSolid 3" by TORLYS Inc.
 - .2 or accepted equal
- .2 Adhesive: moisture cure type, as recommended by the manufacturer.
- .3 Subfloor Filler: as recommended by manufacturer.

3 Execution

3.1 **PREPARATION**

- .1 Comply with Section 09 60 10 - General Requirements for Floor Finishes. Be responsible for full compliance with such requirements and install flooring to stay in place without failure.
 - .2 Vacuum clean and remove from surfaces to receive Work of this section, oil, grease and other materials deleterious to bond.
 - .3 Fill cracks, crevices and holes in concrete sub-floors. Finish smooth and level. Grind bumps and ridges level.
 - .4 Grout sawcut and control joints to be covered with flooring.
-

3.2 INSPECTION OF SUBSTRATE

- .1 Have the technical representative of the flooring material manufacturer inspect the prepared substrate. Prior to flooring installation, obtain a written confirmation from the flooring material manufacturer that the prepared floor substrate is suitable to receive the floor finish material.

3.3 FLOORING INSTALLATION

- .1 Apply adhesive evenly over floor surfaces. Allow adhesive to become tacky before laying flooring. Conform to manufacturer's installation guidelines.
- .2 Lay flooring with joints straight, in true plane, butted to moderate contact, symmetrical with and parallel to axes of rooms to provide equal size perimeter tile on each side. Distribute variations in shade or pattern to obtain a uniform effect. Abrupt variations will not be acceptable.
- .3 Cut and fit neatly around fixed objects. Fit tightly to electrical and mechanical fittings, piping and equipment. Scribe and fit to abutting surfaces.
- .4 At door openings, where no thresholds occur and where the flooring is not continuous, finish flooring against strike side of door stop.

3.4 FIELD QUALITY CONTROL

- .1 Promptly remove and replace flooring showing bumps from underlying dirt, discolouration, excessive wear, shrinkage or adhesion failure. Remove and replace base showing shrinkage or adhesion failure.

3.5 CLEANING AND PROTECTION

- .1 Comply with flooring manufacturer's recommendations.
- .2 Limit foot traffic on finished wood flooring.
- .3 Protect from damage during construction operations. Promptly repair any damaged surfaces. Remove and replace Work which cannot be satisfactorily repaired.
- .4 Clean products in accordance with the manufacturer's recommendations.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- .1 AODA - Accessibility for Ontarians with Disabilities Act

1.3 **SUBMITTALS**

.1 Samples

- .1 Submit three samples of each type of resilient tile flooring and base, and treads and nosings.

- .2 Identify samples with Project name, job number, date, colour, manufacturer's name and Contractor's name.

.2 Product Data: Submit adhesive Product data confirming specified requirement.

1.4 **DELIVERY, STORAGE AND HANDLING**

- .1 Deliver and store materials undamaged in original wrappings or containers, with manufacturer's labels and seals intact. Store materials in a warm, dry area.

- .2 Prevent damage to materials during handling and storage. Stack material not over two cartons in height, nor in excess of allowable floor loading. Store materials on smooth surfaces only, in an area designated by Consultant.

- .3 Protect this Work and the work of other trades at all times.

1.5 **PROJECT CONDITIONS**

- .1 Maintain temperature of rooms and materials a minimum of 18°C (65°F) forty-eight hours before, during, and after tile installation. Avoid high humidity and cold drafts.

1.6 **MAINTENANCE**

- .1 Extra stock: Leave maintenance tiles in quantity equivalent to 5% to nearest full carton of each installed tiles for Owner's future use. Label cartons as to contents and indicate areas where tiles were used.

2 Products

2.1 **RESILIENT FLOOR TILES**

- .1 Vinyl composition tile (VCT-1): in accordance with ASTM F-1066, Class 2 (Through pattern tile, homogeneous type, asbestos free.

- .1 Size: Minimum 305 mm x 305 mm

- .2 Thickness/wear layer: 2 mm thick
-

- .3 Slip Resistance (ASTM D 2047): ≥ 0.5 SCOF
- .4 Colour: Granit NARWHAL 0453
- .5 Acceptable manufacturer:
 - .1 "iQ Granit" by Tarkett Canada
 - .2 or accepted equal

2.2 **ANTI-FATIGUE FLOORING**

- .1 Anti-Fatigue Flooring (MAT-1): Highly compressed homogeneous vinyl wear layer with a high-performance urethane topcoat, glass fiber interlayer and a calendared CDF backing. To be used to fill in removed flooring under cabinetry, sinks, etc. Flooring shall be flush with the existing flooring when installed.
 - .1 Colour: 13002 Silver Concrete or as later selected by Consultant
 - .2 Acceptable Manufacturer:
 - .1 "Eternal Comfort" by Forbo
 - .2 or accepted equal.

2.3 **RUBBER WALL BASE**

- .1 (RB-1) In accordance with ASTM F1861, rubber wall base, cove type.
 - .1 Size: as indicated on Drawings or match existing
 - .2 Colour and finish: to match existing
 - .3 Acceptable manufacturer: Johnsonite wall base or accepted equal.

2.4 **ACCESSORIES**

- .1 Edge protection and transition strips:
 - .1 (TH-4a): Anodized aluminum profile with textured, sloped exposed surface, tapered leading edge and integrated grout joint spacer. Transition strips shall form a smooth transition where resilient floor abuts another flooring surface.
 - .1 Material and Finish: Satin Anodized Aluminum
 - .2 Height: 12.5 mm
 - .3 Ramp length: 64 mm.
 - .4 Accepted manufacturer: Schluter "RENO-RAMP-K" or accepted equal.
 - .2 Transition for same-height, T-shape profile with 1 mm thick beveled exposed surface and 9 mm tall integrated vertical anchoring leg. To be used in existing floors on both sides of the transition. Example: ceramic tile to VCT, etc.
 - .1 Material and Finish: Stainless Steel or as later selected by Consultant
 - .2 Accepted manufacturer: Schluter "RENO-T" or accepted equal

- .3 (TH-5a): Ball-and-socket hinged profile with sloped exposed surface, tapered leading edge, integrated trapezoid-perforated anchoring leg and integrated grout joint spacer. Transition strips shall form a smooth transition where resilient floor abuts another flooring surface.
 - .4 Material and Finish: Satin Anodized Aluminum
 - .1 Height: as required to coordinate with tile selection and setting system selected.
 - .2 Ramp length: as required.
 - .3 Accepted manufacturer: Schluter "RENO-V" or accepted equal.
 - .2 Sub-floor filler: Non-shrink latex-cement compound to provide cementitious paste, as recommended by flooring manufacturer.
 - .3 Epoxy adhesive and caulking compound: As required for surfaces involved recommended and supplied by rubber tile and tread manufacturer.
 - .4 Adhesive: as recommended by flooring manufacturer.
 - .5 Sawcut and control joint filler: Latex-cement compound.
 - 2.5 **COLOURS AND PATTERNS**
 - .1 Selected by Consultant from manufacturer's standard selection.
 - 3 Execution
 - 3.1 **PREPARATION**
 - .1 Confirm presence of vapour retarder under the floor slab.
 - .2 Comply with Section 09 60 10 - General Requirements for Floor Finishes. Be responsible for full compliance with such requirements and install flooring to stay in place without failure.
 - .3 Vacuum clean and remove from surfaces to receive Work of this section, oil, grease and other materials deleterious to bond.
 - .4 Fill cracks, crevices and holes in concrete sub-floors. Finish smooth and level. Grind bumps and ridges level.
 - .5 Grout sawcut and control joints to be covered with resilient tile flooring.
 - 3.2 **INSPECTION OF SUBSTRATE**
 - .1 Have the technical representative of the flooring material manufacturer inspect the prepared substrate. Prior to flooring installation, obtain a written confirmation from the flooring material manufacturer that the prepared floor substrate is suitable to receive the floor finish material.
 - 3.3 **FLOORING INSTALLATION**
 - .1 Install in accordance with flooring manufacturer.
 - .2 Fill all depression, cracks and other surface irregularities before installation.
-

- .3 All existing resilient flooring and adhesive must be removed prior to installing new flooring.
- .4 Lay tile with joints straight, in true plane, butted to moderate contact, symmetrical with and parallel to axes of rooms to provide equal size perimeter tile on each side. Distribute variations in shade or pattern to obtain a uniform effect. Abrupt variations will not be acceptable. Lay in pattern as directed by Consultant.
- .5 Cut and fit neatly around fixed objects. Fit tightly to electrical and mechanical fittings, piping and equipment. Scribe and fit to abutting surfaces.
- .6 At door openings, where no thresholds occur and where the resilient tile flooring is not continuous, finish resilient tile flooring against strike side of door stop.
- .7 Install metal thresholds with drilled-in stainless steel screws with plastic plugs in concrete sub-floors.
- .8 Install vinyl edge trim with adhesive.

3.4 **BASE INSTALLATION**

- .1 Before installing base, fill cracks and irregularities with a filler recommended by base manufacturer.
 - .1 Install base in longest possible lengths with joints vertical and tight. Accumulated short lengths not permitted.
 - .2 Scribe and fit to abutting surfaces.
 - .3 Bend and apply base continuous on radius corners.
 - .4 Butt joints and keep flush without gaps.

3.5 **FIELD QUALITY CONTROL**

- .1 Promptly remove and replace flooring showing bumps from underlying dirt, discolouration, excessive wear, shrinkage or adhesion failure. Remove and replace base showing shrinkage or adhesion failure.

3.6 **CLEANING AND WAXING**

- .1 Comply with flooring manufacturer's recommendations.
- .2 Remove adhesive and other blemishes from exposed surfaces as work progresses. Clean surfaces with a mild soap solution.
- .3 Clean rubber tile and treads with a mild soap solution. Rinse immediately after mopping, with clean, warm water. Do not use compounds containing oil.

End of Section

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- 1 General
 - 1.1 **SUMMARY**
 - .1 Section Includes
 - .1 Labour, Products, equipment and services necessary to complete the Work of this section.
 - 1.2 **SUBMITTAL**
 - .1 Samples
 - .1 Submit on 150 mm x 150 mm samples of flooring showing colour and finish.
 - .2 Samples shall be identified with Project name, date of submission, colour, manufacturer's name and Subcontractor's name. Include documentation to confirm that samples match existing.
 - .2 Shop Drawings
 - .1 Submit in accordance with Section 01 33 00.
 - .2 Shop Drawings shall be furnished showing installation of cove base and termination detail, and details at floor material transitions and abutting adjoining equipment.
 - 1.3 **REFERENCES**
 - .1 ASTM D2047, Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine
 - .2 ASTM C150/C150M, Standard Specification for Portland Cement
 - 1.4 **STORAGE AND PROTECTION**
 - .1 Protect this Work and the work of other trades from damage at all times.
 - .2 Materials shall be delivered in original containers and shall bear brand and manufacturer's name. Store materials in a dry, warm area of the building, in a manner to prevent damage thereto.
 - 1.5 **EXAMINATION**
 - .1 Ensure that sub-surface is sound, hard, cured, non-dusting, smooth, at correct elevation and slope, clean and free of holes, dirt, soap, grease, oil, curing compounds or other matter which may prevent adhesion. Notify the Consultant in writing of any condition which will preclude the proper execution of this Work. Commencement of Work implies acceptance of existing conditions.
 - 1.6 **QUALITY ASSURANCE**
 - .1 Perform Work of this Section by a company that is in good standing with TTMAC Terrazzo Specification Guide, Specification and Details and has a minimum of 5 years proven experience on installations of similar complexity and scope.
 - 2 Products
 - 2.1 **MATERIALS**
-

- .1 Cementitious Terrazzo Flooring: "Camo-03 Terrazzo" by Marble Trend or accepted equal, colours to match existing conditions. Contractor to submit samples of existing and proposed terrazzo to Consultant for approval.
 - .1 Composition: high concentration of stony materials (marble, granite, quartz, siliceous stone etc.) bonded together with white cement and water.
 - .2 Slip Resistance must meet a static coefficient of friction of 0.5 or greater is required, when tested in accordance with ASTM D2047.
- .2 Dividing strips:
 - .1 Standard Divider Strips: One-piece, flat-type strips for grouting into sawed joints prepared in substrate
 - .2 Match divider-strip width, material, and color unless otherwise indicated.
- .3 Sawcut joint surfacing: Compatible with finished flooring, as recommended by terrazzo manufacturer.
- .4 Strip Adhesive: as recommended by manufacturer and as required for secure attachment to substrate.
- .5 Sealer: UL-listed, colourless, slip and stain-resistant penetrating sealer compatible with finished flooring, as recommended by terrazzo manufacturer.
- .6 Terrazzo crack filler: Two-component, quick dry, semi-rigid epoxy. Colour to match terrazzo.

3 Execution

3.1 **SURFACE PREPARATION**

- .1 Refer to Contract Drawings for locations and details.
 - .2 Comply with requirements of Section 09 60 10 - General Requirements for Floor Finishes. Comply with requirements and install flooring to stay in place without failure.
 - .3 Mask all adjacent surfaces which could become marred or otherwise damaged.
 - .4 Concrete repairs: Repair deficiencies that have shown up in concrete surfaces after surface preparation has been completed. Remove any protruding steel reinforcing fibres which may interfere with or show through finished epoxy floor.
 - .5 At door openings provide sawcut across such openings. Remove concrete on surfacing side of sawcut by grinding, to provide smooth transition to adjacent floor elevation and provide full surfacing thickness through transition.
 - .6 Where floor drains or other works penetrate through concrete sub-floor, carefully grind or chip out concrete around perimeter of such objects approximately 50 mm and sloping towards same objects to a depth of 13 mm. Overall slope established in sub-floor by concrete trade for drainage shall remain.
 - .7 Prior to applying surfacing, mark locations of sawcut control joints required by system manufacturer. Apply surfacing then recut for sawcut control joints. Fill with grout or caulking flush with surface as shown on drawings and as recommended by manufacturer.
-

- .8 Patching: Patch cracks, holes, joints and rough areas epoxy patching materials. Patching material shall consist of 100% solids epoxy mixed with a fumed silica to a paste consistency. Place patching materials as required using hand trowels or putty knives as recommended by manufacturer.

3.2 **REMOVAL OF EXISTING TERRAZZO**

- .1 Remove existing terrazzo where indicated. Use equipment with self-contained dust and debris collector. Remove material to base slab.
- .2 Use equipment and removal methods that do not damage existing flooring or other finishes and elements that are to remain. Do not damage or vibrate divider strips indicated to remain.

3.3 **INSTALLATION**

- .1 General
 - .1 Install in accordance with manufacturer's instructions.
 - .2 Locate all flexible joints required. Provide accessories necessary for complete installation.
- .2 Unless otherwise indicated or specified, install cement terrazzo systems in accordance with recommendations of TTMAC Terrazzo Specification Guide, Specification and Details.
- .3 Set dividing strips with continuous ribbon of epoxy primer, along bases and at maximum 600 mm o.c. both ways to create a grid floor pattern.
- .4 Grind flooring to a smooth finish and vacuum surface. When dry, grout noticeable voids with epoxy binder, allow to dry, and regrind. Wash and vacuum surface and when dry,
- .5 Before terrazzo hardens, spread chips uniformly over floor surface.
- .6 Provide 100 mm high epoxy terrazzo cove base.
- .7 Cover Work temporarily with building paper properly lapped and taped at joints or other suitable protection until the Work is accepted by the Consultant. Remove and dispose of temporary protection before time of final acceptance of the Work.
- .8 Where finished floor surface is subject to heavy construction traffic, adequately protect it with temporary wood planks or plywood covering. Such protective covering shall remain until removal is approved by the Consultant. Reroute traffic to avoid damage to finished flooring.

3.4 **SEALING**

- .1 As soon as possible after final cleaning, apply three coats of terrazzo sealer in accordance with manufacturer's recommendations, including surface preparation and installation methods.

3.5 **TERRAZZO CRACK REPAIR**

- .1 Repair cracks at direction of Owner and Consultant in accordance with Contract Documents.
 - .2 Do repair Work after terrazzo has been cleaned but prior to sealer application.
-

- .3 Rout cracks with power tool and bring to profile that is suitable to receive filler. Grind edges to eliminate burrs. Remove dust and debris with vacuum cleaner. Do second pass to render cavities clean and debris-free.
- .4 Apply epoxy crack filler full depth of cracks. Finish with top flush to surface of floor. Comply with filler material manufacturer's recommendations.
- .5 Protect finished Work with 13 mm thick plywood with beveled edges securely laid in place, suitable for heavy foot traffic without displacement.

3.6 **REFINISHING EXISTING TERRAZZO**

- .1 Strip off applied finishes such as wax or similar coatings. Wet-vacuum floor, to remove dirt and other residue, using industrial wet-vacuum machine with self-contained tank. Grind floor to unfinished sheen of existing, thoroughly rinse and let dry.
- .2 Roller-apply coat of sealer at rate recommended by sealer manufacturer. Let dry, then buff for smooth, polished appearance.

3.7 **TESTING**

- .1 The Consultant may require tests to be made on various surfaces to determine compliance with specified properties and thickness. Pay all costs for such inspection as part of the cost of the Work.
- .2 At the completion of this Work submit test report to the Consultant certifying that conductive floors conform to CSA and NFPA requirements as specified.

3.8 **CLEANING-UP**

- .1 Daily as the Work proceeds and on completion remove all rubbish and surplus materials from the Owner's property. Immediately prior to final acceptance of this Work by the Consultant, thoroughly wet sponge mop and clean-up and leave floors in a clean condition free of debris.

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- .1 AODA, Accessibility for Ontarians with Disabilities Act

1.3 **SUBMITTALS**

.1 Submit in accordance with Section 01 33 00.

.2 Product data: Submit manufacturer's Product data and confirmation of compliance to requirements specified herein.

.3 Samples

- .1 Submit two 300 mm x 300 mm sample plates of flooring system applied on smooth cement board.

- .2 Identify samples with Project name, date of submission, colour, manufacturer's name and Subcontractor's name.

1.4 **DELIVERY, STORAGE AND PROTECTION**

.1 Deliver materials to Site in manufacturer's sealed, labelled containers in sequence to meet building schedule. Carefully unload material and deliver clean and undamaged.

.2 Remove defective or damaged materials from the site and replace at no additional cost to Owner.

.3 Avoid damage to this Work by other trades during application and curing period, as Work proceeds and on completion of each area, install barricades and provide signage at all entrances. Barricades shall remain in place during the curing process.

.4 Store containers of components and other volatile materials in well ventilated places where they will not be exposed to excessive heat or direct sun rays. Keep tightly closed when not in actual use. Remove used cloths from building at the end of every working shift and when not in use, take precautions against spontaneous combustion by drenching with water or placing in air-tight covered metal containers in a cool place.

.5 Be responsible for prevention of fire or explosion caused by improper storage of materials, rags, emptied containers, etc. Vapours may be heavier than air and travel along floor and be ignited at locations distant from handling site and flash back. Post "No Smoking" signs in areas of storage and mixing and strictly enforce this requirement. Provide and maintain CO₂ or appropriate fire extinguishers of minimum 9 kg capacity. Repair damage to storage area or surrounding area at no cost to Owner.

.6 Place covers over adjacent work before surface preparation and coating commence and keep in place until Work is complete.

- .7 Provide continuous ventilation and exhausting to exterior to convey fumes and vapours from Work area during coating application.
- .8 Read and be familiar with manufacturer's literature and MSD Sheets and comply with precautions, handling procedures and equipment requirements.
- .9 Use protective clothing and equipment as necessary to protect applicators during preparation and application.
- .10 Remove and dispose of waste material in accordance with federal, provincial and local safety codes.

1.5 **QUALIFICATION OF APPLICATOR**

- .1 This Work shall be done only by a Subcontractor trained, licensed and approved by the material manufacturer, or by tradesmen in direct employ of material manufacturer.

1.6 **WARRANTY**

- .1 Warrant Work of this section against defects and deficiencies for a period of five years from date Work is certified as substantially performed in accordance with the general conditions of the Contract.
- .2 Promptly make good defects and deficiencies which become apparent within the Warranty Period by replacing defective Work satisfactory to the Consultant and at no expense to the Owner.
- .3 Defects shall include but not limited to flooring showing loss of bond, cracking, deterioration or wear.

2 **Products**

2.1 **MATERIALS**

- .1 Flooring (EFC-1): 100% solids colour low VOC, low odour, high-gloss resin rich broadcast and sealed texture epoxy floor coating with non-slip texture. Products are as follows:
 - .1 Sika Canada "Sikafloor Morritex Broadcast System", with a Sikafloor 261 finish coat.
 - .2 Stonhard "Stonclad GS" with "Stonkote GS4 with slip resistant texture #2".
- .2 Colour: RAL 7030 Stone Grey
- .3 Thickness: 2 - 3 mm
- .4 Primer, underlayment and grout: Epoxy, as recommended by floor finish manufacturer.
- .5 Sawcut/expansion joint filler: As recommended by manufacturer of epoxy used, colour to match epoxy floor.

3 **Execution**

3.1 **SURFACE PREPARATION**

- .1 Confirm presence of vapour retarder under the floor slab.
- .2 Comply with Section 09 60 10 - General Requirements for Floor Finishes. Be responsible for full compliance with such requirements and install flooring to stay in place without failure.
- .3 Mask all adjacent surfaces which could become marred or otherwise damaged.
- .4 Refer to the manufacturer's data sheet for preparing the surface for the specified system in Part 2.
- .5 Equip dry blasting equipment with a self contained vacuum to eliminate airborne dusting. Use portable blast cleaning equipment of a type similar to a wheelabrator "Blastrac" system.
- .6 Complete removal of dust and debris as soon as blast cleaning is completed by vacuum cleaning and magnetically brooming.
- .7 Concrete repairs: Repair deficiencies that have shown up in concrete surfaces after surface preparation has been completed. Remove any protruding steel reinforcing fibres which may interfere with or show through finished epoxy floor.
- .8 At door openings provide sawcut across such openings. Remove concrete on surfacing side of sawcut by grinding, to provide smooth transition to adjacent floor elevation and provide full surfacing thickness through transition.
- .9 Where floor drains or other works penetrate through concrete sub-floor, carefully grind or chip out concrete around perimeter of such objects approximately 50 mm and sloping towards same objects to a depth of 13 mm. Overall slope established in sub-floor by concrete trade for drainage shall remain.
- .10 Prepare existing control joints per flooring manufacturer's directions. Prior to applying surfacing, mark locations of sawcut control joints required by system manufacturer. Apply surfacing then recut for sawcut control joints. Fill with sealant flush with surface.
- .11 Patching: Patch cracks, holes, joints and rough areas with epoxy grout. Level eroded areas with epoxy underlayment mix.

3.2 **MIXING**

- .1 Mix and prepare materials in compliance with manufacturer's standards for the particular material to be applied.
- .2 Clean containers used for storage, mixing and application of materials free of foreign materials and residue.

3.3 **PRIMER APPLICATION**

- .1 After preparation of concrete, mix and spread primer in accordance with manufacturer's instructions. Ensure areas show a continuous film of primer. Recoat sections of concrete which show complete absorption due to porosity.

3.4 **APPLICATION**

- .1 Prior to installation of flooring system, verify moisture content by non-destructive method.
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- .2 Apply flooring to specified thicknesses. Span wall to wall. Apply to a uniform thickness, and free from surface holes, depressions, roller marks, and ridges. At floor drain, place epoxy flooring flush to top of drain and in chase provided, maintaining full surface thickness.
- .3 Install base 100 mm in height, 1.5 mm thick. Cove internal corners; bullnose external corners to a minimum radius recommended by manufacturer, with the exception of the following.
- .4 Extend epoxy floor coating up and on top of building perimeter curbs and up and on top of floor opening curbs.
- .5 Apply top coat and finish coats as recommended by the manufacturer.
- .6 Provide aluminum divider strips as required where epoxy flooring butts to a flooring of different material. Install strips with adhesive recommended by divider strip manufacturer.
- .7 Overall finishes shall be non-slip but suitable for easy and thorough cleaning.

3.5 **SURFACE PROTECTION**

- .1 Protect Work of other trades in progress or completed against contamination and make good at own expense any such damage. Provide adequate covering by drop cloths, masking or tarpaulins to adjacent surfaces which are to be left as is or which are to receive a different flooring system.

End of Section

1 General

1.1 **SECTION INCLUDES**

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.
 - .2 Work of this section includes but is not necessarily limited to, the following:
 - .1 Exterior Painting
 - .1 Heat and smoke vents
 - .2 Fresh air and exhaust air hoods on roof
 - .3 Hollow metal doors, transom panels and frames
 - .4 Steel stairs, handrails, supports, ladders and cage
 - .5 Pipe bumpers
 - .6 Guard posts
 - .7 Steel window sash, sub-frames, mountings, rod bars
 - .8 Sprayed masonry coating
 - .9 Concrete block walls
 - .10 Non-galvanized exposed steel
 - .2 Interior Painting
 - .1 Exposed building surfaces as indicated on Room Finish Schedule(s)
 - .2 Overhead door frames, tracks, brackets, fenders and supplementary steel supports
 - .3 Hollow metal doors, frames and transom panels
 - .4 Fire doors and frames
 - .5 Borrowed light frames
 - .6 Glazed screen frames, mullions and closures
 - .7 Exposed steel items for the work of all trades
 - .8 Steel stairs, landings and railings
 - .9 Pipe bumpers
 - .10 Access panels and doors
 - .11 Screens
 - .12 Steel supports for wood benches
 - .13 Wood fitments unless plastic laminated as noted
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- .14 Natural gas piping
 - .15 Finish painting of prime painted diffusers, registers and grilles
 - .16 Conduit, piping, ductwork, lighting panels, etc. exposed to view in areas listed on the Room Finish Schedule
- .3 Examine the Project Manual and Drawings for the Work of other Sections regarding the provisions for primer and finish coats. Paint or finish materials installed throughout the project which are required to be painted and which are left unfinished or unpainted by other Sections. The only exception to this requirement is where the Drawings, Project Manual or schedules explicitly state that a surface is not to be finish painted.
- .4 The following surfaces are not to be painted:
 - .1 Exterior concrete surfaces
 - .2 Concealed ceiling spaces and walls above gypsum wallboard ceilings and acoustic tile ceilings
 - .3 Surfaces scheduled as having "No Finish" in room finish schedules
 - .4 Exposed concrete floors
 - .5 Plywood backing panels in electrical, telephone and communication equipment rooms
 - .6 Stainless steel piping

1.2

REFERENCES

- .1 Department of Justice Canada
 - .1 Canadian Environmental Protection Act (CEPA).
 - .2 Environmental Protection Agency (EPA)
 - .1 EPA Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24, (for Surface Coatings).
 - .3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
 - .4 Master Painters Institute (MPI)
 - .1 MPI Architectural Painting Specifications Manual.
 - .5 National Fire Code of Canada
 - .6 Society for Protective Coatings (SSPC)
 - .1 SSPC Painting Manual, Volume Two, 8th Edition, Systems and Specifications Manual.
 - .7 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act (TDGA).
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- .8 Accessibility for Ontarians with Disabilities Act (AODA), latest edition

1.3 **QUALITY ASSURANCE**

.1 Qualifications

- .1 Contractor: Minimum of five years proven satisfactory experience. Provide list of last three comparable jobs including, job name and location, specifying authority, and project manager.
- .2 Journeymen: Qualified journeymen who have "Tradesman Qualification Certificate of Proficiency" engaged in painting work.
- .3 Apprentices: Working under direct supervision of qualified tradesperson in accordance with trade regulations.
- .2 Conform to the standards contained in the Master Painters Institute Architectural Painting Specification Manual, latest edition (hereafter referred to a MPI Painting Specification) for all painting procedures including preparation and application of materials. MPI Painting Specification Manual as issued by the local MPI Accredited Quality Assurance Association having jurisdiction.
- .3 All paint manufacturers and Products used shall be as listed under the "Approved Products" section of the MPI Architectural Painting Specification Manual.
- .4 All painting and decorating Work shall be inspected by a paint inspection agency (inspector) acceptable to the specifying authority and the local MPI Accredited Quality Assurance Association. The painting contractors shall notify the paint inspection agency a minimum of one week prior to commencement of Work and provide a copy of the Project painting Specification, plans and elevation drawings (including pertinent details) as well as a finish schedule.
- .5 All surfaces requiring painting shall be inspected by the paint inspection agency who shall notify the Consultant and Contractor in writing of any defects or problems prior to commencing painting Work or after the prime coat shows defects in the substrate.

1.4 **SUBMITTALS**

.1 Product Data

- .1 Submit Product data and instructions for each paint and coating Product to be used.
- .2 Submit Product data for the use and application of paint thinner.
- .3 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS). Indicate VOCs during application and curing.
- .2 Samples
- .1 Submit 200 x 300 mm draw-downs of each colour indicated on the Finish Schedule prior to commencement of painting.
- .1 Colours shall match those specified in the Finish Schedules as indicated Drawings and in this section.
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- .2 Submit sample panels/draw-downs of each paint and stain with clear coating with specified paint or coating in colours, gloss/sheen and textures required to MPI Architectural Painting Specification Manual standards submitted on following substrate materials:
 - .1 3 mm plate steel for finishes over metal surfaces.
 - .2 13 mm maple plywood for finishes over wood surfaces.
 - .3 50 mm concrete block for finishes over concrete or concrete masonry surfaces.
 - .4 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.
 - .3 Where colour availability is restricted, submit full range colour sample chips for Consultant selection.
 - .4 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.
 - .3 MPI Inspection
 - .1 Submit consent of surety with Bid submission as proof of ability to supply a 100% two year maintenance bond, if an MPI Accredited Assurance Association's guarantee option is not used.
 - .2 Submit list of all painting materials to the Consultant and the paint inspection agency for review prior to ordering materials.
 - .3 When requested, submit invoice list of all paint materials ordered for Project Work to paint inspection agency indicating manufacturer, types and quantities for verification and compliance with Specification and design requirements.
 - .4 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .5 Manufacturer's Instructions
 - .1 Submit manufacturer's installation and application instructions.
 - .6 Closeout submittals: Submit maintenance data for incorporation into maintenance manual. Include following:
 - .1 Product name, type and use.
 - .2 Itemized list complete with manufacturer, Product number, paint type and colour coding for all colours used for Owner's later use in maintenance.
 - .3 MPI Environmentally Friendly classification system rating.
 - 1.5 **DELIVERY, STORAGE AND HANDLING**
 - .1 Packing, Shipping, Handling and Unloading
 - .1 Pack, ship, handle and unload materials to jobsite with containers and labels intact.
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- .2 Acceptance at Site
 - .1 Identify Products and materials with labels indicating:
 - .1 Manufacturer's name and address.
 - .2 Type of paint or coating.
 - .3 Compliance with applicable standard.
 - .4 Colour number in accordance with established colour schedule.
 - .3 Remove damaged, opened and rejected materials from site.
 - .4 Storage and Protection
 - .1 Provide and maintain dry, temperature controlled, secure storage.
 - .2 Store materials and supplies away from heat generating devices.
 - .3 Store materials and equipment in well ventilated area with temperature range 7°C to 30°C.
 - .5 Store temperature sensitive Products above minimum temperature as recommended by manufacturer.
 - .6 Keep areas used for storage, cleaning and preparation clean and orderly. After completion of operations, return areas to clean condition.
 - .7 Remove paint materials from storage only in quantities required for same day use.
 - .8 Fire Safety Requirements
 - .1 Provide one 9 kg fire extinguisher adjacent to storage area.
 - .2 Store oily rags, waste Products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
 - .3 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.
 - .9 Waste Management and Disposal
 - .1 Separate waste materials for reuse and recycling.
 - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan (WMP).
 - .4 Separate for reuse and recycling and place in designated containers; steel, metal and plastic waste in accordance with WMP.
 - .5 Place materials defined as hazardous or toxic in designated containers.
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- .6 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, regional and municipal regulations.
- .7 Ensure emptied containers are sealed and stored safely.
- .8 Unused paint and coating materials must be disposed of at legal hazardous material collections site.
- .9 Paint, stain and wood preservative finishes and related materials (thinners, and solvents) are regarded as hazardous Products and are subject to regulations for disposal. Information on these controls can be obtained from provincial Ministries of Environment and regional levels of government.
- .10 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.
- .11 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.
- .12 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into ground follow these procedures:
 - .1 Retain cleaning water for water-based materials to allow sediments to be filtered out.
 - .2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
 - .3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
 - .4 Dispose of contaminants in approved legal manner in accordance with hazardous waste regulations.
 - .5 Empty paint cans are to be dry prior to disposal or recycling (where available).
- .13 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.

1.6

SITE CONDITIONS

- .1 Heating, Ventilation and Lighting
 - .1 Provide heating facilities to maintain ambient air and substrate temperatures above 10°C (50°F) for twenty-four hours before, during and after paint application until paint has cured sufficiently.
 - .2 Provide continuous ventilation for seven days after completion of application of paint.
 - .3 Coordinate use of existing ventilation system with Consultant and ensure its operation during and after application of paint as required.
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- .4 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.
 - .5 Provide minimum lighting level of 323 lux on surfaces to be painted.
 - .2 Temperature, Humidity and Substrate Moisture Content Levels
 - .1 Unless pre-approved written approval by Product manufacturer, do not perform painting when:
 - .1 Ambient air and substrate temperatures are below 10°C (50°F).
 - .2 Substrate temperature is above 32°C (90°F) unless paint is specifically formulated for application at high temperatures.
 - .3 Substrate and ambient air temperatures are not expected to fall within MPI or paint manufacturer's prescribed limits.
 - .4 The relative humidity is under 85% or when the dew point is more than 3°C (38°F) variance between the air/surface temperature. Paint should not be applied if the dew point is less than 3°C (38°F) below the ambient or surface temperature. Use sling psychrometer to establish the relative humidity before beginning paint Work.
 - .5 Rain or snow is forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.
 - .6 Ensure that conditions are within specified limits during drying or curing process, until newly applied coating can itself withstand "normal" adverse environmental factors.
 - .2 Perform painting Work when maximum moisture content of the substrate is below:
 - .1 Allow new concrete and masonry to cure minimum of twenty-eight days.
 - .2 15% for wood.
 - .3 12% for gypsum board.
 - .3 Test for moisture using calibrated electronic moisture meter. Test concrete floors for moisture using "cover patch test".
 - .4 Test concrete, masonry and plaster surfaces for alkalinity as required.
 - .3 Surface and Environmental Conditions
 - .1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
 - .2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.
 - .3 Apply paint when previous coat of paint is dry or adequately cured.
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1.7 **GUARANTEE**

- .1 Furnish either the local MPI Accredited Assurance Association's two year guarantee, or, alternatively, a 100% two year maintenance bond - both in accordance with MPI Architectural Painting Specification Manual requirements. The maintenance bond shall warrant that all painting Work has been performed in accordance with MPI Architectural Painting Specification Manual requirements.
- .2 All painting and decorating Work shall be in accordance with MPI Architectural Painting Specification Manual requirements and shall be inspected by the local MPI Accredited Quality Assurance Association's Paint Inspection Agency (Inspector), whether using either the MPI Accredited Quality Assurance Association's guarantee, or the maintenance bond option. The cost for such inspections, and for either the local MPI Accredited Quality Assurance Association's Guarantee, or the maintenance bond, shall be included in the Base Bid Price.
- .3 Painting and decorating Subcontractors choosing the maintenance bond option shall provide a maintenance bond consent from a reputable surety company licensed to do business in Canada. Cash or certified cheque are not acceptable in lieu of surety consent.

1.8 **EXTRA STOCK MATERIALS**

- .1 Two drawdowns and one 4L can with complete Product code, formula, date used, clearly marked for each paint product, in each finish and colour of paint, used in the Work for use in maintenance.

2 Products

2.1 **MATERIALS**

- .1 Paint materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.): As listed in the MPI Approved Products List (APL) are acceptable for use on this Project.
 - .1 Painting shall be premium grade.
 - .2 Provide paint materials for paint systems from one manufacturer.
 - .2 Only qualified Products with E2 or E3 "Environmentally Friendly" rating are acceptable for use on this Project.
 - .3 Conform to latest MPI requirements for exterior and interior painting Work including preparation and priming.
 - .4 Shellac and turpentine: Highest quality Product from approved manufacturer listed in MPI Architectural Painting Specification Manual, compatible with other coating materials as required.
 - .5 Provide paint Products meeting MPI "Environmentally Friendly" ratings based on VOC (EPA Method 24) content levels.
 - .6 Use MPI listed materials having minimum E2 or E3 rating where indoor air quality (odour) requirements exist.
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- .7 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids:
 - .1 Water-based for concrete, concrete block and gypsum board
 - .2 Manufactured without compounds which contribute to ozone depletion in the upper atmosphere.
 - .3 Manufactured without compounds which contribute to smog in the lower atmosphere.
- .8 Formulate and manufacture water-borne surface coatings with no aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.
- .9 All materials and paints shall be lead and mercury free and shall have low VOC content where possible.
- .10 All paint materials shall have good flowing and brushing properties and shall dry or cure free of blemishes or sags.
- .11 Where required, paints and coatings shall meet flame spread and smoke developed ratings designated by local code requirements and/or authorities having jurisdiction.

2.2 **COLOUR SCHEDULE**

- .1 General: Colours for some elements to be painted are based on certain Product brands as indicated on the Drawings. Other Products may be used on the condition that colours selected by the Consultant must be matched at no extra cost even if it requires custom matching. Refer to Finish Schedule for identification and location of colors.
- .2 PT1:
 - .1 Location: Walls & Baseboards at 1859 Kingston Rd.
 - .1 Colour: Chantilly Lace OC-65 (2121-70)
 - .2 Sheen (or Gloss): Eggshell
 - .3 Light Reflectance Value (LRV): 90.04
 - .4 Manufacturer: Off White Colours Collection by Benjamin Moore
 - .2 Colour: Snowbound SW 7004
 - .1 Sheen (or Gloss): Eggshell
 - .2 Light Reflectance Value (LRV): 83
 - .3 Manufacturer: Sherwin Williams
- .3 PT2:
 - .1 Location: Ceilings at 1859 Kingston Rd.
 - .1 Colour: Chantilly Lace OC-65 (2121-70)
 - .2 Sheen (or Gloss): Flat
 - .3 Light Reflectance Value (LRV): 90.04

- .4 Manufacturer: Off White Colours Collection by Benjamin Moore
- .2 Location: Ceilings
 - .1 Colour: Pure White OC-64 (870)
 - .2 Sheen (or Gloss): Flat
 - .3 Light Reflectance Value (LRV): 78.94
 - .4 Manufacturer: Off White Colours Collection by Benjamin Moore
- .4 PT-3:
 - .1 Match existing. Contractor to provide sample cards to Consultant for selection.
 - .2 Door & Window Trims at 1859 Kingston Rd.
 - .1 Colour: Silent Night - 1613
 - .2 Sheen (or Gloss): Eggshell
 - .3 Light Reflectance Value (LRV): 45.38
 - .4 Manufacturer: Benjamin Moore Classics® Collection by Benjamin Moore
- .5 PT-4:
 - .1 Colour: Ebony Slate 2118-30
 - .2 Sheen (or Gloss): Eggshell
 - .3 Light Reflectance Value (LRV): 9.09
 - .4 Manufacturer: Colour Preview® Collection by Benjamin Moore
- .6 PT-5:
 - .1 Location: Stair guard and handrail at 1904 Queen St. E
 - .2 Colour: Black Beauty 2128-10
 - .3 Sheen (or Gloss): Flat
 - .4 Light Reflectance Value (LRV): 5.32
 - .5 Manufacturer: Colour Preview® Collection by Benjamin Moore
- .7 PT-6:
 - .1 Location: Stair handrails at 1313 Woodbine Ave
 - .2 Colour: Pashmina AF-100
 - .3 Light Reflectance Value (LRV): 44.2
 - .4 Manufacturer: Affinity® Colour Collection by Benjamin Moore

2.3 PAINT MIXES

- .1 Perform colour tinting operations prior to delivery of paint to site.

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

2.4 **GLOSS/SHEEN RATINGS**

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

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

2.5 **PAINTING AND FINISHING SCHEDULE - EXTERIOR SUBSTRATES**

- .1 Concrete, Concrete Block
 - .1 EXT 3.1A - Latex gloss finish
- .2 Structural Steel and Metal Fabrications: Exposed steel, pipe bollards
 - .1 EXT 5.1D - Alkyd semi-gloss finish.
- .3 Galvanized metal (not chrome passivated): Exterior miscellaneous metal, hollow metal doors and pressed steel frames, rooftop ducts, vents, and piping, as indicated and as specified.
 - .1 EXT. 5.3B - Alkyd semi-gloss finish
 - .2 For hot-dip galvanized surfaces, apply polyamine epoxy tie-coat in lieu of cementitious primer and apply alkyd topcoat.
- .4 Natural Gas Piping
 - .1 Paint surface of exterior natural gas piping
 - .2 EXT 5.1D - Alkyd, semi-gloss finish, yellow colour

2.6 **PAINTING AND FINISHING - INTERIOR SUBSTRATES**

- .1 Concrete Vertical Surfaces
 - .1 INT 3.1C - Latex, semi-gloss finish.
- .2 Concrete masonry units: Concrete block:

- .1 INT 4.2D - High performance architectural latex, semi-gloss finish.
 - .3 Structural steel and metal fabrications: Exposed structural and miscellaneous metals
 - .1 INT 5.1C-DD - dry fall, water based acrylic, semi-gloss finish.
 - .4 Galvanized metal (not chrome passivated): Doors, frames, ferrous metal pickets/railings, miscellaneous steel, pipes, exposed decking underside, and ducts
 - .1 INT 5.3K - water based acrylic, semi-gloss finish (over water based primer).
 - .2 For hot-dip galvanized surfaces, apply polyamine epoxy tie-coat in lieu of cementitious primer and apply alkyd topcoat.
 - .5 Galvanized metal (not chrome passivated): Exposed decking underside, and ducts
 - .1 INT 5.3H- dry fall, water based acrylic, flat finish.
 - .6 Gypsum board: Gypsum wallboard:
 - .1 INT 9.2B - High performance architectural latex
 - .1 Ceilings: flat; 1 coat primer and 2 coats flat latex
 - .2 Walls: semi-gloss; 1 coat of primer and 2 coats semi-gloss latex paint
 - .7 Canvas and Cotton Coverings
 - .1 INT 10.1A - Latex, flat finish.
 - .8 Interior of all Pipe Spaces and Ducts Visible Through Grilles, and all Surfaces Visible Through Louvres Occurring in Ceilings
 - .1 INT 10.1A - Latex, flat finish, black colour unless indicated otherwise.

Note: Prepare surfaces as required by applying proper primers on the surface to which paint is applied. For surfaces above ceilings, paint surfaces after all services have been installed and prior to ceiling installation.
 - .9 Piping and Conduit (except gas piping)
 - .1 INT 5.1C-G5 - dry fall, water based acrylic, semi-gloss finish.
 - .10 Natural Gas Piping
 - .1 INT 5.1C-G5 - INT 5.1C-G5 - dry fall, water based acrylic, semi-gloss finish, yellow colour
 - .11 Fire Protection Piping
 - .1 INT 5.1C-G5 - dry fall, water based acrylic, semi-gloss finish, red colour.
 - 3 Execution
 - 3.1 **MANUFACTURER'S INSTRUCTIONS**
 - .1 Compliance: Comply with manufacturer's written recommendations or specifications, including Product technical bulletins, handling, storage and installation instructions, and data sheet.
-

3.2 **GENERAL**

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

3.3 **EXAMINATION**

- .1 Examine substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Consultant damages, defects, and unsatisfactory or unfavourable conditions before proceeding with Work.
- .2 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test". Do not proceed with Work until conditions fall within acceptable range as recommended by manufacturer.

3.4 **PREPARATION**

- .1 Protection
 - .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces as directed Consultant
 - .2 Protect items that are permanently attached such as fire labels on doors and frames.
 - .3 Protect factory finished Products and equipment.
 - .2 Surface Preparation
 - .1 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.
 - .2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
 - .3 Place "WET PAINT" signs in occupied areas as painting operations progress. Signs to approval of Consultant.
 - .3 Clean and prepare surfaces in accordance with MPI Architectural Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:
 - .1 Remove dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths or compressed air, as appropriate for the given condition.
 - .2 Wash surfaces with a biodegradable detergent and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
 - .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
-

- .4 Allow surfaces to drain completely and allow to dry thoroughly.
- .5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.
- .6 Use trigger operated spray nozzles for water hoses.
- .7 Many water-based paints cannot be removed with water once dried. Minimize use of mineral spirits or organic solvents to clean up water-based paints.
- .4 Previously Painted Surfaces: Prepare existing surfaces to be repainted in accordance with paint manufacturer's recommendations.
 - .1 Clean as required to remove oil, grease, loose paint, mill scale, dirt, foreign matter, rust, mould, mildew, mortar efflorescence and sealers which may impair proper bond of the new finish.
 - .2 Peeled, chipped, scratched or otherwise damaged surfaces to be filled, made good and sanded, to provide perfectly smooth and even surface, with surface texture matching surrounding areas.
 - .3 Check for compatibility by applying a test patch of the recommended paint system, covering at least 1 m². Allow to dry for 1 week before testing adhesion in accordance with ASTM D3359. If the new paint system is incompatible, complete removal of the existing paint system is required.
 - .4 Treat new areas as described for preparation of new Work.
- .5 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.
- .6 Where possible, prime non-exposed surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.
 - .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.
- .7 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1 m.
- .8 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast Products from surfaces, pockets and corners to be painted by brushing with clean brushes or other suitable means.
- .9 Touch up of shop primers with primer as specified.

3.5 **APPLICATION**

- .1 Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and Roller Application

- .1 Apply paint in uniform layer using brush and/or roller type suitable for application.
- .2 Work paint into cracks, crevices and corners.
- .3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
- .4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces free of roller tracking and heavy stipple.
- .5 Remove runs, sags and brush marks from finished work and repaint.

.3 Spray Application

- .1 Provide and maintain equipment that is suitable for intended purpose, capable of atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.
 - .2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.
 - .3 Apply paint in uniform layer, with overlapping at edges of spray pattern. Back roll first coat application.
 - .4 Brush out immediately all runs and sags.
 - .5 Use brushes and rollers to work paint into cracks, crevices and places which are not adequately painted by spray.
- .4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access.
- .5 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
- .6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
- .7 Sand and dust between coats to remove visible defects.
- .8 Finish closets and alcoves as specified for adjoining rooms.
- .9 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.6 **MECHANICAL/ELECTRICAL EQUIPMENT**

- .1 Paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as indicated.
 - .2 Boiler room, mechanical and electrical rooms: Paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.
 - .3 Other unfinished areas: Leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.
-

- .4 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.
- .5 Do not paint over nameplates.
- .6 Keep sprinkler heads free of paint.
- .7 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.
- .8 Paint fire protection piping red.
- .9 Paint disconnect switches for fire alarm system and exit light systems in red enamel.
- .10 Paint natural gas piping yellow.
- .11 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.
- .12 Do not paint interior transformers and substation equipment.

3.7 **SITE TOLERANCES**

- .1 Walls: No defects visible from a distance of 1 m at ninety degrees to surface.
- .2 Ceilings: No defects visible from floor at forty-five degrees to surface when viewed using final lighting source.
- .3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

3.8 **RESTORATION**

- .1 Clean and re-install hardware items removed before undertaken painting operations.
- .2 Remove protective coverings and warning signs as soon as practical after operations cease.
- .3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.
- .4 Protect freshly completed surfaces from paint droppings and dust to approval of 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.

3.9 **FIELD QUALITY CONTROL**

- .1 All surfaces, preparation and paint application shall be inspected by the paint inspection agency.
 - .2 Painted surfaces shall be considered to lack uniformity and soundness if any of the following defects are apparent to the painting inspection agency inspector.
 - .1 Runs, sags, hiding or shadowing by inefficient application methods.
 - .2 Evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners and re-entrant angles.
-

- .3 Damage due to touching before paint is sufficiently dry or any other contributory cause.
- .4 Damage due to application on moist surfaces or caused by inadequate protection from the weather.
- .5 Damage and/or contamination of paint due to wind-blown contaminants (dust, sand blast materials, salt spray, etc.).
- .3 Painted surfaces rejected by the inspector shall be made good at the expense of the Contractor. Small affected areas may be touched up; large affected areas or areas without sufficient dry film thickness of paint shall be repainted. Runs, sags of damaged paint shall be removed by scraper or by sanding prior to application of paint.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- .1 AODA - Accessibility for Ontarians with Disabilities Act
- .2 TADG - Toronto Accessibility Design Guidelines

1.3 **SUBMITTALS**

- .1 Shop Drawings shall contain detailed description, and bear item numbers, marked to show quantity, colour, model numbers, fabrication details, and installation instructions.

1.4 **DELIVERY, STORAGE AND HANDLING**

- .1 Deliver packaged materials in original, undamaged containers with manufacturer's labels and seals intact. Handle and store materials in accordance with manufacturer's and Supplier's recommendations to prevent damage thereto.

1.5 **PROTECTION**

- .1 Protect the Work of this section from damage of any kind. Protect other work from damage resulting from Work of this section. Replace damaged work which cannot be repaired, cleaned or restored.

2 Products

2.1 **ACCESSIBLE PUSH BUTTON MOUNTING POST/ PEDESTAL**

- .1 Push plate switch mounting post (pedestal), 6" square post, 1/8" thick walls, molded ABS flame and impact resistant peaked cap, steel surface mounting base and heavy-duty anchor fasteners to secure to existing concrete. Provide in-ground concrete mounting base for new concrete. Posts shall be 42", 48" or 54" in height to accommodate standard push plate switch. Refer to hardware schedule.

- .1 Surface Mounted, stainless steel or aluminum,

- .1 Model No. "CM-42" or CM-48" by Camden
- .2 Model No. "BPS6" (42") by SDC
- .3 Or accepted equal

- .2 In-Ground Mounted, stainless steel or aluminum

- .1 Model No. "CM-42-IG" by Camden
- .2 Model No. "BPG6" in-ground mount (54") by SDC, Security with Black HDPE mortise removable cap with secure transmitter mount.

- .3 Or accepted equal
 - .2 Mounting Post / Pedestal with 2 Preps: Surface mounted, concealed base with standard mounting bolts and welded angled top.
 - .1 Model No. B-4X6-AT-PCCLR-BP-2P (RT13) by Wikk or accepted equal
 - .2 Finish: Mill Aluminum Type 6063 T-5, Powder Coated Tiger Drylac, Anodized Silver or Jet Black.
 - .3 Size of pedestal: 102 mm x 152 mm x 1170 mm high. 3 mm thick wall.
 - .4 2 preps:
 - .1 1- Round Push Plate mounted at 900 mm AFF.
 - .2 1- Card reader or doorbell mounted at 1050 mm AFF.
 - .3 Mounting Post / Pedestal with 3 Preps to accommodate card reader, push button, and doorbell: Surface mounted, aluminum, concealed base with standard mounting bolts and welded angled top.
 - .1 Model B-4X6-AT-PCCLR-BP-3P (RT13) by Wikk or accepted equal
 - .2 Finish: Mill Aluminum Type 6063 T-5, Powder Coated Tiger Drylac, Anodized Silver or Jet Black.
 - .3 Size of pedestal: 102 mm x 152 mm x 1170 mm high. 3 mm thick wall
 - .4 3 preps:
 - .1 1-Round Push Plate mounted at 900 mm AFF, mounted on front of pedestal.
 - .2 1-Card reader at 1050 mm AFF, mounted on front of pedestal.
 - .3 1-Door Bell at 1050 mm AFF, mounted on pedestal side.
 - .4 Touch Panel Column Surface or Bollard Mounted
 - .1 Sturdy 1/8" extrusion with architectural finish, 628 aluminum (standard), 9"x6", 36"x6", Ingress-R.E.X Touch Panel Column, fully active
 - .1 Model No. 482AA9, 482AA36, blue infill, SPDT by SDC Security
 - .2 Or accepted equal
- 2.2 **PUSH PLATE SWITCH**
- .1 Narrow Push Plate Switch
 - .1 Heavy duty, surface or flush mount, all active switch, 18-gauge stainless steel or aluminum, concealed mounting screws. Refer to hardware schedule.
 - .1 "CM-25", CM-26" or CM-35 by Camden
-

.2 Square Push Plate Switch

.1 Heavy duty, surface or flush mount, all active switch, 4 ½" faceplate, stainless steel or aluminum, tamperproof screws. Refer to hardware schedule

.1 "CM-45" or "CM-46" by Camden

.3 Round Push Plate Switch

.1 Heavy duty, surface or flush mount, all active switch, 18-gauge stainless steel faceplate. Stainless steel or aluminum, tamperproof screws. Refer to hardware schedule.

.1 "CM-60" by Camden.

2.3 **TOUCHLESS SWITCH**

.1 Wave Button: surface mounted, wired touchless / hands-free switch, built-in controls, stainless steel face plate, adjustable operating range, motion sensor for indoor and outdoor use. Refer to hardware schedule.

.1 "CM-331" by Camden

.2 Touchless Switch Restroom Kit: Surewave Touchless Restroom Control System. Refer to hardware schedule.

.1 "CX-WC16" by Camden

2.4 **EMERGENCY CALL SYSTEM**

.1 Emergency call kit for universal washroom, complete equipment package, audible and visual annunciation, push/pull mushroom button, instructional signage. Refer to hardware schedule.

.1 "CX-WEC10K2" by Camden

3 Execution

3.1 **INSTALLATION**

.1 Install miscellaneous specialties perfectly rigid in accordance with manufacturers' printed directions.

.2 After installation, test-operate and adjust operable parts as required for ease of operation.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.
- .2 Work includes, but is not necessarily limited to, the following:
 - .1 Sign graphics
 - .2 Cut-out letters
 - .3 Wall plates
 - .4 Door plates
 - .5 Number plates
 - .6 Barrier-free signage plates
 - .7 Signage at magnetic locked doors
 - .8 Project Information signage for public buildings

1.2 **REFERENCES**

- .1 Conform to the latest edition of the following:
 - .1 ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - .2 ASTM B32 - Standard Specification for Solder Metal
 - .3 ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
 - .4 - Aluminum Association Designation System for Aluminum Finishes
 - .5 CAN/CSA-G164 - Hot Dip Galvanizing of Irregularly Shaped Articles
 - .6 CSA W47.2 - Certification of Companies for Fusion Welding of Aluminum
 - .7 CSA W59-M - Welded Steel Construction (Metal Arc Welding)
 - .8 CAN/CGSB-1.108 - Bituminous Solvent Type Paint
 - .9 CGSB 41-GP-6M - Sheets, Thermosetting Polyester Plastics, Glass Fiber Reinforced
 - .10 CSA - Canadian Standards Association
 - .11 CNIB - Canadian National Institute for the Blind
-

.12 AODA - Accessibility for Ontarians with Disabilities Act

1.3 **SUBMITTALS**

.1 Shop Drawings

- .1 Submit Shop Drawings in accordance with Section 01 33 00.
- .2 Submit Shop Drawings and catalogue sheets.
- .3 Indicate materials, thicknesses, sizes, finishes, colours, construction details, removable and interchangeable components, mounting methods, schedule of signs.
- .4 Submit full size templates drawn-to-scale details for individually fabricated or incised lettering indicating word and letter spacing.

.2 Samples

- .1 Submit samples in accordance with Section 01 33 00.
- .2 Submit sample of each type sign, sign image and mounting method.

1.4 **QUALIFICATIONS**

- .1 Manufacturer of signs shall be specialist in this field having minimum five years proven experience in sign manufacturing and installation of each type of signs specified.

1.5 **MAINTENANCE DATA**

- .1 Provide maintenance data for signs for incorporation into manual specified in Section 01 33 00.

2 Products

2.1 **MATERIALS**

.1 Acceptable manufacturers:

- .1 Forward Signs Inc.
- .2 Or accepted equal

.2 Source sign fabrication made by one manufacturer from one of the following:

- .1 Spectra Advertising
- .2 Neon Products Ltd.
- .3 Steel Art Signs Ltd.
- .4 Imperial Sign Ltd.

- .3 Aluminum extrusions: Aluminum Association alloy AA 6063-T5, minimum 2 mm thick, free from scratches and surface blemishes.

- .4 Sheet aluminum: Aluminum alloy AA6063-T5, minimum 0.75 mm thick for exposed work requiring finish to match extruded Sections.
-

- .5 Prefinished sheet aluminum: Plain sheet with manufacturer applied baked enamel finish to Aluminum Association designation AA-M22-C22-A41 (clear) or AA-M22-C22-A42 (black) 0.25 mm thick on face and 0.0076 mm thick on back.
- .6 Prefinished sheet steel: Conforming to Canadian Steel Sheet Building Institute Bulletin finished with Z275 zinc coating in accordance with CSSBI Standards and prepainted as follows:
 - .1 Finish: Coil coated, baked-on, 70% Kynar 500 or Hylar 5000 based fluoropolymer enamel, 10000 Series by Stelco Inc., or Dofasco Inc. on exposed surfaces as applied by Baycoat. Coil coated surfaces pretreated and primed prior to application of coating. Paint colour: As selected by Consultant.
- .7 Galvanized steel sheet: Commercial quality to ASTM A653/A653M, GRADE A, with zinc coating designation.
- .8 Acrylic sheet: Polymethylmethacrylate (PMMA) cast sheet suitable for intended use in sign fabrication, translucent white, transparent clear or colours as indicated.
- .9 Fiberglass sheet: To CGSB 41-GP-6M, flat sheet, smooth finish, colours as indicated.
- .10 Engraving sheet: Lamicoid 3.2 mm thick plastic sheet, black or white core.
- .11 Welding materials: To CSA W59.
- .12 Solder: To ASTM B32.
- .13 Self-stick foam tape: Minimum 1.6 mm thick, 352.4 kg/m³ density polyurethane open-cell foam tape for sign purposes, with synthetic self-stick adhesive on both sides. Width to suit sign sizes.
- .14 Adhesives, paints, sealants and solvents for acrylic and fiberglass sheet: Type recommended by sheet manufacturer for applicable condition.
- .15 Acrylic topcoat: Clear, non-yellowing, exterior grade, satin finish, acrylic polyester resin protective coating, compatible with acrylic or metal surface of type recommended by sheet manufacturer.
- .16 Bituminous paint: To CAN/CGSB-1.108, Type 2.

2.2 **FINISHES**

- .1 Anodized Aluminum
 - .1 Clear finish: Conform to Aluminum Association designation AA-M22-C22-A41 in uncoloured anodized finish with film thickness of 0.25 mm.
 - .2 Colour finish: Conform to Aluminum Association designation AA-M22-C22-A42 to match sample.
 - .2 Galvanized finish: On irregular shaped articles, 600 g/m² zinc coating to CAN/CSA G164.
 - .3 Chrome and nickel plating: To ASTM B456, satin finish.
 - .4 Prefinished metals: As specified herein.
 - .5 Bronze finishes: To match sample.
-

2.3 **GENERAL FABRICATION REQUIREMENTS**

- .1 Fabricate signs in accordance with details on Drawings, Specifications and Shop Drawings to present a safe and rigid installation.
- .2 Build units square, true, accurate to size, free from visual or performance defects.
- .3 Accurately fit and securely join sections to obtain tight, closed joints.
- .4 Allow for thermal movement without distortion of components.
- .5 Do not use exposed fasteners unless indicated otherwise on Drawings, and shall be inconspicuous and same finish and colour as base metal on which they occur.
- .6 Polish exposed edges of plastic and metal to smooth, slightly convex profile.
- .7 Do steel welding to CSA W59 aluminum welding to CSA W47.2 Finish exposed welds flush and smooth.
- .8 Brush-apply bituminous paint to aluminum in contact with dissimilar metals, concrete or masonry.
- .9 Do not locate manufacturer's nameplates on sign surfaces visible in completed work.
- .10 Letters shall be as indicated otherwise on Drawings, and be clear cut and free from ragged or indistinct edges.

2.4 **SIGN GRAPHICS**

- .1 Sign graphics to be well defined, arranged for balanced appearance, and properly word- and letter-spaced. Acceptable manufacturers for computer cut graphics:
 - .1 System Graphics
 - .2 Alpine Graphics Productions
 - .3 Autograph Trim
 - .4 Canada Decal Inc.
- .2 Silk screen process: Apply colour photographic produced silk screen printed images to face or back side of transparent sign faces; face side of opaque sign faces.
- .3 Engraving: Apply sign text using pantograph mechanical engraving machine to obtain incised (paint-filled) letters.
- .4 Self-stick vinyl film: Individual letters, numerals and symbols cut from 0.1 mm thick matte finish, exterior grade PVC film, with self-stick adhesive backing. Colour selected by Consultant from manufacturer's standard range.
- .5 Decals: Silk screened or printed images on minimum 0.025 mm, clear matte finish, PVC film, with self-stick adhesive backing. Protect image subject to abuse with laminated film overlay of same material as decal base.

2.5 **CUT-OUT LETTERS**

- .1 Cut letters and symbols from opaque, translucent, coloured acrylic or aluminum sheet.
-

- .2 Helvetica typeface, upper and lower case; sizes and thicknesses as indicated. Make corners cutter radius or square cut.

- .3 Fabricate aluminum with clear or colour anodizing finish.

2.6 **WALL PLATES**

.1 Plastic Wall Plates

- .1 Fabricate from clear or colour acrylic sheet, minimum 3.2 mm thick. Sizes as indicated.

- .2 Sign graphics: Apply by silk screen paint filled, engraving or self-stick vinyl film letters.

.2 Metal Wall Plates

- .1 Fabricate from sheet aluminum sign plates, minimum 3.2 mm thick, with clear or colour anodized finish. Sizes as indicated.

- .2 Sign graphics: Apply by silk screen, engraving or self-stick vinyl letters.

- .3 Interchangeable mounting: Supply wall plates with semi-concealed, retaining holders that permit quick but vandal-resistant interchange of sign face. No exposed fasteners permitted. Exposed portions to match sign face.

- .4 Fixed mounting: Prepare wall plates for fixing by surface fasteners with rosette covers concealed tamperproof clips to self-stick foam tape. Include back-up plates for fixing to uneven surfaces where required.

- .5 Bracket mounting: Fabricate brackets for wall projecting or ceiling suspended sign plates as detailed: of clear or coloured anodized aluminum finish, 4.8 mm thick.

2.7 **DOOR PLATES**

- .1 Fabricate sign faces of with clear or colour anodizing finish. Sizes and thickness as indicated on Drawings.

- .2 Sign graphics: Apply by silk screen, engraving or self-stick vinyl letters.

- .3 Interchangeable mounting: Supply door plates with semi-concealed, retaining holders that permit quick but vandal-resistant interchange of sign face. No exposed fasteners permitted. Exposed portions to match sign face.

- .4 Fixed mounting: Use self-stick foam tape.

- .5 Mounting on transparent surfaces: Use self-stick foam tape. Include blank back-up plate for opposite side.

- .6 Washroom pictographs: Cut-out figures without backgrounds.

2.8 **NUMBER PLATES**

- .1 Fabricate number plates for columns, doors or windows of engraving sheet. Size as indicated on Drawings.

- .2 Engrave 9.5 mm high, single line numerals incised to expose contrasting coloured core.
-

2.9 **BARRIER-FREE SIGNAGE PLATES**

- .1 3D-graphics signs for the visually impaired, the Barrier-Free Act, building codes and CNIB and CSA recommendations. Minimum description:
 - .1 Raised letters, Grade 2, Braille and graphics system on injection moulded acrylic, styrene or polycarbonate substrate and protected with a non-glare, matt finish.
 - .2 Double sided tape mounting.
 - .3 Colours as selected by the Consultant.
- .2 Washroom Door
 - .1 Tactile type universal male or female symbol and a universal barrier-free symbol on a dark coloured 150 mm wide x 150 mm high square.
 - .2 Braille signs under the universal symbols, within the square.
 - .3 Tactile type bilingual text (Men-Hommes) or (Women-Femmes) under the dark coloured square.
- .3 Stair Shaft
 - .1 The sign is to be multi-layer process consisting of substrate, laminating adhesive, background film, profile film, test film and top film.
 - .2 Location: Mounted on wall on the latch side of doors leading to stair shafts.
- .4 Handrails Braille Signage
 - .1 150 mm long high contrast handrail wayfinding sign with Braille and 25 mm wide hazard strip on either side of the sign to be 200 mm in total length indicating the stair number and floor/level number.
 - .2 Location: On centre within the extension piece of the handrail.
 - .3 Colour: as indicated on Drawings.
 - .4 Acceptable Manufacturer:
 - .1 Atec Signs Inc.
 - .2 or accepted equal.

2.10 **SIGNAGE AT MAGNETIC LOCKED DOORS**

- .1 Aluminum plate with the following text engraved in Helvetica typeface, 25 mm high: "EMERGENCY EXIT, UNLOCKED BY FIRE ALARM".
- .2 Paint plate with one colour. Paint engraved text with a contrasting colour. Paint to be baked enamel finished.
- .3 Colours as selected by Consultant.

2.11 **PROJECT INFORMATION SIGNAGE FOR PUBLIC**

- .1 Refer to Section 10 14 00.01 City of Toronto Construction-Improvement Signs for information on the standard template to be used for projects accessible to the public.
-

3 Execution

3.1 **INSTALLATION**

- .1 Erect and secure signs plumb and level at elevations.
- .2 Comply with sign manufacturer's installation instructions and approved Shop Drawings.
- .3 Mechanical Attachment
 - .1 Apply signage to concrete or solid masonry with lag screws and expansion bolts or screws.
 - .2 Apply to hollow masonry with toggle bolts or equivalent.
 - .3 Secure behind stud walls or above ceilings into framing members.
 - .4 Mechanical fasteners shall be non-staining, non-ferrous type.
 - .5 Fabricate special fasteners as required for installation conditions.
- .4 Adhesive attachment: Use self-stick adhesive foam tape to manufacturer's instructions to adequately fix sign and prevent "rocking". Keep tape maximum 1.6 mm from edges.

3.2 **CLEANING**

- .1 Leave signs clean and polish all exposed surfaces.
- .2 Touch up any damaged finishes.

End of Section

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City of Toronto

Construction-Improvement Signs

Corporate Specialty Signage – Capital Construction/Improvement Sign: Large

All requests for variations from the Corporate Identity Program (CIP) standards must be submitted to approvals@toronto.ca

As well as the corporate "family" of standard signs, specific Capital Construction/Improvement signs have been approved for use in order to consistently identify City of Toronto construction sites and road/sidewalk repair work. There are two sizes of Capital Construction/Improvement signs – 48" square (see example at right) and 24" square (see page 49).

The sign's fixed **Header** includes the Toronto Primary Logo positioned in the upper left corner and a consistent standard slogan "Building a great city together".

The sign's **Body** consists of a Project Title (maximum three lines and 28 characters per line), Additional Project Details (maximum three lines and 34 characters per line), Expected Completion Date and Contract Number.

The sign's fixed **Footer** includes the Call 311 identifier positioned at left and the Toronto website address positioned at right.

The Header bar, Project Title and Footer bar will be in the corporate blue (Pantone 647) with reversed white logos/text. All other text will be black.



Header:

Fixed Toronto Primary Logo and slogan text Pantone 647 blue (with reversed white logos/text)

Body:

1 Project Title (two lines preferred)

Univers 65 bold - 250 pt, Pantone 647 blue, upper/lower case

Line 1: Project type (primary work) e.g., "Watermain Replacement"

Line 2: Primary street where work is taking place e.g., "Bloor Street West"

28 characters maximum per line

2 Project Details (one or two lines preferred may use three)

Univers 55 Roman - 200 pt, Black, upper/lower case

Provide limits of project e.g., "Bay Street to Avenue Road"

34 characters maximum per line

3 Start

Univers 65 - 150 pt, Black, upper/lower case

"Spring" + Year or "Summer" + Year or "Fall" + Year or "Winter" + Year or Month + Year

4 End

Univers 65 - 150 pt, Black, upper/lower case

"Spring" + Year or "Summer" + Year or "Fall" + Year or "Winter" + Year or Month + Year

5 Contract Number (two lines)

Line 1 Univers 55 Roman Bold - 150 pt, Black, upper/lower case

Line 2 Univers 55 Roman - 150 pt, Black, upper/lower case

Footer:

Fixed standard Call 311 identifier and City of Toronto web address, Pantone 647 Blue (with reversed white logo/text)

Notes:

- Only 1, 2, 3, 4, 5 are fields in which text can be specific to each job.
- Project title and information should use clear language and avoid technical jargon and reflect Construction Notices.

Drawing specifications also found at: http://www.toronto.ca/techservices/conspecs_signs.htm

To assure compliance with CIP sign specifications, requests for signage consultation and sign design development must be submitted to design@toronto.ca during the planning stage.

Corporate Specialty Signage – Capital Construction/Improvement Sign: Small

All requests for variations from the Corporate Identity Program (CIP) standards must be submitted to approvals@toronto.ca

As well as the corporate "family" of standard signs, specific Capital Construction/Improvement signs have been approved for use in order to consistently identify City of Toronto construction sites and road/sidewalk repair work. There are two sizes of Capital Construction/Improvement signs – 24" square (see example at right) and 48" square (see page 48).

The sign's fixed **Header** includes the Toronto Primary Logo positioned in the upper left corner and a consistent standard slogan "Building a great city together".

The sign's **Body** consists of a Project Title (maximum three lines and 28 characters per line), Additional Project Details (maximum three lines and 34 characters per line), Expected Completion Date and Contract Number.

The sign's fixed **Footer** includes the Call 311 identifier positioned at left and the Toronto website address positioned at right.

The Header, Project Title and Footer will be in the corporate blue (Pantone 647) with white reversed logos/text. All other text will be black.



Header:

Fixed Toronto Primary Logo and slogan text Pantone 647 blue (with reversed white logos/text)

Body:

- 1 Project Title** (two lines preferred)
Unifers 65 bold - 125 pt, Pantone 647 blue, upper/lower case
Line 1: Project type (primary work) e.g., "Watermain Replacement"
Line 2: Primary street where work is taking place e.g., "Bloor Street West"
28 characters maximum per line
- 2 Project Details** (one or two lines preferred may use three)
Unifers 55 Roman - 100 pt, Black, upper/lower case
Provide limits of project e.g., "Bay Street to Avenue Road", 34 characters maximum per line
- 3 Start**
Unifers 65 - 75 pt, Black, upper/lower case
"Spring" + Year or "Summer" + Year or "Fall" + Year or "Winter" + Year or Month + Year
- 4 End**
Unifers 65 - 75 pt, Black, upper/lower case
"Spring" + Year or "Summer" + Year or "Fall" + Year or "Winter" + Year or Month + Year
- 5 Contract Number** (two lines)
Line 1 Unifers 55 Roman Bold - 75 pt, Black, upper/lower case
Line 2 Unifers 55 Roman - 75 pt, Black, upper/lower case

Footer:

Fixed standard Call 311 identifier and City of Toronto web address, Pantone 647 blue (with reversed white logo/text)

Notes:

- It is preferred that 24 x 24 signs are installed for pedestrian / foot traffic only as this size sign is difficult for moving traffic to read.
- Only 1, 2, 3, 4, 5 are fields in which text can be specific to each job.
- Project title and information should use clear language and avoid technical jargon and reflect Construction Notices.

Drawing specifications also found at: http://www.toronto.ca/techservices/conspescs_signs.htm

To assure compliance with CIP sign specifications, requests for signage consultation and sign design development must be submitted to design@toronto.ca during the planning stage.

Corporate Specialty Signage – Capital Construction/Improvement Sign: Informational/Didactic

All requests for variations from the Corporate Identity Program (CIP) standards must be submitted to approvals@toronto.ca

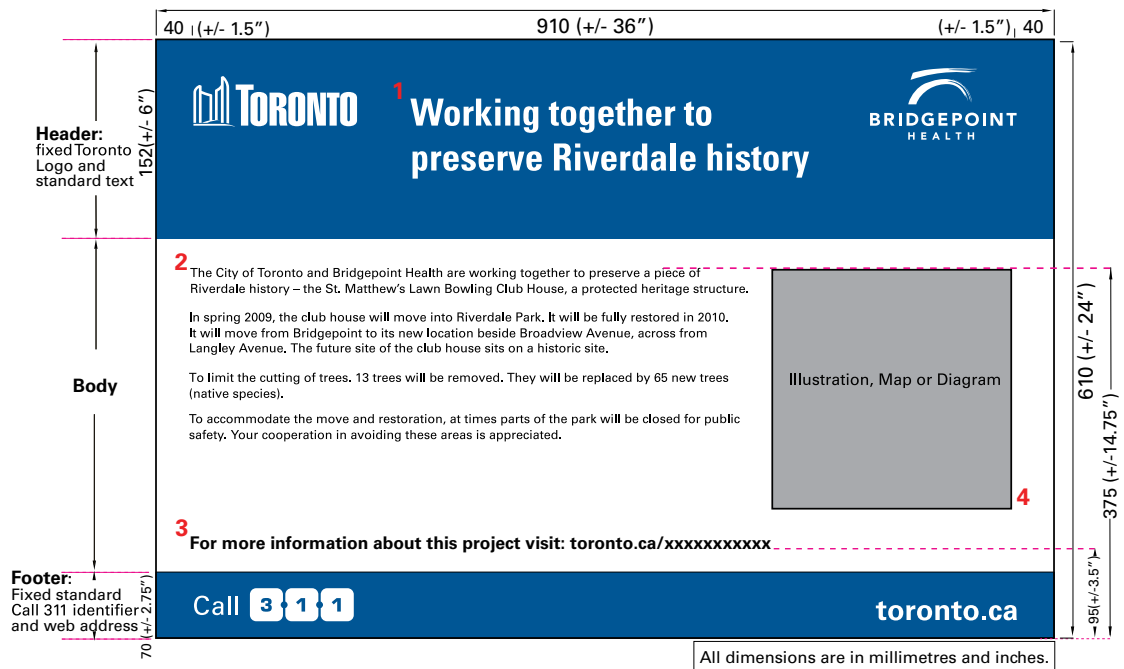
As well as the corporate "family" of standard signs, and the two sizes of specialty Capital Construction/Improvement signs, an Informational/Didactic sign has also been approved for use. As shown in the example at right, this Informational/Didactic sign format allows for extensive descriptive information and visuals related to the project, but does not replace the need for the large and/or small Capital Construction/Improvement signs required at the street or sidewalk.

The sign's **Header** can accommodate the Toronto Primary Logo, a unique heading and a partner identifier, as needed and appropriate.

The sign's **Body** includes descriptive text and can also accommodate appropriate photos, plans and/or graphics.

The sign's fixed **Footer** includes the Call 311 identifier and the Toronto website at right.

The Header and Footer will be in the corporate blue (Pantone 647) with reversed white logos/text. All other text will be black.



Header:

Fixed Toronto Primary Logo and slogan text (1) Univers Bold 100 pt, White and partner logo if applicable, Pantone 647 Blue (with reversed white logos/text)

Body:

2 Project Details

Univers 55 Roman - 36 pt, Black, upper/lower case, flush left as in example above, column width variable as needed

3 Information Line

Univers 65 Bold - 50 pt, Black, upper/lower case

4 Illustration, Map or Diagram - 10"x10" in example, or multiple images as needed

Footer:

Fixed standard Call 311 identifier and City of Toronto web address, Pantone 647 Blue (with reversed white logo/text)

Notes:

- Only 1, 2, 3, 4 are fields specific to each job.
- Project title and information should use clear language and avoid technical jargon.
- All white areas are white engineering grade reflective sheeting.
- All blue areas are Pantone 647 blue.
- Size is 36"x24" (910mm x 610mm).
- Signboards will be constructed out of 19mm exterior grade plywood or 19mm PVC foamboard.

To assure compliance with CIP sign specifications, requests for signage consultation and sign design development must be submitted to design@toronto.ca during the planning stage.

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.
- .2 Work includes, but is not necessarily limited to, the following:
 - .1 Field-verify dimensions and site conditions at sign locations; engineer signs and sign foundations; provide electrical hook-up to illuminated signs where needed; and provide fastenings for attachment and installation of all signs where needed.
 - .2 Coordinate with Owner and other trades as required for completing the Work.
 - .3 Installation shall include unloading, receiving and handling, storing, relocating, uncrating, inspecting, cleaning and assembly, testing and adjusting sign units into final locations.
 - .4 Installation of all work shall be completed according to deadlines determined by Owner's Representative.

1.2 **REFERENCES**

- .1 Conform to the latest edition of the following:
 - .1 AODA - Accessibility for Ontarians with Disabilities Act

1.3 **GENERAL REQUIREMENTS**

- .1 Provide all materials, labour, equipment, and services to furnish and install the complete sign package.
 - .2 The new signs shall have internally illuminated logo and letters electrically controlled by a photocell, in the case of primary and secondary Identification signs, or applied vinyl in the case of other identification signs and guide, information, orientation and regulation signage.
 - .3 The Owner's logo shall be done using the colour of Akzo/Nobel Blue ATO-208 and the colour shall match the Owner's previously selected colour shades and utilize the Owner's standard fonts and text as specified in the Design Intent Drawings.
 - .4 All signs shall meet the local governing sign ordinances, including those addressing content, anchorage and weather durability.
 - .5 Extent of the signage and graphics is shown on the Drawings and in the appendix. Quantities of required signs shall be per scheduled in message schedule unless revised by Owner.
 - .6 Symbols shall be as specified by the United States Department of Transportation (DOT) and the American with Disabilities Act (ADA).
 - .7 Forms of signage shall include site identification, directional and regulatory, and parking area/space identification.
-

1.4 **DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver signs and mounting hardware to Site packaged to prevent damage and marked for easy identification.
- .2 Store materials in clean, dry location protected from damage and stored horizontal and flat to prevent warping. Replace damaged materials at no added cost to the Owner.

1.5 **QUALITY ASSURANCE**

- .1 Materials and workmanship shall be new and of the best grades of their kind for their specified purpose.
- .2 Contractors who wish to bid on a material or method assumed "equal" to those specified must submit a written request including supporting technical data with their bid.
- .3 Sign units shall be engineered to be rigid, without buckling of any member, failure of any points, distortion, or other damage. Joints shall be weathertight and vandal proof.
- .4 Joints in members shall be internally aligned and shall provide for thermal expansion and contraction. Exposed corners of frames shall be mitered and welded, with sharp ninety degree corners, unless otherwise specified. Joints and seams shall be filled and ground smooth so as not to be visible on the finished sign.
- .5 Welding shall conform to applicable AWS standard and shall be free of defects. Welding shall be done prior to finishing. Aluminum-to-aluminum joints on the exterior of a sign shall be continuous heli-arc welded and finished smooth.
- .6 Exterior signs shall be engineered to be rigid and withstand movement, shear and torsion loads. Exposed areas of sign shall not oilcan. Sign shall withstand wind load of 30 pounds per square foot (psf) without permanent malformation or damage, or a higher wind load as specified by applicable local ordinances.
- .7 Use only personnel thoroughly skilled and experienced with the Products and method for fabrication and installation of signage specified. Work done and materials furnished shall be first class in every respect and, unless otherwise specified, materials and equipment shall be new and of the latest design.

1.6 **ELECTRICAL WORK**

- .1 Electrical Work shall bear the label of Underwriters Laboratories of Canada, Inc. (cUL) approval.
 - .2 Electrical fixtures and assemblies shall meet cUL requirements and be installed in accordance with National Electrical Code (NEC) standards.
 - .3 The Owner will be responsible for providing a power source to the base of each sign requiring power. The Owner will identify main trunk lines from which electrical power may be pulled. Power to be 120/240 volts at 60 cycles unless otherwise noted in the documents.
 - .4 It is the responsibility of the Sign Contractor to provide required illumination and electrical connections, manipulate the existing conduit to its proper location, install an external disconnect, extend the conduit through the concrete base to align with the point of hookup, run the power supply through it and hook up the sign. Conduit running from the disconnect switch to the sign shall travel within the concrete base, not on its surface.
 - .5 The Contractor shall coordinate with Division 26 Specification sections and Drawings.
-

1.7 **FIELD MEASUREMENTS**

- .1 Take field measurements where required to verify or supplement dimensions indicated and be responsible for accurate fit of the work.

1.8 **UTILITIES AND SERVICES**

- .1 Protect existing utilities and services within and adjacent to area of Work, from damage while performing the Work.
- .2 If utilities or services are uncovered that are not indicated on the Drawings, advise Owner and do not work in the immediate area until instructed by the Owner.

1.9 **EARTHWORK**

- .1 Backfill excavations as promptly as work permits.
- .2 Repair and re-establish grades where damaged during demolition and installation.

1.10 **SUBMITTALS**

- .1 Drawings: Submit Shop Drawings for fabrication and installation of the signs. Include plans, elevations, and typical large-scale details of construction, sign working and lettering layout. Show anchorages and accessory items. Furnish location template Drawings for items supported or anchored to permanent construction.
- .2 Samples: Submit samples/prototypes for verification of the following:
 - .1 Two samples of each specified sign colour, paint and vinyl, for colour verification, 100 mm x 100 mm minimum size.
 - .2 Two samples of Casocryl Black'n White acrylic sheet, 100 mm x 100 mm minimum size.
 - .3 Two samples of ACM Alucobond with silver metallic A 3001-DXLE finish.
- .3 Submit within ten days following approvals, a final schedule of fabrication and installation and total completion.
- .4 Submit two copies of maintenance and instructional information for use by the Owner. Information shall describe proper maintenance such as cleaning and touch-up, and shall include guarantees, special warranties and replacement data. Manufacturer brochures describing the material used in the Work shall also be furnished. This shall include finish paint formula and manufacturer's numbers, etc.
- .5 All submittals shall be sent to the Architect-Engineer through the Owner's Representative per Division 1 requirements.
- .6 Submit Product data for lamping/lighting fixtures.

1.11 **WARRANTY**

- .1 Provide a written five year full replacement warranty to the Owner that all signage will be free of defects due to workmanship or materials including but not limited to fading, peeling, de-lamination, and installation.
-

- .2 During the Warranty Period, the Contractor agrees to restore defective Work to the standard of the Contract Documents without cost to the Owner, including materials and labour.
- .3 Lamps and light fixtures shall be warranted a minimum of one year from final approval against failure of operation. If a unit becomes defective within this time period it shall be replaced at no cost to Owner.
- .4 Joints in acrylic plastic construction shall be warranted for five years against failure or delamination. If unit becomes defective within this time period it shall be replaced at no cost to the Owner.
- .5 Vinyl die-cut letters shall be warranted for five years against delamination from substrate.
- .6 All warranties shall begin on the date of the Owner's final acceptance of the Work.

2 Products

2.1 **ACCEPTABLE MANUFACTURERS**

- .1 Forward Signs Inc.
- .2 Approved alternative

2.2 **ADHESIVE VERY HIGH BOND TAPE**

- .1 Double-coated high bond acrylic tape for joining of sign units, of thickness needed to achieve maximum adhesion with minimum visibility.
- .2 Acceptable manufacturers:
 - .1 Graphtec Industries
 - .2 3M Co.

2.3 **ALUMINUM**

- .1 Aluminum sheet: Provide aluminum sheet of alloy and temper recommended by the aluminum producer or finisher for the type of use and finish indicated, and with not less than the strength and durability properties specified in ASTM B 209 for 5005-H-15.
- .2 Aluminum extrusions: Provide aluminum extrusions of alloy and temper recommended by the aluminum producer or finisher for the type of use and finish indicated, and with not less than the strength and durability properties specified in ASTM B 221 for 6063-T5.
- .3 Filler metal for welding aluminum shall be the alloy recommended for each application by the manufacturer of aluminum alloy.
- .4 Aluminum shall be separated from direct contact with concrete and metals other than stainless steel, zinc, cadmium or nickel bronze, by painting contact surfaces with zinc chromate primer and aluminum paint or with a coat of heavy-bodied bituminous paint or by non-absorptive tape or gasket.

2.4 **ANCHORS AND INSERTS**

- .1 Use non-ferrous metal inserts for interior installations. Furnish inserts, as required, to be set into masonry Work.

2.5 **FASTENERS**

- .1 Unless otherwise indicated, use concealed fasteners fabricated from metals that are non-corrosive to either the sign material or the mounting surface.

2.6 **CEILING SUSPENSION CABLING**

- .1 Follow manufacturer recommendation.

2.7 **PLASTICS**

- .1 Cast acrylic sheet: Provide cast (not extruded or continuous cast) methyl methacrylate monomer plastic sheet, in sizes and thickness indicated, with a minimum allowable continuous service temperature of 80°C (176°F), and of the following types.
- .2 Transparent sheet: Where sheet material is indicated as “clear” provide colourless sheet in matte finish, with light transmittance of 92%, when tested in accordance with the requirements of ASTM D 1003.
- .3 Acceptable Manufacturer (Transparent Sheets)
 - .1 Plexiglass (Rohm and Haas Co.)
 - .2 Lexan (General Electric Co.)
- .4 Opaque plastic sheet: ABS sheet, in thickness indicated, with lightly textured surface. Polyvinylchloride (PVC) sheet, expanded low-density closed cell material with smooth flat surfaces.
- .5 Acceptable Manufacturer (Opaque Sheet)
 - .1 Alucobond Technologies Inc.
 - .2 Architect-Engineer approved equivalent.

2.8 **VINYL FILM**

- .1 Provide opaque non-reflective, vinyl film, 2 mil minimum thickness, with pressure sensitive adhesive backing, suitable for interior applications.
- .2 Legends shall securely adhere when subjected to any temperature within the range of -34°C to +93°C (-30°F to +200°F) and shall not crack, chip or peel voluntarily.
- .3 Shrinkage of letters shall not exceed 0.4 mm in any direction.
- .4 Acceptable Products are:
 - .1 3M's Scotchcal
 - .2 Avery Dennison's "Fasson 1000 series Premium Vinyl

2.9 **CONCRETE**

- .1 Concrete Work shall conform to applicable ACI codes and standards in conformance with the requirements of Section 03 30 00.
 - .2 Concrete Work for sign foundations shall be 3000 psi mix, air entrained in conformance with the requirements of Section 03 30 00. Concrete shall be vibrated during the pour to adequately distribute aggregate and eliminate air pockets or other surface imperfections.
-

Exposed concrete shall be smooth finish, without form marks or discolouration. Exposed edges shall be even.

- .3 Metal reinforcement shall be steel bars or wire as engineered by the sign fabricator and as shown on the Shop Drawings.
- .4 Install inserts as required for anchorage of sign units and cast in conduit as indicated, in conformance with the requirements of Section 03 30 00.

2.10 **FABRICATION**

- .1 The work shall be shop fabricated.
 - .2 Sign content, including messaging, must be provided to the Owner and approved by the Owner before signage is fabricated.
 - .3 Fastenings shall be concealed where possible. Exposed fastenings shall occur only where concealed fastenings are not specified and shall be finished to match the surrounding surface.
 - .4 Touch-up of artwork for photographic enlargement, and quality of artwork for finished signage shall be the responsibility of the Contractor. The Owner reserves the right to reject artwork if it fails to meet the standards of quality established.
 - .5 Edges and corners of finished letter forms and symbols shall be photographically precise, crisp, clean; tick marks, rounded corners, discontinuous curves, line wave, cut or ragged edges, edge build-up, bleeding, surface pinholes or other imperfections will not be accepted.
 - .6 Letterforms and symbols shall be aligned to maintain a base line parallel to the sign format. Letterforms and symbols shall conform to the prescribed letter from proportions.
 - .7 Message copy, unless otherwise specified, shall be GM sans regular and bold as indicated. Alternate letterforms shall not be accepted. Message copy colours shall be as indicated on the Drawings.
 - .8 Message copy on Drawings is for layout purposes. Actual copy for signs shall be as scheduled.
 - .9 Fabrication of acrylic plastic sheet shall be in accordance with approved Shop Drawings and with techniques and recommendations of the manufacturer.
 - .10 Remove protective paper from acrylic sheet only as required during fabrication. Exercise care in handling and fabrication to avoid scratching, chipping or crazing of the acrylic plastic sheet.
 - .11 Panel signs: Fabricate panel signs to comply with the requirements indicated for materials, thickness, finishes, colours, designs, shapes, sizes and details of construction. Produce smooth, even, level sign panel surfaces, constructed to remain curved or flat (as specified in the Design Intent Drawings) under installed conditions within a tolerance of plus or minus 1.5 mm measured diagonally.
 - .12 Brackets: Fabricate brackets and fittings for bracket-mounted signs from flat aluminum to suit sign panel construction and mounting conditions indicated.
-

- .13 Graphic image process: Provide sign copy to comply with the requirements indicated for sizes, styles, spacing, content, positions, materials, finishes and colours of letters, numbers, symbols and other graphic devices.
- .14 Graphics shall be executed in such manner that edges and corners are true, clean and photographically precise. Graphics with rounded corners, cut or ragged edges or edge build-up will not be accepted.
- .15 Apply pressure-sensitive vinyl graphics to clean surface; surface and air temperature shall be 16°C (60°F) minimum.
- .16 Substrates shall be considered dirty and shall be wiped with a solvent recommended by the acrylic manufacturers prior to the application of vinyl film or sheeting. Dry the surface with a lint-free cloth before the solvent evaporates from the surface.
- .17 ACM Alucobond curved sign panels; approximate size and proportions as shown on the Design Intent Drawings. All signs of same size shall be totally uniform in size, proportions, and colour.
- .18 Fabricate signs with adequately sized stiffener channels and mounting brackets: Front of structure - recessed, rear of structure - surface mounted.
- .19 Field verify dimensions of surface before preparing signs. Coordinate with masonry or wall Contractor for correctly sized sleeves and recessed boxes.
- .20 Coordinate necessary adjustments in signs with the Owner's Representative.
- .21 Contractor shall review the Design Intent Drawings and their relevant graphics, fonts, format, colours and shades in preparing his/her Bid.

2.11 **FINISHES**

- .1 Metal finishes: Comply with NAAMM (National Association of Architectural Metal Manufacturers) "Metal Finishes Manual" for finish designations and applications recommendations.
 - .2 Aluminum finishes: Aluminum shall be pretreated as recommended by the paint manufacturer. Prime surfaces to be painted with paint manufacturer's recommended primer.
 - .3 Paints and inks shall be made of other surface material on which they are to be applied and as recommended by the manufacturer of the paint or ink. Identification of paint or ink shall be noted on Shop Drawings with method of application. Prime coats or other surface pre-treatments, where recommended, shall be included in the Work. Coating shall be even over entire surface to be painted, without voids, runs, sags, brush or roller marks.
 - .4 In general, paint application shall be by brush or airless spray. Paint applied by brush shall be free of objectionable brush marks and meet the approval of the Owner.
 - .5 Interior paint finishes shall be acrylic polyurethane, semi-gloss on aluminum substrates, matte finish on plastic substrates.
 - .6 Acrylic polyurethane finish shall be applied at the rate of 2.5 mils per coat by air or airless spray.
-

- .7 Acceptable manufacturers include:
 - .1 Matthews Paint Co.
 - .2 Akzo Coatings Inc.
- .8 Sign colours shall match approved samples and shall be exactly as specified. Sign colours shall be consistent in chroma and in value, shall maintain even opacity and be free of any imperfections.

2.12 **SIGN GRAPHICS AND COMPONENTS**

- .1 Paint colour for exterior sign types is identified as silver/metallic on Design Intent Drawings. Colour to match Alucobond exterior signage panels.
- .2 Identity Signs (Series 100-1400):
 - .1 Aluminum framing with ACM Alucobond sign panels, painted, constructed to create frameless box with curved sign faces as specified. Sign type is internally illuminated, with routed out graphics with Day/Night Casocryl acrylic back up.
 - .2 Provide Icetron lamps, 120/240 volts, for even illumination with no halation. Provide electrical shut-off switch inside sign box.
- .3 Guide Signs (Series 1600-2100):
 - .1 Aluminum framing and faces, painted, constructed to create an exposed frame with curved sign faces as specified.
 - .2 Sign type is non-illuminated, with applied vinyl graphics.
 - .3 Aluminum plate of various thicknesses with removable panels, painted. Aluminum extruded square profile posts, various thicknesses, painted, with aluminum caps, designed to accept curved sign panels on a custom bracket.
 - .4 Sign type is non-illuminated, with surface applied vinyl graphics.
- .4 Orientation Signs (Series 2200-2400):
 - .1 Aluminum fabricated cabinets and brackets, various thicknesses, painted. Single aluminum post, square with diamond profile, custom brackets to accept directory cabinet, various thicknesses, painted, with custom aluminum caps.
 - .2 Sign type is non-illuminated, with surface applied vinyl graphics.
- .5 Regulatory Signs (Series 2700-4100):
 - .1 Aluminum sign panels, .090 minimum thickness, painted. Single aluminum post, square profile, with sign panel centered on post, fastened mechanically through sign panel, various thicknesses, painted, with extruded aluminum caps.
 - .2 Sign type is non-illuminated, with surface applied vinyl graphics. Stop symbol signs have reflective graphics.

3 Execution

3.1 **INSPECTION**

- .1 Before installation of signs, examine site conditions and Work of others in so far as it affects Work of this section and report immediately in writing to Owner's Representative all conditions which interfere with installation and its electrical service.
- .2 Begin installing signs only after deficiencies have been corrected in an acceptable manner.
- .3 Commencement of installation implies acceptance of related Work performed by others.

3.2 **PREPARATION**

- .1 Verify sleeves and recess sizing for proper alignment and service to an acceptable sign installation.
- .2 Protect surrounding areas from Work of this section.

3.3 **DEMOLITION**

- .1 The Contractor is responsible for the removal and disposal of certain existing freestanding signs and sign elements as identified in the sign Drawings. Existing sign demolition and/or renovation is not to commence until new signage is fabricated and ready for immediate installation.
- .2 The Contractor shall at all times keep the Owner's premises and the adjoining premises, driveways and streets clean of rubbish caused by the demolition operations, and the job site shall be left safe, neat and clean at the completion of each day's operation. All rubbish and debris shall be deposited off the Owner's property in an approved sanitary landfill site.
- .3 At the completion of the Work, the Contractor shall remove all the rubbish, tools, equipment, temporary work and surplus materials, from and about the premises, and shall leave the Site graded level with new sod. Again, all rubbish and debris shall be disposed of off the Owner's property in an approved sanitary landfill site.

3.4 **INSTALLATION**

- .1 Install sign units level, plumb and at the height indicated, with sign surfaces free from distortion or other defects in appearance.
- .2 Use of power-propelled fasteners to install signs is prohibited unless the Contractor receives written permission from the Owner.
- .3 Locate sign units and accessories where shown or scheduled, using mounting methods of the type described and in compliance with the manufacturer's instructions. Exact position of exterior directional signs shall be field located.

3.5 **CLEANING AND PROTECTION**

- .1 Keep the premises free of rubbish and debris caused by this Work, and upon completion of the Work leave the area included in the Contract broom clean. Remove waste materials and debris from the site and dispose of at legal disposal area away from the site.
-

- .2 Provide adequate protection for sign units from damage to materials or finish due to handling, storage, assembly and installation, until acceptance from Owner.
- .3 In the event of damage, be responsible to immediately make repairs and replacements to the approval of the Owner, at no cost to the Owner.
- .4 Use only those cleaning materials and methods recommended by manufacturers of surface materials to be cleaned.
- .5 At completion of installation, clean soiled sign surfaces in accordance with material manufacturer's instructions.
- .6 All installed sign units shall be free of tape, dirt, smudges and other foreign material.

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- | | | |
|----|-----------------------|--|
| .1 | ASTM A653/A653M | - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process |
| .2 | CAN/CSA-G40.20/G40.21 | - General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels |
| | | - Aluminum Association Designation System for Aluminum Finishes |
| .3 | CAN/CSA-G164 | - Hot Dip Galvanizing of Irregularly Shaped Articles |
| .4 | CSA W47.2 | - Certification of Companies for Fusion Welding of Aluminum |
| .5 | CSA W59-M | - Welded Steel Construction (Metal Arc Welding) |
| .6 | CAN/CGSB-1.108 | - Bituminous Solvent Type Paint |
| .7 | AODA | - Accessibility for Ontarians with Disabilities Act |

1.3 **DESIGN**

- .1 Design signs to withstand wind loading equal to 1.67 kPa without failure of sign faces, posts or connections.

1.4 **SUBMITTALS**

.1 Shop Drawings

- .1 Submit in accordance with Section 01 33 00.
- .2 Show material information, thicknesses, sizes, finishes, colours of materials, construction details, letter typeface, posts and concrete bases.

.2 Samples

- .1 Submit samples in accordance with Section 01 33 00.
- .2 If requested, submit sample of each type sign, sign image and mounting method.

1.5 **QUALIFICATIONS**

- .1 Manufacturer of signs shall be specialist in this field having minimum five years proven experience in sign manufacturing and installation of type of signs specified.

2 Products

2.1 **MATERIALS**

.1 Acceptable Manufacturers

.1 Forward Signs Inc.

.2 Or accepted equal

.2 Sign blanks: Steel sign blanks fabricated from galvanized/galvalume steel made from sheets. Galvanized steel shall conform to ASTM A653/A653M, regular type, coating designation Z-275.

.1 Galvalume steel shall conform to ASTM A 792, coating designation AZ-150.

.2 The coated steel shall be minimum 1.5 mm thick.

.3 Fasteners: Hardened aluminum or stainless steel or of type that will not permit galvanic action.

.4 Sign posts: Breakaway installed, 50 mm square posts fabricated from 14 ga galvanized steel tube with pre-punched holes on 25 mm centers on all four sides. Posts, spacers, bolts, nuts and lock washers shall be galvanized after fabrication conforming to ASTM A-123.

.1 All holes shall be punched or drilled cleanly prior to galvanizing and shall be freed of excess deposits of zinc.

.2 Design posts to allow removal and replacement without breaking out concrete.

.5 Sign anchors: Direct buried minimum 609.6 mm and 50-75 mm above finish grade. Hammered down anchor for concrete and asphalt complete with non-shrink grout. Hammered down omni-directional anchor for soil.

.6 Sign graphics: Self-sticking UV resistant, premium quality vinyl film by 3M.

.7 Bituminous paint: Henry 410-02.

.8 Concrete bases: Air entrained 20 MPa concrete at 28 days, conforming to Section 03 30 00.

.9 Concrete base forms: "Sonotube".

2.2 **PROJECT INFORMATION SIGNAGE FOR PUBLIC**

.1 Refer to Section 10 14 00.01 City of Toronto Construction-Improvement Signs for information on the standard template to be used for projects accessible to the public.

2.3 **SIGN SCHEDULE**

.1 Refer to Signage Drawings.

2.4 **GENERAL FABRICATION REQUIREMENTS**

.1 Fabricate signs in accordance with details on Drawings, Specifications and Shop Drawings to present a safe and rigid installation.

.2 Build units square, true, accurate to size, and free from visual or performance defects.

- .3 Accurately fit and securely join sections to obtain tight, closed joints.
- .4 Do steel welding to CSA W59 and aluminum welding to CSA W47.2 Finish exposed welds flush and smooth.
- .5 Apply bituminous paint to aluminum in contact with dissimilar metals, concrete or masonry.
- .6 Sign Faces
 - .1 Fabricate sign faces in one piece.
 - .2 Installed face to present rigid surface with minimal distortion.
 - .3 Degrease sign blanks before applying vinyl.

3 Execution

3.1 **EXCAVATION AND CONCRETE WORK**

- .1 Excavate post holes to suit depth of concrete bases, cleanly cut to diameters as specified, ready to receive posts set in concrete fill. Remove excavated earth from the site.
- .2 Form the top 200 mm of the concrete bases with specified form.
- .3 Mix concrete with a minimum amount of water and ram solidly into the excavations and around posts.
- .4 Unless Drawings show otherwise, concrete bases shall be of diameter as specified below and approximately 50 mm above grade with tops pitching away from posts and finished smooth and even.
 - .1 For all posts: 300 mm diameter, 1200 mm deep.

3.2 **INSTALLATION**

- .1 Build and erect signs plumb true, square, straight level and accurate to sizes detailed on reviewed Shop Drawings, free from distortion of defects detrimental to appearance and performance.
- .2 Comply with sign manufacturer's installation instructions and approved Shop Drawings.
- .3 Install poles in concrete foundation. Refer to and comply with Section 03 30 00 for concrete requirements.

3.3 **CLEANING**

- .1 Leave signs clean and polish all exposed surfaces.
- .2 Touch up any damaged finishes.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- .1 AODA - Accessibility for Ontarians with Disabilities Act
- .2 TADG - Toronto Accessibility Design Guidelines

1.3 **SUBMITTALS**

- .1 Submit manufacturer's specifications and technical data, installation instructions, as required, and catalogue cuts and templates where required to explain the construction and incorporate it into the project.
- .2 Submit shop drawings showing complete fabrication details, fastener and anchor location, plans of plate placement including joints, and material to be used as well as outlining installation materials and procedure.
- .3 Samples: Submit samples illustrating colour and finish.

1.4 **QUALIFICATIONS:**

- .1 Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of the Products, systems and assemblies specified and with approval and training of the Product manufacturers.
 - .1 Installers shall have received training from the manufacturer for the installation of the specified tactile warning systems.

1.5 **DELIVERY, STORAGE AND HANDLING**

- .1 Deliver packaged materials in original, undamaged containers with manufacturer's labels and seals intact. Handle and store materials in accordance with manufacturer's and Supplier's recommendations to prevent damage thereto.

1.6 **PROTECTION**

- .1 Protect the Work of this section from damage of any kind. Protect other work from damage resulting from Work of this section. Replace damaged work which cannot be repaired, cleaned or restored.

2 Products

2.1 **TACTILE WALKING SURFACE INDICATORS**

- .1 Surface Applied Composite Polymer Tile (TA-1a)
 - .1 Engineered polymers truncated dome tile with beveled edges, surface mounted and secured with adhesive and fasteners matching the colour of the tile.

- .1 Application: Interior and existing exterior applications, existing cured concrete surfaces where a detectable warning system is required, curb ramps, pedestrian crossings, parking areas, wheelchair ramps, top and bottom of stairs, or platforms.
 - .2 Sizes: 305 x 305 mm, 610 x 610 mm, 610 x 915, 610 x 1220 mm, 610 x 1524 mm or unless indicated otherwise.
 - .3 Colour: Federal Yellow or as selected by Consultant from manufacturer's standard colours.
 - .4 Acceptable Manufacturer:
 - .1 Access Tile® by Kinesik Engineered Products
 - .2 AlertTile® by Cityscape Supply Group
 - .2 Replaceable Cast-In-Place Polymer Tile (TA-1b)
 - .1 High density truncated domes with diamond grip pyramid micro texture, slip resistance in wet and dry conditions, installed directly into wet set concrete. Nylon composite, self-threading, corrosion resistant anchor and stainless-steel fastener allowing for re-installation.
 - .1 Application: Exterior use for new concrete application for curb ramps, pedestrian crossings, vehicular passage ways, parking areas, top and bottom of stair landings, and platforms
 - .2 Sizes: 305 x 305 mm, 610 x 610 mm, 610 x 915 mm, 610 x 1220 mm, 610 x 1524 mm or unless indicated otherwise. Contact Manufacturer for additional sizes available.
 - .3 Colour: Federal Yellow or as selected by Consultant from manufacturer's standard colours.
 - .4 Acceptable Manufacturer:
 - .1 Access Tile® by Kinesik Engineered Products
 - .2 AlertCast® by Cityscape Supply Group
 - .3 Or accepted equal
 - .3 Surface Applied Fire-Resistant Composite Polymer Tile (TA-1c)
 - .1 Composite truncated dome tile with beveled edges meeting ULC-S102.2 fire standard (less 25 flame and 50 smoke).
 - .1 Application: Interior application at exit stair wells, vestibules to exit stairs and lobbies, corridors.
 - .2 Sizes: 305 x 305 mm, 305 x 1220 mm, 610 x 610 mm, 610 x 915 mm, 610 x 1220 mm, 610 x 1524 mm or unless indicated otherwise. Contact Manufacturer for additional sizes available.
 - .3 Colour: Federal Yellow or as selected by Consultant from manufacturer's standard colours.
-

- .4 Acceptable Manufacturer:
 - .1 Access Tile FR® by Kinesik Engineered Products
 - .2 AlertTile® FR by Cityscape Supply Group
 - .3 Or accepted equal
 - .4 Surface Applied Vitrified Polymer Tile (TA-2a)
 - .1 Diamond-hard vitrified polymer composite with bevelled edges, weather and wear resistance. Slip Resistance of Tile when tested by ASTM C1028 of 0.80 wet and dry static coefficient of friction on top of domes and field area.
 - .1 Application: Interior non-fire rated and exterior application in existing cured concrete surfaces where a detectable warning system is required, curb ramp, parking areas, pedestrian crossings, top of stairs or where a change in elevation greater than 250mm or a slope steeper than a ratio of 1:3.
 - .2 Sizes: 160mm x 610mm, 610mm x 915mm, 610mm x 1220mm, 610mm x 1524mm, or contact Manufacturer for additional sizes available.
 - .3 Colour: Federal Yellow or as selected by Consultant from manufacturer's standard colours.
 - .4 Acceptable Manufacturer:
 - .1 Armor Tile® by Kinesik Engineered Products
 - .2 Or accepted equal
 - .5 Cast in Place Vitrified Polymer Tile (TA-2b)
 - .1 Diamond-hard vitrified polymer composite detectable warning tile with, truncated domes and integral embedment flanges, weather and wear resistance. Minimum 0.8 wet/dry static coefficient of friction in accordance with ASTM C1028.
 - .1 Application: Exterior use for new concrete application and non-fire rated interior application, curb ramps, pedestrian crossings, parking areas, top of stairs landings or where the change in elevation is greater than 250mm or the slope is steeper than a ratio of 1:3,
 - .2 Sizes: 305 mm x 305 mm, 615 mm x 625 mm, 625 mm x 915 mm, 625 x 1220, 625 x 1524, unless indicated otherwise. Contact manufacturer for additional sizes available.
 - .3 Colour: Federal Yellow or as selected by Consultant from manufacturer's standard colours.
 - .4 Acceptable Manufacturer:
 - .1 ArmorTile® by Kinesik Engineered Products
 - .2 Or accepted equal
-

.6 Resilient Rubber / Polymer Tactile Indicator Tile (TA-3)

- .1 Flexible polymer tiles for attention indicators for warning (truncated domes) or directional indicators for way finding (bars).
 - .1 Application: Interior surface applied application, curb ramps, parking areas, top of stair landing, vehicular passage ways, or where the change in elevation is greater than 250 mm or the slope is steeper than in a ratio of 1:3. Interior applications ideal for laminate, parquet, VCT, sealed concrete or terrazzo flooring.
 - .2 Sizes: 300 mm x 300 mm x 3 mm, unless indicated otherwise
 - .3 Colour: as indicated on Drawings or selected by Consultant from manufacturer's standard colours.
 - .4 Acceptable Manufacturer:
 - .1 Eon Tile® by Kinesik Engineered Products
 - .2 RediMat® by Cityscape Supply Group
 - .3 Or accepted equal

.7 Porcelain Tactile Tile (TA-4)

- .1 Porcelain tactile walking surface indicator with truncated domes for warning, and direction indicators for wayfinding bars.
 - .1 Wayfinding Tile pattern parallel to principal direction of travel.
 - .2 Application: interior or exterior application for porcelain and other tiled floor applications, curb ramps, parking areas, top of stair landing, vehicular passage ways, or where the change in elevation is greater than 250 mm or the slope is steeper than in a ratio of 1:3.
 - .3 Sizes: 300 mm x 300 mm, unless indicated otherwise
 - .4 Colour: as indicated on Drawings or selected by Consultant from manufacturer's standard colours.
 - .5 Acceptable Manufacturer:
 - .1 Elan Tile® by Kinesik Engineered Products
 - .2 Cityscape Supply Group
 - .3 Or accepted equal

.8 Permanent Cast-in-Place Cast-Iron Tactile Tile (TA-5)

- .1 Lightweight cast iron plate truncated dome with integral texture for a slip resistant surface, permanently embedded into concrete and bolted connection.
 - .1 Application: Exterior – new concrete applications, curb ramps, pedestrian crossings, transit platforms, parking areas, top of stair landings or where the change in elevation is greater than 250 mm or the slope is steeper than in a ratio of 1:3.

- .2 Sizes: 457mm x 610mm, 610mm x 610mm, 762mm x 610mm, 610mm x Various Radii
 - .3 Colour: Natural Uncoated Patina or as selected by consultant from manufacturer's powder coating options.
 - .4 Acceptable Manufacturer:
 - .1 Advantage Tactile Systems® by Kinesik Engineered Products
 - .2 Cityscape Supply Group
 - .3 Or accepted equal
 - .9 Stainless Steel Surface Applied Plate Tactile Indicators (TA-6)
 - .1 Surface applied 316L marine grade stainless steel plate with truncated domes attention indicator or directional wayfinding bars.
 - .1 Application: Exterior and interior applications, wheelchair ramps, parking areas, top of stair landings, revolving door approaches, or where the change in elevation is greater than 250 mm or the slope is steeper than in a ratio of 1:3.
 - .2 Sizes: 305 mm x 305 mm or 305 mm x 610 mm
 - .3 Finish: Stainless steel
 - .4 Acceptable Manufacturer:
 - .1 Advantage One Plate® by Kinesik Engineered Products
 - .2 Cityscape Supply Group
 - .3 Or accepted equal
 - .10 Individual Metallic Tactile Domes and Guidance Bars (TA-7 & TA-8)
 - .1 Truncated Domes (TA-7)
 - .1 Interior application
 - .1 Individual 316L marine grade stainless steel installed on any type of flooring, for high aesthetic finish applications
 - .2 Application: Non-heritage floor and carpeting.
 - .3 Installation method: drilled
 - .4 Pattern: Concentric Ring Design.
 - .5 Acceptable Manufacturer:
 - .1 Advantage One® by Kinesik Engineered Products
 - .2 Cityscape Supply Group
 - .3 Or accepted equal
-

- .2 Exterior application
 - .1 Black Physical Vapor Deposition Coating (PVD) coated stainless steel. Carborundum Insert, Crosshatch or Concentric Ring Design
 - .2 Sizes: 22 mm diameter x 4.5 mm high, unless indicated otherwise
 - .3 Acceptable Manufacturer:
 - .1 Advantage One® by Kinesik Engineered Products
 - .2 Cityscape Supply Group
 - .3 Or accepted equal
- .2 Guidance Bars (TA-8)
 - .1 Wayfinding, individual stainless steel, brass, or aluminum, Dome Pattern: Carborundum Insert, Crosshatch or linear groove design.
 - .2 Use: Interior application, installed on any type of flooring, for high aesthetic finish applications or non-heritage designated stairs.
 - .3 Pattern: Dome Pattern: Carborundum Insert, Crosshatch or Concentric Ring Design.
 - .4 Sizes: 280mm x 27mm, unless indicated otherwise
 - .5 Acceptable Manufacturer:
 - .1 Advantage One® by Kinesik Engineered Products
 - .2 Cityscape Supply Group
 - .3 Or accepted equal

2.2 **TEXTURAL AND COLOUR CONTRAST WARNING STRIP AND NOSING**

- .1 Slip resistance, weather resistance, UV resistance, stain resistance textural warning surfaces for edge and pathway marking with photoluminescent powder and non-slip materials. Configuration in accordance with Contract Drawings and conforming to manufacturer's printed instruction for accurate, secure installation Colour: as indicated on Drawings or selected by Owner.
- .2 Non-Photoluminescent Non-Slip Strips (TA-11)
 - .1 Hard-wearing silicon carbide, integrally bonded to aluminum substrate, anti-slip protection for step edge.
 - .2 Application: Indoor and outdoor use
 - .3 Sizes: 37.3 mm or 51 mm x 1.8 mm thick, unless indicated otherwise
 - .4 Collection: "N-30 Series" by Kinesik Ecoglo, or accepted equal

- .3 Cast-In-Place Inserts (TA-12)
 - .1 Photoluminescent nosings installed in wet concrete, clear anodized aluminum finish, hard-wearing silicon carbide non-slip material integrally bonded to the aluminum substrate.
 - .2 Application: Indoor and outdoor use in poured concrete flat and ramp applications and concrete filled steel pan stairs.
 - .3 Sizes: 51 mm or 54.6 mm x 9.5 mm thick, unless indicated otherwise
 - .4 Acceptable Manufacturers
 - .1 "S-1 Series" by Kinesik Ecoglo,
 - .2 ADA Solutions - Cast-in-Place Nosing by Cityscape Supply Group
 - .3 or accepted equal
 - .4 Photoluminescent Stair Nosing
 - .1 Flat Stair Nosing (TA-16)
 - .1 Photoluminescent anodized right-angled aluminum flat step nosing, clear anodized aluminum finish.
 - .2 Application: Indoor and outdoor use on concrete, timber, tiles, steel, checker plate and thin carpeted stairs.
 - .3 Sizes: 68.8 mm x 19.1 high, unless indicated otherwise
 - .4 Acceptable Manufacturers
 - .1 "F4 or F5B" Series by Kinesik Ecoglo
 - .2 ADA Solutions - Flat Stair Nosing by Cityscape Supply Group
 - .3 or accepted equal
 - .2 Tile Stair Nosing (TA-17)
 - .1 Photoluminescent tile nosing, anodized aluminum profile, integrated anti-slip contrast strips, all-weather slip resistance.
 - .2 Application: Indoor and outdoor use on tiled stairs that are between 5mm and 8.5mm thick
 - .3 Size: 86.9 mm x 19.5 mm high, unless indicated otherwise
 - .4 Acceptable Manufacturers
 - .1 "M4 Series" by Kinesik Ecoglo,
 - .2 ADA Solutions - Tile Nosing by Cityscape Supply Group
 - .3 or accepted equal
-

- .3 Carpet Stair Nosing (TA-18)
 - .1 Photoluminescent anodized carpet stair nosing with integrated anti-slip contrast strips, all-weather slip resistance, anodized aluminum finish.
 - .2 Application: Indoor use on carpeted stair landings and ramps in public stairways, exit ways and other applications.
 - .3 Size: 68 mm x 33.3 high, unless indicated otherwise
 - .4 Acceptable Manufacturers
 - .1 "C4 or RC4 Series" by Kinesik Ecoglo
 - .2 or accepted equal
 - .4 Poured Concrete Nosing (TA-19 & TA-20)
 - .1 (TA-19): Integrally extruded, heat treated extruded, aluminum alloy 6063-T-6, filled with a mixture of virgin aluminum oxide and silicon carbide abrasive granules in an epoxy binder.
 - .1 Application: Outdoor use in poured concrete, terrazzo stairs or non-heritage designated stairs.
 - .2 Size: 53.9 mm, 79.4 mm or 101.6 mm x 9.5 thick, unless indicated otherwise
 - .3 Acceptable Manufacturers
 - .1 "FA-211D", FA-311D or FA-411D by American Safety Tread
 - .2 "Spectra" by Cityscape Supply Group
 - .3 or accepted equal
 - .2 (TA-20): Photoluminescent nosing installed in wet concrete, clear anodized aluminum finish, hard wearing silicon carbide non-slip material integrally bonded to the aluminum substrate.
 - .1 Application: Indoor and Outdoor use in new poured concrete stairs, where the nosing insert is wet-set, and the contrast strip is installed into the nosing post-construction to prevent fouling.
 - .2 Size: 55.8mm x 19.7mm, unless indicated otherwise
 - .3 Colour: Black (TA-20a), Grey (TA-20b), Yellow (TA-20c)
 - .4 Acceptable Manufacturers
 - .1 "S2 or S4" Series by Kinesik Ecoglo,
 - .2 Wooster NiteGlow" by Cityscape Supply Group
 - .3 or accepted equal.
-

2.3 ACCESSORIES

.1 Fasteners and anchors:

.1 As recommended by manufacturer for secure anchorage of tactile warning surfaces. Provide noncorrosive fasteners that are compatible with each material joined, and complying with the following:

.1 Furnish color appropriate nylon sleeve, stainless-steel fasteners for exterior use.

.2 Fastener Heads: for nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant heads, colored to match tile.

.2 Adhesives:

.1 Tactile Walking Surface Indicators:

.1 Adhesives: As applicable for type of installation. Acceptable manufacturers Mapei, Bostik, Sika, Tactile Bond & Seal or accepted equal.

.2 Textural and Colour Contrast Warning Strip and Nosing:

.1 Adhesives: polyurethane adhesive, mechanically fastened or as recommended by the manufacturer

.3 Sealant:

.1 As recommended by manufacturer for sealing perimeter of tactile warning surfacing unit.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions:

.1 Verify existing conditions and finishes are ready to receive specified work. Ensure backings are structurally sound, level and plumb within required tolerances as indicated in 03 35 00. Notify Consultant in writing of unacceptable substrate conditions.

.2 Ensure compatibility of adhesion, reinforcing and fillers with adjacent substrate and component coming in contact with these products.

.3 Ensure manufacturers, examine substrate conditions, verify conditions are suitable for installation prior to commencement and review application procedures. If requested, submit written reports.

.2 Evaluation and Assessment:

.1 Prior to installation, set aside for further inspection and replacement, tiles that are sub-standard, fractured, chipped or has pinholes or voids that are unusable for cuts. Contractor shall replace substandard and/or pre-damaged tiles at no additional cost to the Owner.

- .2 Before setting, examine tile backs for possible dust or other contaminants. If necessary, use a slightly damp towel and wipe tile backs to remove any dust or contaminant residues.

- .3 Commencement of work implies acceptance of previously completed work.

3.2 **PREPARATION**

- .1 Ensure substrates are clean and free of dust, oil, grease, paint, tar, wax, curing agent, primer, sealer, form release agent or any deleterious substance and debris which may prevent or reduce adhesion.
- .2 Thoroughly clean the surface with an appropriate floor cleaner, ensuring all paint or sealant is removed.
- .3 Provide templates and rough-in measurements as required.

3.3 **INSTALLATION**

- .1 Install tactile warning systems and accessories to manufacturer's written instructions.
- .2 Install securely and rigidly, bonded to substrate.

3.4 **FIELD QUALITY CONTROL**

- .1 Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to the Owner.
- .2 Manufacturer Services: Have manufacturer's representative visit site at commencement of work to give proper direction and thereafter at regular intervals to ensure proper workmanship.

3.5 **PROTECTION**

- .1 Protect other parts of work from spatters, stains or damage.
- .2 Protect finished work from foot traffic and heavy commercial and equipment traffic. Follow Product instructions for requirements.
- .3 Protect finished work from damage by other trades and general abuse until substantial completion or acceptance.

3.6 **CLEANING**

- .1 Remove grout and other residue immediately while work progresses and before materials harden on tile surface.
- .2 Clean tile completely leaving no apparent cement laitance on the surface.
- .3 Clean adjacent surfaces that have been soiled or otherwise marred, to completely remove evidence of materials causing same.

End of Section

-
- 1 General
 - 1.1 **SUMMARY**
 - .1 Section Includes
 - .1 Labour, Products, equipment and services necessary to complete the Work of this section.
 - 1.2 **REFERENCES**
 - .1 Conform to the latest edition of the following:
 - .1 AODA - Accessibility for Ontarians with Disabilities Act
 - 1.3 **SUBMITTALS**
 - .1 Shop Drawings
 - .1 Submit in accordance with Section 01 33 00.
 - .2 Show compartment and screen layout, dimensions, finishes, and other pertinent information.
 - .2 Samples: Submit two 300 mm x 300 mm corner samples of partition.
 - 1.4 **DELIVERY, STORAGE AND HANDLING**
 - .1 Deliver materials in sequence to meet installation schedule. Provide protection from marring or other damage.
 - .2 Carefully unload materials; handle and store in a manner to prevent damage. Remove unsatisfactory materials and replace to Consultant's satisfaction at no cost to Owner.
 - 2 Products
 - 2.1 **MANUFACTURERS**
 - .1 "Elite Max Series" by Hadrian Manufacturing (Basis of Design)
 - .2 ASI Global
 - .3 General Storage Systems
 - .4 Shanahan
 - .5 Or accepted equal
 - 2.2 **MATERIALS**
 - .1 Stainless Steel: to ASTM A167, Type 304
 - .2 Sheet Steel: to ASTM A653/A653M, galvanized coating
 - .3 Aluminum Extrusions: to ASTM B221, 6063-T5 alloy and temper
 - .4 Attachments, Screws and Bolts: stainless steel, tamper proof type, heavy duty extruded aluminum brackets.
-

.5 Mounting Style:

- .1 Floor mounted, Headrail braced Pedestal. Headrail shall be extruded anodized aluminum with double-ridge anti-grip design.
- .2 Pilasters shall be securely and rigidly fastened to the floor and fitted with a jack levelling screw for vertical adjustment. The floor fastening shall be concealed and protected by a 102mm (4") high, die-formed stainless steel pilaster shoe or #4 brushed stainless steel pedestal, mounted panel-to-floor with a panel.

2.3 **FINISH**

- .1 All sheet metal to be thoroughly cleaned, phosphated and finished with a high-performance poly-urethane anti-graffiti powder coating, electrostatically applied and oven cured to provide a uniform smooth protective finish.
- .2 Colour: #828 Dovetail or as later selected by Consultant.
- .3 Pilaster and panel pedestals to be stainless steel with a #4 brushed finish.

2.4 **COMPONENTS**

.1 Construction:

- .1 Doors, Panels and Pilasters shall be constructed of two sheets of panel flatness zinc-coated type 304, #4 brushed stainless steel, laminated to a honeycombed core, and formed edges with an oval crown locking bar mitred, welded and finished at corners.

.2 Doors and Panels:

- .1 Regular stalls: 25 mm thick with cover sheets not less than 22-gauge (0.8mm). All doors are 1981mm (78") high. Maximum panel depth is 1473mm (58").

.3 Pilasters:

- .1 32 mm thick with cover sheets not less than 20-gauge (0.9mm).
- .2 Pilaster tops shall be reinforced with a 20-gauge channel to create extra strength and twist-free rigidity along with minimizing damage by handling and/or shipping.

.4 Headrail:

- .1 25 mm x 41 mm extruded anodized aluminum with double-ridge anti-grip design. Wall thickness to be 1.5mm (0.060").
- .2 Headrail shall be securely and rigidly attached to wall and pilasters with manufacturer's fittings.
- .3 All joints in headrails shall be made at pilaster

.5 Hardware: Heavy duty type, as follows: (Type 304 stainless steel as follows):

- .1 Panel-to-wall connection: full-height channels, finished to match partitions. Fasteners shall be #4 brush finished stainless steel 12 x 1-3/4" and 12 x 5/8" TR-27 6-lobe security screws.
 - .2 Panel-to-pilaster connection: Heavy duty full height continuous aluminum channel.
-

- .3 Urinal screen-to-wall connection: Heavy duty aluminum "U" flanged brackets with two holes for connection to wall and four holes for connection to screen.
 - .4 Hinges: standard zinc #4 brushed finish die cast gravity type hinges, mounted on upper and lower pilaster hinge brackets. Threaded top hinge pin shall be metal with a self-lubricating nylon sleeve.
 - .5 Latching device: surface mounted with occupancy indicator, Type 304 #4 stainless steel finish. Provide a full-length aluminum continuous stop and full-length aluminum hinge side filler to eliminate all sightline gaps between pilasters and doors.
 - .6 Accessories: Provide brackets and combination coat hook/bumper in regular compartments. Equip barrier-free compartments with door pull, and coat hook on side wall, projecting 25 mm maximum.
 - .7 Screws: Long-life coated, theft-proof head sheet metal screws. Use shields designed for the wall to which panels and screens are connected to, so as to achieve a rigid installation.
- .6 Urinal screens: 450 mm deep x 1219 mm high, same construction as partitions. Screens shall be 25 mm thick cover sheets, not less than 22 gauge, type 304, #4 brushed finish stainless steel, laminated to a vertical honeycomb core. Edges to be welded together and inter-locked under tension with a roll-formed oval crown locking bar, mitred, welded and ground smooth at the corners. Honeycomb to have a maximum 12.5 mm cell size. Screens shall be anchored into wall with two brackets spaced at approximately 902 mm apart.

2.5 **FABRICATION**

- .1 Visit site and take necessary measurements required before fabrication.
- .2 Verify spacing and locations of plumbing fixtures to assure compatibility with compartments
- .3 Accurately follow methods of fabrication reinforcement and anchorage shown on reviewed Shop Drawings.
- .4 Cut, shear, straighten and work steel in a manner to prevent disfigurement of finished Work.
- .5 Use metal end caps only, in colour to match panels.
- .6 Reinforce doors, partitions and screens for hardware and for partition mounted tissue dispensers.
- .7 Ensure finished Work is free of warp, open seams, buckles and other surface defects detrimental to appearance.

3 **Execution**

3.1 **INSTALLATION**

- .1 Install compartments and screen plumb and square to building lines and according to manufacturer's printed directions. Secure to wall with brackets. Use three brackets per panel. Use two brackets per urinal screen. Mechanically fasten with screws and shields so that panels and screens are firmly attached.

- .1 Set compartments 102 mm above finished floor or as indicated on Drawings.
- .2 Set urinal screens approximately 305 mm above finished floor or as indicated on Drawings.
- .2 Perform drilling of steel, masonry or concrete necessary to install the Work. Co-ordinate installation of any inserts, anchors or reinforcements which must be built in by other trades.
- .3 Install hardware and ensure it is visually aligned.
- .4 Maintain uniform consistent width between panels and pilasters, between panels and walls and between pilasters and walls such that persons using the compartments cannot be seen.
- .5 Test and adjust hinges and latches for ease of operation. Set hinges so doors stay open thirty degrees when compartment is not in use.
- .6 Touch up damaged shop paint to match original finish.

3.2 **CLEANING**

- .1 Remove factory installed strippable protective coating from metal panels.
- .2 Clean and make good surfaces soiled or damaged. Replace materials that cannot be satisfactorily cleaned and restored as determined by Consultant.

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.
- .2 Furnish Products of one manufacturer to extent possible.

.2 General Requirements

- .1 The following products will be supplied by NEXT Plumbing Supply (NPS):
 - .1 Toilet Tissue Dispensers, Double Roll
 - .2 Paper Towel Dispensers (Barrier Free)
 - .3 Soap Dispensers – Wall Mounted
 - .4 Soap Dish – wall mounted
 - .5 Hand Dryers
 - .6 Napkin Disposal Bins
 - .7 Unit Mirrors
 - .8 Mirror Shelf
 - .9 Grab Bars:
 - .1 Straight
 - .2 L-shaped grab bar:
 - .3 Folding grab bar
 - .4 Stainless steel grab bar with padded back rest
 - .10 Folding Shower Seats
 - .11 Baby Change Table
 - .2 As part of the Shop Drawing submittal, Contractor is to submit a by-building order form to the Consultant and Owner listing the items and quantities for each building the equipment is to be installed. Refer to the Appendices for the Plumbing and Accessories Order Form.
 - .3 Once the Shop Drawings are reviewed and the order form quantities are verified by the Consultant and Owner, the Owner will submit the order form to NPS for processing as well as pay NPS for the order directly.
 - .4 Contractor is to coordinate delivery of supplied items with NPS and store on site as needed prior to installation.
-

- .5 Material defects of the products and equipment are the responsibility of NPS and the Contractor to coordinate and replace as required with no extra expense to the Owner.
- .6 Replacement of any equipment or appurtenances listed in section 1.1.2.1 of this specification will be at the expense of the Contractor.

1.2 REFERENCES

- .1 Conform to the latest edition of the following:
 - .1 CAN/CGSB-12.5-M - Mirrors, Silvered
 - .2 AODA - Accessibility for Ontarians with Disabilities Act
 - .3 TADG - Toronto Accessibility Design Guidelines
 - .4 ETL - Electrical Testing Laboratories

1.3 SUBMITTALS

- .1 Shop Drawings
 - .1 Submit in accordance with Section 01 33 00.
 - .2 Submit Shop Drawings in the form of catalogue cuts and fully illustrating specified materials with description of components, surface finishes, hardware and securement devices.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials in sealed cartons and containers with manufacturer's name and Product description clearly marked thereon.

1.5 WARRANTY

- .1 Warrant the following Work against defects and deficiencies for the period specified from date Work is certified as substantially performed in accordance with the general conditions of the Contract:
 - .1 Deterioration of mirror silvering: Ten years
- .2 Promptly make good defects and deficiencies which become apparent within the Warranty Period by replacing defective Work satisfactory to the Consultant and at no expense to the Owner.

2 Products

2.1 TOILET TISSUE DISPENSERS (TPD)

- .1 Surface mounted (TPD-1): type 304, 20 gauge stainless steel cabinet with satin finish, twin jumbo roll type, tumbler key locking mechanism and high impact ABS dispensing mechanism. 18 gauge stainless steel door with wide viewing slot:
 - .1 Bobrick, Model No. 2892
 - .2 Bradley, Model No. 5425 (Product No. 5425000000)
 - .3 Or accepted equal

- .2 Surface mounted (TPD-2): Circular toilet paper dispenser, stainless steel with satin finish, jumbo roll, tumbler key locking mechanism, and refill indicator viewing slot:
 - .1 Bradley, Model No. 5424
 - .2 Or accepted equal
- .3 Surface mounted (TPD-3): Type 304 stainless steel with satin finish, double roll type, one-piece seamless construction with four mounting holes, 18 gauge hood and chrome plated plastic spindles with internal springs.
 - .1 Bobrick, Model No. B-69997
 - .2 Bradley, Model No. 5126
 - .3 Or accepted equal
- .4 Surface mounted (TPD-4): 22 gauge stainless steel cabinet and doors in satin finish. All-welded construction, dispensing mechanism, inner housing and cam. Multi-roll, flush tumbler lock and 2 heavy-duty theft-resistant spindles to hold standard core toilet tissue rolls.
 - .1 Bobrick, Model No. B-2888
 - .2 Bradley, Model 5402
 - .3 Or accepted equal

2.2 **PAPER TOWEL DISPENSERS (PTD)**

- .1 Surface mounted (PTD (S)): Automatic , universal toll paper towel dispenser, Type 304, 18 gauge stainless steel with all welded construction, satin finish door with tumbler lock key cabinet, one piece seamless door secured to cabinet with full length stainless steel piano hinge.
 - .1 Bobrick, Model B-2974
 - .2 Or accepted equal
 - .2 Surface mounted (PTD (PR)): Translucent, high impact plastic cover with double latch-key lock. Heavy gauge powder coated steel back and fiberglass reinforced ABS plastic push lever.
 - .1 Bradley, Model No. 2497
 - .2 Or accepted equal
 - .3 Surface mounted (PTD (SM)): Type 304, 18 gauge stainless steel, all heliarc welded construction with defined edges and corners. Cabinet connected to backplate via a hinge at the unit's rear bottom, backplate with recessed key lock mounting holes.
 - .1 Bobrick, Model No. B9262
 - .2 Or accepted equal
 - .4 Recessed (PTD (R)): type-304, heavy-gauge stainless steel, all-welded construction, exposed surfaces have satin finish, stainless steel door secured to cabinet with piano-hinge.
-

.1 Bobrick, Model No. B-35903

.2 Or accepted equal

2.3 **PAPER TOWEL DISPENSERS AND WASTE RECEPTACLE (PTD/WR)**

.1 Surface Mounted (PTD/WR (S)): Type Type-304, 22 gauge stainless steel, satin finish, all welded construction, stainless steel doors secured to cabinet with full-length piano hinges and knob latch. and heavy gauge removable waste receptacle:

.1 Bobrick, Model No. 3699

.2 Or accepted equal

.2 Recessed (PTD/WR (R)): Type-304, heavy-gauge stainless steel. Welded construction. Exposed surfaces with satin-finish, stainless steel door, semi-concealed tumbler lock keyed and round towel tray with hemmed opening, removeable waste container with minimum capacity of 6 gal.

.1 Bobrick, Model No. 3940

.2 Or accepted equal

.3 Semi-recessed (PTD/WR (SR)): Type-304, heavy-gauge stainless steel with satin finish. All-welded construction, rounded towel tray, door secured to cabinet with concealed, full-length, stainless steel piano-hinge and equipped with a stainless steel cable door-swing limiter and two flush tumbler locks. Removeable rigid molded plastic waste container with minimum capacity of 6.3 gal:

.1 Bobrick, Model No. 38032

.2 Or accepted equal

2.4 **SOAP DISPENSERS (SD)**

.1 Soap Dispenser

.1 Wall mounted (SD-1), automatic stainless steel housing with satin finish, clear acrylic refill-indicator window and key lock, refillable plastic container with liquid type 850 ml capacity container with no touch, sensor-activated valve:

.1 Bradley, Model No. 6A00-11 (Product No. 6A00110000)

.2 Or accepted equal

.2 Counter Mounted (SD-2): Touch free, one piece, cast brass construction above deck, single mount foam soap dispenser with adjustable sensor and vandal resistant below deck box.

.1 Moen, Model No. 8560

.2 Or accepted equal

.2 Drip Trays / Soap Collector. Submit product data sheets to Consultant for approval prior to installation.

.1 Wall mounted, brushed stainless steel drip tray for mounting below soap dispensers.

.2 Acceptable Products:

.1 NSU 7 by SanTRAL®Classic by Ophardt Hygiene Technologies Inc. or accepted equivalent.

.1 (DT-1) Short Option: (Product No. 1420573)

.1 Size (W x H x D): 122 mm x 30 mm x 181 mm

.2 (DT-2) Long Option: (Product No. 1420574)

.1 Size (W x H x D): 122 mm x 137 mm x 181 mm

.2 NSU 11 by SanTRAL®Classic by Ophardt Hygiene Technologies Inc. or accepted equivalent.

.1 (DT-3) Short Option: (Product No. 1420575)

.1 Size (W x H x D): 95 mm x 30 mm x 183.3 mm

.2 (DT-4) Long Option: (No. 1420576)

.1 Size (W x H x D): 95 mm x 240 mm x 183.3 mm

2.5 **SOAP DISH**

.1 Surface mounted (SDI-1), stainless steel, type 304 flange, chrome-plated, support arm and concealed wall plate, one-piece seamless construction.

.1 Bradley Model No. 901 (Product No. 901-000000)

.2 Or accepted equal

.2 Recessed mounted (SDI-1), heavy-duty stainless steel with satin finish, one-piece seamless construction.

.1 Bradley Model No. SA16

.2 Or accepted equal

2.6 **HAND DRYERS (HNDR)**

.1 "Airblade V" by Dyson Canada Limited, Model HU02 Nickel finish, or accepted equal. Low voltage option: 307174-01. High voltage option: 307172-01. Polycarbonate casing with anti-microbial molded additive. Anti-microbially integrated external plastics and seals with anti-tamper M4 exterior pin-hex screws. Water ingress protection to IP24.

.1 Operation: Touch free capacitive sensor activation.

.1 Hand dry time: 12 seconds.

.2 Airspeed at nozzle: 675 km/h

.3 Operating airflow: up to 28 l/s.

.4 Rated operating noise power: 79 db(A)

.2 Motor: Dyson Digital Motor (DDM), V4 switched reluctance brushless DC type; 83,000 rpm motor speed.

- .3 Electrical requirements: 100-110V, 50/60Hz, 1000W, 9.01-10A 120V, 60Hz, 100W, 8.33A.
 - .4 Operating temperature range: 0-40°C
 - .5 Standby power consumption: Less than 0.5 W.
 - .6 Supply ten spare HEPA filters, turn over to the Owner upon Substantial Performance of the Project.
 - .2 Hand dryer back panel: Dyson Canada Limited, made of stainless steel, satin finish to protect walls from water droplets. 800 mm x 400 mm x 0.5 mm.
- 2.7 **NAPKIN DISPOSAL BINS (ND)**
- .1 Surface mounted stainless steel all welded construction, satin finish, incorporating integral finger depression for opening cover:
 - .1 Bradley, Model 4781-11 (Product No. 4781110000)
 - .2 Or accepted equal
- 2.8 **UNIT MIRRORS (MIR)**
- .1 6 mm float glass, thermosetting infrared cured paint backing with Poly-Glaze protective finish. Frame shall be one-piece, rolled formed stainless steel with bright annealed finish, channel return at rear with snap locking design and 16-gauge galvanized sheet steel backing. All edges protected by shock-absorbing, neoprene tubing. Size: 457 mm x 914 mm.
 - .1 Bradley, Model No. 781-1836
 - .2 Bobrick, Model No. B-165 1836
 - .3 Or accepted equal
- 2.9 **GRAB BARS (GRB)**
- .1 L-shaped grab bar: Type 304 stainless steel, 18-gauge stainless steel tubing, 38 diameter, satin finish with peened gripping surface. Complete with standard mounting plates, concealed flanges and accessories.
 - .1 (GRB-1): 762 x 762 mm size: Bradley, Model No. 812-057 (Product No. 8122057000), or accepted equal
 - .2 (GRB-2): 1016 x 762 mm (customized size): Bradley, Model 812-057 configuration), or accepted equal
 - .2 Straight grab bar type: Stainless steel, 38 mm diameter, 609.6 mm long, Type 304 stainless steel, 18-gauge tubing with satin finish, peened gripping surface, 38 mm maximum clearance from the wall, and complete with standard mounting plates, concealed flanges and accessories.
 - .1 (GRB-3): 762 mm long, Bradley, Model No. 812 001-30), or accepted equal
 - .2 (GRB-4): 914 mm long: Bradley, Model No. 812 001-36), or accepted equal
 - .3 (GRB-5): 1016 mm long: (customized size): Bradley Model 812 001 series, or accepted equal
-

- .4 609 mm long: Bradley, Model No. 812 001-24 (Product No. 8122001240), or accepted equal
- .3 Folding grab bar with Toilet Paper Dispenser (FD-GBFD-1): Swing-up, Type 304, 18-gauge stainless steel tubing with satin finish, 32 mm outside diameter. Tissue dispenser shall be 18 gauge stainless steel welded to bar. Wall plate shall be stainless steel with mounting holes. Grab bar shall be operable with only one hand.
 - .1 Bradley, Model No. 8370-108
 - .2 Bobrick, Model No. Gamco-125TPH
 - .3 ASI, Model No. 3413-25
 - .4 Or accepted equal
- .4 Folding grab bar (FD-GBFD-2): Swing-up, Type 304, 18-gauge 1.2 mm stainless steel tubing with satin finish with peened gripping surface, 32 mm outside diameter. 5 mm thick backplate, satin finish stainless steel with four screw holes for attachment to wall.
 - .1 Bradley, Model No. 8370-107 (Product No. 8372107000)
 - .2 Bobrick, Model No. B-4998
 - .3 Or accepted equal
- .5 Stainless steel grab bar with padded back rest (BR): Type 304, 18-gauge, concealed mounting flange, snap flange cover. Complete with 360 x 160 x 40 mm backrest, white polyurethane integral foam secured to grab bar with stainless steel C-clamps.
 - .1 Franke, Model No. CM-16104
 - .2 Bobrick, Model No. 5892
 - .3 Or accepted equal

2.10 **FOLDING SHOWER SEATS (SHWS)**

- .1 Constructed of reversible, solid phenolic seat slats, integrated slots for water drainage, stainless steel carriage bolts and acron nuts, stainless steel with stain finish frame, flange, and base plate. Static load limit of 250 lbs.
 - .1 Bradley, Model No. 9569 (Product No. 9569000000), 876 mm x 559 mm
 - .2 Bobrick, Model No. 5181, 840 mm x 565 mm
 - .3 Or accepted equal
 - .2 Rectangular shaped, reversible, 12 mm thick solid phenolic seat slats, integrated slots for water drainage, stainless steel carriage bolts and acron nuts, 18 gauge stainless steel with stain finish frame, 7 gauge stainless flange with mounting holes, and base plate.
 - .1 Bradley, Model No. 9562, 724 mm x 381 mm
 - .2 Bobrick, Model No. 5193, 650 mm x 365 mm
 - .3 Or accepted equal
-

2.11 **SHOWER SEAT/CHANGE ROOM BENCH - WOOD**

- .1 Teak, Grade A solid wood, free standing shower bench with narrow slats, smooth round edges. Finish wood tops with two coats of clear polyurethane varnish or other clear finish system standard with the manufacturer. Size as indicated on Drawings.
 - .1 "BEN563 - Fiji" by ARB Teak and Specialties
 - .2 Teakworks4U
 - .3 Or accepted equal
- .2 Wall Mounted Bench
 - .1 Bench Seats
 - .1 Construct of laminated teak, hard maple or clear vertical grain Douglas Fir slats, clear satin finish, standard with the manufacturer, Finish wood tops with two coats of clear polyurethane varnish or other clear finish system standard with the manufacturer.
 - .1 Size: minimum as indicated on Drawings
 - .2 Backrest
 - .1 Construct of Douglas Fir vertical grain slats, steel backrest supports of widths and lengths shown. Finish wood tops with two coats of clear polyurethane varnish or other clear finish system standard with the manufacturer.
 - .3 Bench Supports
 - .1 Bench Supports: Provide steel pedestals for benches, of minimum 33 mm O.D. steel pipe or tubing, with top and bottom steel flanges welded thereto and pre-drilled for expansion bolting to floor. Provide stainless steel anchor bolts.
 - .1 Size: minimum 460 mm AFF, 760 mm AFF (with back support) or as indicated on Drawings.
 - .2 Finish: Black powder coat

2.12 **CLOTHES HOOK (CTH)**

- .1 (CTH-1): Stainless steel, 14-gauge auto-release clothes hook with exposed satin finish, vandal -resistant, faceplate with sloped edges.
 - .1 Bobrick, Model B-983
 - .2 Bradley, Model No. SA36
 - .3 Or accepted equal
 - .2 (CTH-2): Heavy duty clothes hook with 12 gauge concealed mounting, one-piece brass casing with satin nickel-pated finish. Hook shall be able to withstand 136 kg (300 lbs.)
 - .1 Bobrick, Model B-2116
 - .2 Bradley, Model 9119
-

.3 Or accepted equal

2.13 **SHOWER CURTAIN AND ROD (SHWC)**

.1 Shower Curtain: Waterproof, mildew-proof and cold treated, white vinyl, with reinforced aluminum grommets. Provide two (2) curtains for Barrier-free shower stalls. Length of shower curtain shall have minimum length of 1971 mm long (78").

.1 Acceptable Manufacturers:

- .1 Frost
- .2 ASI
- .3 Grainger
- .4 Global Industry
- .5 Or accepted equal

.2 Rod: Stainless steel, satin finish, Type 304, minimum 25 mm diameter, complete with satin finish stainless steel end flanges and with curtain hold back hook and chain:

- .1 Frost Model No. 1145
- .2 Bobrick, Model No. B-6107
- .3 ASI Group Canada, Model No. 1214
- .4 Or accepted equal

.3 Shower Curtain Hook: Type 304, stainless steel, 2 mm diameter. Hooks shall be usable with 25 mm and 50 mm diameter shower curtain rods.

- .1 Frost Model No. 1144
- .2 Bradley, Model No. 9536
- .3 Bobrick, Model No. B-204-1
- .4 Or accepted equal

2.14 **STAINLESS STEEL SHELF (SHLF)**

.1 Stainless steel, 18-8, type-304, 18-gauge (1.2mm) stainless steel with satin finish and all welded corners.

- .1 Gamco, Model MS-18
- .2 Bradley Model SA49
- .3 Bobrick, Model B-295
- .4 Or accepted equal

2.15 **BABY CHANGE TABLE**

.1 Surface mounted, horizontal unit with fold-down platform from store position, complete with cam buckle safety strap, integral liner dispenser and bag/purse hook. Type 304

brush stainless steel exterior with molded high density polyethylene interior and full length steel hinge.

- .2 Provide wall reinforcement to support baby change table designed to support a 0.22 kN (50 lbs) load applied to it.
- .3 Load Capacity: not less than 250 lbs. per ASTM F2285
- .4 Size: 953 mm x 549 mm x 102 mm
- .5 Acceptable Manufacturer:
 - .1 Bradley, Model No. 962-11 (Product No. 962110000)
 - .2 Bobrick, Koala Kare Products, Model No. KB310
 - .3 Or accepted equal

2.16 **ADULT CHANGE TABLE (FOR FUTURE INSTALLATION)**

- .1 Surface mounted, powder-coated steel frame and PVC canvas table. Foldable and height adjustable adult change table with wired hand control, and safety rail.
- .2 Provide wall reinforcement to support future adult change table designed for a minimum load of 1.33 kN. Provide mounting kit suitable for wall types indicated on the Drawings.
- .3 Provide stamped Shop drawings for the steel reinforcement within the partition for the change table and indicating an acceptable method of securing the change table to the structure. Shop Drawings shall be stamped by a Professional Engineers licensed in Ontario.
- .4 Maximum load capacity: 331 lbs.
- .5 Size: 1400 mm x 735 mm
- .6 Acceptable Product:
 - .1 Pressalit 1000 Series "R8402000-93" by Can-dan Global
 - .2 or accepted equal

3 Execution

3.1 **INSTALLATION**

- .1 Install miscellaneous washroom and shower room accessories as per manufacturer's printed installation instructions.
 - .2 Install wall reinforcement for miscellaneous fixtures, equipment and accessories. Provide fire retardant treated wood blocking and minimum 18 gauge sheet steel secured to stud to support manufactured components and accessories. Provide wall reinforcement to support future adult change table designed for a minimum load of 1.33 kN. All anchoring devices shall be appropriate for specific wall construction.
 - .3 Provide exposed screws of stainless steel or chrome plated steel to match units, with theft proof heads.
 - .4 Coordinate with Consultant and fill units with necessary supplies before final acceptance of building. Clean and polish exposed surfaces.
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- .5 Adjust accessories for proper operation and verify mechanisms function smoothly.
- .6 Install grab bars to withstand minimum 1112 N (250 lb. pound-force) downward pull.

End of Section

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- 1 General
 - 1.1 **SUMMARY**
 - .1 Section Includes
 - .1 Labour, Products, equipment and services necessary to complete the Work of this section.
 - 1.2 **REFERENCES**
 - .1 Conform to the latest edition of the following:
 - .1 AODA - Accessibility for Ontarians with Disabilities Act
 - 1.3 **SUBMITTALS**
 - .1 Submit Shop Drawings in accordance with Section 01 33 00.
 - .2 Shop Drawings shall contain detailed description, and bear item numbers, marked to show quantity, colour, model numbers, fabrication details, and installation instructions.
 - 1.4 **DELIVERY, STORAGE AND HANDLING**
 - .1 Deliver packaged materials in original, undamaged containers with manufacturer's labels and seals intact. Handle and store materials in accordance with manufacturer's and Supplier's recommendations to prevent damage thereto.
 - 1.5 **PROTECTION**
 - .1 Protect the Work of this section from damage of any kind. Protect other work from damage resulting from Work of this section. Replace damaged work which cannot be repaired, cleaned or restored.
 - 2 Products
 - 2.1 **SWIMMING POOL HANDRAIL**
 - .1 49 inch O.D, type 304 polished stainless steel handrail with 4 bend design tube and welded base plate.
 - .2 Size: 1244.6 mm long x 101.6 mm wide x 850.9 mm high
 - .3 Accepted Manufacturer: Model No. 09146853 by Costway or accepted equal.
 - 2.2 **CORNER GUARDS**
 - .1 16 gauge, 1.3 mm thick, Type 304 stainless steel, #4 satin finish, 50 mm wide wings or 65 mm wide wings x 1200 mm long with radiused edges and pre-drilled for countersunk screws or 4 staggered long-life coated screws per 1200 mm lengths, supplied in longest lengths possible.
-

2.3 **PUSH PLATE SWITCH**

- .1 Refer to ADO requirements in appendices, hardware schedules and Section 10 00 00.

2.4 **THRESHOLDS**

- .1 Saddle Threshold (TH-1a): smooth top, aluminum alloy 6063, mill finish, slip resistant. Select appropriate saddle sizes to match thickness of abutting flooring materials and to conceal areas where flooring is removed.
 - .1 "Model No. 410" by National Guard Products Inc (NGP) as distributed by DMG Services or accepted equal
 - .1 Size: 63.5 mm (2-1/2") wide x 6.35 mm (1/4") high x 3.2 mm (0.125") thick
 - .2 "Model No. 411" by National Guard Products Inc (NGP) as distributed by DMG Services or accepted equal
 - .1 Size: 76.2 mm (3") wide x 6.35 mm (1/4") high x 3.2 mm (0.125") thick
 - .3 "Model No. 412" by National Guard Products Inc (NGP) as distributed by DMG Services or accepted equal
 - .1 Size: 101.6 mm (4") wide x 12.7 mm (1/2") high x 3.2 mm (0.125") thick
 - .4 "Model No. 512" by National Guard Products Inc (NGP) as distributed by DMG Services or accepted equal
 - .1 Size: 127 mm (5") wide x 12.7 mm (1/2") high x 3.4 mm (0.135") thick
 - .5 "Model No. 111" by National Guard Products Inc (NGP) as distributed by DMG Services or accepted equal
 - .1 Size: 152.4 mm (6") wide x 12.7 mm (1/2") high x 3.2 mm (0.125") thick
- .2 Thermal Break Saddle Threshold (TH-2a): Aluminum alloy 6063, T5 temper, fluted top, rigid thermoplastic spline, or slip resistant, mill finish.
 - .1 Model No. "8429" by National Guard Products Inc or accepted equal
 - .1 Size: 232 mm (9 1/8") x 12.7 mm (1/2")
- .3 Saddle Threshold (TH-3a): fluted top, aluminum alloy 6063, mill finish, slip resistant.
 - .1 Model No. "513" by National Guard Products Inc or accepted equal
 - .1 Size: 127mm (5") x 6.35 mm (1/4")

2.5 **PRECAST BUMPER CURBS (WHEEL STOPS)**

- .1 35 MPa compressive strength at twenty-eight days, air entrained, smooth finished with chamfered edges, 140 mm x 250 mm x 2400 mm long sections, with two anchor holes, unless indicated otherwise.
- .2 Grout: Pre-mixed, non-shrink, flowable type, Euclid "Euco NS", Master Builders "Construction Grout", Sika "Grout 212" or "M-Bed Standard", W.R. Meadows "CG 86", CPD "Non-Shrink" or Dayton Superior "1107 Advantage Grout"; without aggregate fillers

2.6 **KITCHEN TOUCHLESS SOUP DISPENSER**

.1 Counter Mounted, touchless, one piece, cast brass construction above deck, single mount foam soap dispenser with adjustable sensor and vandal resistant below deck box.

.1 Moen, Model No. 8560, or accepted equal

3 Execution

3.1 **INSTALLATION**

.1 Install miscellaneous specialties perfectly rigid in accordance with manufacturers' printed directions.

.2 After installation, test-operate and adjust operable parts as required for ease of operation.

.3 Precast Bumper Curbs

.1 Compact grade and secure bumper curbs in place with 600 mm long x 12 mm diameter anchor bar pins. Drive top of pins to slightly below top of curb. Grout holes with non-shrink grout.

End of Section

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- 1 General
 - 1.1 **SUMMARY**
 - .1 Section Includes
 - .1 Labour, Products, equipment and services necessary to complete the Work of this section.
 - 1.2 **SUBMITTALS**
 - .1 Samples: Submit samples of countertop materials to the Consultant for acceptance. The materials used in the building shall correspond to the approved samples.
 - .2 Shop Drawings
 - .1 Submit Shop Drawings for the fabrication and installation of Work of this section for review in accordance with Section 01 33 00.
 - .2 Show and describe items, dimensions, finishes, installation details, anchors and fastenings, details of construction and related work and location.
 - .3 Show locations and sizes of furring, blocking, including concealed blocking and reinforcement required.
 - .4 Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers and other items installed in solid surface.
 - .3 Maintenance Data and Material
 - .1 Submit manufacturer's care and maintenance data, including repair and cleaning instructions. Include in project closeout documents.
 - .2 Provide maintenance kit for finishes.
 - 1.3 **DELIVERY, HANDLING AND STORAGE**
 - .1 Deliver units to meet installation schedule. Arrange for strategic, off-the-ground, covered storage locations.
 - .2 Surfaces shall be covered with heavy kraft paper, or tops shall be put in cartons for protection during shipment.
 - .3 Provide adequate protection until finally accepted. Protect installed surface with heavy kraft paper secured in position with masking tape.
 - 1.4 **PROTECTION**
 - .1 Countertop surfaces shall be covered with heavy kraft paper, or tops shall be put in cartons for protection during shipment.
 - .2 Protect installed countertop with heavy kraft paper secured in position with masking tape. Do not remove until final inspection.
-

2 Products

2.1 **COUNTERTOP AND BACKSPLASH**

- .1 Quartz (Q-1): Cast, nonporous, crushed quartz aggregate combined with polyester resins and pigments and fabricated into slabs using a vacuum vibro-compaction process.
 - .1 Size: as indicated on Drawings
 - .2 Thickness: 20 mm or as indicated otherwise on Drawings
 - .3 Finish: Polished, veined pattern
 - .4 Colour: 5151 Empira White
 - .5 Edge profile: mitred corners or as indicated otherwise on Drawings
 - .6 Acceptable Manufacturer:
 - .1 "Supernatural Collection" by Caesarstone
 - .2 or accepted equal.
- .2 Adhesive: Type recommend by manufacturer for application and conditions of use. Adhesive that will be visible in finished work should be tinted to match surface.
- .3 Joint Sealant: manufacturer standard mildew-resistant silicone sealant recommended by manufacturer for application and conditions of use.
- .4 Cleaning Agents: non-abrasive or as recommended by manufacturer

2.2 **FABRICATION**

- .1 Obtain and verify dimensions at the building before fabrication of casework takes place, and in ample time to prevent unnecessary delays in the Work.
 - .2 Make work plumb, level and true, in as long lengths as practicable with joints arranged to be as inconspicuous as possible, and with proper provision for shrinkage.
 - .3 Factory-fabricate components to greatest extent practical to sizes and shapes indicated, in accordance with reviewed Shop Drawings and manufacturer's printed instructions and technical bulletins.
 - .4 Form joints between components using manufacturer's standard joint adhesive without conspicuous joints.
 - .5 Provide factory cutouts for plumbing fittings and accessories as indicated on the Drawings.
 - .6 Rout and finish component edges with clean, sharp returns. Rout cutouts, radii and contours to template. Smooth edges. Repair or reject defective and inaccurate Work.
 - .7 Fabricate tops in one piece, unless otherwise indicated. Comply with surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
-

.8 Countertop Framing:

- .1 Fabricate countertop framing, using steel shapes and plates, and cold finished mild steel bars at exposed conditions, for support framing and plywood, to thicknesses, sizes and shapes shown, and as required to produce work of adequate strength and durability.
- .2 Slabs for horizontal surfaces, such as countertops to be supported not less than every 457 mm (18").

3 Execution

3.1 **EXAMINATION**

- .1 Inspect existing conditions upon which Work of this section is dependent. Report to the Consultant in writing any defects or discrepancies. Commencement of Work implies acceptance of existing conditions.
- .2 Substates must be sound, flat, smooth and free from dust or other surface contaminants.
- .3 Site verify by field measurements prior to fabrication.

3.2 **INSTALLATION**

- .1 Install surfacing components plumb, level and true and in accordance to approved shop drawings and manufacture's instruction.
- .2 Fasten surfacing components to base cabinets or other supporting substrates with suitable adhesives acceptable to manufacturer.
- .3 Form joint seams with seam adhesive. Seams to be inconspicuous in completed work. Seams in location shown on approved shop drawings and acceptable to Consultant.
- .4 Install backsplashes and end splashes where indicated on Drawings. Caulk space between backsplash and wall with silicone sanitary sealant.
- .5 If cutting, grinding, or polishing is required at the jobsite, use water-cooled tools.
- .6 Remove and replace surfacing components that are damaged and cannot be satisfactorily repaired at no cost to the owner.

3.3 **CLEANING**

- .1 Promptly as Work proceeds and upon completion, clean up and remove from the site all rubbish and surplus materials resulting from Work under this section.
- .2 Clean surfacing components according to manufacturer's recommendations. Completely remove excess adhesives and sealants from finished surfaces.
- .3 Protect completed work from damage during construction period.

End of Section

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- 1 General
 - 1.1 **SECTION INCLUDES**
 - .1 Labour, Products, equipment and services necessary to complete the Work of this section.
 - 1.2 **QUALITY ASSURANCE**
 - .1 Workmanship shall be of highest quality, in accordance with best standard practice for installation of this type of furniture. Execute Work in accordance with drawings, Specifications, and manufacturer's printed directions.
 - 1.3 **SUBMITTALS**
 - .1 Shop Drawings
 - .1 Submit Shop Drawings for the fabrication and installation of Work of this section for review in accordance with Section 01 33 00.
 - .2 Show and describe items, dimensions, finishes, installation details, anchors and fastenings, details of furniture construction and related work. and location of each furniture unit.
 - .3 Custom Millwork (Reception Counter/Desk)
 - .1 Contractor shall submit stamped Shop Drawings for miscellaneous metal framing and supports and components used in the assembly of the desks/counter.
 - .2 Shop Drawings shall bear the seal and signature of a Professional Engineer licensed in the Province of Ontario.
 - 1.4 **DELIVERY, HANDLING AND STORAGE**
 - .1 Handle components with care and provide protection for surfaces against marring or other damage. Ship and store members with cardboard or other resilient spacers between surfaces. Use lifting chokers of material which will not damage surface of steel members.
 - 1.5 **ASSIGNED FURNITURE WORK**
 - .1 The City of Toronto's furniture vendors shall supply, deliver to Site and install furniture based on "generic" furniture layouts and a furniture and equipment schedule.
 - .2 The City's furniture vendor will be assigned to the Contractor. It will be the Contractor's responsibility to:
 - .1 Confirm orders
 - .2 Schedule and coordinate deliveries of various furniture items
 - .3 Provide supervision and oversee installation
 - .4 Store as required
 - .5 Provide security
 - .6 Provide all required voice/data/power connections
-

- .7 Clean and polish furniture

1.6 **UNASSIGNED FURNITURE WORK**

- .1 Any furniture not supplied by the City of Toronto's furniture vendors and shown on the Drawings are to be Provided by the Contractor.
- .2 The City of Toronto may supply stored furniture to be installed by the Contractor.
- .3 In addition to the above, it will be the Contractor's responsibility to:
 - .1 Confirm orders
 - .2 Schedule and coordinate deliveries of various furniture items
 - .3 Provide supervision and oversee installation
 - .4 Store as required
 - .5 Provide security
 - .6 Provide all required voice/data/power connections
 - .7 Clean and polish furniture.

2 Products

2.1 **CUSTOM MILLWORK**

- .1 Custom fabricated millwork in accordance with the Drawings.
 - .1 Acceptable Manufacturers:
 - .1 G&P Millwork
 - .2 Svend Nielsen
 - .3 Spectrum
 - .4 Ell-Rod
 - .5 Or accepted equal.

2.2 **OUTDOOR FURNITURE**

- .1 Outdoor furniture is to be supplied and installed by the General Contractor.
- .2 Colour chart and finishes for all items specified shall be submitted to the Consultant for selection in accordance with 1.3 Submittals.
- .3 Accessible Picnic Table:
 - .1 Plastic lumber slats tale top with 304.8 mm extended table top on each side to allow for accessible seating. The frame shall comply with AODA standards.
 - .1 Table Size (LxWxH): 1829 mm x 852 mm x 778 mm
 - .2 Seat Size (LxWxH): 1219 mm x 280 mm x 457 mm
 - .3 Knee clearance: 703 mm

- .4 Finish of table top (slats): Charcoal
- .5 Finish for legs (frame): Black zinc-plated powder coated steel
- .6 Mounting: Freestanding
- .7 Acceptable Manufacturer: "Compliant 46" by Classic Displays or accepted equal.

2.3 **ADAPTABLE SEATING - INDOOR**

- .1 Adaptable seating is to be supplied and installed by the General Contractor.
- .2 Furniture shall come with attachments, brackets, hardware, etc required to be fully assembled and functioning per the manufacturer's instructions.
- .3 Colour chart and finishes for all items specified shall be submitted to the Consultant for selection in accordance with 1.3 Submittals.
- .4 Reception Seating:
 - .1 Fixed base floor-mounted seat. Finish: Birch plywood with a fixed silver metal base with armrests. Fabric shall be anti-microbial vinyl. Colour: "Whisper Series WHI-2139 Charcoal" (dark grey) or as later selected by Consultant.
 - .1 Acceptable Manufacturer: "Jumpseat" by Sedia Systems.
 - .2 Or accepted equal.

2.4 **FURNITURE SUPPLIED BY OTHERS**

- .1 Contractor shall schedule and coordinate deliveries of various furniture items with the suppliers.
 - .1 Adjustable Table/Desk: table with straight corners and seamless laminate finish, electric height adjustable base, display with up/down memory, undersurface cable management with 3 dual plastic trays and power bar and diamond shaped rectangular cutout in the center of the table for grommet.
 - .2 Extended Corner Table: Height adjustable extended corner worksurface with extended electrical, laminate finish. Sizes as indicated on Drawings.
 - .3 Table Base:
 - .1 C-leg style, freestanding, electric height adjustable table base with extended range electric, standard foot, display with up/down memory.
 - .2 T leg with 2 x post legs standard with up/down switch style.
 - .4 Monitor Arm: Fully adjustable single arm, monitor mounting hardware and wire management to support 5-12 pounds. Height adjustment range of 10", tilt adjustment of 135°, monitor swivel of 180° and positions in landscape or portrait. Arm reach and clamp shall include integrated wire management.
 - .5 Power Station: Desk edge clamped, 2 power, 2 USB ports and 1 data port. Plug-in type with 10' cord, unless indicated otherwise.
 - .6 Pedestal: Freestanding 2-drawer mobile solid storage cabinet with metal front, full pull, 4 casters. Pedestals shall be keyed random.

- .7 Task Chair: Dual upholstery tilt task chair, no headrest, width and height adjustable T-arms on caster wheels, fully assembled.

2.5 **GENERAL FABRICATION REQUIREMENTS**

- .1 For shop welding conform to the requirements of CSA W59.1. Have work done by a firm fully certified according to CSA W47. All welders employed in the field shall be qualified as Class "O" as defined in CSA W47.
- .2 Make Work in true planes with adequate fastenings. Build and erect Work plumb, true, square, straight, level and accurate to sizes detailed, free from distortion or defects detrimental to appearance or performance.
- .3 Grind exposed welds flush and smooth to match adjacent surfaces.

3 Execution

3.1 **INSTALLATION**

- .1 Install furniture in accordance with manufacturer's instructions.
- .2 Use only workers skilled in the Work of this section. Do Work to best standard practice.
- .3 Fit and assemble Work in shop where possible. Execute Work according to details and reviewed Shop Drawings. Where shop fabrication is not possible, make trial assembly in shop.

3.2 **CLEANING**

- .1 Promptly as Work proceeds and upon completion, clean up and remove from the site on a daily basis, all rubbish and surplus materials resulting from Work under this section.
- .2 On completion, touch up marred or abraded finished surfaces.
- .3 Wipe down surfaces to remove fingerprints and markings and leave in clean conditions to the satisfaction of the Consultant.
- .4 To prevent damage to finishes, clean surfaces of furniture with cleaners recommended by the manufacturer.

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Provide all design, labour, methods, Products, equipment and accessories for Commercial wheelchair lifts as shown on drawings, specified herein, and as required for the complete and proper execution of Work of this Section.
- .2 Barrier Free Lift for Scarborough Arts Council located at 1859 Kingston Road.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- .1 ASME A18.1 - Safety Standard for Platform Lifts and Stairway Chairlifts
- .2 ASME B29.2M - Inverted Tooth (Silent) Chains and Sprockets
- .3 AODA - Accessibility for Ontarians with Disabilities Act
- .4 CAN/CSA B355 - Platform lifts and stairs lift for barrier-free access
- .5 CAN/CSA W47.1 - Certification of Companies for Fusion Welding of Steel
- .6 CAN/CSA-G40.20/ G40.21-M - General requirements for rolled or welded steel/Structural quality steel
- .7 ICC/ANSI A117.1 - Accessible and Usable Buildings and Facilities
- .8 NFPA 70 - National Electric Code
- .9 CSA W48.1-M - Carbon Steel Covered Electrodes for Shielded Metal Arc Welding
- .10 CSA W59-M - Welding Steel Construction (Metal Arc Welding)

1.3 **QUALITY ASSURANCE**

- .1 Overall standards: Comply with CAN/CSA-B44 for Work of this section including, but not limited to the following; design, fabrication, installation, testing, maintenance and inspection, unless more stringent regulations and procedures are set forth by jurisdictional authorities.
- .2 Requirements of governing standards: Perform Work of this section in accordance with CAN/CSA-B44, including amendments to-date, the Canadian Electrical Code, municipal bylaws and federal and provincial codes which may govern requirements of the installation.
- .3 Fabricate and install Work carried out by workmen specially trained and experienced in this type of Work. Installers to have a minimum of 2 years experience installing similar products and acceptable to the manufacturer.
 - .1 Skilled tradesmen shall be employees of the installing contractor approved by the manufacturer, with demonstrated ability to perform the work on a timely basis.

- .2 Execute work of this section only by a company that has adequate product liability insurance.

- .4 Welder Qualifications

- .1 Execute welding by a firm certified per CSA W47.1 Division 1 or 2.1.
 - .2 Qualify welding operators employed on the work per CSA W47.1.

1.4 **PERMITS AND INSPECTION**

- .1 Obtain and pay for necessary municipal and provincial inspection and permits, except operation or ownership permits, and make such tests as are required by regulations of such authorities. Perform tests in presence of authorized representatives of such authorities.

1.5 **SUBMITTALS**

- .1 Shop Drawings

- .1 Submit Shop Drawings and erection diagrams signed and sealed by a Professional Engineer registered in the province of Ontario for review in accordance with elevating devices and in accordance with Section 01 33 00. Show complete layout of lift equipment, power and control wiring diagrams, power control equipment, electrical performance characteristics, location of machinery and apparatus in relation to work of other contracts, loads to be carried on building structure, and hoistway entrances. Submit additional pertinent data and information as required for the complete and proper execution of Work.
 - .2 Following review by Consultant, send Shop Drawings to the Technical Standards and Safety Authority (TSSA) for approval. Submit two copies of Drawings approved by TSSA to Consultant.
 - .3 Show on Shop Drawings or otherwise furnish in ample time for use of other trades on the Work, the complete layout of lift equipment and detailing dimensions, clearances, openings or anchors as required. In event of failure to furnish correct and prompt information, have all required cutting and patching and making good to the satisfaction of Consultant without adjustment to Contract Price.

- .2 Samples

- .1 For each finish product specified requiring selection of color or finish, provide two complete sets of color charts representing manufacturer's full range of available colors and patterns.

- .3 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.

- .4 Operating and maintenance data:

- .1 Submit bound Operating and Maintenance Manuals containing the following in accordance with Section 01 33 00:
-

- .1 Replacement parts lists.
 - .2 Instructions explaining operation, including car control panel.
 - .3 Lubrication chart, indicating lubrication points and type and frequency of lubrication recommended for equipment.
 - .4 Complete set of reviewed Shop Drawings and manufacturers' Product data.
 - .5 Copy of registered design submission to TSSA.
- .2 Submit a complete set of wiring diagrams mounted on 3 mm thick hardboard, provided in wall-hung rack in machine room

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver equipment and accessories to comply with construction schedule and arrange ahead for strategic off-the-ground, covered storage locations. Do not load any area beyond design limits.
- .2 Use safe and adequate equipment on Site to execute the Work, including cranes, hoists, scaffolding, staging, safety protection equipment, tools, and other equipment as required for completion of Work.
- .3 Store Products in manufacturer's unopened package until ready for installation.
- .4 Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 MAINTENANCE SERVICE

- .1 Perform full maintenance and emergency call-back service on equipment for a period of twelve months after completion of installation and acceptance of equipment by Consultant. Under this service, include regular examinations by a qualified elevator mechanic to clean, oil, and adjust apparatus, making whatever repairs as may be required and replacing worn parts when necessary using only genuine standard parts supplied by manufacturer of material/equipment concerned. This provision shall exclude such parts damaged by misuse, accidents or negligence caused by others.
 - .2 Include lubricants, cleaning materials and repair parts required to keep installation in good working order during maintenance service period.
 - .3 Perform maintenance service during Elevator Contractor's regular working hours and Working Days.
 - .4 Upon request, submit documentary evidence to substantiate experience in satisfactory complete maintenance of elevators with a staff of competent personnel to handle this service, maintains locally an adequate stock of parts for replacement for emergency call basis, and has qualified service personnel on-call in close proximity to installation location to ensure fulfillment of this service to preclude unreasonable downtime of equipment.
 - .5 Perform maintenance work by personnel under supervision and in direct employ of Elevator Contractor. Maintenance service to include call-back service between regular inspections and be available at all times.
-

- .6 Have emergency call-back service available twenty-four hours a day, seven days a week. In event of emergency call-backs in overtime, Elevator Contractor will be reimbursed for travelling time and expenses incurred during such calls at applicable overtime rates.
- .7 Set up and follow a preventative maintenance program. Design program to minimize elevator shut-downs. Submit details before completion of installation.
- .8 Work under this maintenance service is under direct responsibility of Elevator Contractor and shall not be assigned, or transferred to any agent or Subcontractor.
- .9 Owner has the right to postpone commencement of agreed maintenance in connection with specified unit, providing such unit is taken out of service at time of completion and acceptance of the Work by Consultant. Elevator Contractor shall put into service such unit on the basis of seven days notice from Owner.

1.8 **DEVIATIONS**

- .1 Base the Work on basic design, arrangement and details shown on Drawings and specified herein. Minor deviations will be considered which do not change intent of Drawings and Specifications, subject to approval by Consultant. Clearly define deviations from Drawings and Specifications per requirements of Contract Documents.
- .2 Within ten days of Contract Award, submit complete information on equipment which is proposed for the Work. Include illustrations, details, descriptions, specifications, sources and names of manufacturers of major items and components in the Work.

1.9 **WARRANTY**

- .1 Submit written warranty, signed and issued in the name of Owner, stating that materials and workmanship is warranted for three years from date of Substantial Performance for following:
 - .1 Blistering, spalling or peeling of paint due to improper substrate surface preparation or material application.
 - .2 Opening of joints due to improper design or use of ineffective fastening devices.

2 **Products**

2.1 **ACCEPTABLE MANUFACTURERS**

- .1 Garaventa Lift Canada
- .2 Or accepted equal

2.2 **COMMERCIAL WHEELCHAIR LIFT**

- .1 Car:
 - .1 Hydraulic Vertical Platform Lift:
 - .1 Genesis Model GL-SW-96.
 - .2 Hydraulic Vertical Platform Lift: The lift shall consist of a standalone hydraulic tower with a lifting platform. The platform is made to accommodate wheelchair user or a person with impaired mobility. The lift can be used indoor or outdoor in commercial application.

- .3 Work described in this section includes providing equipment, incidental material and labor required for complete, operable roped hydraulic wheelchair lift installation. Lifts shall be erected, installed, adjusted, tested and placed in operation by lift system manufacturer, or manufacturer's authorized installer. Lifts shall be in accordance with CAN/CSA B355.
- .4 The following preparatory work to receive the lifts specified in this section is part of the Work of other sections:
 - .1 Permanent 120 VAC, 20 amp single phase power to operate lift to be provided from a lockable fused/cartridge type disconnect switch with auxiliary contacts for battery operation. Refer to drawings for permanent power specifications and location of disconnects. Temporary power may be provided to expedite installation of lift.
 - .2 Provide rough openings per lift contractor's shop drawings.
 - .3 Provide substantial, level pit floor slab as indicated on the lift contractor's shop drawings.

2.3 MATERIALS

- .1 Steel sheet metal: Conforming to ASTM A1008/A1008M, cold rolled sheet, commercial quality with zinc coating conforming to ASTM A653/A653M.
- .2 Galvanize touch-up primer: W.R. Meadows "Galvafruid" or Kerry Industries "ZRC"
- .3 Provide the following materials for exposed parts of the lift as indicated:
 - .1 Panel: 16 gauge galvanized steel panel. Powder coated semi matte, Silver Moon or as later selected by Consultant.
 - .2 Insert and anchors: Inserts, anchors, bearing plates, brackets, supports and bracing required to be built-in by other trades prior to construction of affected work.

2.4 TECHNICAL DATA

- .1 Characteristics:
 - .1 Indoor Unit - Pit Mount
 - .2 Number of Stops - Tow stop Kit
 - .2 Car Dimension (WxD): 993 x 1524 mm
 - .3 Levels Service: 2
 - .4 Drive Mast
 - .1 Chain Hydraulic drive systems complete with Continuous Mains Power with Auxiliary Batter power system, platform emergency lowering, shoring pin and pressure gauge
 - .2 Motor - 2.2 kW, (3.00 HP), 24 VDC
 - .3 Travel Speed - 340 kg @ 5.2 m/m in (750 lb @ 17 ft/min)
-

- .4 Power Supply - 120 VAC, single phase, 60 Hz, on a dedicated 15 amp. circuit
Equipped with - Negative Pressure Switch, Pit Switch Kit, Oil Recovery System
 - .5 Controls
 - .1 Platform Controls - Push button (tactile) type complete with illuminated directional buttons and illuminated rough (push/pull) emergency stop switch/audible alarm.
 - .2 Lower landing call station - Push button (tactile) frame mount
 - .3 Upper Landing call station - Push button (tactile) frame mount
 - .4 Equipped with time delay door lock, keyed operation kit
 - .6 Platform:
 - .1 Size - large complete with grab rail, anti-skid deck and 1100 mm (43 1/4") high wall
 - .2 Configuration - on/off same side (360°) exit/entry
 - .3 Capacity - maximum 340 kg (750 lbs) operating load
 - .4 Equipped with platform edge shim kit
 - .7 Door/Gate:
 - .1 Lower - 1067 mm (42") R.H clear width, Pro-door (fire-rated) complete with Prudhomme interlock and ceramic glass vision panel.
 - .2 Upper - 1067 mm (42") R.H clear width, Pro-door (fire-rated) complete with Prudhomme interlock and ceramic glass vision panel
 - .8 Shaft way:
 - .1 Lifting height (H1): 2420 mm (95 1/4") to upper floor plus 76 mm (3") deep pit.
 - .2 Equipped with mast side wall panel (96" mast size), anchor and shim kit
 - 3 Execution
 - 3.1 **EXAMINATION**
 - .1 Examine existing conditions upon which Work of this section is dependent. Report to Consultant in writing, any defects or discrepancies. Commencement of Work implies acceptance of existing conditions.
 - .2 Coordinate and verify, by measurement at the Job site, dimensions affecting the Work. Notify General Contractor in writing of all field dimensions and/or conditions which are at variance with those on Contract Documents and/or detrimental to proper and timely installation of the Work. Obtain agreement regarding corrective measures from General Contractor prior to proceeding with the Work.
 - .3 Do not begin installation until hoistway and machine room has been properly prepared.
 - .4 Site dimensions shall be taken to verify that tolerances and clearances have been maintained and meet local regulations.
-

- .5 If substrate preparation is the responsibility of another installer, notify the Consultant 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 **LIFT INSTALLATION**

- .1 Install all the components of the lift system that are specified in this section to be provided, and that are required by jurisdictional authorities to license the lift.
- .2 Trained employees of the lift contractor shall perform all installation work of this section.
- .3 Adjust lift for proper operation and clean unit thoroughly.

3.4 **ELECTRICAL WORK**

- .1 Install complete, necessary insulated wiring to connect all parts of equipment complete. Install wiring in accordance with the Canadian Electrical Code and such other regulations as may properly apply.
- .2 Install fixed wiring in rigid metal conduit.
- .3 Install control wiring complete, including tagging of each line.

3.5 **FIELD QUALITY CONTROL**

- .1 Test demonstrate operation and features in presence of Owner's Representative and Consultant.
- .2 Touch-up, repair or replace damaged products before Substantial Completion.
- .3 Execute training and instructing of Owner's maintenance personnel in maintenance and service of elevator in accordance with "Maintenance Service" specified herein.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Provide all design, labour, methods, Products, equipment and accessories for Swimming Pool / Aquatic lifts as shown on drawings, specified herein, and as required for the complete and proper execution of Work of this Section.

1.2 **SUBMITTALS**

.1 Shop Drawings: Submit Shop Drawings in accordance with Section 01 33 00.

- .1 Shop Drawings shall be signed and sealed by a Professional Engineer licensed to practice in the Province of Ontario.
- .2 Include on layout, the general arrangement of components, anchorage requirements, clearances, tolerances and accessories.

.2 Product Data: Manufacturer's data sheets on product to be used, including:

- .1 Preparation instructions and recommendations.
- .2 Storage and handling requirements and recommendations.

.3 Installation methods

1.3 **REFERENCES**

.1 Conform to the latest edition of the following:

- .1 ASTM A967/A967M - Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts
- .2 AODA - Accessibility for Ontarians with Disabilities Act

1.4 **QUALITY ASSURANCE**

- .1 Overall standards: Work of this section including, but not limited to the following: design, fabrication, installation, testing, maintenance and inspection, unless more stringent regulations and procedures are set forth by jurisdictional authorities.
- .2 Fabricate and install Work carried out by workmen specially trained and experienced in this type of Work. Installers to have a minimum of 2 years' experience installing similar products and acceptable to the manufacturer.
- .3 The equipment shall be tested and confirmed to comply with design standards outline in the Accessibility for Ontarians with Disabilities Act (AODA).

1.5 **DELIVERY, STORAGE AND HANDLING**

- .1 Deliver equipment and accessories to comply with construction schedule and arrange ahead for strategic off-the-ground, covered storage locations. Do not load any area beyond design limits.
- .2 Use safe and adequate equipment on Site to execute the Work, including cranes, hoists, scaffolding, staging, safety protection equipment, tools, and other equipment as required for completion of Work.
-

- .3 Store Products in manufacturer's unopened package until ready for installation.
- .4 Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.6 **WARRANTY**

- .1 Submit written warranty, signed and issued in the name of Owner, stating that materials and workmanship is warranted for minimum five years from date of Substantial Performance.

2 Products

2.1 **ACCEPTABLE MANUFACTURER**

- .1 "Motion Trek BP 350" by Spectrum Aquatics (Basis of Design)
- .2 Or accepted equal

2.2 **SYSTEM DESCRIPTION**

- .1 Work described in this section includes providing equipment, incidental material and labor required for complete, operable aquatic lift installation. Lifts shall be erected, installed, adjusted, tested and placed in operation by lift system manufacturer, or manufacturer's authorized installer.
- .2 Swimming Pool / Aquatic Lift is a wireless battery powered, self-operable lift that has a lifting capacity of 350 pounds (158.7 kg). The lift shall be able to accommodate setback of 152.4 mm (6") to 711.2 (28") and water draft up to 330.2 mm (13").
- .3 The lift shall be capable of transferring (rotating) payload over a wall height of 254 mm (10") without footrest.
- .4 The lift shall have two independent handset control points. One located independent of the lift and the other on the lift's seat arm.

2.3 **COMPONENTS**

- .1 Components of the lift include an armrest and adjustable footrest. The armrest shall provide stability to the user during lift movement and structurally capable of supporting the user during transfer from a wheelchair onto the lift's seat. The adjustable footrest shall be provided with a 304.8 mm (12") vinyl covering.
- .2 Superstructure
 - .1 The superstructure and component shall be of type 304L stainless steel, no dissimilar metal shall be allowed. Lift shall be finished with electro-polished followed by passivation ensuring maximum corrosion resistance in accordance with ASTM A967/A967M.
 - .2 The lift's boom arm shall be constructed of 48.26 mm (1.90") O.D by 38.1 mm (1.50") I.D stainless steel tube. The mast arm shall be constructed of 60.32 mm (2.375") O.D. x 52.50 mm (2.067") I.D. stainless steel tube.

.3 Seat Assembly

- .1 The seat shall be constructed of 304L stainless steel frame attached to a polymer seat assembly. The assembly shall be attached to the lift superstructure by a 48.26 mm (1.90") O.D by 38.1 mm (1.50") I.D stainless steel tube.
- .2 The minimum seat width shall be 501.79 mm (19.76") wide. The seat back shall have a minimum height of 458.28 mm (18.04") height and features a contour design for seating comfort.
- .3 The seat shall be equipped with a seat belt assembly employing wide synthetic webbed belts, with a quick release, non-metallic, cam-lock buckle.

.4 Swing-up Outer Armrest Assembly

- .1 The swing-up arm rest shall be constructed of 25.4 mm (1") x 3.048 mm (.120") type 304L stainless steel tube. Provide a 152 mm (6") black vinyl covering.
- .2 The swing-up outer armrest assembly shall be supplied with a type 304 stainless steel mounting plate to be attached to the lift by mounting directly under the lift's seat assembly.

.5 Anchor

- .1 The lift is to be secured to a concrete deck with a single anchor point, allowing ease of installation and removal. An anchor cover with a removal key shall be supplied for use when the lift is not installed.

2.4 **OPERATING CONTROLS AND POWER SOURCE**

.1 Operating Controls

- .1 Handset/Remote: The equipment shall include a wired control handset to allow operation from pool or deck. The handsets shall consist of molded plastic and be sealed to prevent water damage. Control button shall provide directional control, i.e., rotational travel-left or right and vertical travel-up or down.
- .2 Power Rotation: 360 degrees in either direction.
- .3 Actuator:
 - .1 Linear: The batter power ram shall be bolted to the lift superstructure and shall have maximum thrust of 700N. The driver shall be driven by a permanent magnet motor, 24-VDC and operate at a noise level of 60-db or less. The unit shall operate with a push direction only.
 - .2 Rotational: The 24-VDC rotational motor gear drive systems shall allow for continuous mast rotation in either direction (360°).

.2 Power Source

- .1 The lift shall be powered by a low voltage (24-VDC) rechargeable battery and rated for a 350-pound (158 kg) operating load capacity with a 1.5-safety factor. The rechargeable battery shall power the lift's drive motors. A battery charger, wall current to charge, complete with a mounting bracket and electrical power cord, for remote installation is to be provided for the lift.
-

- .2 Additional Battery: The Contractor shall include the cost of an additional rechargeable battery in the Base Bid Price.

3 Execution

3.1 **EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for the lift installation in accordance with manufacturer's written instructions.

3.2 **INSTALLATION**

- .1 Install lift in accordance with manufacturer's instructions, approved submittals and in proper relationship to adjacent construction.

3.3 **PROTECTION**

- .1 Protect installed products until completion of project. Touch-up, repair or replace damaged products before substantial completion.

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **CODES, REGULATIONS AND STANDARDS**

- .1 Comply with municipal and provincial codes, rules and regulations and/or authorities having jurisdiction.
- .2 Comply with the National Building Code in areas where municipal or provincial regulations and/or codes are not mandatory.
- .3 Revisions issue: Latest version as amended to date.

1.3 **REFERENCES**

- .1 Comply with applicable requirements of the latest issue of the following Standards:
- .1 OFC - Ontario Fire Code
- .2 NFPA 10 - Portable Fire Extinguishers
- .3 SMACNA - Seismic Restraint Manual Guidelines for Mechanical Systems
- .4 NFPA - 13 Installation of Sprinkler Systems
- .5 ASHRAE - HVAC Applications, Seismic and Wind Restraint Design
- .6 CAN/ULC-S508 - Rating and Fire Testing of Fire Extinguishers
- .7 NFPA - All relevant sections

1.4 **WORKING DRAWINGS AND DOCUMENTS**

.1 Design Drawing Intent

- .1 The design drawings are schematic in arrangement, and describe the general design intent but do not show the exact details for the installation. They are not fabrication or installation drawings.
- .2 The Work is suitably outlined on the drawings with regard to sizes, locations, general arrangements and installation details, and has been generally coordinated for routing of services. The routing of ductwork, piping and equipment arrangement are shown more or less in diagram except where in certain cases the Drawings may include details giving the exact locations and arrangements required.
- .3 The location of equipment, and the associated arrangement of piping, ductwork, and other material describes the general requirements of the Work. Final location is dependant on the actual equipment supplied. The Consultant reserves the right to make reasonable adjustment of up to 1 m to the location of equipment, floor drains, routing of major piping and ductwork, at no cost to the Owner.
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- .4 In order to provide clarity to the arrangement of the Work, not all details including valves, thermometers, pressure gauges, etc. are shown on the Plan Drawings. Refer to Schematic Drawings, standard details and the Specification for these requirements.
 - .5 Where specific installation dimensions for location of equipment and access space requirements are indicated on the drawings, install to these requirements.
 - .6 Where standard details are provided, these show the general installation requirements, and are applicable to each occurrence in the Work, unless otherwise specified or shown.
- .2 Contractor Coordination Responsibilities
- .1 Provide the services of a mechanical/electrical coordination supervisor, to coordinate this division of the Work, as well as providing coordination with other divisions and/or contracts. This supervisor may be full time or part time on site, as appropriate to the work stage and complexity of the Work, at the discretion of the Owner.
 - .2 Where multiple trades are required, the mechanical coordinating supervisor shall be the lead coordinator.
 - .3 The Owner reserves the right to require the coordinating supervisor to increase their attendance at site, at no cost to the Owner, if in the Owner's opinion the current level of coordination is not sufficient for the progress of the Work.
 - .4 Make changes and modifications as necessary to ensure coordination and to avoid interference and conflicts with other trades.
 - .5 Prepare construction/installation/fabrication drawings, coordinated with other trades and contracts, as required.
 - .1 Provide sufficient detail to disclose critical interferences of major equipment and services to ensure adequate accessibility.
 - .2 Specific dimensions for equipment location or access which are shown on the Consultants Drawings.
 - .3 Indicate sleeves, openings and stress points (such as anchors, guides and inserts).
 - .4 Indicate deviation in sizes and weights and also in water, drainage, electric power or other service requirements for all equipment proposed which is different from those shown on the design drawings.
 - .5 Provide these drawings to other trades for coordination with their work.
 - .6 Update these drawings as part of the As-Built Drawings, showing actual locations of major equipment, services, access doors, shut-off valves, etc.
 - .6 The Design Drawings show the major requirements for the installation of equipment based on one manufacturer's requirements, but may not show all installation requirements. The Contractor will include as part of the Work the specific manufacturer's installation requirements for the equipment actually provided by the Contractor.
-

- .7 The construction/installation/fabrication drawings are not to be submitted as Shop Drawings. Make them available for viewing at site when requested by the Consultant.
 - .3 Review Before Proceeding (HOLD)
 - .1 Where the word "HOLD" appears on drawings and other Contract Documents, the Work is included in the Contract.
 - .2 Execute such Work only after verification of dimensions, verification of materials and obtaining Consultant's written permission to proceed.
 - 1.5 **COORDINATION AND EXAMINATION**
 - .1 Reference
 - .1 To Section 01 10 00.
 - .2 Examination
 - .1 Carefully examine Work and Drawings of all related trades and thoroughly plan the Work so as to avoid interferences.
 - .2 Report defects which would adversely affect the Work. Do not commence installation until such defects have been corrected.
 - .3 Coordination
 - .1 Coordinate Work of Division 21, 22, 23 and 25 such that items will properly interface with work of other divisions. Prepare Installation Drawings of critical locations and submit to Consultant for review.
 - .2 Architectural Drawings, or in their absence, Mechanical Drawings govern all locations.
 - 1.6 **EXISTING SERVICE**
 - .1 Tie-in to Existing Services
 - .1 Do not shut down or make tie-in connections to any existing service without written permission of the Owner and/or Consultant.
 - .2 Arrange Work to minimize interruption to physical access to the building.
 - .3 Include for all costs associated with making connections to existing services, including but not limited to, cutting and patching of existing floors, partitions, ceilings and finishes.
 - .2 Work in Existing Buildings
 - .1 Route pipes, conduits and other services to avoid interference with existing installation.
 - .2 Relocate existing services and equipment to suit installation of new work.
 - .3 Cut back and cap existing services not being used, so that finished Work presents a neat and clean appearance.
-

- .4 Unless noted to be reused, fixtures and materials being removed become the property of the Contractor and are to be removed from site, unless otherwise noted.

- .3 Continuity of Services

- .1 Be responsible for any damage to existing systems, including insulation and coverings, when making connections.
- .2 Keep existing buildings in operation with minimum length of shut-down periods.
- .3 Include overtime work to tie-in piping or wiring at night or on weekends.

1.7 **PROVISION FOR FUTURE**

- .1 Future Equipment

- .1 Where indicated as reserved for future equipment or services, leave identified space clear and install services and equipment so that connections can be made in the future.

1.8 **SUBMITTALS**

- .1 Shop Drawings

- .1 Conform to Section 01 33 00 and the following.
- .2 Shop Drawings showing more than one size or model will not be considered unless properly marked up.
- .3 For electrically driven, and fuel fired appliances, provide the following information:
 - .1 Electrical characteristics including voltage, phase, frequency and power rating.
 - .2 For motors, NEMA, class and efficiency ratings.
 - .3 Fuel input ratings including flow rates and pressures.
 - .4 Equipment performance ratings, including flow rates, pressures, efficiencies, part load values and/or efficiencies (IPLV's), plotted flow characteristics (pump and fan curves) with operating points clearly plotted.
- .4 For other equipment include the following information:
 - .1 Equipment performance ratings, including flow rates, pressures drops.
 - .2 Electrical control power requirements.
- .5 For all equipment, include the following:
 - .1 Equipment dimensions and weights.
 - .2 Itemized product description with optional items clearly marked as being included.

- .6 Provide wiring Shop Drawings:
 - .1 Wiring diagrams and schematics for all equipment which has electrical controls or devices furnished with the equipment.
 - .2 Wiring diagrams alone are not sufficient; schematic and interconnecting drawings and sequence of operation of equipment are required for review.
 - .3 Clearly indicate the materials and/or equipment being supplied
 - .1 Details of construction, finish, accurate dimensions, capacities and performance.
 - .2 Certify drawings correct for construction by the manufacturer, before submission.
 - .3 Identify equipment Shop Drawings with designations as shown on the drawings or in the Specifications.
 - .4 If not complied with, Shop Drawings will not be reviewed and will be returned to the Contractor.
 - .4 Coordinate equipment which attaches to and/or where external wiring provided connects to other equipment.
 - .1 Do such coordination whether such equipment is supplied under this or other contracts or subcontracts, for which relevant information will be provided by Owner/Consultant.
- .7 Shop Drawings shall conform to the requirements of NFPA 13, NFPA 14, NFPA 20, and other relevant sections as necessary.

1.9 **"AS-BUILT" RECORD DRAWINGS**

- .1 Reference
 - .1 Conform to Section 01 33 00.
 - .2 Maintain an accurate dimensional record of all underground piping and all deviations and changes in aboveground piping and equipment.

1.10 **INSTALLATION AND START-UP INSTRUCTIONS**

- .1 Reference
 - .1 Conform to Section 01 33 00.
 - .2 Submit copies of installation instructions and copies of start-up instructions for any item of equipment when requested by the Consultant.

1.11 **OPERATING AND MAINTENANCE INSTRUCTION MANUALS**

- .1 Reference
 - .1 Conform to Section 01 33 00.
 - .2 In addition, include the following in the manuals:

- .1 Non-dimensional layout showing location of all electrical devices on mechanical equipment.
- .2 Operating instructions, including start-up and shut-down procedure.
- .3 Lubricating instructions and recommended cycle of lubrication for each item of equipment, including various types of lubricants.
- .4 List of spare parts.
- .3 All the above applies to component parts of equipment whether they are manufactured by the Supplier of the equipment or are supplied as a component part of an item of equipment.

1.12 **CLEANING, TESTING AND APPROVAL RECORDS**

- .1 Records
 - .1 Maintain records of all pressure tests and flushing and sterilization tests, glycol/ water concentrations, inspections and approvals by the plumbing inspector.
 - .2 Forward these tests to the Owner on completion of the Work in accordance with Section 01 33 00.
 - .3 Forward to Consultant, copy of records on site on completion of each test, cleaning operation, etc.

1.13 **DIMENSIONS AND QUANTITIES**

- .1 Dimensions
 - .1 Dimensions shown on drawings are approximate.
 - .2 Verify dimensions by reference to Shop Drawings and field measurement.
- .2 Quantities
 - .1 Quantities or lengths indicated in any of the Contract Documents are approximate only and shall not be held to gauge or limit the Work.

1.14 **TRADE QUALIFICATIONS**

- .1 Applicable to the following trades
 - .1 Sprinkler/Fire Protection
 - .2 Requirements
 - .1 Trade workers to have a certificate of qualification as journeyman or apprentice registration for the province where the work is performed or an interprovincial certificate.
 - .2 Ratio of journeyman to apprentice not to exceed the defined ratio in the Apprenticeship Act of Ontario.
 - .3 On award of Contract, submit a list of trade journeyman and apprentices, together with their certificate and registration numbers.
 - .4 Certificates and registration must be provided to the Consultant on request.
-

- .5 Maintain on-site an up-to-date record listing journeyman and apprentices working on site.

2 Products

2.1 **MATERIALS**

- .1 Use new materials and equipment, free from defects impairing strength and durability, as specified or specified equivalent.
- .2 Of Canadian manufacture wherever possible.
- .3 Labelled or listed as required code and/or inspection authorities.
- .4 Design of mechanical systems has been based on the first listed Supplier and model number/size stated on the equipment schedules on the drawings. Bear all costs due to physical or performance differences between stated equipment and proposed equipment. These differences include but are not limited to size, layout, arrangement, connection size, location and/or quantity of connections, or performance differences such as noise, power requirements, flow, throw, etc.

2.2 **EQUIPMENT/STRUCTURE COORDINATION**

- .1 Locations and dimensions of curbs and roof and floor opening framing, where indicated on the drawings, are based on an arrangement to suit the above named Supplier.
- .2 Be responsible to verify the actual size requirements of the openings, and notify the Consultant immediately in case the dimension of the unit supplied and the connecting ductwork/piping, etc. are at variance with the dimensions given on the Drawings.
- .3 Bear all costs for modification of curbs and floor/roof openings resulting from failure to notify the Consultant prior to the fabrication or construction of opening framing and curb.

2.3 **STANDARD SPECIFICATIONS**

- .1 Product Quality
 - .1 Ensure that the chemical and physical properties, design, performance characteristics and methods of construction of all Products provided comply with the latest issue of applicable standard Specifications issued by authorities having jurisdiction.
 - .2 Do not apply such standard Specifications to decrease the quality of workmanship, Products and services required by the Contract Documents.

2.4 **MANUFACTURER'S NAMEPLATES**

- .1 Metal Nameplates
 - .1 Provided with raised or recessed lettering, on each piece of equipment.
 - .2 Mechanically fasten nameplate on a metal stand-off bracket arranged to clear insulation.
 - .3 Mount, on same stand-off, Underwriters Laboratories and/or CSA registration plates.
-

.2 Nameplate Data

.1 Indicate:

- .1 Size
- .2 Capacity
- .3 Equipment model
- .4 Manufacturer's name
- .5 Serial number
- .6 Voltage
- .7 Cycle
- .8 Phase and power of motors

2.5 **MOTORS AND WIRING**

- .1 In accordance with Section 23 05 13 Motors and Wiring for Mechanical.

2.6 **PIPES, FITTINGS AND VALVES**

- .1 In accordance with Section 23 05 23 Pipes, Fittings and Valves.

2.7 **HANGERS AND SUPPORTS**

- .1 In accordance with Section 23 05 29 Pipe Hangers and Supports.

2.8 **VIBRATION AND SEISMIC RESTRAINT**

- .1 In accordance with Section 23 05 48 Noise and Vibration Control, and Section 23 05 49 Seismic Control.

2.9 **IDENTIFICATION FOR EQUIPMENT AND PIPING**

- .1 In accordance with Section 23 05 53 Mechanical Identification.

2.10 **GAUGES**

.1 Pressure Gauge

- .1 90 mm dial and overload stops and dial range approximately double the operating pressure, with 1% accuracy.
- .2 Polished brass case, phosphor bronze bushed rotary movement, bronze bourdon tube
- .3 Needle valve: Round handle, with NPS ¼ connecting piping or tubing with each gauge. Each gauge shall be provided with a snubber.
- .4 Acceptable Manufacturers:
 - .1 Tetric
 - .2 Ashcroft

- .3 Winters
 - .4 Weksler
 - .2 Thermometers
 - .1 225 mm scale, straight adjustable angle tubular glass type with red appearing mercury in lens front tube.
 - .2 Cast aluminum case, and brass stem complete with separable socket, and combination Celsius/Fahrenheit scale.
 - .3 Scale range to be approximately double the operating temperature range of the particular system in which thermometers are to be installed.
 - .4 Stems to be of sufficient length to provide for proper insertion in piping or equipment in which they are installed to ensure correct temperature readings.
 - .5 Acceptable Manufacturers
 - .1 Terice
 - .2 Ashcroft
 - .3 Weksler
 - .4 Winters
 - .3 Level Gauges
 - .1 150 mm diameter dial, with graduated scale with minor markings, and numbers at major depth levels.
 - .2 Scale range to be a minimum of 110% higher than overflow level of tank.
 - .3 Black finished cast aluminum case, adjustable micrometer type pointer, stainless steel bourdon tube and stainless steel rotary type movement. Dial range to be 0 to 18 m.
 - .4 Acceptable Manufacturers
 - .1 Ashcroft
 - .2 Terice
 - .3 Winters
 - .4 Weksler
 - 2.11 **SUPERVISORY SWITCHES**
 - .1 Tamper Switches
 - .1 120 volt, N.O. switches on riser valves and other isolating valves. Listing: ULC, FM approved.
 - .2 Acceptable Manufacturers
 - .1 Potter Electric
-

- .2 System Sensor
 - .3 Viking
 - .2 Flow Switches
 - .1 120 volt, N.O. switches in risers in locations indicated on Drawings. Listing: ULC, FM approved.
 - .2 Acceptable Manufacturers
 - .1 Potter Electric
 - .2 System Sensor
 - .3 Viking
 - 2.12 **FIRE DEPARTMENT PUMPER (INLET) CONNECTIONS**
 - .1 Wall Siamese Fittings - Flush Type
 - .1 Cast brass body, brass plate, brass swivel adapters and brass plugs with polished finish. ULC listed and FM approved.
 - .2 64 mm "Ontario" standard hose threads with caps and chains
 - .3 Double inlet clappers
 - .4 Imprinted escutcheon plate, embossed "SPRINKLER SYSTEM CONNECTION", "STANDPIPE" or "AUTOSPKR AND STANDPIPE" as required.
 - .5 Ball drip on yard side of Siamese check valve.
 - .6 Acceptable Manufacturers
 - .1 National Fire Equipment Ltd.
 - .2 Wilson and Cousins
 - .3 Croker
 - .2 Sidewalk Siamese Fitting - Standpipe Mounted
 - .1 Free-standing double inlet with 500 gpm capacity, ULC listed and FM approved
 - .2 Cast brass construction
 - .3 64 mm "Ontario" standard hose thread with caps and chains
 - .4 Double inlet clappers
 - .5 Imprinted escutcheon plate embossed "SPRINKLER SYSTEM CONNECTION", "STANDPIPE" or "AUTO SPKR AND STANDPIPE" as required.
 - .6 Acceptable Manufacturers
 - .1 National Fire Equipment
 - .2 Wilson and Cousins
-

.3 Croker

2.13 **PORTABLE FIRE EXTINGUISHING EQUIPMENT**

.1 Portable Fire Extinguishers

.1 Extinguishers to be complete with full operating charge and wall mounting bracket, and of the following class:

.1 Dry Chemical Class ABC 2.3 kg

.2 Acceptable Manufacturers

.1 Levitt (Ansul)/Tyco

.2 National Fire Equipment

.3 Flag Fire Equipment

.2 Fire Extinguisher Cabinets

.1 1.6 mm (16 gauge) steel tub

.2 2.8 mm (12 gauge) hollow channel door and rebated frame

.3 Where flush mounted, return edges by 13 mm or bevel on outer edge of door trim

.4 Semi-concealed piano hinges

.5 Door latch and 5 mm plate glass in door

.6 Cabinet finish: Grey primer to door, trim and full cabinet

.7 Door finish: Polished chrome plated

.8 Acceptable Manufacturers

.1 National Fire Equipment

.2 Herbert Williams

.3 Wilson and Cousins

2.14 **SIGNS**

.1 Enamelled steel with fire department red enamel background, white letters; inscription in accordance with (NFPA) (FM) Standards.

.2 150 mm x 150 mm for automatic control valves and alarm valves.

.3 50 mm x 150 mm for other valves.

.4 Fitted on control valves, shut-off valves, drain valves and test valves.

3 Execution

3.1 **GENERAL**

.1 Execute Work in accordance with requirements specified in the various sections of Division 22.

- .2 Lay out Work of each trade so that it does not interfere with work under other divisions of Specifications.
- .3 Make good any damage to Owner's property or other trade's work caused by improperly locating or carrying out of Work.
- .4 Supply anchor bolts and templates for installation by other divisions.
- .5 Location of pipes, ductwork, raceways and equipment may be altered without extra cost provided alteration is made before installation.

3.2 **EQUIPMENT INSTALLATION**

- .1 Set equipment in place, align, connect and place in operation with:
 - .1 Controls set for efficient, stable operation.
 - .2 Initial lubrication and oil sumps filled.
 - .3 Connections and required safety devices installed.
- .2 Protect equipment from damage during and after installation, and on completion of Work ensure that equipment is free from cracks, scratches, discolourations, tool marks, and other defects.
- .3 Thoroughly clean finished surfaces before acceptance of Work.
- .4 Install heater vents complete with necessary supports, hangers, braces, roof flashing, storm collar, and round top.

3.3 **PROTECTION**

- .1 Protect Work and materials before, during and after erection, from weather and other hazards and keep in a clean and orderly manner.
- .2 Protect pipe ends, valves and parts of equipment left unconnected to prevent damage or intrusion of foreign matter. Provide pipe caps for threaded male connections and plugs for threaded female connections.
- .3 Protect plumbing fixtures or mechanical equipment having a baked enamel finish by covering with polyethylene sheet securely held in place.
- .4 Protect finished floor slabs from scuffing, cracking, chipping, staining, cutting and other damage resulting from Work of this Contract.
 - .1 Place a 19 mm thick plywood underlaid with 25 mm thick polystyrene insulation board adhered to same, over floor areas when working from, or over, such surfaces.
 - .2 Provide such protection below hoist rigs, ladders, pallets of material, and in other circumstances where the flooring is exposed to potential damage.
 - .3 Work damaged due to failure in providing such protection is to be removed and replaced, or repaired, as directed by the Owner, at no increase in Contract Price.

3.4 **MAINTENANCE OF BEARINGS**

- .1 During Construction
-

- .1 Turn-over rotating equipment at least once a month after delivery:
 - .1 Run-in sleeve type bearings in accordance with manufacturer's recommendations.
 - .2 Drain, flush out and refill with new charge of oil or grease.
 - .3 Protect bearings, shafts and sheaves against damage, corrosion and dust accumulation.
 - .4 Provide extended grease nipples for bearing lubrication.

3.5 **FIRE EXTINGUISHERS**

- .1 Provide fire extinguishers as follows:
 - .1 In each fire hose cabinet
 - .2 One extinguisher for each 300 m² of floor area in an electrical or mechanical service room.
 - .3 In each extinguisher cabinet and at intervals to comply with the local fire code.
 - .4 At each fire hose reel, rack or tray, mounted to wall construction with substantial wall brackets provided with extinguishers.
 - .5 Type: Class ABC unless shown otherwise.
 - .6 As shown on drawings.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.
- .2 Section includes, but is not necessarily limited to, the following:
 - .1 Design of automatic sprinkler systems
 - .2 Preparation of Working Drawings
 - .3 Incorporation of facilities and equipment in an overall fire protection system
 - .4 Connection to buried fire mains 1.5 m outside building wall and buried leads into building and to above floor line including thrust blocks at buried elbows
 - .5 Exterior pumper connections
 - .6 Wet pipe sprinkler system(s)
 - .7 Dry pipe sprinkler system(s)
 - .8 Excavating, bedding, and backfilling of pipe trenches for buried piping installed under this section
 - .9 Supervisory switches on riser valves and other isolating valves, waterflow switches and pressure switches on alarm valves and risers
 - .10 Electrical wiring as noted and/or as shown on Drawings

1.2 **REFERENCE STANDARDS**

- .1 Comply with the latest edition of the following:
 - .1 National Fire Protection Association
 - .1 NFPA 13 Standard for the Installation of Sprinkler Systems
 - .2 NFPA 72 National Fire Alarm and Signaling Code

1.3 **DESIGN CRITERIA**

.1 Design Submissions

- .1 Prepare complete drawings of fire protection system to include:
 - .1 Drawings and calculations bearing stamp of a Professional Engineer employed by the fire protection company and who is registered as a member of the Association of Professional Engineers of the Province of Ontario.
 - .2 Submit six copies of plans, hydraulic design calculation sheets, Shop Drawings and equipment submittals through Owner's fire insurance

broker for approval by designated organization. Shop Drawings shall conform to NFPA 13 requirements.

- .3 Submit all copies of drawings, etc., duly approved by Owner's insurance underwriter to Consultant for final review prior to commencement of work.
- .4 Submit reviewed Shop Drawings to local municipal authority.
- .5 Provide systems in accordance with approved drawings, subject to inspection and testing requirements of Owner's Insurance Underwriter and Consultant.

.2 Underwriters/Owners Approval

- .1 Fire protection work requires approval of Owner's fire insurance underwriter and Consultant.
- .2 Reviewing organization:
 - .1 Insurers Advisory Organization
 - .2 Canadian Industrial Risks Insurers
 - .3 FM Global
 - .4 Factory Insurance Association

1.4 **SUBMITTALS**

.1 Shop Drawings

- .1 Submit Shop Drawings in accordance with Section 01 33 00.
- .2 Sprinklers shall be referred to on drawings and Product submittals and be specifically identified by the manufacturer's listed model or series designation. Trade names and other abbreviated listings are not allowed.

.2 Samples

- .1 Submit samples for the following
 - .1 Each type of sprinkler.
 - .2 Signs.

.3 Operation and Maintenance Data

- .1 Submit printed operating instructions and maintenance data in accordance with Section 01 33 00.

.4 Maintenance Materials

- .1 Provide the following materials at Project handover:
 - .1 Storage cabinet.
 - .2 Sprinkler wrench.

- .3 Spare stock of sprinklers. Include at least one head of each type and temperature rating installed in system.

1.5 **QUALITY ASSURANCE**

.1 Qualifications

- .1 An accredited member in good standing of the Canadian Automatic Sprinkler Association.

1.6 **CODES AND REGULATIONS, PERMITS, COSTS AND FEES**

- .1 Comply with municipal and provincial codes, rules and regulations and/or authorities having jurisdiction.
- .2 Apply for and obtain permits required for this Work and pay costs levied for permits, inspections and fees.
- .3 Comply with the National Building Code in areas where municipal or provincial regulations and/or codes are not mandatory.
 - .1 Revisions issue: Latest version as amended to date.

2 **Products**

2.1 **LINE MATERIALS**

.1 General

- .1 Unless otherwise noted, equipment and apparatus to be ULC listed and labelled, and FM approved.
- .2 All grooved couplings and fittings, valves and specialties shall be the Products of a single manufacturer. Grooving tools shall be of the same manufacture as the grooved components.
 - .1 All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

2.2 **SPRINKLER HEADS**

.1 Ratings

- .1 ULC and FM listed for fire service.
- .2 Sprinkler body shall be die-cast, with a hex-shaped wrench boss integrally cast into the sprinkler body to reduce the risk of damage during installation. Wrenches shall be provided by the sprinkler manufacturer that directly engage the wrench boss.
- .3 Standard orifice size: 12 mm diameter orifice or 13 mm diameter orifice.
- .4 Standard temperature rating: 57°C to 74°C (135°F to 165°F).
- .5 Intermediate and high temperature rating heads to suit local conditions.

.2 Type

- .1 Indicated by type in accordance with the following

- .2 No ceilings
 - .1 "U-1": Upright, bronze body, glass-bulb or link and lever type
 - .3 Suspended or drop ceilings
 - .1 "P-1": Pendant, chrome plated body and escutcheon plate, link and lever type.
 - .2 "P-2": Pendant, chrome plated body and escutcheon plate, glass bulb type.
 - .3 "P-3": Recessed, chrome plated body ring and cup, glass bulb type.
 - .4 "P-4": Flush, concealed with adjustable, diffusable (chrome) (white) (factory painted, colour to be selected) cover plate.
 - .4 Side wall
 - .1 "S-1": Side wall, bronze body and chrome escutcheon plate, glass bulb or fusible solder type.
 - .2 "S-2": Side wall, chrome plated body and escutcheon plate, glass bulb or fusible solder type.
 - .5 Deluge systems
 - .1 Open type heads, of style to suit location.
 - .6 Spare heads and cabinet
 - .1 Each sprinkler system: ULC approved metal cabinet containing required number of spare sprinkler heads of each type and temperature rating.
 - .2 Wrench for removal and replacement of sprinkler heads.
 - .7 Acceptable Manufacturers
 - .1 Victaulic Company
 - .2 Viking Sprinkler Company
 - .3 Reliable Automatic Sprinkler Company
 - .4 Tyco
 - .5 Or accepted equal
 - .3 In lieu of rigid pipe offsets or return bends for sprinkler drops, the Victaulic VicFlex™ Multiple-Use Flexible Stainless Steel Sprinkler Drop System may be used to locate sprinklers as required by final finished ceiling tiles and walls.
 - .1 The drop system shall consist of a braided type 304 stainless steel flexible tube, zinc plated steel 1" NPT male threaded nipple for connection to branch-line piping, and a zinc-plated steel reducer with a 1/2" or 3/4" NPT female thread for connection to the sprinkler head.
 - .2 Include a ULC/UL approved Series AH2 braided hose with bend radius to 50 mm to allow for proper installation in confined spaces.
-

- .1 The hose shall be listed for (four bends at 787.5 mm length) (five bends at 915 mm length) (six bends at 1220 mm length) (six bends at 1524 mm length) (seven bends at 1830 mm length). Union joints shall be provided for ease of installation.
- .3 The flexible drop shall attach to the ceiling grid using a one-piece open gate Series AB1 bracket.
 - .1 The bracket shall allow installation before the ceiling tile is in place.
- .4 The braided drop system is ULC/UL listed and FM approved for sprinkler services to 1206 kPa (175 psi).

2.3 **ALARM CHECK VALVES**

- .1 General
 - .1 ULC and FM listed for fire service.
 - .2 Of same manufacture as specified for sprinkler heads.
 - .3 Valve internal components shall be replaceable without removing the valve from the installed position.
 - .2 Wet Sprinkler Systems
 - .1 Construction
 - .1 Resiliently seated wet alarm check valve
 - .2 Fitted with OS & Y gate valves or supervised butterfly valves
 - .3 Flow and pressure switches
 - .4 Alarm piping connection to water motor gong
 - .5 Upstream and downstream pressure gauges
 - .6 Test connection
 - .7 Main drain valve
 - .3 Dry Sprinkler Systems
 - .1 Construction
 - .1 Resiliently seated dry alarm check valve with accelerator
 - .2 Required air pressure shall be 90 kPa (13 psig)
 - .3 Valve shall be externally resettable.
 - .4 Fitted with OS & Y gate valves or supervised butterfly valves
 - .5 Flow and pressure switches
 - .6 Alarm piping connection to water motor gong
 - .7 Upstream and downstream pressure gauges
-

- .8 Test connection
- .9 Main drain valve
- .2 Air compressor
 - .1 Electric motor drive air compressor.
 - .2 Complete with piping and controls for automatic operation of compressor to maintain air pressure on downstream side of each dry pipe valve.
 - .3 Normally Open pressure switches with snubbers on downstream side of each dry pipe valve.

2.4 **ANCILLARY EQUIPMENT**

- .1 Water Gong
 - .1 Water operated outside alarm bell, weather protected.
 - .2 Excess Pressure Pump
 - .1 Construction
 - .1 Close coupled bronze pump with stainless steel shaft
 - .2 Motor size, pump size, and head capacity as shown
 - .3 Pressure switch with pressure differential of 100 kPa (5 psi) to operate excess pressure pump
 - .4 Shut-off valve and strainer on pump inlet
 - .5 Relief valve, check valve and shut-off valve on pump discharge connection
 - .2 Acceptable Manufacturers
 - .1 Albany
 - .2 Price Pump Company
 - .3 Double Check Valves and Backflow Preventers
 - .1 Construction
 - .1 ULC and FM listed for fire service
 - .2 Double check valve assemblies to be in accordance with CSA Standard B64.5, latest edition
 - .3 Backflow preventer assemblies to be in accordance with CSA Standard B64.4, latest edition
 - .2 Acceptable Manufacturers
 - .1 Zurn
 - .2 Watts
-

- .3 Victaulic
- .4 Conbraco
- .5 Or accepted equal

3 Execution

3.1 **GENERAL**

.1 Apportionment of the Work

- .1 Classify and apportion all materials and the performance of all labour to trades involved in accordance with all local customs, rules, regulations, jurisdictional awards, decisions, etc., insofar as they may apply and as required to efficiently execute the work involved in this Contract.

.2 Measurements and Deviations

- .1 Where any parts of the Work are specifically located by dimensions on the Drawings, check and verify these dimensions on the Site prior to installation.
- .2 Examine work of other trades or Contractors prior to commencement of fire protection installations. Immediately report in writing to Consultant any discrepancies on the part of any other Contractor which will affect fire protection installations. Failure to report discrepancies shall be considered acceptance of conditions.
- .3 Where Site conditions require minor deviations from indicated arrangements or locations, make changes on approval of Consultant without additional cost to Owner.
- .4 Should discrepancies occur during installation of fire protection work which will necessitate major revisions, immediately notify Consultant and secure his authorization in writing before proceeding with the Work.

3.2 **INSTALLATION**

.1 Sprinkler Head Selection

- .1 Select heads for general areas in accordance with the following:

Exposed - no ceilings	U-1
Suspended or drop ceilings - unless otherwise shown on Drawings	(P-1) (P-2) (P-3) (P-4)
Side wall	(S-1) (S-2)
Installation in column webs	S-1

- .2 In T-bar ceilings, locate heads in centre of ceiling tile to present an orderly appearance.
 - .3 For deluge systems, use open type heads, of style to suit location.
-

- .2 Do not install any sprinklers that have been dropped, damaged, or show a visible loss of fluid. Never install any sprinkler with a cracked bulb.
 - .1 Sprinkler bulb protector shall be removed by hand. Do not use any tools or devices that could damage the bulb.
- .3 Test Connections and Drains
 - .1 Locate inspector's test connections, complete with valve, sight glass, and drain piping either at high points of sprinkler system or at the end of the longest run of sprinkler piping in accordance with NFPA 13.
- .4 Flushing of Piping
 - .1 Flush sprinkler system piping in accordance with NFPA requirements.
 - .2 Flush underground piping and lead-in connections before connection is made to sprinkler system risers.

3.3 **TESTING**

- .1 Requirements
 - .1 Execute fire protection systems and equipment tests in accordance with NFPA requirements
 - .2 Minimum hydrostatic test of not less than 1380 kPa (200 psig) pressure for two hours, or at 345 kPa (50 psi) in excess of maximum static pressure developed in system, if maximum static pressure is in excess of 1034 kPa (150 psig).
 - .3 Execute tests in presence of Consultant and Owner's authorized representative.
 - .4 Promptly repair defects which develop during tests, and then re-test system to complete satisfaction of authorized inspectors.
 - .5 Submit a certificate covering materials and tests to Underwriter's Inspection Authority, together with a request for inspection and approval of complete fire protection system. On receipt of approval, forward certificate to Owner.

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section including but not limited to that listed herein.
- .2 The terms “mechanical work”, “Mechanical Contractor” or their derivatives includes the Work of Divisions 21, 22, 23, and 25, unless otherwise specified.
- .3 Piping systems:
 - .1 Storm drainage system within building(s) including roof drains and connection to buried storm sewer 1.5 m outside building wall
 - .2 Sanitary drainage and venting system within building(s) including connection to buried sanitary sewer 1.5 m outside building wall
 - .3 Domestic cold, hot and recirculating water piping to plumbing fixtures within building
 - .4 Domestic cold water piping to 1.5 m outside building wall
 - .5 Natural gas piping
 - .6 Excavation, bedding, and backfilling of pipe trenches for buried piping inside building and to 1.5 m outside
- .4 Equipment:
 - .1 City water meter
 - .2 Plumbing specialties
 - .3 Drainage specialties
 - .4 Plumbing fixtures and fittings
 - .5 Hot water storage tank(s) and heater(s)
 - .6 Pumps

1.2 **CODES, REGULATIONS AND STANDARDS**

- .1 Comply with municipal or provincial codes, rules and regulations and/or authorities having jurisdiction.
- .2 Comply with the National Building Code in areas where municipal or provincial regulations and/or codes are not mandatory.
- .3 Revisions issue: Latest version as amended to date.

1.3 **PERMITS AND INSPECTIONS**

- .1 Material Approvals
-

- .1 Obtain special inspection and approvals by CSA and/or local authorities, for materials where specified.
- .2 Obtain such approval for the particular installation with the co-operation of the material Supplier.
- .2 Permits
 - .1 Obtain permits required for the installation of mechanical trades work including:
 - .1 Plumbing inspection
 - .2 Electrical inspection
 - .2 Arrange for inspections and tests and pay all fees and costs for the permits, inspections and tests. Obtain permits immediately after notification of award of Contract.
 - .3 Obtain copies of Drawings from the Consultant for submission with application for permits.

1.4 **WORKING DRAWINGS AND DOCUMENTS**

- .1 Design Drawing Intent
 - .1 The design drawings are schematic in arrangement, and describe the general design intent but do not show the exact details for the installation. They are not fabrication or installation drawings.
 - .2 The Work is suitably outlined on the Drawings with regard to sizes, locations, general arrangements and installation details, and has been generally coordinated for routing of services. The routing of ductwork, piping and equipment arrangement are shown more or less in diagram except where in certain cases the Drawings may include details giving the exact locations and arrangements required.
 - .3 The location of equipment, and the associated arrangement of piping, ductwork, and other material describes the general requirements of the Work. Final location is dependant on the actual equipment supplied. The Consultant reserves the right to make reasonable adjustment of up to 1 m to the location of equipment, floor drains, routing of major piping and ductwork, at no cost to the Owner.
 - .4 In order to provide clarity to the arrangement of the Work, not all details including valves, thermometers, pressure gauges, etc. are shown on the plan drawings. Refer to Schematic Drawings, standard details and the Specification for these requirements.
 - .5 Where specific installation dimensions for location of equipment and access space requirements are indicated on the Drawings, install to these requirements.
 - .6 Where standard details are provided, these show the general installation requirements, and are applicable to each occurrence in the Work, unless otherwise specified or shown.
 - .2 Contractor Coordination Responsibilities
 - .1 Provide the services of a mechanical/electrical coordination supervisor, to coordinate this division of the Work, as well as providing coordination with other
-

divisions and/or contracts. This supervisor may be full time or part time on site, as appropriate to the work stage and complexity of the Work, at the discretion of the Owner.

- .2 Where multiple trades are required, the mechanical coordinating supervisor shall be the lead coordinator.
- .3 The Owner reserves the right to require the coordinating supervisor to increase their attendance at site, at no cost to the Owner, if in the Owner's opinion the current level of coordination is not sufficient for the progress of the Work.
- .4 Make changes and modifications as necessary to ensure coordination and to avoid interference and conflicts with other trades.
- .5 Prepare construction/installation/fabrication drawings, coordinated with other trades and contracts, as required.
 - .1 Provide sufficient detail to disclose critical interferences of major equipment and services to ensure adequate accessibility.
 - .2 Specific dimensions for equipment location or access which are shown on the Consultants Drawings.
 - .3 Indicate sleeves, openings and stress points (such as anchors, guides and inserts).
 - .4 Indicate deviation in sizes and weights and also in water, drainage, electric power or other service requirements for all equipment proposed which is different from those show on the Design Drawings.
 - .5 Provide these Drawings to other trades for coordination with their Work.
 - .6 Update these Drawings as part of the As-Built Drawings, showing actual locations of major equipment, services, access doors, shut-off valves, etc.
- .6 The Design Drawings show the major requirements for the installation of equipment based on one manufacturer's requirements, but may not show all installation requirements. The Contractor will include as part of the Work the specific manufacturer's installation requirements for the equipment actually provided by the Contractor.
- .7 The construction/installation/fabrication Drawings are not to be submitted as Shop Drawings. Make them available for viewing at Site when requested by the Consultant.

.3 Review Before Proceeding (HOLD)

- .1 Where the word "HOLD" appears on Drawings and other Contract Documents, the Work is included in the Contract.
- .2 Execute such Work only after verification of dimensions, verification of materials and obtaining Consultant's written permission to proceed.

1.5 **COORDINATION AND EXAMINATION**

- .1 Reference

- .1 To Section 01 10 00.
 - .2 Examination
 - .1 Carefully examine Work and Drawings of all related trades and thoroughly plan the Work so as to avoid interferences.
 - .2 Report defects which would adversely affect the Work. Do not commence installation until such defects have been corrected.
 - .3 Coordination
 - .1 Coordinate Work of Division 21, 22, 23 and 25 such that items will properly interface with Work of other divisions. Prepare Installation Drawings of critical locations and submit to Consultant for review.
 - .2 Architectural Drawings, or in their absence, Mechanical Drawings govern all locations.
 - 1.6 **EXISTING SERVICE**
 - .1 Tie-in to Existing Services
 - .1 Do not shut down or make tie-in connections to any existing service without written permission of the Owner and/or Consultant.
 - .2 Arrange Work to minimize interruption to physical access to the building.
 - .3 Include for all costs associated with making connections to existing services, including but not limited to, cutting and patching of existing floors, partitions, ceilings and finishes.
 - .2 Work in Existing Buildings
 - .1 Route pipes, ducts, conduits and other services to avoid interference with existing installation.
 - .2 Relocate existing services and equipment to suit installation of new work.
 - .3 Temporarily remove existing plumbing fixtures to suit new construction; reconnect fixtures at completion of the Work.
 - .1 Do not reuse existing fixtures in new locations.
 - .4 Cut back and cap existing services not being used, so that finished Work presents a neat and clean appearance.
 - .5 Unless noted to be reused, fixtures and materials being removed become the property of the Contractor and are to be removed from site, unless otherwise noted.
 - .3 Continuity of Services
 - .1 Be responsible for any damage to existing systems, including insulation and coverings, when making connections.
 - .2 Keep existing buildings in operation with minimum length of shut-down periods.
 - .3 Include overtime work to tie-in piping or wiring at night or on weekends.
-

1.7 **PROVISION FOR FUTURE**

.1 Future Equipment

- .1 Where indicated as reserved for future equipment or services, leave identified space clear and install services and equipment so that connections can be made in the future.

1.8 **SUBMITTALS**

.1 Shop Drawings

- .1 Conform to Section 01 33 00 and the following:
- .2 Shop Drawings showing more than one size or model will not be considered unless properly marked up.
- .3 For electrically driven, and fuel fired appliances, provide the following information:
 - .1 Electrical characteristics including voltage, phase, frequency and power rating.
 - .2 For motors, NEMA, class and efficiency ratings.
 - .3 Fuel input ratings, including flow rates and pressures.
 - .4 Equipment performance ratings, including flow rates, pressures, efficiencies, part load values and/or efficiencies (IPLV's), plotted flow characteristics (pump and fan curves) with operating points clearly plotted.
- .4 For other equipment include the following information:
 - .1 Equipment performance ratings, including flow rates, pressures drops.
 - .2 Electrical control power requirements.
- .5 For all equipment, include the following:
 - .1 Equipment dimensions and weights.
 - .2 Itemized product description with optional items clearly marked as being included.
- .6 Provide wiring Shop Drawings:
 - .1 Wiring diagrams and schematics for all equipment which has electrical controls or devices furnished with the equipment.
 - .2 Wiring diagrams alone are not sufficient; schematic and interconnecting drawings, and sequence of operation of equipment are required for review.
 - .3 Clearly indicate the materials and/or equipment being supplied:
 - .1 Details of construction, finish, accurate dimensions, capacities and performance.

- .2 Certify drawings correct for construction by the manufacturer, before submission.
 - .3 Identify equipment Shop Drawings with designations as shown on the Drawings or in the Specifications.
 - .4 If not complied with, Shop Drawings will not be reviewed and will be returned to the Contractor.
 - .4 Coordinate equipment which attaches to and/or where external wiring provided connects to other equipment.
 - .1 Do such coordination whether such equipment is supplied under this or other contracts or subcontracts, for which relevant information will be provided by Owner/Consultant.
 - 1.9 **AS-BUILT" RECORD DRAWINGS**
 - .1 Reference
 - .1 Conform to Section 01 33 00.
 - .2 Maintain an accurate dimensional record of all underground piping and all deviations and changes in aboveground piping and equipment.
 - 1.10 **INSTALLATION AND START-UP INSTRUCTIONS**
 - .1 Reference
 - .1 Conform to Section 01 33 00.
 - .2 Submit copies of installation instructions and copies of start-up instructions for any item of equipment when requested by the Consultant.
 - 1.11 **OPERATING AND MAINTENANCE INSTRUCTION MANUALS**
 - .1 Reference
 - .1 Conform to Section 01 33 00.
 - .2 In addition, include the following in the manuals:
 - .1 Non-dimensional layout showing location of all electrical devices on mechanical equipment.
 - .2 Operating instructions, including start-up and shut-down procedure.
 - .3 Lubricating instructions and recommended cycle of lubrication for each item of equipment, including various types of lubricants.
 - .4 List of spare parts.
 - .3 All the above applies to component parts of equipment whether they are manufactured by the Supplier of the equipment or are supplied as a component part of an item of equipment.
 - 1.12 **CLEANING, TESTING AND APPROVAL RECORDS**
 - .1 Records
-

- .1 Maintain records of all pressure tests and flushing and sterilization tests, glycol/ water concentrations, inspections and approvals by the plumbing inspector.
- .2 Forward these tests to the Owner on completion of the Work in accordance with Section 01 33 00.
- .3 Forward to Consultant, copy of records on site on completion of each test, cleaning operation, etc.

1.13 **DIMENSIONS AND QUANTITIES**

- .1 Dimensions
 - .1 Dimensions shown on Drawings are approximate.
 - .2 Verify dimensions by reference to Shop Drawings and field measurement.
- .2 Quantities
 - .1 Quantities or lengths indicated in any of the Contract Documents are approximate only and shall not be held to gauge or limit the Work.

1.14 **TRADE QUALIFICATIONS**

- .1 Applicable to the following trades:
 - .1 Plumbers
- .2 Requirements
 - .1 Trade workers to have a certificate of qualification as journeyman or apprentice registration for the province where the work is performed or an interprovincial certificate.
 - .2 Ratio of journeyman to apprentice: not to exceed the defined ratio in the Apprenticeship Act of Ontario.
 - .3 On award of Contract, submit a list of trade journeyman and apprentices, together with their certificate and registration numbers.
 - .4 Certificates and registration must be provided to the Consultant on request.
 - .5 Maintain on-site an up-to-date record listing journeyman and apprentices working on site.

2 **Products**

2.1 **MOTORS AND WIRING**

- .1 In accordance with Section 23 05 13 Motors and Wiring for Mechanical

2.2 **METERS AND GAUGES**

- .1 In accordance with Section 23 05 19 Meters

2.3 **PIPE, FITTINGS AND VALVES**

- .1 In accordance with Section 23 05 23 Pipes, Fittings and Valves

2.4 EXPANSION FITTINGS AND LOOPS

- .1 In accordance with Section 23 05 24 Piping Specialties

2.5 HANGERS AND SUPPORTS

- .1 In accordance with Section 23 05 29 Pipe Hangers and Supports

2.6 VIBRATION AND SEISMIC RESTRAINT

- .1 In accordance with Section 23 05 48 Noise and Vibration Control and 23 05 49 Seismic Restraint

2.7 IDENTIFICATION FOR EQUIPMENT AND PIPING

- .1 In accordance with Section 23 05 53 Mechanical Identification

2.8 PIPING INSULATION

- .1 In accordance with Section 23 07 19 Piping Insulation

2.9 MATERIALS

- .1 Use new materials and equipment free from defects impairing strength and durability, as specified or specified equivalent.
- .2 Of Canadian manufacture wherever possible.
- .3 Labelled or listed as required by code and/or inspection authorities.
- .4 Design of mechanical systems has been based on the first listed Supplier and model number/size stated on the equipment schedules on the Drawings. Bear all costs due to physical or performance differences between stated equipment and proposed equipment. These differences include but are not limited to size, layout, arrangement, connection size, location and/or quantity of connections, or performance differences such as noise, power requirements, flow, throw, etc.

2.10 EQUIPMENT/STRUCTURE COORDINATION

- .1 Locations and dimensions of curbs and roof and floor opening framing, where indicated on the Drawings, are based on an arrangement to suit the above named Supplier.
- .2 Be responsible to verify the actual size requirements of the openings, and notify the Consultant immediately in case the dimension of the unit supplied and the connecting ductwork/piping, etc. are at variance with the dimensions given on the Drawings.
- .3 Bear all costs for modification of curbs and floor/roof openings resulting from failure to notify the Consultant prior to the fabrication or construction of opening framing and curb.

2.11 STANDARD SPECIFICATIONS

- .1 Product Quality
 - .1 Ensure that the chemical and physical properties, design, performance characteristics and methods of construction of all Products provided comply with the latest issue of applicable standard Specifications issued by authorities having jurisdiction.
-

- .2 Do not apply such standard Specifications to decrease the quality of workmanship, products and services required by the Contract Documents.

2.12 **MANUFACTURER'S NAMEPLATES**

.1 Metal Nameplates

- .1 Provided with raised or recessed lettering, on each piece of equipment.
- .2 Mechanically fasten nameplate on a metal stand-off bracket arranged to clear insulation.
- .3 Mount on same stand-off Underwriters Laboratories and/or CSA registration plates.

.2 Nameplate Data

- .1 Indicate:
 - .1 Size
 - .2 Capacity
 - .3 Equipment model
 - .4 Manufacturer's name
 - .5 Serial number
 - .6 Voltage
 - .7 Cycle
 - .8 Phase and power of motors

3 Execution

3.1 **GENERAL**

- .1 Execute Work in accordance with requirements specified in the various sections of Division 22.
- .2 Lay out work of each trade so that it does not interfere with work under other divisions of Specifications.
- .3 Make good any damage to Owner's property or other trade's work caused by improperly locating or carrying out of Work.
- .4 Supply anchor bolts and templates for installation by other divisions.
- .5 Location of pipes, ductwork, raceways and equipment may be altered without extra cost provided alteration is made before installation.

3.2 **INSTALLATION**

- .1 General
-

- .1 Install complete plumbing, drainage and vent piping within washrooms, etc. in accordance with the Ontario Building Code, standard trade practice and as specified herein.
- .2 Arrange piping within pipe spaces behind washroom fixtures to allow unimpeded access to piping for servicing.
- .2 Balancing Valves
 - .1 Where two or more branches connect to a domestic hot water recirculating line, provide each return branch with a globe or circuit balancing valve.
- .3 Air Handling Equipment Drains
 - .1 Provide drains for fan casings, air handling equipment, and low points in ductwork in locations and in arrangements as indicated on the Drawings, or as required by design.
 - .2 Drain piping is as specified for sanitary drainage, with deep seal copper trap.
 - .3 Install trap seal equivalent to not less than one and one-half times the maximum static pressure in duct system.

3.3 **EQUIPMENT INSTALLATION**

- .1 Set equipment in place, align, connect and place in operation with:
 - .1 Controls set for efficient, stable operation.
 - .2 Initial lubrication and oil sumps filled.
 - .3 Connections and required safety devices installed.
- .2 Protect equipment from damage during and after installation, and on completion of Work ensure that equipment is free from cracks, scratches, discolourations, tool marks, and other defects.
- .3 Thoroughly clean finished surfaces before acceptance of Work.
- .4 Install heater vents complete with necessary supports, hangers, braces, roof flashing, storm collar, and round top.

3.4 **FLUSHING AND STERILIZATION**

- .1 Sterilize water piping connected to municipal water supply in accordance with local municipal requirements.
 - .2 Flush each system after completion by allowing full flow of water through the system for a period of fifteen minutes or longer when directed by the Consultant.
 - .3 After flushing of the system is completed, perform a twenty-four hour contact sterilization treatment by treating the water with 50 ppm of chlorine as recommended in AWWA Specification C-651.
 - .4 After sterilization period has elapsed, flush system to reduce chlorine content to an acceptable level, but not less than thirty minutes.
-

- .5 Remove and clean strainer screens after flushing operation is completed. Repeat two weeks after initial operation of systems and within two weeks after Substantial Completion.

3.5 **SPARE PARTS**

- .1 Furnish spare parts
 - .1 One set of packing glands for each size of pump gland.
 - .2 One casing joint gasket for each size pump.
 - .3 One head gasket for each heat exchanger.
 - .4 One glass for each gauge glass.
 - .5 One set of V-belts for each drive.
 - .6 One filter cartridge or set of filter media for each filter or filter bank installed.

3.6 **PROTECTION**

- .1 Protect work and materials before, during and after erection from weather and other hazards and keep in a clean and orderly manner.
- .2 Protect pipe ends, valves and parts of equipment left unconnected to prevent damage or intrusion of foreign matter. Provide pipe caps for threaded male connections and plugs for threaded female connections.
- .3 Protect plumbing fixtures or mechanical equipment having a baked enamel finish by covering with polyethylene sheet securely held in place.
- .4 Protect finished floor slabs from scuffing, cracking, chipping, staining, cutting and other damage resulting from work of this Contract.
 - .1 Place a 19 mm thick plywood underlaid with 25 mm thick polystyrene insulation board adhered to same, over floor areas when working from, or over, such surfaces.
 - .2 Provide such protection below hoist rigs, ladders, pallets of material, and in other circumstances where the flooring is exposed to potential damage.
 - .3 Work damaged due to failure in providing such protection is to be removed and replaced, or repaired, as directed by the Owner, at no increase in Contract Price.

3.7 **MAINTENANCE OF BEARINGS**

- .1 During Construction
 - .1 Turn-over rotating equipment at least once a month after delivery;
 - .1 Run-in sleeve type bearings in accordance with manufacturer's recommendations.
 - .2 Drain, flush out and refill with new charge of oil or grease.
 - .3 Protect bearings, shafts and sheaves against damage, corrosion and dust accumulation.

.4 Provide extended grease nipples for bearing lubrication.

End of Section

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- 1 General
 - 1.1 **SUMMARY**
 - .1 Section Includes
 - .1 Labour, Products, equipment and services necessary to complete the Work of this section.
 - 1.2 **SUBMITTALS**
 - .1 Shop Drawings
 - .1 Submit Shop Drawings in accordance with Section 01 33 00.
 - .2 Operation and Maintenance Data
 - .1 Submit printed operation instructions and maintenance data in accordance with Section 01 33 00.
 - 1.3 **REFERENCE STANDARDS**
 - .1 Back-flow preventers: To CAN/CSA B64 standard series
 - 2 Products
 - 2.1 **BACK FLOW PREVENTERS**
 - .1 General
 - .1 Products from Watts have been used as a guide to establish standard of construction. Comparable Products are acceptable from the following manufacturers:
 - .1 Watts
 - .2 Honeywell/Braukmann
 - .3 Zurn Wilkins
 - .4 Cla-Val
 - .5 Apollo
 - .6 Conbraco
 - .2 Vacuum Breakers, Pressure Type (PVB)
 - .1 To CSA B64.1.2 for back-siphonage, no back pressure.
 - .2 Working pressure: To 1000 kPa (150 psig).
 - .3 Working temperature: To 60°C (140°F).
 - .4 NPS ½ to NPS 2: Anti-siphon pressure vacuum breaker complete with bronze body and spring loaded single float and disc with independent first check, shut off valves and bronze type test cocks for winterization draining. Springs should be of stainless steel construction.
-

- .3 Double Check Valve Assemblies (DCVA)
 - .1 To CSA B64.5
 - .2 Two independent positive seating check valves with captured springs and seat discs. The valve seat and discs shall be replaceable. All internal components shall be serviceable by access cover(s).
 - .3 Working pressure: To 1200 kPa (175 psig).
 - .4 Working temperature: To 60°C (140°F).
 - .5 NPS ½ to NPS 2: Complete with quarter turn shut-off valves, bronze strainer and test cocks.
 - .6 NPS 2½ to 10: Complete modular check valve assemblies with centre stem guiding, non-rising stem gate valves, test cocks and strainer.
 - .4 Backflow Preventer with Intermediate Atmospheric Vent (DCAP)
 - .1 To CSA B64.8.
 - .2 Two independent check valves with intermediate vacuum breaker and relief vent.
 - .3 Working pressure: To 1200 kPa (175 psig).
 - .4 NPS ½ to NPS ¾: All bronze construction complete with integral strainer, union connection on inlet and outlet.
 - .5 Dual Check Vacuum Breaker for Vending Machines
 - .1 To CSA B64.8.
 - .2 Dual check valve, ball check valve and atmospheric vent.
 - .3 Working pressure: To 1000 kPa (150 psig).
 - .4 NPS 3/8: Stainless steel body construction.
 - .6 Reduced Pressure Principle (RPP)
 - .1 To CSA B64.4.
 - .2 Two independent check valves with captured springs, access for maintaining internals, replaceable valve seats, intermediate relief valve, shut-off valves and ball type test cocks.
 - .3 Working pressure: To 1200 kPa (175 psig).
 - .4 NPS ½ to NPS 2: Complete with quarter turn shut-off valves and bronze strainer.
 - .5 NPS 2½ to NPS 10: Complete with non-rising stem, shut-off gate valves and strainer.
 - .6 Backflow preventer test kit: Pressure gauge, colour coded needle valves and hose, adaptors, replaceable hose filters and valve stem seals, carrying case.
-

2.2 MISCELLANEOUS EQUIPMENT

.1 Make-up Water Feeder Valves

.1 Line size, complete with adjustable pressure reducing valve, anti-siphon check and strainer. Products from the following manufacturers are acceptable.

- .1 Taco
- .2 Armstrong
- .3 Watts

.2 Water Pressure Reducing Valve

.1 Spring loaded, field adjustable, strainer, replaceable seat. Access for servicing internal components. Products from the following manufacturers are acceptable.

- .1 Watts
- .2 Zurn
- .3 Conbraco

.3 Shock Absorbers

.1 Water hammer arrestor, sized in accordance with P.D.I.-WH201. Products from the following manufacturers are acceptable.

- .1 Watts
- .2 Zurn Shoktrol
- .3 PPP Inc.

.4 Non-Freeze Wall Hydrants (WH)

.1 "WH-1": Non-freeze box type, flush mounting to wall, with NPS 3/4 hose connection, self-draining, integral hose end vacuum breaker, hinged locking cover, galvanized wall sleeve, ground joint union elbow adapter and operating key. Products from the following manufacturers are acceptable.

- .1 Ancon
- .2 Zurn
- .3 MI Fab

.2 "WH-2": Non-freeze exposed type, with NPS 3/4 hose connection, self-draining, integral hose end vacuum breaker, galvanized wall sleeve, ground joint union elbow adapter and operating key.

- .1 Ancon
 - .2 Zurn
 - .3 MI Fab
-

- .5 Hose Bibbs (HB)
 - .1 Rough brass construction with hose end spout, size as indicated.
 - .1 Emco
 - .2 Cambridge Brass
 - 3 Execution
 - 3.1 **INSTALLATION - MISCELLANEOUS**
 - .1 Back Flow Preventers
 - .1 Provide backflow preventers selected in conformance to CSA B64.10, where a connection is made between any system conveying potable water and a system carrying non-potable water or any other liquid.
 - .2 Install backflow preventers where shown on Drawings, in accordance with manufacturers recommendations, and as follows:
 - .1 Locate RPP devices at 1.2 mm above finished floor.
 - .2 Locate VBP devices exposed as close to fixture connection as possible.
 - .3 Provide drain collector at relief valves and NPS 3/4 drain from DCAP and RPP devices and run drain to nearest floor drain.
 - .3 Testing:
 - .1 Provide the services of an independent inspection agency to verify operation of all backflow prevention devices provided with testing ports.
 - .2 Provide inspection tag on each such device.
 - .3 Submit test results to building plumbing inspector and Consultant.
 - .2 Make-up Water Valves
 - .1 Locate in domestic water lines to heating and cooling systems where shown.
 - .3 Water Pressure Reducing Valves
 - .1 Locate in domestic water lines as shown, with capacity and pressure reduction ratings as shown.
 - .2 Provide pressure gauge on downstream side of pressure relief valve, complete with pet-cock.
 - .3 Provide pressure relief valve suitably sized and pipe to drain.
 - .4 Shock Absorbers
 - .1 Locate shock absorbers in hot and cold water lines:
 - .1 At far ends of mains
 - .2 At branch lines to each flush valve and quick closing valve
-

- .3 At dead ends of branch piping or to groups of plumbing fixtures
 - .4 At isolated individual plumbing fixtures
 - .5 Wall Hydrants
 - .1 Verify wall thickness at each hydrant to ensure correct hydrant length.
 - .6 Hose Bibbs
 - .1 Mount 1050 mm above finished floor.
 - .2 Provide a line mounted vacuum breaker selected for continuous pressure.
- End of Section

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- 1 General
 - 1.1 **SUMMARY**
 - .1 Section Includes
 - .1 Labour, Products, equipment and services necessary to complete the Work of this section.
 - 1.2 **SUBMITTALS**
 - .1 Shop Drawings
 - .1 Submit Shop Drawings in accordance with Section 01 33 00.
 - .2 Operation and Maintenance Data
 - .1 Submit printed operation instructions and maintenance data in accordance with Section 01 33 00.
 - 2 Products
 - 2.1 **PUMPS - GENERAL REQUIREMENTS**
 - .1 The following are minimum construction requirements, unless specified elsewhere.
 - .2 Pump Casings
 - .1 Close grained cast iron or cast bronze as specified.
 - .2 Fitted with casing or impeller wear rings, or both.
 - .3 Impellers
 - .1 Enclosed bronze or duralloy.
 - .2 Dynamically balanced.
 - .3 Mounted on carbon steel shaft fitted with stainless steel or bronze sleeves.
 - .4 Seals
 - .1 Suction pressures less than 640 kPa (100 psi): Fitted with mechanical seals.
 - .2 Stuffing box pressure in excess of 690 kPa (100 psig): Balanced type seals.
 - .3 Pumps with packing glands: Fitted with stainless steel shaft sleeves for full length of stuffing box.
 - .5 Performance
 - .1 Characteristic curve to be continuously rising from run-out to shut-off.
 - .2 Select pump to operate within flow range from 30% below point of maximum efficiency to 10% above that point for impeller diameter chosen.
 - .3 Installed impeller diameter not to exceed 90% of maximum impeller diameter catalogued for pump casing.
-

- .4 Motors to be sized for continuous operation without motor overload at runout condition for impeller size and rotational speed selected.

2.2 **DOMESTIC WATER PUMPS - IN LINE CIRULATORS**

.1 Construction

- .1 Working pressure: to 1200 kPa (175 psi).
- .2 Bronze fitted or bronze construction with alloy steel shaft.
- .3 Shaft with integral thrust collar, mechanical seal, supported by two oil lubricated bronze sleeve bearings.
- .4 Resiliently mounted motor.

.2 Manufacturers

- .1 S. A. Armstrong Limited
- .2 ITT Fluid Products Canada (Bell & Gossett)
- .3 Taco

3 Execution

3.1 **INSTALLATION**

.1 General

- .1 Set in place, and make piping and electrical connections to pumps in accordance with manufacturer's instructions.
- .2 Check pump rotation.
- .3 Set up and adjust controls.
- .4 Pipe drain tapping to drain.
- .5 Install gauges.

.2 In-line Circulators

- .1 Install with fluid flow direction as indicated by flow arrows on pump body.
- .2 Support piping and pump at flanges or near unions on connections to unit.
- .3 Install with bearing lubrication points accessible.
- .4 Check pump rotation.

End of Section

- 1 General
 - 1.1 **SUMMARY**
 - .1 Section Includes
 - .1 Labour, Products, equipment and services necessary to complete the Work of this section.
 - 1.2 **SUBMITTALS**
 - .1 Shop Drawings
 - .1 Submit Shop Drawings in accordance with Section 01 33 00.
 - .2 Operation and Maintenance Data
 - .1 Submit printed operation instructions and maintenance data in accordance with Section 01 33 00.
 - 2 Products
 - 2.1 **DRAINAGE SPECIALTIES**
 - .1 Acceptable Manufacturers
 - .1 Watts
 - .2 Zurn Industries Ltd.
 - .3 MI Fab
 - .2 Products from Watts have been used as a guide to establish the standard of construction. Comparable Products are acceptable from the above listed manufacturers. Sizes are as shown on Drawings.
 - 2.2 **FLOOR DRAINS**
 - .1 General Construction
 - .1 Drain body to have tapped primer connection.
 - .2 The type letter allocated to the following list of floor drains identifies that particular drain on the Drawings.
 - .2 FD-"A"
 - .1 Two-piece Dura coated cast iron body with double drainage flange, weep holes, non-puncturing flashing collar, adjustable 13 mm thick, 150 mm diameter polished nickel bronze strainer, and push-on, caulked or "MJ" bottom outlet.
 - .3 FD-"B"
 - .1 Two-piece Dura coated cast iron body with double drainage flange, weep holes, non-puncturing flashing collar, adjustable 13 mm thick, 150 mm diameter polished nickel bronze strainer, sediment bucket, and push-on, caulked or "MJ" bottom outlet.
-

- .4 FD-"D"
 - .1 Two-piece Dura coated cast iron body with double drainage flange, weep holes, non-puncturing flashing collar, adjustable 125 diameter nickel bronze combination strainer and 100 mm x 225 mm oval funnel, and push on, caulked or "MJ" bottom outlet.
- .5 FD-"E"
 - .1 Two-piece Dura coated cast iron body with double drainage flange, weep holes, non-puncturing flashing collar, adjustable 100 mm diameter cast iron above floor hub and push-on, caulked or "MJ" bottom outlet.
- .6 FD-"F"
 - .1 Dura coated cast iron body with 300 mm square fixed top, double drainage flange, clamp device, weep holes, heavy duty Dura coated iron grate, removable sediment bucket, and push on, caulked or "MJ" bottom outlet.
- .7 FD-"H"
 - .1 Dura coated cast iron scupper drain with flashing flange, removable bolted brass sloping grate with flange serving as flashing clamp, and ninety degree threaded outlet.
- .8 Floor Drain Traps and Primers
 - .1 Trap seal primer valves: Cast brass body, integral vacuum breaker and NPS ½ sweat connections.
 - .2 Automatic flush tank for priming of trap: Automatic syphon, tank liner, concealed top cover, bottom supply and screw driver stop.
 - .3 As an alternative to automatic flush tanks electronic trap seal primer system with air gap and 13 mm solenoid valve.

2.3 **DRAINAGE CLEANOUTS**

- .1 Buried Piping
 - .1 Flush floor type: Cast iron ferrule with inside caulked or spigot connection outlet, seal plug and nickel brass frame, cover suitable for type of floor in which it is to be installed, e.g. tile, terrazzo, carpet, concrete, etc. and push on, caulked or "MJ" bottom outlet. Provide membrane clamp if installed on membrane floors.
 - .2 Exposed Piping
 - .1 Cast iron piping in exposed location or in accessible pipe chases: Cast iron body with straight threaded, coated plug having a tapered shoulder that seats against a lead seal.
 - .2 Copper stack piping in exposed locations or in accessible pipe chases: Bronze cleanout tee, bronze ferrule and cover, secured to ferrule by bronze cap screws.
 - .3 Access cover for cleanouts concealed in walls: Type to suit wall surface and construction.
-

- .4 Cover for cleanouts at base of vertical sanitary stacks or rainwater leaders: Bolted type, neoprene gasket, and brass cap screws or bolt studs, unless shown otherwise on Drawings.

2.4 MISCELLANEOUS PRODUCTS

.1 Back-Water Valves

- .1 Cast iron body with gasketed cover, removable bronze disc and seat, and access cover.
- .2 In finished areas, provide nickel bronze frame and round scoriated type cover.

3 Execution

3.1 INSTALLATION

.1 Floor Drains

- .1 Provide each floor drain installation with a deep seal "P" trap unless otherwise shown, complete with trap primer connection tapping to conform to code requirements.

.2 Floor Drain Primers

- .1 Provide each floor drain with a trap seal primer.
 - .1 Exception: Floor drains located in shower stalls, group showers and other locations where the floor is exposed to water on a daily basis.
- .2 Use trap seal primer valves where a domestic cold water line serving a washroom fixture (preferably a water closet) is within 15.25 m of the floor drains.
 - .1 Above ground floor drains: Provide an NPS ½ Type K copper pipe to primer connection on drain body.
 - .2 Below ground floor drains: Provide an NPS ½ Type K copper pipe to within 300 mm of the floor line. Provide 9.5 mm white polybutylene tubing from this point and connect to drain body.
- .3 Install trap primer in truss space or other accessible location, or as directed by Consultant.
- .4 In other areas with remote floor drains, use an automatic flush tank.

.3 Cleanouts

- .1 Locate drainage cleanout fittings in drainage piping:
 - .1 At locations indicated on the Drawings.
 - .2 At base of each vertical stack.
 - .3 As required to comply with applicable plumbing code.

.4 Back-Water Valves

- .1 Provide where shown.

.5 Expansion Joints

.1 Provide vertical expansion joints near top of drainage pipe risers where total riser height exceeds 10 m from ground level.

.2 Provide horizontal expansion joints on suspended drainage pipe which:

.1 Is welded.

.2 Crosses a building expansion joint, whether the pipe is welded or not.

End of Section

- 1 General
 - 1.1 **SUMMARY**
 - .1 Section Includes
 - .1 Labour, Products, equipment and services necessary to complete the Work of this section.
 - 1.2 **SUBMITTALS**
 - .1 Shop Drawings
 - .1 Submit Shop Drawings in accordance with Section 01 33 00.
 - .2 Operation and Maintenance Data
 - .1 Submit printed operation instructions and maintenance data in accordance with Section 01 33 00.
- 2 Products
 - 2.1 **PUMP GENERAL REQUIREMENTS**
 - .1 The following are minimum construction requirements, unless specified elsewhere.
 - .1 Pump casings:
 - .1 Close grained cast iron or cast bronze as specified.
 - .2 Fitted with casing or impeller wear rings, or both.
 - .2 Impellers:
 - .1 Enclosed bronze or duralloy.
 - .2 Dynamically balanced.
 - .3 Mounted on carbon steel shaft fitted with stainless steel or bronze sleeves.
 - .3 Seals:
 - .1 Suction pressures less than 690 kPa (100 psi): Fitted with mechanical seals.
 - .2 Stuffing box pressure in excess of 690 kPa (100 psig): Balanced type seals.
 - .3 Pumps with packing glands: Fitted with stainless steel shaft sleeves for full length of stuffing box.
 - .4 Performance
 - .1 Characteristic curve to be continuously rising to from run-out to shut-off.
 - .2 Select pump to operate within flow range from 30% below point of maximum efficiency to 10% above that point for impeller diameter chosen.

- .3 Installed impeller diameter not to exceed 90% of maximum impeller diameter catalogued for pump casing.
- .4 Motors to be sized for continuous operation without motor overload at runout condition for impeller size and rotational speed selected.

2.2 **SANITARY SUMP PUMPS**

.1 Construction

- .1 Simplex (Duplex) pump set.
- .2 Centrifugal sewage pump, vertical, shaft driven, single stage, non-clog.
- .3 Cast iron casing and cast iron semi-open impeller, alloy steel shaft.
- .4 Ball thrust bearing, bronze guide bearings, grease lubrication.
- .5 Cast iron motor support.
- .6 Motor.
- .7 Schedule 40 black steel pump leg and discharge pipe.

.2 Fitments

- .1 Aluminum cover plate complete with structural steel curb frame suitable for grouting into a concrete sump, and heavy gasket.
- .2 Coordinate delivery of curb frame to meet construction requirements. Frame will be installed by General Trades when pouring concrete sump.
- .3 300 x 300 mm inspection cover in the cover plate.
- .4 NPS 3 vent tapping.
- .5 Sleeved holes for mounting float rods.

.3 Access Ladder

- .1 Provide a hot dipped galvanized steel ladder 450 mm wide.
- .2 75 x 13 mm stringers.
- .3 19 mm diameter rungs at 300 mm o.c.
- .4 Provide first step 150 mm below manhole.
- .5 Locate steps in concrete formwork before concrete is poured.

.4 Simplex Pump Control

- .1 Simplex Pump automatically controlled by liquid level switch mounted on a bracket attached to floor plate.
 - .2 Complete with brass float rod, limit stops, float rod guide, and seamless copper float.
 - .3 Single point power supply.
-

.5 Duplex Pump Control

- .1 Duplex pumps automatically controlled by (a mechanical) (an electric) alternator.
- .2 Automatically alternates lead pump and operates both pumps on high flow demand.
- .3 Provide alternator control assembly complete with starters, mounting bracket, brass float rod, limit stops, float rod guide, copper float and control transformer.
- .4 Single (Dual) point power supply.

.6 Manufacturers

- .1 S.A. Armstrong
- .2 ITT-Goulds
- .3 Paco
- .4 Aurora

2.3 **SUBMERSIBLE SUMP PUMP**

.1 Construction

- .1 Bronze (Cast iron) construction with semi-open type bronze impeller to pass solids of 32 mm diameter.
- .2 Stainless steel shaft.
- .3 Integrally cast base and discharge elbow.
- .4 Motor with built-in thermal overload protection, and sealed from contact with pumped fluid.

.2 Pump Control

- .1 Automatic operation by a diaphragm actuated, factory set, integral liquid level control (floats to be oil resistant).
- .2 Complete with 3 m long ULC approved waterproof, three-wire power cable with U-ground moulded plug.

.3 Manufacturers

- .1 Xylem Flygt
- .2 Goulds
- .3 Little Giant
- .4 Grundfos

2.4 **PROCESS SUMP PUMP CONTROLS**

.1 Where Required

- .1 Process effluent sump tanks.
-

- .2 Where shown on Drawings.
 - .2 Level Control
 - .1 Magentrol Model 103 F EP/VP-TDM-S13-S13 explosion proof electrical liquid level control, Arrangement No. 1.
 - .2 Suitable for liquid operating conditions of 20°C (68°F) and specific gravity of 0.90 to 1.0.
 - .3 Level controller to be supplied with 3 m of cable and NPS 4 1035 kPa (150 lb) steel mounting flange.
 - .4 Install level control inside NPS 8, Schedule 40 steel stilling pipe with NPS 4 flange at top. Cut four 50 mm wide x 300 mm high slots in top and bottom of NPS 8 stilling pipe starting 75 mm above bottom and 75 mm below cover plate.
 - .3 Sequence of Operation
 - .1 When level in pit drops to 300 mm above bottom of pit, level controls stop pump.
 - .2 When level in pit rises to 900 mm above bottom of pit, level controls start pump.
 - 3 Execution
 - 3.1 **INSTALLATION**
 - .1 General
 - .1 Make piping and electrical connections to pumps.
 - .2 Check pump rotation.
 - .3 Set up and adjust controls.
 - .4 Pipe drain tapping to drain.
 - .5 Install gauges.
 - .2 Sanitary Sump Pumps
 - .1 Power wiring between starters and pump motors. Line side wiring will be connected to starters under (Division 26) (a separate Electrical Contract).
 - .2 Provide gate valve and non-slam counterweighted check valve and flexible metal hose just above cover plate, in discharge line from each pump. Set counterweight arm in horizontal position.
 - .3 Keep discharge piping clear of pumps to facilitate removal from sump.
 - .4 Align pump assembly after mounting and securing cover plate.
 - .3 Submersible Sump Pump
 - .1 Provide check valve just below cover plate in discharge line from each pump.
 - End of Section
-

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- 1 General
 - 1.1 **SUMMARY**
 - .1 Section Includes
 - .1 Labour, Products, equipment and services necessary to complete the Work of this section.
 - 1.2 **SUBMITTALS**
 - .1 Shop Drawings
 - .1 Submit Shop Drawings in accordance with Section 01 33 00.
 - .2 Operation and Maintenance Data
 - .1 Submit printed operation instructions and maintenance data in accordance with Section 01 33 00.
 - 2 Products
 - 2.1 **DRAINAGE SPECIALTIES**
 - .1 Acceptable Manufacturers
 - .1 Watts
 - .2 Zurn Industries Ltd.
 - .3 J.R. Smith
 - .4 MI Fab
 - .5 ACO (trench drain only)
 - .2 Product description from Watts is used as a basis to establish standard of construction. Comparable Products from the above listed manufacturers are acceptable.
 - 2.2 **DRAINAGE CLEANOUTS**
 - .1 Buried Piping
 - .1 Flush floor type: Cast iron ferrule with inside caulked or spigot connection outlet, seal plug and nickel brass frame and cover suitable for type of floor in which it is to be installed, e.g. tile, terrazzo, carpet, concrete, etc. Provide membrane clamp if installed on membrane floors. Provide heavy duty top for cleanouts installed in heavy duty traffic areas.
 - .2 Exposed Piping
 - .1 Cast iron piping in exposed location or in accessible pipe chases: Cast iron body with straight threaded, coated plug having a tapered shoulder that seats against a lead seal.
 - .2 Copper stack piping in exposed locations or in accessible pipe chases: Bronze cleanout tee, bronze ferrule and cover, secured to ferrule by bronze cap screws.
-

- .3 Access cover for cleanouts concealed in walls: Type to suit wall surface and construction.
- .4 Cover for cleanouts at base of vertical sanitary stacks or rainwater leaders: Bolted type, neoprene gasket, and brass cap screws or bolt studs, unless shown otherwise on Drawings.

2.3 MISCELLANEOUS PRODUCTS

.1 Back-Water Valves

- .1 Cast iron body with gasketed cover, removable bronze valve disc and seat, and access cover. Sizes indicated on Drawings.
- .2 In finished areas, provide nickel bronze frame and round scoriated type cover. Sizes indicated on Drawings.

3 Execution

3.1 INSTALLATION

.1 Roof Drains

- .1 As indicated by architects.
- .2 Provide adaptors for connection to roof drain bodies.

.2 Cleanouts

- .1 Locate drainage cleanout fittings in drainage piping:
 - .1 At locations indicated on the Drawings.
 - .2 At base of each vertical stack or rainwater leader.
 - .3 As required to comply with applicable plumbing code.

.3 Back-Water Valves

- .1 Provide where shown.

.4 Expansion Joints

- .1 Provide vertical expansion joints near top of drainage pipe risers where total riser height exceeds 10 m from ground level.
- .2 Provide horizontal expansion joints on suspended drainage pipe which:
 - .1 Is welded.
 - .2 Crosses a building expansion joint, whether the pipe is welded or not.

End of Section

- 1 General
 - 1.1 **SUMMARY**
 - .1 Section Includes
 - .1 Labour, Products, equipment and services necessary to complete the Work of this section.
 - 1.2 **CODES AND REGULATIONS**
 - .1 Conform to the latest edition of the codes and standards referenced herein.
 - .2 Pressure Ratings
 - .1 Suitable for working pressure of 860 kPa (125 psi) (1035 kPa (150 psi))
 - .3 Efficiency and Stand-by Loss Ratings
 - .1 To ASHRAE/IES 90.1b
 - .4 Electric Hot Water Heaters to:
 - .1 CSA C22.2 No. 110
 - .2 CSA C191 Series M
 - .5 Relief Valves
 - .1 Temperature, pressure and combination: To CAN1-4.4, or ANSI Z21.22
 - 1.3 **SUBMITTALS**
 - .1 Shop Drawings
 - .1 Submit Shop Drawings in accordance with Section 01 33 00.
 - .2 Provide certification for compliance to ASHRAE 90.1 for efficiency and stand-by loss ratings.
 - .2 Operation and Maintenance Data
 - .1 Submit printed operation instructions and maintenance data in accordance with Section 01 33 00.
 - 2 Products
 - 2.1 **GENERAL REQUIREMENTS**
 - .1 Connections up to NPS 3 to be screwed and over NPS 3 to be flanged.
 - .2 Water heaters to be factory pre-piped and pre-wired, except where devices are specified to be shipped loose to be installed by others.
 - 2.2 **LIGHT COMMERCIAL ELECTRIC TANK-TYPE**
 - .1 Construction
 - .1 Glass lined steel tank with replaceable magnesium anode
-

- .2 50 mm mineral wool or foam injected insulation
- .3 Baked enamelled steel jacket housing
- .4 Zinc plated copper sheathed medium watt immersion elements arranged for flip-flop operation controlled by close tolerance positive snap action thermostats
- .5 Manual reset high temperature limit switch
- .6 Built-in and factory pre-wired controls including contactors
- .7 Hose threaded drain valve
- .8 ASME rated temperature and pressure relief valve
- .2 Electrical
 - .1 Capacities to 54 kW
 - .2 As indicated on Drawings.
- .3 Manufacturer
 - .1 A.O. Smith
 - .2 J.H Wood
 - .3 Bradford White
 - .4 Rheem

2.3 **HEAVY DUTY ELECTRIC TANK-TYPE**

- .1 Construction
 - .1 Glass lined steel tank with replaceable magnesium anode
 - .2 R16 50 mm mineral wool or foam injected insulation
 - .3 Baked enamelled steel jacket housing
 - .4 Incoloy medium watt immersion elements arranged for flip-flop operation controlled by close tolerance positive snap action thermostats
 - .5 Manual reset high temperature limit switch
 - .6 Built-in and factory pre-wired controls including contactors, complete with pilot light and switch, sequencing, time clock, low water cutoff, circuit fusing, alarm bell, modulating step control
 - .7 Handhold cleanout
 - .8 Hose threaded drain valve
 - .9 ASME rated temperature and pressure relief valve
 - .2 Electrical
 - .1 As indicated on Drawings.
-

.3 Manufacturer

- .1 A.O.Smith
- .2 J.H Wood
- .3 Bradford White
- .4 Rheem

2.4 **HIGH CAPACITY/HIGH STORAGE ELECTRIC TANK**

.1 Construction

- .1 Glass lined steel tank with replaceable magnesium anode
- .2 ASME construction
- .3 50 mm fibreglass insulation
- .4 Baked enamelled steel jacket housing
- .5 Incoloy medium watt immersion elements arranged for flip-flop operation controlled by close tolerance positive snap action thermostats
- .6 Manual reset high temperature limit switch
- .7 Built-in and factory pre-wired controls including contactors, complete with pilot light and switch, sequencing, time clock, low water cutoff, control and power circuit fusing, alarm bell, modulating step control, terminal blocks, safety door interlock, manual limiting switches
- .8 Magnetic contactors UL rated for 100,000 cycles
- .9 Handhold cleanout
- .10 Hose threaded drain valve
- .11 ASME rated temperature and pressure relief valve

.2 Electrical

- .1 As indicated on Drawings.

.3 Manufacturer

- .1 A.O.Smith
- .2 J.H Wood
- .3 PVI
- .4 Rheem

2.5 **INSTANTANEOUS WATER HEATER**

.1 Construction

- .1 Low watt density, copper sheathed electric heating elements, flange mounted for easy removal.

- .2 Hot dipped galvanized steel tank, with minimum of 25 mm thick insulation, and baffles to direct flow of water across all elements.
 - .3 Full automatic controls and control panel mounted on heater, including manual reset high temperature safety cut-out, thermostat, magnetic contactor and control transformer.
 - .4 Pressure temperature relief valve.
 - .2 Manufacturers
 - .1 Rheem
 - .2 Patterson-Kelly
 - .3 Bosch
 - .4 A.O. Smith
 - 3 Execution
 - 3.1 **INSTALLATION**
 - .1 General
 - .1 Provide structural steel for horizontal mounted tanks and for instantaneous heaters.
 - .2 Provide valved drain from each tank to nearest funnel or hub drain.
 - .3 Pipe-up T&P relief valve down to floor.
 - .4 Connect up to cold water supply lines and domestic hot water distribution piping.
 - .5 Provide thermometer on outlet piping from hot water tank (and as shown).
 - .2 Electric Hot Water Heaters
 - .1 Power wiring and unfused disconnected by electrical Division 26.
 - End of Section
-

-
- 1 General
 - 1.1 **SUMMARY**
 - .1 Section Includes
 - .1 Labour, Products, equipment and services necessary to complete the Work of this section.
 - 1.2 **CODES AND REGULATIONS**
 - .1 Conform to the latest edition of the codes and standards referenced herein.
 - .2 Pressure Ratings
 - .1 Suitable for working pressure of 860 kPa (125 psi) (1035 kPa 150 psi))
 - .3 Efficiency and Stand-by Loss Ratings
 - .1 To ASHRAE/IES 90.1b-1992
 - .4 Gas Fired Hot Water Heaters to:
 - .1 CSA 4.1 or CSA 4.3
 - .2 CGA Certification requirements
 - .5 Oil Fired Hot Water Heaters to:
 - .1 CSA B140.12
 - .6 Relief Valves
 - .1 Temperature, pressure and combination: To CSA 4.4, or ANSI Z21.22
 - 1.3 **SUBMITTALS**
 - .1 Shop Drawings
 - .1 Submit Shop Drawings in accordance with Section 01 33 00.
 - .2 Provide certification for compliance to ASHRAE 90.1 for efficiency and stand-by loss ratings.
 - .2 Operation and Maintenance Data
 - .1 Submit printed operation instructions and maintenance data in accordance with Section 01 33 00.
 - 2 Products
 - 2.1 **GENERAL REQUIREMENTS**
 - .1 Connections up to NPS 3 to be screwed and over NPS 3 to be flanged.
 - .2 Water heaters to be factory pre-piped and pre-wired, except where devices are specified to be shipped loose to be installed by others.
 - .3 Provide gas pressure regulators in gas train to suit gas distribution pressure of 1.7 - 3.5 kPa (7-14 in WG).
-

2.2 **GAS STORAGE WATER HEATER - POWER BURNER**

.1 Construction

- .1 Vertical cylinder tank
- .2 Glass lined steel tank with replaceable magnesium anode
- .3 ASME construction
- .4 50 mm mineral wool or foam injected insulation
- .5 Baked enamelled steel jacket housing
- .6 Power gas burner for natural gas or propane, 120 V, 1 phase
- .7 Hose threaded drain valve
- .8 ASME rated temperature and pressure relief valve
- .9 Handhold cleanout
- .10 Manual reset high temperature safety cut-out
- .11 Automatic controls with operating thermostat
- .12 Barometric draft damper
- .13 Flame inspection port opening
- .14 Gas train including gas valve, gas pressure regulator, and 100% safety shut-off
- .15 120 VAC, 1 phase complete with transformer

.2 Manufacturer

- .1 A.O.Smith
- .2 Ruud
- .3 J.H.Wood
- .4 PVI
- .5 Lochinvar

2.3 **ANCILLARY EQUIPMENT**

.1 Vents

- .1 Type "A" vent: To CAN/ULC S604 insulated double wall chimney, with stainless steel outer casing and stainless steel inner liner
 - .2 Type "B" vent: To CAN/ULC S605 double wall construction with annular insulating air space, with galvanized steel outer casing and aluminum inner liner
 - .3 Vent Fittings
-

.1 45°F fixed angle, swivel wye, draft hood connectors, vent cap with birdscreen, mounting brackets and hardware, fire stop separators, roof flashing kits with storm collars

.4 Manufacturers

.1 Selkirk-Metalbestos

.2 Ryder

.3 Bell

3 Execution

3.1 **INSTALLATION**

.1 General

.1 Provide structural steel for horizontal mounted tanks and for instantaneous heaters.

.2 Provide valved drain from each tank to nearest funnel or hub drain.

.3 Pipe-up T&P relief valve down to floor.

.4 Connect up to cold water supply lines and domestic hot water distribution piping.

.5 Provide thermometer on outlet piping from hot water tank (and as shown).

.2 Vents

.1 Gas power burners: Type "A" vent.

.2 Gas atmospheric burners: Type B vent.

.3 Vent pipe to extend from vent outlet on heater to a minimum of 1.8 m above roof or as shown on Drawing. Include all necessary supports, hangers, braces, roof flashing, storm collar, and round top.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

.1 Products, equipment and services necessary to complete the Work of this section.

.2 General Requirements

.1 The following products will be supplied by NEXT Plumbing Supply (NPS):

.1 Lavatories

.1 L1

.2 L1H (Barrier Free Use)

.3 L1R (Regular Use), except wall mounting carrier

.4 L2H (Barrier Free Use)

.5 L3H (Barrier Free Use)

.6 L3R (Regular Use), except wall mounting carrier

.2 Urinals

.1 U1H

.3 Water Closets

.1 W1

.2 W1H

.3 W2

.4 W2H

.5 W3

.6 W3H

.2 As part of the Shop Drawing submittal, Contractor is to submit a by-building order form to the Consultant and Owner listing the items and quantities for each building the equipment is to be installed in. Refer to the Appendices for the Plumbing and Accessories Order Form

.3 Once the shop drawings are reviewed and the order form quantities are verified by the Consultant and Owner, the Owner will submit the order form to NPS for processing as well as pay NPS for the order directly.

.4 The Contractor is to coordinate delivery of supplied items with NPS and store on site as needed prior to installation.

.5 Material defects of the products and equipment are the responsibility of NEXT and the Contractors to coordinate and replace.

- .6 Replacement of any equipment or appurtenances listed in section 1.1.2.1 of this specification will be at the expense of the Contractor.

1.2 REFERENCES

- .1 Conform to the latest edition of the following:
 - .1 AODA - Accessibility for Ontarians with Disabilities Act
 - .2 TADG - Toronto Accessibility Design Guidelines

1.3 SUBMITTALS

- .1 Shop Drawings
 - .1 Submit Shop Drawings in the form of catalogue cuts and fully illustrating specified materials with description of components, surface finishes, hardware and securement devices.

1.4 WARRANTY

- .1 Warrant the following Products against defects and deficiencies for a period of two years from date Work is certified as substantially performed in accordance with the general conditions of the Contract:
- .2 Promptly make good defects and deficiencies which become apparent within the Warranty Period by replacing defective Product satisfactory to the Consultant and at no expense to the Owner.

2 Products

2.1 PLUMBING FIXTURES

- .1 General Requirements
 - .1 CSA approved plumbing fixtures and fittings, of make, type and size specified herein.
 - .2 Comply with the current water saving ratings of the Ontario Building Code, and ASHRAE/IEEE 90.1.
 - .1 Lavatories: Maximum 8.3 L/min at 413 kPa (60 psig)
 - .2 Urinals: Maximum 3.8 L/flush
 - .3 Water closets: Maximum 6.0 L/flush
 - .4 Shower heads: Maximum 9.5 L/min
 - .3 Plumbing supplies and fixture trim material to be of CSA approved plumbing brass with chrome plated finish, and of make and type specified.
 - .1 Each item to bear name of manufacturer or identifying trademark.

2.2 LAVATORIES

- .1 Lavatories - Type L1H (Barrier Free Use)
 - .1 Type: Wall hung, vitreous china.

- .2 Lavatory: White, 508 mm x 464 mm for barrier free use, dilled for concealed arm carrier with single faucet hole and overflow, complete with semi-pedestal P-trap cover.
 - .1 American Standard "Decorum with EverClean" No. 9024.001EC.020
 - .3 Supply fitting: Electronic, adjustable infrared sensor-activated faucet, polished chrome finish, single hole mounting, magnetic solenoid valve.
 - .1 Moen Align Sensor Faucet - 8559 (Electronic No-Touch Hardwired)
 - .1 Moen AC Conversion Kit - 182538
 - .2 Moen AC Transformer – 104630
 - .4 Lavatory supplies: Chrome plated polished brass, ¼ turn ball valve angle stop, convertible ¼ turn/loose key handles, horizontal extension tubes, escutcheons and flexible copper risers. Products from the following manufacturers are acceptable.
 - .1 McGuire Supply Kit - H170LK-BV-RB
 - .5 Trap: Adjustable durable solid brass "P" trap with 32 mm O.D outlet, adjustable rotation on tube outlet, slip joint inlet and cleanout plug. Products from the following manufacturers are acceptable:
 - .1 McGuire No. MC-8872CB
 - .6 Sanitary Covering:
 - .1 McGuire MC-PW-2000 PW2000 PROWRAP
 - .7 Waste fitting: Drain with open grid strainer, cast brass one piece top and tailpiece.
 - .1 McGuire No. 155A
 - .8 Basin carrier: Heavy duty steel uprights with integral welded feet., concealed arms, wall flanges to attach to backing plate secured in wall with locking device and levelling screws, wall mounted steel plated hardware. Type and model as recommended by manufacturer for each wall hung basin to suit wall construction. Products from the following manufacturers are acceptable.
 - .1 Watts No. WCA-411-CA-481
 - .9 Water Mixing Valve
 - .1 Powers Point of use Under Counter Thermostatic Mixing Valve
 - .1 LFE480-10
 - .2 Lavatories - Type L1R (Regular)
 - .1 Type: Wall hung, vitreous china.
 - .2 Lavatory: White, 508 mm x 464 mm, dilled for concealed arm carrier with single faucet hole and overflow, complete with semi-pedestal P-trap cover.
 - .1 American Standard "Decorum with EverClean" No. 9024.001EC.020
-

- .3 Supply fitting: Electronic, adjustable infrared sensor-activated faucet, polished chrome finish, single hole mounting, magnetic solenoid valve.
 - .1 Moen Align Sensor Faucet - 8559 (Electronic No-Touch Hardwired)
 - .1 Moen AC Conversion Kit - 182538
 - .2 Moen AC Transformer – 104630
 - .4 Lavatory supplies: Chrome plated polished brass, ¼ turn ball valve angle stop, convertible ¼ turn/loose key handles, horizontal extension tubes, escutcheons and flexible copper risers. Products from the following manufacturers are acceptable.
 - .1 McGuire Supply Kit - H170LK-BV-RB
 - .5 Trap: Adjustable durable solid brass “P” trap with 32 mm O.D outlet, adjustable rotation on tube outlet, slip joint inlet and cleanout plug. Products from the following manufacturers are acceptable:
 - .1 McGuire No. MC-8872CB
 - .6 Sanitary Covering:
 - .1 McGuire MC-PW-2000 PW2000 PROWRAP
 - .7 Waste fitting: Drain with open grid strainer, cast brass one piece top and tailpiece.
 - .1 McGuire No. 155A
 - .8 Basin carrier:
 - .1 To be provided by mechanical contractor, model ZURN Z1231EZ Universal Concealed Arm Carrier System. Refer to specification 22 42 00 section 1.1.2 General Requirement.
 - .1 Wall mounted, dura-coated, ductile iron universal arms, with leveling screws and locking devices. Tested in accordance to ASME A112.6.1M at all rough-in positions.
 - .2 Contractor to verify exact service line rough-in connection location and include waste line sleeve, adapter, extension sleeve when required to meet installation location as required.
 - .9 Water Mixing Valve
 - .1 Powers Point of use Under Counter Thermostatic Mixing Valve
 - .1 LFE480-10
 - .3 Lavatories Type L1:
 - .1 Type: Countertop, self-rimming, vitreous china
 - .2 Lavatory: White, self-rimming, rear/front overflow, drilled for 100 mm supply fitting.
 - .1 American Standard "Aqualyn" #0475.047.020 518 x 441 mm
-

- .3 Supply fitting: Electronic, adjustable infrared sensor-activated faucet, polished chrome finish, single hole mounting, magnetic solenoid valve.
 - .1 Moen Align Sensor Faucet - 8559 (Electronic No-Touch Hardwired)
 - .1 Moen AC Conversion Kit - 182538
 - .2 Moen AC Transformer - 104630
 - .3 McGuire Supply Kit - H170LK-BV-RB
 - .4 Lavatory supplies: Chrome plated polished brass, ¼ turn ball valve angle stop, convertible ¼ turn/loose key handles, horizontal extension tubes, escutcheons and flexible copper risers. Products from the following manufacturers are acceptable.
 - .1 McGuire Supply Kit - H170LK-BV-RB
 - .5 Trap: Adjustable durable solid brass "P" trap with 32 mm O.D outlet, adjustable rotation on tube outlet, slip joint inlet and cleanout plug. Products from the following manufacturers are acceptable:
 - .1 McGuire No. MC-8872CB
 - .6 Waste fitting: Chrome plated drain with open grid strainer with adjustable offset waste connection, cast brass construction.
 - .1 McGuire No. 155A
 - .7 Sanitary Covering
 - .1 McGuire MC-PW-2000 PW2000 PROWRAP.
 - .8 Trap: NPS 1¼ adjustable tubular chrome plated polished cast brass "P" Trap with cleanout and wall escutcheon. Products from the following manufacturers are acceptable.
 - .1 McGuire No. 8872CB
 - .9 Water Mixing Valve
 - .1 Powers Point of use Under Counter Thermostatic Mixing Valve
 - .1 LFE480-10
 - .4 Lavatories Type L2H: (Barrier Free Use):
 - .1 Type: Countertop, self-rimming with rim sealant, vitreous china
 - .2 Lavatory: White, for barrier free use, self-rimming with sealant, overflow, drilled for 100 mm supply fitting.
 - .1 American Standard "Aqualyn" #0475.047.020 518 x 441 mm
 - .3 Supply fitting: Electronic, adjustable infrared sensor-activated faucet, polished chrome finish, single hole mounting, magnetic solenoid valve.
 - .1 Moen Align Sensor Faucet - 8559 (Electronic No-Touch Hardwired)
-

- .1 Moen AC Conversion Kit - 182538
 - .2 Moen AC Transformer - 104630
 - .3 McGuire Supply Kit - H170LK-BV-RB
 - .4 Waste fitting: Chrome plated drain with open grid strainer with adjustable offset waste connection, cast brass construction.
 - .1 McGuire No. 155WC
 - .5 Trap: NPS 1¼ adjustable tubular chrome plated polished cast brass "P" Trap with cleanout and wall escutcheon. Products from the following manufacturers are acceptable.
 - .1 McGuire No. 8872CB
 - .6 Sanitary Covering
 - .1 McGuire MC-PW-2000 PW2000 PROWRAP.
 - .7 Lavatory supplies: Chrome plated polished brass, ¼ turn ball valve angle stop, convertible ¼ turn/loose key handles, horizontal extension tubes, escutcheons and flexible copper risers. Products from the following manufacturers are acceptable.
 - .1 McGuire No. H170LK-BVRB
 - .8 Water Mixing Valve
 - .1 Powers Point of use Under Counter Thermostatic Mixing Valve
 - .1 LFE480-10
 - .5 Lavatories - Type L3H (Barrier Free Use)
 - .1 Type: Wall hung, vitreous china.
 - .2 Lavatory: White, 533 mm x 514 mm for barrier free use, dilled for concealed arm carrier with single faucet hole and overflow, complete with semi-pedestal P-trap cover.
 - .1 American Standard "Decorum with EverClean" No. 9134.001EC/0059.020EC shroud
 - .3 Supply fitting: Electronic, adjustable infrared sensor-activated faucet, polished chrome finish, single hole mounting, magnetic solenoid valve.
 - .1 Moen Align Sensor Faucet - 8559 (Electronic No-Touch Hardwired)
 - .1 Moen AC Conversion Kit - 182538
 - .2 Moen AC Transformer – 104630
 - .4 Lavatory supplies: Chrome plated polished brass, ¼ turn ball valve angle stop, convertible ¼ turn/loose key handles, horizontal extension tubes, escutcheons and flexible copper risers. Products from the following manufacturers are acceptable.
-

- .1 McGuire Supply Kit - H170LK-BV-RB
 - .5 Trap: Adjustable durable solid brass "P" trap with 32 mm O.D outlet, adjustable rotation on tube outlet, slip joint inlet and cleanout plug. Products from the following manufacturers are acceptable:
 - .1 McGuire No. MC-8872CB
 - .6 Waste fitting: Drain with open grid strainer, cast brass one piece top and tailpiece.
 - .1 McGuire No. 155A
 - .7 Basin carrier: Heavy duty steel uprights with integral welded feet., concealed arms, wall flanges to attach to backing plate secured in wall with locking device and levelling screws, wall mounted steel plated hardware. Type and model as recommended by manufacturer for each wall hung basin to suit wall construction. Products from the following manufacturers are acceptable.
 - .1 Watts No. WCA-411-CA-481
 - .8 Water Mixing Valve
 - .1 Powers Point of use Under Counter Thermostatic Mixing Valve
 - .1 LFE480-10
 - .6 Lavatories - Type L3R (Regular Use)
 - .1 Type: Wall hung, vitreous china.
 - .2 Lavatory: White, 533 mm x 514 mm, dilled for concealed arm carrier with single faucet hole and overflow, complete with semi-pedestal P-trap cover.
 - .1 American Standard "Decorum with EverClean" No. 9134.001EC/0059.020EC shroud
 - .3 Supply fitting: Electronic, adjustable infrared sensor-activated faucet, polished chrome finish, single hole mounting, magnetic solenoid valve.
 - .1 Moen Align Sensor Faucet - 8559 (Electronic No-Touch Hardwired)
 - .1 Moen AC Conversion Kit - 182538
 - .2 Moen AC Transformer – 104630
 - .4 Lavatory supplies: Chrome plated polished brass, ¼ turn ball valve angle stop, convertible ¼ turn/loose key handles, horizontal extension tubes, escutcheons and flexible copper risers. Products from the following manufacturers are acceptable.
 - .1 McGuire Supply Kit - H170LK-BV-RB
 - .5 Trap: Adjustable durable solid brass "P" trap with 32 mm O.D outlet, adjustable rotation on tube outlet, slip joint inlet and cleanout plug. Products from the following manufacturers are acceptable:
 - .1 McGuire No. MC-8872CB
-

- .6 Waste fitting: Drain with open grid strainer, cast brass one piece top and tailpiece.
 - .1 McGuire No. 155A
 - .7 Basin carrier:
 - .1 To be provided by mechanical contractor, model ZURN Z1231EZ Universal Concealed Arm Carrier System. Refer to specification 22 42 00 section 1.1.2 General Requirement
 - .1 Wall mounted, dura-coated, ductile iron universal arms, with leveling screws and locking devices. Tested in accordance to ASME A112.6.1M at all rough-in positions.
 - .2 Contractor to verify exact service line rough-in connection location and include waste line sleeve, adapter, extension sleeve when required to meet installation location as required.
 - .8 Water Mixing Valve
 - .1 Powers Point of use Under Counter Thermostatic Mixing Valve
 - .1 LFE480-10
 - .7 Lavatories Type L4H: (Barrier Free Use):
 - .1 Type: Undercounter lavatory, vitreous china
 - .2 Lavatory: White, for barrier free use with rear overflow and undermount clips
 - .1 American Standard "Ovalyn Universal Access" #9482.000 489 x 400 mm
 - .3 Supply fitting: Electronic, adjustable infrared sensor-activated faucet, polished chrome finish, single hole mounting, magnetic solenoid valve.
 - .1 Moen Align Sensor Faucet - 8559 (Electronic No-Touch Hardwired)
 - .1 Moen AC Conversion Kit - 182538
 - .2 Moen AC Transformer - 104630
 - .3 McGuire Supply Kit - H170LK-BV-RB
 - .4 Waste fitting: Chrome plated drain with open grid strainer with adjustable offset waste connection, cast brass construction.
 - .1 McGuire No. 155WC
 - .5 Trap: NPS 1¼ adjustable tubular chrome plated polished cast brass "P" Trap with cleanout and wall escutcheon. Products from the following manufacturers are acceptable.
 - .1 McGuire No. 8872CB
 - .6 Sanitary Covering
 - .1 McGuire MC-PW-2000 PW2000 PROWRAP.
-

- .7 Lavatory supplies: Chrome plated polished brass, ¼ turn ball valve angle stop, convertible ¼ turn/loose key handles, horizontal extension tubes, escutcheons and flexible copper risers. Products from the following manufacturers are acceptable.

- .1 McGuire No. H170LK-BVRB

- .8 Water Mixing Valve

- .1 Powers Point of use Under Counter Thermostatic Mixing Valve

- .1 LFE480-10

2.3 **URINALS**

- .1 Urinals - Type U1H (Barrier Free Use)

- .1 Type: Wall hung, exposed electronic "No Touch" automatic flush valve.

- .2 Urinal: White, vitreous china, washdown, with integral extended shields, and trap; complete with 19 mm top spud, non-metallic strainer, outlet connection and wall hanger.

- .1 American Standard "Washbrook FloWise" No.6590001.020

- .3 Automatic flush control: Exposed, chrome plated, 1.9 L factory set flow, quiet action diaphragm type, urinal flushometer complete with infrared sensor with solenoid operated flush controller circuitry, back-check angle stop, vacuum breaker located above urinal.

- .1 Moen Sensor Operated WC flush valve – 8315AC05

- .1 Moen AC Transformer - 104630

- .4 Carrier: Complete Steel hanger plate with epoxy coated steel uprights with welded feet support. Products from the following manufacturers are acceptable.

- .1 Watts No. CA-321

- .5 Wall cleanout: Urinal cleanout with stainless steel access cover and stainless steel vandal proof securing screw. Products from the following manufacturers are acceptable:

- .1 American Standard "WUCO"

2.4 **WATER CLOSETS**

- .1 Water Closets - Type W1 - Flushometer Valve

- .1 Type: Wall hung, exposed flush valve, vitreous china.

- .2 Closet bowl: White, vitreous china with Everclean antimicrobial surface, syphon-jet bowl with elongated bowl, direct-fed siphon jet action, concealed trap and NPS 1½ top spud.

- .1 American Standard "Afwall Millennium FloWise " No. 3351.101.020

- .3 Flush valve: Exposed, sensor-operated, complete with angle stop, 1½ high back pressure vacuum breaker with spud coupling and flange, vandal-resistant cap.

- .1 Moen Sensor Operated WC flush valve – 8311AC12
 - .1 Moen AC Transformer - 104630
 - .4 Closet seat: White, solid plastic elongated open front seat, less cover with reinforced stainless steel check hinge and post nuts and washers.
 - .1 Centoco – 500STSCC
 - .5 Closet carrier: Type and model as recommended by manufacturer for each wall hung closet to suit wall construction. Products from the following manufacturers are acceptable.
 - .1 Watts No. ISCA-101-L/R-M11
 - .2 Water Closets - Type W1H (Barrier Free Use) - Flush Valve
 - .1 Type: Wall hung, flushometer valve
 - .2 Closet bowl: White, vitreous china, direct-fed syphon-jet, elongated bowl and 38 mm top spud, concealed trapway. Bowl height from floor to rim 400 mm - 410 mm.
 - .1 American Standard "Afwall Millennium FloWise" No. 3351.101.002
 - .3 Flush valve: Exposed, sensor-operated, complete with angle stop, 1½ high back pressure vacuum breaker with spud coupling and flange, vandal-resistant cap.
 - .1 Moen Sensor Operated Flush Valve – 8311AC12
 - .1 Moen AC Transformer – 104630
 - .2 Moen 24" Flush Tube - 104585
 - .4 Toilet seat: White, elongated solid plastic, heavy duty open front, less cover, stainless steel check hinges with gasket,
 - .1 Centoco 500 Series No. 500STSCC
 - .5 Toilet Back Rest:
 - .1 Bobrick – CM-16104
 - .6 Closet carrier: Type and model as recommended by manufacturer for each wall hung closet to suit wall construction. Products from the following manufacturers are acceptable.
 - .1 Watts No. ISCA-101-L/R-M11
 - .2 Zurn No. Z1203-ND4
 - .3 or accepted equal
 - .3 Water Closets - Type W2 - Flush Valve
 - .1 Type: Floor mounted, bottom outlet, flush valve.
 - .2 Closet bowl: White vitreous china, syphon-jet bowl with elongated bowl, condensation channel, bolt caps and 38 mm top spud, and china bolt caps.
-

- .1 American Standard "Madera" No. 3451.001.020
 - .3 Flush valve: Exposed, sensor-operated, complete with angle stop, 1½ high back pressure vacuum breaker with spud coupling and flange, vandal-resistant cap.
 - .1 Moen Sensor Operated Flush Valve – 8311AC12
 - .1 Moen AC Transformer – 104630
 - .4 Closet seat: White solid plastic elongated open front seat, less cover, reinforced stainless steel check hinges and post nuts and washers..
 - .1 Centoco 500 Series No. 500STSCC
 - .4 Water Closets - Type W2H (Barrier Free Use) - Flush Valve
 - .1 Type: Floor mounted, bottom outlet, flush valve.
 - .2 Closet bowl: White vitreous china, syphon-jet bowl with elongated bowl, condensation channel, bolt caps and 38 mm top spud, and china bolt caps.
 - .1 American Standard "Madera" No. 3461.001.020
 - .3 Flush valve: Exposed, sensor-operated, complete with angle stop, 38 mm high back pressure vacuum breaker with spud coupling and flange, vandal-resistant cap.
 - .1 Moen Sensor Operated Flush Valve – 8311AC12
 - .1 Moen AC Transformer – 104630
 - .2 Moen 24" Flush Tube - 104585
 - .4 Closet seat: White solid plastic elongated open front seat, less cover, reinforced stainless steel check hinges and post nuts and washers.
 - .1 Centoco 500 Series No. 500STSCC
 - .5 Toilet Back Rest:
 - .1 Bobrick – CM-16104
 - .5 Water Closets - Type W3
 - .1 Type: Floor mounted, back outlet, pressure assist flush tank, low consumption.
 - .2 Closet combination: White vitreous china, siphon jet flush closet bowl with elongated rim and close coupled vitreous china pressure assisted closet tank complete with fittings.
 - .1 American Standard "Cadet RH PA Universal Bowl – White
 - .1 American Standard – PA Tank, 1.1 GPF White
 - .3 Closet seat: White, heavy duty, solid plastic elongated open front with cover, with stainless steel check hinges and stainless steel posts and nuts.
 - .1 Centoco No. 820STS
-

- .4 Closet supply: NPS 3/8 with lockshield, rigid copper sweat tube nipples, combination V.P. loose key handle, turn ball angle stop and wall escutcheon and flexible risers. Products from the following manufacturers are acceptable.
 - .1 McGuire No. MC-H172LK-BV
 - .6 Water Closets - Type W3H (Barrier Free Use) - Pressure Assist Tank
 - .1 Type: Floor mounted, back outlet, pressure assist flush tank.
 - .2 Closet combination: White vitreous china, siphon jet flush trap closet bowl with elongated rim and close coupled vitreous china pressure assisted closet tank complete with fittings.
 - .1 American Standard "Cadet RH PA Universal Bowl – White
 - .1 American Standard – PA Tank, 1.1 GPF White
 - .3 Closet seat: White, heavy duty, solid plastic elongated open front with cover, with stainless steel check hinges and stainless steel posts and nuts.
 - .1 Centoco No. 500STSCC
 - .4 Closet supply: 13 mm turn ball valve angle stops, coppers sweat nipples, combination V.P. loose key stop and wall escutcheon and flexible copper risers. Products from the following manufacturers are acceptable.
 - .1 McGuire No. MC-H172LK-BV
 - 2.5 **SERVICE SINK**
 - .1 Mop Sinks - Type M2
 - .1 Type: Pre-cast terrazzo floor mounted.
 - .2 Sink: 610 x 610 mm, precast terrazzo with one piece integral stainless steel cap on all four sides and integral drain with strainer. "P" trap under floor.
 - .1 Stern Williams Serviceptor No. SB-900
 - .2 Fiat
 - .3 Or accepted equal
 - .3 Faucets: Mop sink supply fitting with vacuum breaker, integral stops, cross or lever handles, rigid spout with pail hook, brace to wall, minimum 787 mm hose and stainless steel hanger, adjustable wall flanges and NPS ½ IPS connections.
 - .1 Chicago Faucets No. 897-RCF-Hose
 - .2 American Standard
 - .3 Delta
 - .4 Zurn
 - .5 Or accepted equal
-

.2 Mop Sinks - Type M3

.1 Type: Terrazzo floor mounted corner mop sink.

.2 Sink: Precast terrazzo 711 x 711 x 304 mm deep, floor mounted, with stainless steel cast integral cap on front drop and integral drain with strainer, "P" trap under floor, and two stainless steel wall guards.

.1 Stern Williams No. CRS2200

.2 Fiat

.3 Or accepted equal

.3 Faucets: Mop sink supply fitting with vacuum breaker, integral stops, cross or lever handles, rigid spout with pail hook, brace to wall, 787 mm rubber hose and coupling, adjustable wall flanges and NPS ½ IPS connections.

.1 American Standard No. GL-8344.111-002

.2 Chicago Faucets

.3 Delta

.4 Zurn

.5 Or accepted equal

2.6 **STAINLESS STEEL SINKS**

.1 Stainless Steel Sinks - Type S1 (Barrier Free Use)

.1 Single compartment: 406 x 533 x 127 mm OD undermount, stainless steel sink drawn from 18-10 Type 304 heavy gauge stainless steel, with undercoating, and complete with 90 mm stainless steel crumb cup strainer and brass tailpiece.

.1 Franke Commercial UCS6105P

.2 Blanko

.3 Kindred Industries Limited

.4 AMI Industries

.2 Faucets: Chrome plated solid cast brass deck type sink supply fitting with 232 mm swing spout, single lever handle and maximum 8.3 L/min flow, water saver aerator, pull-out spray with adjustable spray pattern, lock & turn activation button, 10 mm compression inlets, braided flexible supply hoses.

.1 American Standard No. 7074100.002

.2 Chicago Faucets

.3 Delta

.4 Zurn

.5 Or accepted equal

- .2 Stainless Steel Sinks - Type S2 (Barrier Free Use)
 - .1 Double compartment: 451 x 784 x 127 mm OD undermount stainless steel sink drawn from 18-10 Type 304 heavy gauge stainless steel, with undercoating, and complete with 90 mm stainless steel crumb cup strainers and brass combination tailpiece.
 - .1 Franke Commercial UCD6405P
 - .2 Blanko
 - .3 Kindred Industries Limited
 - .4 AMI Industries
 - .2 Faucets: Chrome plated solid cast brass deck type sink supply fitting with 232 mm swing spout, single lever handle and maximum 8.3 L/min flow, water saver aerator, pull-out spray with adjustable spray pattern, lock & turn activation button, 10 mm compression inlets, braided flexible supply hoses.
 - .1 American Standard No. 7074100.002
 - .2 Chicago Faucets
 - .3 Delta
 - .4 Zurn
 - .5 Or accepted equal
 - .3 Stainless Steel Sinks - Type S3 (Barrier Free Use)
 - .1 Single compartment: 406 x 533 x 127 mm OD undermount, stainless steel sink drawn from 18-10 Type 304 heavy gauge stainless steel, with undercoating, and complete with 90 mm stainless steel crumb cup strainer and brass tailpiece.
 - .1 Franke Commercial UCS6105P
 - .2 Blanko
 - .3 Kindred Industries Limited
 - .4 AMI Industries
 - .2 Faucets: Electronic "No-Touch" AC powered faucet, chrome plated finish, cast brass body, high arc spout, single hole only, single lever handle and 5.7 L/min flow, pull-down spray with adjustable spray pattern, 10 mm compression inlets, braided flexible supply hoses.
 - .1 Moen Align with MotionSense No. 7565EC
 - .2 American Standard
 - .3 Chicago Faucets
 - .4 Delta
 - .5 Zurn
-

- .6 Or accepted equal
 - .4 Stainless Steel Sinks - Type S4 (Barrier Free Use)
 - .1 Double compartment: 451 x 784 x 127 mm OD undermount stainless steel sink drawn from 18-10 Type 304 heavy gauge stainless steel, with undercoating, and complete with 90 mm stainless steel crumb cup strainers and brass combination tailpiece.
 - .1 Franke Commercial UCD6405P
 - .2 Blanko
 - .3 Kindred Industries Limited
 - .4 AMI Industries
 - .2 Faucets: Electronic "No-Touch" AC powered faucet, chrome plated finish, cast brass body, high arc spout, single hole only, single lever handle and 5.7 L/min flow, pull-down spray with adjustable spray pattern, 10 mm compression inlets, braided flexible supply hoses.
 - .1 Moen Align with MotionSense No. 7565EC
 - .2 American Standard
 - .3 Chicago Faucets
 - .4 Delta
 - .5 Zurn
 - .6 Or accepted equal
 - .5 Fittings
 - .1 Trap: Adjustable cast brass 38 mm "P"-trap 38 mm with cleanout.
 - .2 Sanitary Covering: PW2000 PROWRAP or accepted equal.
 - .3 Supplies: Pair 12 mm rough stops with flexible risers.
 - .1 Acceptable manufacturers for trap and supplies:
 - .1 McGuire
 - .2 Zurn
 - .3 Kohler
 - .4 Water Mixing Valve
 - .1 Lawler TMM-1070
 - .2 Symmons
 - .3 Powers
 - .4 Leonard
-

.5 Zurn

.6 Or accepted equal

.5 Provide tee, adaptors and flexible copper tubing to suit installation.

2.7 **SHOWER**

.1 Individual Showers - Type SH2

.1 Type: Non-scald pressure balance shower valve with lever handle, integral service stops or and check stops, deluxe shower head with adjustable spray pattern capacity 5.7 L/min with flow restrictor, bent arm and escutcheon.

.1 Symmons No. 1-100

The above mentioned manufacturer/trade name/catalogue number has been used as a guide to establish the standard of construction and style. Comparable Products from the following manufacturers are acceptable.

.2 Zurn

.3 Delta

.2 Individual Showers - Type SH2H (Barrier Free Use)

.1 Type: Non-scald pressure balancing shower trim and mixing valve with high temperature limit stop, shower head with flow restrictor, wall mount shower arm and wall flange, hand shower set with 1752 mm flexible hose, vacuum breaker bracket, and wall supply. In-wall 3-way diverter trim and valve kit with single lever handle.

.1 Chicago Faucets No. SH-PB1-13-040

.2 Leonard

.3 Delta

2.8 **MISCELLANEOUS**

.1 Below Deck Mechanical Water Mixing

.1 Type: Bronze body, temperature adjusting dial, high temperature thermostatic limit stop, shut-off valve with automatic reset.

.2 Capacity: 1.9 L/min to 19 L/min at 140 kPa (20 psig) pressure drop, or as shown. Products from the following manufacturers are acceptable:

.1 Lawler Model No. TMM-1070

.2 Symmons

.3 Powers

.4 Leonard

.5 Or accepted equal

3 Execution

3.1 **INSTALLATION**

.1 Water Flow Rate

.1 Flush valve urinals and water closets.

- .1 Adjust flush valves to provide specified water flow rate based on manufacturers calibration data for valve open time vs. inlet water pressure

.2 Showers:

- .1 Adjust valve so that maximum temperature will be not more than 40°C

.2 Barrier Free Use

- .1 Rough-in and install plumbing fixtures and drinking fountains at the recommended height for normal or handicapped use as applicable to location.

.2 Water closets:

- .1 Seat located between 400 and 460 mm above the floor
- .2 Horizontal position is between 460 and 480 mm between centerline of fixture and at least one adjacent side wall

.3 Lavatory:

- .1 Top not more than 840 mm above floor
- .2 Horizontal position is not less than 460 mm from centerline of fixture and side wall
- .3 Insulate exposed supplies

.4 Showers:

- .1 Locate shower head complete with hose and slide rail to be within reach of the seated position

.3 Wall Hung Lavatories and Urinals

- .1 Install hanger brackets supplied with fixtures to wall with 10 mm bolt studs welded to steel anchor plates embedded within wall.
- .2 In locations where a pipe space is provided behind wall, extend bolt studs through wall and anchor with steel back-plates. Ensure proper placement and positioning of anchor plates and bolt studs during wall construction.

.4 Wall Hung Water Closets

- .1 Install chair carriers of type as recommended by manufacturer for each particular installation with due regard to construction and piping details.
-

.5 Floor Mounted Water Closets

.6 On sloping floors, where the slope exceeds 6 mm from the back to the front of the fixture, level the fixture by grouting the base until the slope is within the above limits.

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Comply with applicable requirements of the latest issue of the following references:

- .1 ANSI Z358.1-1998 - Emergency Eyewash and Shower Equipment

1.3 **SUBMITTALS**

.1 Shop Drawings

- .1 Submit Shop Drawings in accordance with Section 01 33 00.

.2 Operation and Maintenance Data

- .1 Submit printed operation instructions and maintenance data in accordance with Section 01 33 00.

2 Products

2.1 **SAFETY STATIONS**

.1 Eyewash Fountain - Type EE1

- .1 Eyewash fountain: Complete with stainless steel receptor, two chrome plated aerator heads, separate flow control for each head, mounted on NPS 1½ pipe standard with floor flange (mounted on wall) (mounted in countertop) and NPS ½ supply and (NPS 1½ drain) (NPS 1½ chrome plate waste trap) (connections through countertop) and push-to-operate ball valve.

.2 Pipe standard mounted

- .1 Haws No. 7361
- .2 Bradley No. S19-210B

.3 Wall mounted

- .1 Haws No. 7460 BT
- .2 Bradley No. S19-220B
- .3 Speakman

.4 Countertop mounted

- .1 Haws No. 7301 DM
 - .2 Bradley No. S19-260
 - .3 Speakman
-

.2 Emergency Mixing Valve

- .1 Type packaged, mixing cold and hot water to maintain a set outlet temperature of 15-29°C.
- .2 Construction: thermostatic mixing valve, failure to close on loss of cold water, failure to close on loss of hot water, cold water by-pass outlet temperature gauge.
 - .1 Haws No. TWBS.EWE
 - .2 Leonard
 - .3 Speakman
 - .4 Bradley

3 Execution

3.1 **INSTALLATION**

.1 Emergency Eyewash Stations

- .1 Install eyewash stations in accordance with manufacturers instructions.
- .2 On pipe standards, plug spare tee branches if not used.

.2 Emergency Blending Valve Stations

- .1 Mount valve station with top of case at 1.5 m above finished floor.
- .2 Provide lock-shield valves on inlet hot and cold water connections. Wire seal the valves in the open position.

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

.1 Products, equipment and services necessary to complete the Work of this section.

.2 General Requirements

.1 The following product will be supplied by NEXT Plumbing Supply (NPS):

.1 Drinking Fountains:

.1 DFC

.2 As part of the Shop Drawing submittal, Contractor is to submit a by-building order form to the Consultant and Owner listing the items and quantities for each building the equipment is to be installed in. Refer to the Appendices for the Plumbing and Accessories Order Form

.3 Once the shop drawings are reviewed and the order form quantities are verified by the Consultant and Owner, the Owner will submit the order form to NPS for processing as well as pay NPS for the order directly.

.4 The Contractor is to coordinate delivery of supplied items with NPS and store on site as needed prior to installation.

.5 Material defects of the products and equipment are the responsibility of NPS and the Contractor to coordinate and replace as required with no extra expense to the Owner.

.6 Replacement of any equipment or appurtenances listed in section 1.1.2.1 of this specification will be at the expense of the Contractor.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

.1 AODA - Accessibility for Ontarians with Disabilities Act

.2 TADG - Toronto Accessibility Design Guidelines

1.3 **SUBMITTALS**

.1 Shop Drawings

.1 Submit Shop Drawings in the form of catalogue cuts and fully illustrating specified materials with description of components, surface finishes, hardware and securement devices.

1.4 **WARRANTY**

.1 Warrant the following Products against defects and deficiencies for a period of two years from date Work is certified as substantially performed in accordance with the general conditions of the Contract:

- .2 Promptly make good defects and deficiencies which become apparent within the Warranty Period by replacing defective Product satisfactory to the Consultant and at no expense to the Owner.

2 Products

2.1 **PLUMBING FIXTURES**

.1 General Requirements

- .1 CSA approved plumbing fixtures and fittings, of make, type and size specified herein.
- .2 Plumbing supplies and fixture trim material to be of CSA approved plumbing brass with chrome plated finish, and of make and type specified.
 - .1 Each item to bear name of manufacturer or identifying trademark.
- .3 Manufacturer's standard design and material specification as indicated by trade name and/or catalogue number, and as described.
- .4 Type number allocated to each style of fixture identifies that particular fixture on Drawings.

2.2 **DRINKING FOUNTAIN COOLERS (DFC)**

.1 Water Cooler - Type DF-2 (Barrier Free Use)

- .1 Wall mounted wheelchair type water cooler with stainless steel top, front and side mounted push to operate lever(s), sensor, touchless activation with auto shut off bottle filler, flexi-guard safety bubbler, and trap package.
 - .1 Elkay (EZH2O) No. EZSDWSLK
- .2 Fixture carrier: steel hanger plate, heavy gauge epoxy coated steel uprights with welded feet supports
 - .1 Watts No. CA-311
- .3 Drinking Fountain Supply: chrome plated finish polished brass, straight stops, V.P Loose keys
 - .1 McGuire No. HST-11LK
- .4 Trap: NPS 1¼ adjustable tubular chrome plated polished cast brass "P" Trap with cleanout and wall escutcheon. Products from the following manufacturers are acceptable.
 - .1 McGuire No. MC-8872CB

3 Execution

3.1 **INSTALLATION**

.1 Barrier Free Use:

- .1 Rough-in and install drinking fountains at the recommended height for normal or handicapped use as applicable to location.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

.1 Labour, Products, equipment and services necessary to complete the Work of this section.

.2 The terms "Mechanical Work", "Mechanical Contractor" or their derivatives includes the work of Division 21, 22, 23 and 25 unless otherwise specified.

1.2 **CODES, REGULATIONS AND STANDARDS**

.1 Comply with municipal or provincial codes, rules and regulations and/or authorities having jurisdiction.

.2 Comply with the National Building Code in areas where municipal or provincial regulations and/or codes are not mandatory.

.3 Comply with the Occupational Health and Safety Act and Regulations for Construction Projects, Ontario Regulation 691.

.4 Owners Health and Safety Requirements.

.5 Revisions issue: Latest version as amended to date.

1.3 **PERMITS AND INSPECTIONS**

.1 Material Approvals

.1 Obtain special inspection and approvals by CSA and/or local authorities, for materials where specified.

.2 Obtain such approval for the particular installation with the co-operation of the material Supplier.

.2 Permits

.1 Obtain permits required for the installation of mechanical trades work including:

.1 Plumbing inspection

.2 Pressure vessel inspection

.3 Piping and boiler inspection

.4 Electrical inspection

.2 Arrange for inspections and tests and pay all fees and costs for the permits, inspections and tests. Obtain permits immediately after notification of award of Contract.

.3 Obtain copies of Drawings from the Consultant for submission with application for permits.

1.4 **WORKING DRAWINGS AND DOCUMENTS**

.1 Design Drawing Intent

- .1 The Design Drawings are schematic in arrangement, and describe the general design intent but do not show the exact details for the installation. They are not fabrication or installation drawings.
- .2 The Work is suitably outlined on the Drawings with regard to sizes, locations, general arrangements and installation details, and has been generally coordinated for routing of services. The routing of ductwork, piping and equipment arrangement are shown more or less in diagram except where in certain cases the Drawings may include details giving the exact locations and arrangements required.
- .3 The location of equipment, and the associated arrangement of piping, ductwork, and other material describes the general requirements of the Work. Final location is dependant on the actual equipment supplied. The Consultant reserves the right to make reasonable adjustment of up to 1 m to the location of equipment, floor drains, routing of major piping and ductwork, at no cost to the Owner.
- .4 In order to provide clarity to the arrangement of the work, not all details including valves, thermometers, pressure gauges, etc. are shown on the Plan Drawings. Refer to Schematic Drawings, standard details and the Specification for these requirements.
- .5 Where specific installation dimensions for location of equipment and access space requirements are indicated on the Drawings, install to these requirements.
- .6 Where standard details are provided, these show the general installation requirements, and are applicable to each occurrence in the Work, unless otherwise specified or shown.

.2 Contractor Coordination Responsibilities

- .1 Provide the services of a mechanical/electrical coordination supervisor, to coordinate this division of the Work, as well as providing coordination with other divisions and/or contracts. This supervisor may be full time or part time on site, as appropriate to the work stage and complexity of the work, at the discretion of the Owner.
 - .2 Where multiple trades are required, the mechanical coordinating supervisor shall be the lead coordinator.
 - .3 The Owner reserves the right to require the coordinating supervisor to increase their attendance at site, at no cost to the Owner, if in the Owner's opinion the current level of coordination is not sufficient for the progress of the Work.
 - .4 Make changes and modifications as necessary to ensure coordination and to avoid interference and conflicts with other trades.
 - .5 Prepare Construction/Installation/Fabrication Drawings, coordinated with other trades and contracts, as required.
 - .1 Provide sufficient detail to disclose critical interferences of major equipment and services to ensure adequate accessibility.
-

- .2 Specific dimensions for equipment location or access which are shown on the Consultants drawings.
 - .3 Indicate sleeves, openings and stress points (such as anchors, guides and inserts)
 - .4 Indicate deviation in sizes and weights and also in water, drainage, electric power or other service requirements for all equipment proposed which is different from those shown on the Design Drawings.
 - .5 Provide these Drawings to other trades for coordination with their Work.
 - .6 Update these Drawings as part of the As-Built Drawings, showing actual locations of major equipment, services, access doors, shut-off valves, etc.
 - .6 The Design Drawings show the major requirements for the installation of equipment based on one manufacturer's requirements, but may not show all installation requirements. The Contractor will include as part of the Work the specific manufacturer's installation requirements for the equipment actually provided by the Contractor.
 - .7 The Construction/Installation/Fabrication Drawings are not to be submitted as Shop Drawings. Make them available for viewing at site when requested by the Consultant.
 - .3 Review Before Proceeding (HOLD)
 - .1 Where the word "HOLD" appears on Drawings and other Contract Documents, the Work is included in the Contract.
 - .2 Execute such Work only after verification of dimensions, verification of materials and obtaining Consultant's written permission to proceed.
- 1.5 **COORDINATION AND EXAMINATION**
- .1 Reference
 - .1 To Section 01 10 00.
 - .2 Examination
 - .1 Carefully examine Work and Drawings of all related trades and thoroughly plan the Work so as to avoid interferences.
 - .2 Report defects which would adversely affect the Work. Do not commence installation until such defects have been corrected.
 - .3 Coordination
 - .1 Coordinate Work of Mechanical Division such that items will properly interface with Work of other divisions. Prepare Installation Drawings of critical locations and submit to Consultant for review.
 - .2 Architectural Drawings, or in their absence, Mechanical Drawings govern all locations.
-

.4 Measurements and Deviations

- .1 Where any parts of the mechanical work are specifically located by dimensions on the Drawings, check and verify these dimensions on site prior to installation.
- .2 Before installing piping, review Architectural, Structural and Electrical Drawings with Mechanical Drawings
- .3 Where interference may occur and departures from arrangements as shown are required, consult with other trades involved, come to agreement as to changed locations or elevations and obtain approval of the Consultant for proposed changes before proceeding with the Work.
- .4 Where site conditions require minor deviations from indicated arrangements or locations, make such changes on approval of the Consultant without additional cost to the Owner.
- .5 Should any discrepancies occur during installation of mechanical work which will necessitate major revisions to the mechanical trades work or the work of other trades or contractors, notify the Consultant immediately and obtain written authorization before proceeding with the work.

1.6 **SCAFFOLDING AND HOISTING EQUIPMENT**

.1 References

- .1 To Section 01 10 00.

.2 Building Attachments

- .1 Obtain prior written Consultant's approval before drilling, cutting or welding of the building steel or building structure for erection of materials or equipment.

.3 Overloading

- .1 During installation of mechanical work, do not load any part of the building structure with a load greater than it is capable of bearing.
- .2 Should any accident occur or damage result through the violation of this requirement, the contractor shall be held solely responsible.
- .3 Design temporary supports used during installation as being equivalent to permanent supports.
- .4 Remove temporary supports at completion of Work.

1.7 **CUTTING AND PATCHING**

- .1 Do not cut, remove or burn structural parts or sections of the building, whether they are steel, concrete or masonry without the written authorization of the Consultant.
- .2 Should cutting, repairing, and patching of previously finished work of other trades be required to allow installation of mechanical work, pay all costs for the trade concerned to perform the work.

1.8 **EXISTING SERVICE**

- .1 Tie-In to Existing Services
-

- .1 Do not shut down or make tie-in connections to any existing service without written permission of the Owner and/or Consultant.
 - .2 Arrange work to minimize interruption to physical access to the building.
 - .3 Include for all costs associated with making connections to existing services, including but not limited to, cutting and patching of existing floors, partitions, ceilings and finishes.
 - .2 Work in Existing Buildings
 - .1 Route pipes, ducts, conduits and other services to avoid interference with existing installation.
 - .2 Relocate existing services and equipment to suit installation of new work.
 - .3 Cut back and cap existing services not being used, so that finished Work presents a neat and clean appearance.
 - .4 Unless noted to be reused, fixtures and materials being removed become the property of the Contractor and are to be removed from site, unless otherwise noted.
 - .3 Continuity of Services
 - .1 Be responsible for any damage to existing systems, including insulation and coverings, when making connections.
 - .2 Keep existing buildings in operation with minimum length of shut-down periods.
 - .3 Include overtime work to tie-in piping or wiring at night or on weekends.
 - 1.9 **PROVISION FOR FUTURE**
 - .1 Future Equipment
 - .1 Where indicated as reserved for future equipment or services, leave identified space clear and install services and equipment so that connections can be made in the future.
 - 1.10 **SUBMITTALS**
 - .1 Shop Drawings
 - .1 Conform to Section 01 33 00 and the following.
 - .2 Shop Drawings showing more than one size or model will not be considered unless properly marked up.
 - .3 For electrically driven, and fuel fired appliances, provide the following information:
 - .1 Electrical characteristics including voltage, phase, frequency and power rating.
 - .2 For motors, NEMA, class and efficiency ratings
 - .3 Fuel input ratings, including flow rates and pressures
-

- .4 Equipment performance ratings, including flow rates, pressures, efficiencies, part load values and/or efficiencies (IPLV's), plotted flow characteristics (pump and fan curves) with operating points clearly plotted.
- .4 For other equipment include the following information:
 - .1 Equipment performance ratings, including flow rates, pressures drops.
 - .2 Electrical control power requirements.
- .5 For all equipment, include the following:
 - .1 Equipment dimensions and weights.
 - .2 Itemized product description with optional items clearly marked as being included.
- .6 Provide wiring Shop Drawings:
 - .1 Wiring diagrams and schematics for all equipment which has electrical controls or devices furnished with the equipment.
 - .2 Wiring diagrams alone are not sufficient; schematic and interconnecting drawings, and sequence of operation of equipment are required for review.
 - .3 Clearly indicate the materials and/or equipment being supplied:
 - .1 Details of construction, finish, accurate dimensions, capacities and performance.
 - .2 Certify Drawings correct for construction by the manufacturer, before submission.
 - .3 Identify Equipment Shop Drawings with designations as shown on the Drawings or in the Specifications.
 - .4 If not complied with, Shop Drawings will not be reviewed and will be returned to the Contractor.
 - .4 Coordinate equipment which attaches to and/or where external wiring provided connects to other equipment.
 - .1 Do such coordination whether such equipment is supplied under this or other contracts or subcontracts, for which relevant information will be provided by Owner/Consultant.

1.11 **"AS-BUILT" RECORD DRAWINGS**

- .1 Reference
 - .1 Conform to Section 01 33 00.
 - .2 Maintain an accurate dimensional record of all underground piping and all deviations and changes in aboveground piping and equipment.
-

1.12 **INSTALLATION AND START-UP INSTRUCTIONS**

.1 Reference

- .1 Conform to Section 01 33 00.
- .2 Submit copies of installation instructions and copies of start-up instructions for any item of equipment when requested by the Consultant.

1.13 **OPERATING AND MAINTENANCE INSTRUCTION MANUALS**

.1 Reference

- .1 Conform to Section 01 33 00.
- .2 In addition, include the following in the manuals:
 - .1 Non-dimensional layout showing location of all electrical devices on mechanical equipment.
 - .2 Operating instructions, including start-up and shut-down procedure.
 - .3 Lubricating instructions and recommended cycle of lubrication for each item of equipment, including various types of lubricants.
 - .4 List of spare parts.
- .3 All the above applies to component parts of equipment whether they are manufactured by the Supplier of the equipment or are supplied as a component part of an item of equipment.

1.14 **CLEANING, TESTING AND APPROVAL RECORDS**

.1 Records

- .1 Maintain records of all pressure tests and flushing and sterilization tests, glycol/water concentrations, inspections and approvals by the plumbing inspector.
- .2 Forward these tests to the Owner on completion of the Work in accordance with Section 01 33 00.
- .3 Forward to Consultant, copy of records on site on completion of each test, cleaning operation, etc.

1.15 **DIMENSIONS AND QUANTITIES**

.1 Dimensions

- .1 Dimensions shown on Drawings are approximate.
- .2 Verify dimensions by reference to Shop Drawings and field measurement.

.2 Quantities

- .1 Quantities or lengths indicated in any of the Contract Documents are approximate only and shall not be held to gauge or limit the Work.
-

1.16 **TRADE QUALIFICATIONS**

.1 Applicable to the following trades

- .1 Sheet metal workers
- .2 Plumbers
- .3 Steamfitters

.2 Requirements

- .1 Trade workers to have a certificate of qualification as journeyman or apprentice registration for the province where the Work is performed or an interprovincial certificate.
- .2 Ratio of journeyman to apprentice: Not to exceed the defined ratio in the Apprenticeship Act of Ontario.
- .3 On award of Contract, submit a list of trade journeyman and apprentices, together with their certificate and registration numbers.
- .4 Certificates and registration must be provided to the Consultant on request.
- .5 Maintain on-site an up-to-date record listing journeyman and apprentices working on site.

2 Products

2.1 **MATERIALS AND EQUIPMENT**

.1 Materials

- .1 Use new materials and equipment, free from defects impairing strength and durability, as specified or specified equivalent.
- .2 Of Canadian manufacture wherever possible.
- .3 Labelled or listed as required by code and/or inspection authorities.
- .4 Design of mechanical systems has been based on the first listed Supplier and model number/size stated on the equipment schedules on the Drawings. Bear all costs due to physical or performance differences between stated equipment and proposed equipment. These differences include but are not limited to size, layout, arrangement, connection size, location and/or quantity of connections, or performance differences such as noise, power requirements, flow, throw, etc.

.2 Equipment/Structure Coordination

- .1 Locations and dimensions of curbs and roof and floor opening framing, where indicated on the Drawings, are based on an arrangement to suit the above named Supplier.
 - .2 Be responsible to verify the actual size requirements of the openings, and notify the Consultant immediately in case the dimension of the unit supplied and the connecting ductwork/piping, etc. are at variance with the dimensions given on the Drawings.
-

- .3 Bear all costs for modification of curbs and floor/roof openings resulting from failure to notify the Consultant prior to the fabrication or construction of opening framing and curb.

2.2 **STANDARD SPECIFICATIONS**

.1 Product Quality

- .1 Ensure that the chemical and physical properties, design, performance characteristics and methods of construction of all Products provided comply with the latest issue of applicable standard specifications issued by authorities having jurisdiction.
- .2 Do not apply such standard specifications to decrease the quality of workmanship, Products and services required by the Contract Documents.

2.3 **MANUFACTURER'S NAMEPLATES**

.1 Metal Nameplates

- .1 Provided with raised or recessed lettering, on each piece of equipment.
- .2 Mechanically fasten nameplate on a metal stand-off bracket arranged to clear insulation.
- .3 Mount on same stand-off Underwriters Laboratories and/or CSA registration plates.

.2 Nameplate Data

- .1 Indicate:
 - .1 Size
 - .2 Capacity
 - .3 Equipment model
 - .4 Manufacturer's name
 - .5 Serial number
 - .6 Voltage
 - .7 Cycle
 - .8 Phase and power of motors

2.4 **PHASE AND POWER OF BUILDING ATTACHMENTS**

.1 Welding Studs

- .1 Maximum size: 10 mm for attaching miscellaneous materials and equipment to building steel.
 - .2 If the weight of materials or equipment require bolts or studs larger than 10 mm diameter, use steel clips or brackets, secured to building steel by (welding or) bolting as approved by the Consultant.
-

- .3 Acceptable Manufacturers:
 - .1 Graham
 - .2 Omark
 - .3 Nelson
- .2 Self Drilling Expansion Type Concrete Inserts
 - .1 To secure miscellaneous equipment and materials to masonry or concrete construction already in place.
 - .2 Of sufficient number and size to prevent concrete from breaking away.
 - .3 The use of powder or power actuated fasteners will not be allowed unless prior written approval is obtained from the Consultant.
 - .4 Acceptable Manufacturers:
 - .1 ITW "Redhead"
 - .2 Star "SSS"
 - .3 USM "Parabolt"
- .3 Supports For Any Suspended Items
 - .1 Do not fasten/attach to or extend through steel pan type roofs or through concrete slab roofs.
- .4 Beam Clamps
 - .1 Two-bolt design, and of such type that the rod load is transmitted only concentrically to the beam web centreline.
 - .2 The use of "C" and "I" beam side clamps, etc., will not be allowed without written consent of the Consultant.
 - .3 Acceptable Manufacturers:
 - .1 Grinnell
 - .2 Myatt
 - .3 Carpenter & Paterson
 - .4 Taylor Pipe Supports

2.5 **DRIVES AND ACCESSORIES**

- .1 Drives
 - .1 V-belt drive selection: 150 percent of the motor size rating.
 - .2 Sheaves: Cast iron construction with machined grooves.
 - .1 Sheaves 75 mm size and larger diameter: taper lock bushings.
 - .2 Multi-belt drives: Matched sets.
-

- .3 Statically and dynamically balance all sheaves as an operating unit.
 - .3 Adjustable sheaves:
 - .1 Motors less than 11 kW (15 HP) rating: Adjustable pitch motor sheave with diameter range selected to obtain specified RPM of the driven equipment at approximately the mid-point setting of the sheave.
 - .4 Fixed sheaves:
 - .1 Motors of 11 kW (15 HP) and greater: Solid type.
 - .2 Drive Couplings
 - .1 Acceptable Manufacturers:
 - .1 Falk
 - .2 Fast
 - .3 Thomas
 - .3 Lubricating Devices
 - .1 Equipment to have oil reservoirs with level indicators, or pressure grease fittings.
 - .2 Inaccessible fittings: Provide extended tubes to an accessible location.
 - .3 Grease fittings: Zerk or Alemite.
 - .1 All fittings of one type.
 - .4 Drive Guards
 - .1 To OSHA requirements.
 - .2 Build guards of all welded construction on exposed rotating parts or elements and on all drives including the following:
 - .1 V-belt drives
 - .2 Flexible couplings
 - .3 Gear drives
 - .3 Construction (except fan drives):
 - .1 Total enclosure type fabricated of minimum 1.3 mm (18 gauge) black sheet steel.
 - .2 Hinged side to allow access for lubrication, inspection or removal of the drive parts.
 - .3 Maximum clearance of openings in guards to rotating parts: Not to exceed 13 mm.
 - .4 Make provision for slide rail adjustment.
-

- .4 Construction for fan drives:
 - .1 V-belt drives: Total enclosure type as specified above.
 - .2 Enclosure sides: 13 mm mesh, 2.7 mm wire screening.
 - .3 Tachometer holes at shaft centres, reinforced as required to maintain rigidity of guard.
- .5 Flexible drive coupling guards:
 - .1 Location: Between motor and driven equipment.
 - .2 Minimum 1.3 mm (18 gauge) black sheet steel, securely fastened to the equipment baseplate and readily removable.
 - .3 Leave a clearance of approximately 13 to 25 mm between the guard and the coupling.
 - .4 Extend the guard to within 13 mm of both motor and driven equipment housing.
- .6 Rework any substandard guards supplied with mechanical equipment to conform to the above requirements.

2.6 **SEALANTS, CONCRETE AND GROUTS**

- .1 Pipe Sleeve Seals
 - .1 Acceptable Manufacturers:
 - .1 Thunderline "Link-Seal" Series LS
- .2 Concrete
 - .1 Strength: 25 MPa concrete: to CSA-A23.1/A23.2
- .3 Concrete Grouts
 - .1 Acceptable Manufacturers:
 - .1 Sternson "M-Bed Standard"
 - .2 Sika "Sikagrout 212"
 - .3 Master Builders "Construction Grout"
 - .4 Meadows "CG-86"
 - .5 Euclid "Euco NS Grout"
 - .6 CPD "Non-Shrink Grout"
- .4 Bonding Agents
 - .1 Acceptable Manufacturers:
 - .1 Sika "Sikadur 32" Hi-Mod

- .5 Caulking Compounds
 - .1 Acceptable Manufacturers:
 - .1 Denso-Plast
- .6 Firestopping
 - .1 ULC listed firestopping assembly
 - .2 Rating to suit wall and floor penetrations
 - .3 Acceptable Manufacturers:
 - .1 Fire Stop Systems
 - .2 Dow Corning
 - .3 3M
 - .4 Tremco
 - .5 A/D Fire Protection System
 - .6 Johns Manville
 - .7 Hilti

2.7 **MISCELLANEOUS**

- .1 Access Doors
 - .1 Minimum size: 200 mm x 200 mm size, unless otherwise specified on the Drawings or in other divisions of the Specifications, or as required to replace or repair said equipment.
 - .2 Material:
 - .1 Fabricated of 2.5 mm (12 gauge) bonderized steel.
 - .2 Fabricated of 2.5 mm (12 gauge) stainless steel in areas finished with tile or marble surfaces.
 - .3 Flush mounted, concealed hinges and screwdriver lock.
 - .4 Plast lock and anchor straps.
 - .5 Doors to be of a type and fire rating to suit the particular type of wall or ceiling construction in which they are to be installed.
 - .3 Acceptable Manufacturers:
 - .1 E.H. Price
 - .2 Titus
 - .3 Controlled Air
 - .4 Williams (S.M.S.)
-

- .5 Acudor
 - .2 Isolating Unions
 - .1 Acceptable manufacturers:
 - .1 Epco
 - .2 Marpac "Petro"
 - .3 Corrosion Service
 - .3 Fabricated Equipment Supports (Floor Stands and Ceiling or Wall Mounted Supports)
 - .1 Structural steel members of welded construction or steel pipe and fittings, suitably braced and secured to the floor by mild steel floor pads or pipe flanges with bolts or anchors.
 - 3 Execution
 - 3.1 **GENERAL**
 - .1 Execute Work in accordance with requirements specified in the various sections of Division 23.
 - .2 Lay out Work of each trade so that it does not interfere with work under other divisions of Specifications.
 - .3 Make good any damage to Owner's property or other trade's work caused by improperly locating or carrying out of Work.
 - .4 Supply anchor bolts and templates for installation by other divisions.
 - .5 Location of pipes, ductwork, raceways and equipment may be altered without extra cost provided alteration is made before installation.
 - 3.2 **EQUIPMENT INSTALLATION**
 - .1 General
 - .1 Install equipment in a compact, neat and workmanlike manner.
 - .2 Align, level and adjust for satisfactory operation.
 - .3 Install in such a manner that connecting and disconnecting of piping and accessories can be made readily and that all parts are easily accessible for inspection, operation, maintenance and repair.
 - .4 Install and start up items of equipment in accordance with the manufacturer's printed installation and operating instructions.
 - .2 Noise and Vibration
 - .1 Noise and vibration levels of equipment and systems shall be within design intent.
 - .2 If noise or vibration levels created by any mechanical equipment and systems and transmitted to occupied portions of building or other mechanical work are
-

over the limits, make all necessary changes and additions as approved by the Consultant without additional cost.

.3 Lubrication

- .1 Lubricate all equipment prior to start up in accordance with the manufacturer's printed instructions.
- .2 Supply all lubrication including sufficient quantity for drainage and refilling of oil sumps, etc., when required by manufacturer's instructions.

3.3 **EQUIPMENT SUPPORTS**

.1 Housekeeping Bases and Pads

- .1 Construct bases and pads for all mechanical equipment as required to allow the proper performance of the equipment.
 - .1 Exception: Bases and pads detailed on the Structural Drawings are for purposes of design intent only.
 - .2 Construction:
 - .1 20 m deformed dowel anchors to concrete slabs (six per base or pad).
 - .2 Drill slabs and grout dowels in place.
 - .3 Bond pads and bases to floor. Use grout and bonding agent according to manufacturer's printed instructions.
 - .4 Height of bases and pads: Minimum of 150 mm or as shown.
 - .5 Width and length: Sufficient to extend 75 mm beyond centreline of anchor bolts, or to extend a minimum of 50 mm beyond equipment base.
 - .6 Chamfer all upper perimeter edges of base.
 - .7 On approval of the Consultant, concrete pads of 150 mm maximum thickness may be poured under equipment after equipment is set in place, with concrete fully vibrated into place under the equipment base plate.
 - .3 Layout coordination:
 - .1 Verify size of bases shown on Structural Drawings with actual requirements and advise the Consultant and the respective trades if change in size or shape of pad is required.
 - .4 Anchor bolts:
 - .1 Supply anchor bolts required for mechanical equipment unless indicated otherwise on the Drawings.
 - .2 Sleeve anchor bolts.
 - .3 Supply anchor bolts and sleeves to trade constructing bases in sufficient time for setting in formwork prior to placing concrete and provide anchor bolt location drawing or template for locating anchor bolts.
-

- .4 Check anchor bolt locations for proper position before concrete is poured.
 - .2 Setting and Alignment of Equipment - Rotating Equipment (fans, pumps, etc):
 - .1 Use millwrights to set and align to lines established with an engineer's level.
 - .2 Shim equipment using standard brass or bronze shim stock of suitable thickness to provide proper level and alignment.
 - .3 Place 25 mm minimum thick grout between equipment base and concrete pad or foundation.
 - .4 Have Consultant approve equipment settings for equipment mounted on concrete pads or foundations prior to grouting.
 - .5 Re-check alignment prior to start-up of equipment.
 - .3 Floor Stands
 - .1 Provide stands for floor mounted equipment.
 - .2 Secure to the floor by mild steel floor pads or pipe flanges with bolts or anchors.
 - .4 Ceiling or Wall Mounting
 - .1 Where ceiling or wall mounting is indicated or required, provide a suspended platform, bracket or shelf.
 - .2 Materials: Standard steel members and steel plates of welded construction throughout.
 - .3 Attach to building steel with rod hangers and beam clamps, or attach to precast structure as the case may be.
 - .4 Place additional structural steel as required between building steel where beam spacing does not meet requirements.
 - .5 Do not use inserts unless specifically shown on the Drawings or approved by the Consultant for any particular item of equipment.
 - .6 Attach brackets or shelves to vertical member or sections of the building structure as hereinbefore specified.
 - .5 Suspended Equipment Support
 - .1 Provide double locknuts on suspended equipment supports as follows.
 - .2 Upper attachment
 - .1 Beam clamp: Provide a double nut on end of beam clamp tie rod.
 - .2 Supplemental steel: Double nut all mechanical fasteners fixing supplemental steel to building structural steel.
 - .3 Middle attachment
 - .1 Upper load bearing point, to beam clamp: Not applicable.
-

- .2 Upper load bearing point, to supplemental steel: Double nut on top of load bearing point, single locknut on underside of bearing point
- .3 Lower load bearing point, all: Double nut on underside of bearing point, single locknut on top of bearing point.
- .4 Lower attachment
 - .1 Trapeze hanger or equipment fastening: Refer to middle attachment requirements above.
- .5 Apply Loctite 242 to the second nut (and matchmark both nuts).

3.4 **MISCELLANEOUS STEEL**

- .1 Hang or support equipment, piping, ductwork etc., with miscellaneous structural supports, platforms, braces as may be required unless Drawings or other sections of the Specifications state otherwise.
 - .2 Materials and Fabrication
 - .1 Conform to:
 - .1 CAN/CSA-S16.1-M for materials, design of details and execution of the work.
 - .2 CSA-G40.20/G40.21 grade 300W for structural shapes, plates, etc.
 - .3 CSA W47.1 for qualification of welders.
 - .4 CSA W48.1-M for electrodes (only coated rods allowed).
 - .5 CSA W59-M for design of connections and workmanship.
 - .6 CSA W117.2 for safety.
 - .3 Construction
 - .1 Welded construction wherever practicable.
 - .2 Chip welds to remove slag, and grind smooth.
 - .3 Bolted joints allowed for field assembly using high strength steel bolts.
 - .4 Painting and Cleaning
 - .1 Clean steel to Steel Structures Painting Council SSPC-SP6, Commercial Blast Cleaning.
 - .2 Apply one coat of oil alkyd primer conforming to CISC/CPMA 2.75 to all miscellaneous steel.
 - .3 In the field, touch up all bolt heads and nuts, previously unpainted connections and surfaces damaged during erection with primer as hereinbefore specified.
 - .4 Apply two coats of primer to all surfaces which will be inaccessible after erection.
 - .5 Thoroughly remove all foreign matter from steelwork on completion of installation.
-

3.5 CONCRETE INSERTS

- .1 Install inserts required for attachment of hangers, either for suspension of piping or equipment.
- .2 For masonry or poured concrete construction use expansion type units. Insert into the concrete after concrete has cured. Do not use anchors or inserts installed by explosive means.

3.6 FLASHINGS

- .1 Flash and counterflash all gas vent stacks through roof, with Thaler Model MEF-4A.
- .2 Safety vents, plumbing vents and all other pipes passing through roofs, stack flashings will be supplied and installed by roofing trade, unless otherwise shown on Drawings.

3.7 FIRE STOPPING

- .1 Submit Shop Drawings, including the following information:
 - .1 ULC/CUL listing number.
 - .2 Installation Drawings for each type of penetration.
 - .3 Installation materials.
- .2 General
 - .1 Seal piping, ductwork, conduits and miscellaneous support steel penetrating fire separations.
 - .2 Install firestopping in accordance with manufacturer's instructions and ULC listing requirements.
 - .3 Provide a written report on completion of firestopping, by area or floor if necessary, indicating the Work is completed and ready for inspection. Do not cover over firestopping, including installation of walls and ceilings, until Work is inspected.

3.8 ACCESS DOORS

- .1 Supply access doors for installation by other trades in walls or ceilings where accessibility is required for the operation and/or maintenance of:
 - .1 Concealed valves
 - .2 Traps
 - .3 Cleanouts
 - .4 Dampers
 - .5 VAV boxes
 - .6 Control equipment

3.9 SPARE PARTS

- .1 Furnish spare parts
-

- .1 One set of packing glands for each size of pump gland.
- .2 One casing joint gasket for each size pump.
- .3 One head gasket for each heat exchanger
- .4 One glass for each gauge glass
- .5 One set of V-belts for each drive
- .6 One filter cartridge or set of filter media for each filter or filter bank installed

3.10 **PROTECTION**

- .1 Protect Work and materials from weather and other hazards before, during, and after erection, and keep in a clean and orderly manner.
- .2 Protect pipe ends, valves and parts of equipment left unconnected to prevent damage or intrusion of foreign matter. Provide pipe caps for threaded male connections and plugs for threaded female connections.
- .3 Protect plumbing fixtures or mechanical equipment having a baked enamel finish by covering with polyethylene sheet securely held in place.
- .4 Protect finished floor slabs from scuffing, cracking, chipping, staining, cutting and other damage resulting from work of this Contract.
 - .1 Place a 19 mm thick plywood underlaid with 25 mm thick polystyrene insulation board adhered to same, over floor areas when working from or over, such surfaces.
 - .2 Provide such protection below hoist rigs, ladders, pallets of material, and in other circumstances where the flooring is exposed to potential damage.
 - .3 Work damaged due to failure in providing such protection is to be removed and replaced, or repaired, as directed by the Owner, at no increase in Contract Price.

3.11 **MAINTENANCE OF BEARINGS**

- .1 During Construction
 - .1 Turn-over rotating equipment at least once a month after delivery;
 - .1 Run-in sleeve type bearings in accordance with manufacturer's recommendations.
 - .2 Drain, flush out and refill with new charge of oil or grease.
 - .3 Protect bearings, shafts and sheaves against damage, corrosion and dust accumulation.
 - .4 Provide extended grease nipples for bearing lubrication.

3.12 **CONSTRUCTION REVIEW**

- .1 The construction review will include milestone and periodic reviews.
 - .2 Milestone Reviews
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- .1 Specific milestone reviews will be performed by the Consultant for compliance with the Ontario Building Code, including any or all of the following:
 - .1 Buried drainage
 - .2 Before installation of roofing membrane
 - .3 Before closure of service shafts and pipe chases
 - .4 Before closure of walls
 - .5 Before closure of ceilings
 - .6 Equipment demonstration and training
 - .7 Substantial Performance and deficiency review
 - .8 Total Performance
 - .2 Some or all of these reviews are of portions of the Work which may be concealed. If Work is enclosed before the Consultant can review the installation, the Consultant may direct the Contractor to expose the Work for it to be examined, at no additional cost to the Project, including rework affecting other trades.
 - .3 If deficiencies are noted during any review where Work will be enclosed, correct noted deficiencies and have them reviewed by the Consultant prior to the Work being enclosed.
 - .4 Provide a minimum of seven Calendar Days written notice to the Consultant when requesting each review date.
 - .5 The Consultant will provide a check-list to the Contractor of required milestone reviews which must be completed. Maintain this list on site along with identified test reports, and make available for Consultants review when requested. When completed, include this checklist form with the test reports forms specified in Section 23 08 16.
- .3 Periodic Reviews
- .1 The Consultant will conduct periodic reviews as required for the Project. These reviews are for the benefit of the Owner to describe the progress and workmanship of the Work and are not intended as any form of quality assurance for the Contractor.
 - .2 Deficiencies will generally not be reported as part of this review, as the Work has not been reported by the Contractor as being complete. However, deficiencies may be reported where it may not be possible to correct the Work at a later date, or at great expense.
 - .3 The Contractor shall not rely on these periodic reviews to identify deficiencies during the progress of the Work.
- .4 Deficiency Review
- .1 The Consultant will conduct a deficiency review only after the Contractor submits an application for Substantial Performance. As part of this application, the Contractor shall submit their own comprehensive deficiency list of incomplete or
-

incorrect work. Failure by the Contractor to list any deficiency does not relieve the Contractor from correcting or completing the Work.

- .2 The Consultant shall review the work and any deficiencies noted will be classified as Major or Minor.

- .1 Major deficiencies are required to be corrected as part of obtaining Substantial Performance.

- .2 Minor deficiencies may be corrected before or after Substantial Performance.

- .5 Final Review

- .1 The Consultant will conduct a final review only after the Contractor submits a declaration that all of the following has been completed:

- .1 Noted deficiencies have been corrected

- .2 Final As-Built Drawings have been submitted to the Owner

- .3 Final Operating and Maintenance Manuals have been submitted to the Owner

- .4 Final test reports, including alternate season tests have been submitted to the Owner.

- .2 The Consultant will only review the deficiency list to confirm these deficiencies have been corrected.

3.13 **PERFORMANCE TESTING AND BALANCING**

- .1 Refer to 23 08 00 series.

3.14 **ADJUSTMENT AND OPERATION OF SYSTEMS**

- .1 When the Work is complete:

- .1 Adjust equipment items of the various systems for proper operation within the framework of design intent, and the operating characteristics as published by the equipment manufacturer.

- .2 Complete additional instructions are specified under the respective sections of Division 23.

- .2 The Consultant reserves the right to require the services of an authorized representative of the manufacturer in the event that any item of equipment is not adjusted properly.

- .1 Arrange for such services and pay all costs thereof.

- .2 After completion of adjustments, place systems in full operating condition and advise Consultant that the Work is ready for acceptance.

3.15 **ACCEPTANCE**

- .1 After all equipment has been installed and adjusted and all systems balanced:

- .1 Conduct performance tests in the presence of the Consultant and the Owner.

- .2 Arrange the time for these tests at the convenience of the Consultant and Owner.
 - .3 Conduct tests under climatic circumstances to ensure complete and comprehensive tests and of such a manner and duration as the Consultant may deem necessary.
- .2 During these tests:
- .1 Demonstrate the correct performance of all equipment items and of the systems they comprise.
 - .2 Should any system or any equipment item fail to function as required, make such changes, adjustments or replacements necessary to meet performance requirements.
 - .3 Repeat tests until requirements have been fully satisfied and all systems accepted by the Consultant.

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **RELATED SECTIONS**

.1 Division 26: Electrical

- .1 Power wiring between the electrical distribution system and motor or equipment.
- .2 Motor Control Centres (MCC).
- .3 Motor starters including variable frequency drives and soft-start starters, except where specified as an integral component of the mechanical equipment.
- .4 Fused or unfused disconnects, except where specified as an integral component of the mechanical equipment.

1.3 **REFERENCE STANDARDS**

.1 Standards

- .1 CSA 390 M (motor efficiency ratings).
- .2 IEEE 112 (motor efficiency ratings) for three phase motors.
- .3 IEEE 114 (motor efficiency ratings) for single phase motors.

1.4 **CODES AND REGULATIONS; PERMITS, COSTS AND FEES**

.1 Codes

- .1 Electrical Safety Authority (ESA).
- .2 Canadian Electrical Code.

.2 Permits

- .1 Obtain electrical permits and inspections and pay all costs for the portion of the Work performed by this division.

1.5 **QUALITY ASSURANCE**

.1 Contractor Qualifications

- .1 Electrical wiring for mechanical trades work performed by a specialist firm with an established reputation in this field.

1.6 **SUBMITTALS**

.1 Shop Drawings

- .1 Submit in accordance with Section 01 33 00.
 - .2 Include nameplate data, motor efficiencies, NEMA rating and insulation rating.
-

2 Products

2.1 **MOTORS**

.1 General

.1 Motor nameplate rating:

- .1 Not less than input brake horsepower of driven equipment plus 5%, at specified operating conditions, and
- .2 Not less than the scheduled minimum horsepower.
- .3 Premium efficiency.
- .4 Selected for chemical duty or explosion proof where scheduled.
- .5 Service factor: 1.15 minimum for three phase motors.

.2 Single Phase Motors

.1 Continuous duty, resilient mount.

- .1 Motor rating: Less than 375 W (1/2 HP).
- .2 Voltage, frequency and RPM as scheduled.

.3 Three Phase Motors, 350 W to 525 W (1/2 HP to 3/4 HP)

.1 EEMAC, Class B, Type F insulation, squirrel cage induction, continuous duty, ball bearing.

- .1 Voltage, frequency and RPM as scheduled.
- .2 Motor type: ODP with 90°C (194°F) temperature rise (TEFC with 80°C (176°F) temperature rise) unless otherwise scheduled.
- .3 1800 RPM or as scheduled.

.4 Three Phase Motors, 750 W (1 HP) and Larger

.1 EEMAC, T-Frame, Class B, Type F insulation, squirrel cage induction, continuous duty, ball or sleeve bearing.

- .1 Motor efficiency: Premium efficiency.
- .2 Voltage and frequency as scheduled.
- .3 Motor type: TEFC with 80°C (176°F) temperature rise (ODP with 90°C (194°F) temperature rise) unless otherwise scheduled.
- .4 1800 RPM or as scheduled.

.5 Three Phase Motors, 750 W (1 HP) and Larger, Variable Frequency Drive Applications

.1 EEMAC, T-Frame, Class B, Type F triple build, form wound insulation, squirrel cage induction, continuous duty, ball bearing, 40°C (104°F) temperature rise.

- .1 Motor efficiency: Premium efficiency.
-

- .2 Inverter duty rated.
 - .3 Maximum speed turndown: 25%.
 - .4 Voltage and frequency as scheduled.
 - .5 Motor type: ODP for variable torque applications, TEFC for constant torque applications.
 - .6 1800 RPM or as scheduled.
 - .6 Multiple Speed Motors
 - .1 For 2:1 speed ratios: Single winding consequent pole (two winding).
 - .2 For all other speed ratios: Two winding.
 - .7 Grounding Lug
 - .1 Motors less than 15 kW (20 HP):
 - .1 Ground lug on motor terminal box.
 - .2 Motors 15 kW (20 HP) and larger:
 - .1 Directly bolted to motor frame.
 - .2 Located inside terminal box on motor.
 - .8 Winding Temperature Sensors - RTD's
 - .1 Where required:
 - .1 Motors greater than 224 kW (300 HP).
 - .2 Inverter duty motors greater than 112 kW (150 HP).
 - .2 Type:
 - .1 RTD sensor in each winding, wired to separate terminal box on side of motor.
 - .2 RTD relay/control circuit by others.
 - .9 Winding Temperature Sensor Protection
 - .1 Where required:
 - .1 Motors 37 kW (50 HP) up to 225 kW (300 HP).
 - .2 Motors 18.6 kW (25 HP) up to 30 kW (40 HP) located in air ducts, plenum chambers or in air stream inside air conditioning equipment.
 - .2 Type:
 - .1 Winding temperature sensor wired to disconnect motor on high temperature.
 - .2 120 V control transformer.
-

- .3 "Push-to-Test" red pilot light (high winding temperature).
 - .4 Reset button.
 - .5 Supply control unit to the Contractor under Division 26 for installation in motor starter.
 - .6 Acceptable Manufacturers:
 - .1 Siemens Canada Limited - PTC thermistor with 3-UN2131 tripping unit
 - .10 Winding Temperature Thermostat
 - .1 Where required:
 - .1 Single phase, and three phase motors up to 15 kW (20 HP) located in air ducts, plenum chambers or in air stream inside air conditioning equipment.
 - .2 Type:
 - .1 Klixon Motor winding thermostats.
 - 2.2 **WIRING AND CONDUIT**
 - .1 Wire
 - .1 RW-90 X-link.
 - .2 Minimum No. 12 AWG for power.
 - .3 Colour coded No. 14 AWG for control power, 120 VAC and lower.
 - .4 Individually identify conductors on each end with slip-on, plastic wire markers. Identification to match wiring diagrams.
 - .2 Conduit
 - .1 Thin wall conduit:
 - .1 Up to 32 mm size in ceilings, furred spaces, in hollow walls and partitions and where not exposed to mechanical injury.
 - .2 Rigid galvanized steel:
 - .1 38 mm size and larger.
 - .2 Any size where located in poured concrete, and where exposed.
 - 2.3 **EQUIPMENT SERVICE LIGHTS**
 - .1 Service Lights
 - .1 LED type with tempered glass globe and wire guard (silicone free).
 - .2 Acceptable Manufacturers:
 - .1 Crouse Hinds
-

- .2 Killark
 - .2 Switches
 - .1 Twenty ampere, single pole, with pilot light, installed in cast metal box.
 - .2 Acceptable Manufacturers:
 - .1 Hubbell
 - .2 P & S
 - .3 Arrow Hart
 - .4 Leviton
 - 2.4 **CORROSION PROTECTION ANODES**
 - .1 Sacrificial Anode
 - .1 High grade electrolytic zinc, 99.99% pure: To ASTM B-418 Type II.
 - .2 Supplied with 5 mm diameter minimum steel core with #8 TWH stranded connecting wire or bolt-on strap connection where required.
 - 3 Execution
 - 3.1 **INSTALLATION**
 - .1 Motor and Equipment Control
 - .1 Motor control centre, starters and/or disconnect switch for each motor or electrically connected item: Provided by Electrical Division 26.
 - .1 Exception: Disconnects which are specified as part of the equipment.
 - .2 Power Conduit and Wire
 - .1 Provided by Mechanical Division:
 - .1 Line voltage thermostats, and wiring from thermostat to fan coil units, unit heaters and cabinet unit heaters.
 - .2 Hardwire interlock wiring between control devices (pressure switches, temperature switches, limit switches, etc.) and motor starters.
 - .3 Between junction box provided by Division 26, to switch and equipment service lights.
 - .2 Provided by Electrical Division 26:
 - .1 Power wiring at all voltages 120 VAC and higher to motors or equipment.
 - .2 To junction box on adjacent wall, column or ceiling for equipment service lights (marine lights).
 - .3 Control Conduit and Wire
 - .1 Provided by Mechanical Division:
-

- .1 Control wiring, conduit and relays to interlock starters and connect safety and operating controls.
 - .4 Equipment Service Lights
 - .1 Mount switches in accessible location on outside of plenum.
 - .2 Provide one switch for each fan system.
 - .3 Provide minimum of one marine light per 3 m length of plenum.
 - .5 Grounding
 - .1 Ground electrical equipment and wiring in accordance with Electrical Safety Authority and local authority's rules and regulations.
 - .6 Corrosion Protection Anodes
 - .1 Provide external corrosion protection anodes for:
 - .1 Buried ductile iron water mains, fittings, and hydrants
 - .2 Metallic services as shown.
- End of Section
-

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- 1 General
 - 1.1 **SUMMARY**
 - .1 Section Includes
 - .1 Labour, Products, equipment and services necessary to complete the Work of this section.
 - 1.2 **DESIGN CRITERIA**
 - .1 Refer to drawings schedule.
 - 1.3 **REFERENCE STANDARDS**
 - .1 Gas Meters
 - .1 CGA approved.
 - 1.4 **SUBMITTALS**
 - .1 Shop Drawings
 - .1 Submit Shop Drawings in accordance with Section 01 33 00.
 - .2 Operation and Maintenance Data
 - .1 Submit printed operation instructions and maintenance data in accordance with Section 01 33 00.
 - 2 Products
 - 2.1 **GENERAL**
 - .1 Sensor Elements
 - .1 Selected for thermowells designed for 50 mm insulation.
 - 2.2 **FLOW INDICATORS**
 - .1 Liquids
 - .1 Construction:
 - .1 Visual flow indication.
 - .2 Equipped with a dual flow scale L/s-USgpm.
 - .3 Protected against accidental breakage of the glass indicator.
 - .4 In-line type for pipe sizes up to NPS 1½.
 - .5 By-pass type with isolating valves for larger sizes.
 - .2 Acceptable Manufacturer:
 - .1 ITT Bell & Gossett - Thermoflow
-

2.3 VOLUME FLOW MEASUREMENT

.1 Turbine Type

.1 Operating medium:

- .1 Water

.2 Primary flow element:

- .1 Bidirectional turbine flow meter

.3 Flow transmitter:

- .1 Measuring transmitter with 0-10 VDC pulse output
- .2 Pulse output: [0.06 L/s] [0.6 L/s] [6.0 L/s]
- .3 Digital register (dual) L/s (USGPM)
- .4 Maximum pressure drop 7 kPa (1 psi) at full flow
- .5 Maximum operating temperature: 95°C (200°F)
- .6 Square root extractors
- .7 Additional contacts for remote monitoring and/or initiation of system chemical feed pumps after each 200 litres
- .8 Accuracy: $\pm 1\%$ of full range
- .9 Repeatability: $\pm 0.1\%$
- .10 Power supply: 120VAC

.4 Acceptable Manufacturers:

- .1 Neptune

.2 Rotary Type

.1 Operating medium:

- .1 Natural gas

.2 Primary flow element:

- .1 Rotary positive displacement
- .2 Line mounting body style
- .3 Contra-rotating impeller
- .4 Splash lubricated ball bearing design

.3 Flow transmitter

- .1 Microprocessor based flow meter
 - .2 Alkaline battery operation
-

- .3 Magnetic shaft sensors
 - .4 Single point temperature calibration/compensation
 - .5 Liquid crystal display in cubic metres
 - .6 Four isolated, adjustable output points
 - .7 Accuracy: $\pm 0.3^{\circ}\text{C}$ ($\pm 0.5^{\circ}\text{F}$)
 - .8 Temperature resolution: 0.1°C ($\pm 0.1^{\circ}\text{F}$)
 - .9 Pulse outputs: One non-compensated, two compensated, one alarm
 - .10 Pulse output range: Refer to Drawings for each meter
 - .11 NEMA 4X enclosure
 - .4 Acceptable Manufacturers:
 - .1 Roots-Dresser M175 Series with VTC Transmitter
 - .3 Differential Pressure Type
 - .1 Operating medium:
 - .1 Water
 - .2 Natural gas
 - .2 Primary flow element:
 - .1 Insertion bar or orifice differential pressure type
 - .2 Integral three-valve manifold
 - .3 Pipe size: NPS 2 to NPS 20
 - .4 Material: Type 316SS
 - .5 (Designed for "Hot-Tap" installation on existing piping)
 - .3 Flow rate transmitter:
 - .1 Simultaneous calibration of flow element and transmitter
 - .2 Keypad entry and display of information including span and zero
 - .3 Accuracy: $\pm 1\%$ of reading over a minimum of 10:1 turndown
 - .4 Repeatability: $\pm 0.1\%$
 - .5 Output: 4-20 mA flow rate transmitter with a three valve manifold for isolation and testing
 - .6 Square root extractors
 - .7 Remote mounted for systems operating at 93°C (200°F) and over
 - .8 NEMA 4 housing
-

- .9 Power supply: 120 VAC
- .10 HART communication module, overlaid on 4-20 mA wiring)
- .4 Acceptable Manufacturers:
 - .1 Annubar
 - .2 Elsag Bailey
 - .3 Rosemount
 - .4 Foxboro

2.4 **MASS FLOW**

- .1 Differential Pressure Type
 - .1 Operating medium:
 - .1 Natural gas
 - .2 Primary flow element:
 - .1 Insertion bar or orifice differential pressure type
 - .2 Integral three-valve manifold
 - .3 Pipe size: NPS 2 to NPS 20
 - .4 Material: Type 316SS and Inconel
 - .5 (Designed for "Hot-Tap" installation on existing piping)
 - .3 Flow rate transmitter:
 - .1 Simultaneous calibration of flow element and transmitter
 - .2 Keypad entry and display of information including span and zero
 - .3 Accuracy: $\pm 1\%$ of reading over a minimum of 10:1 turndown
 - .4 Repeatability: $\pm 0.1\%$
 - .5 Output: 4-20 mA flow rate transmitter with a three valve manifold for isolation and testing
 - .6 Square root extractors
 - .7 Remote mounted for systems operating at 93°C (200°F) and over
 - .8 NEMA 4 housing
 - .9 Power supply: 120 VAC
 - .4 Pressure transmitter
 - .1 Piezo-electric silicon chip sensor
 - .2 Rangeability: 5:1 turndown
-

- .3 Type 316SS body and drain valves
- .4 Electronics housing: NEMA 4
- .5 Output: 4-20 mA
- .6 Power supply: 120 VAC
- .5 Temperature sensor:
 - .1 Three wire, 100 OHM platinum RTD
 - .2 4-20 mA output
 - .3 Accuracy: 0.2% of calibrated span
 - .4 Aluminum housing
 - .5 Power supply: 24 VDC
- .6 Mass flow rate computer:
 - .1 Calculates Reynolds numbers, flow profiles, and mass flow rate compensated for temperature and pressure
 - .2 Adjustable digital flow averaging
 - .3 Menu-driven software entered through face mounted keypad
 - .4 Two line x twenty character LCD display
 - .5 Output: RS-422 serial communication, dry contact, 2x 4-20 mA configurable
 - .6 Lithium battery back-up
 - .7 NEMA 4X enclosure
 - .8 Power supply: 120 VAC
- .7 Acceptable Manufacturers:
 - .1 Annubar
 - .2 Elsag Bailey
 - .3 Rosemount
 - .4 Foxboro

2.5 **ENERGY FLOW METERING**

- .1 Differential Pressure Type
 - .1 Operating medium:
 - .1 Hydronic heating and cooling systems
 - .2 Primary flow element:

- .1 Insertion bar or orifice differential pressure type
 - .2 Matching flanges and pressure taps for orifice plates
 - .3 Integral three-valve manifold
 - .4 Pipe size: NPS 2 to NPS 20
 - .5 Material: Type 316SS and Inconel
 - .6 (Designed for "Hot-Tap" installation on existing piping)
 - .3 Flow rate transmitter:
 - .1 Simultaneous calibration of flow element and transmitter
 - .2 Keypad entry and display of information including span and zero
 - .3 Accuracy: $\pm 1\%$ of reading over a minimum of 10:1 turndown
 - .4 Repeatability: $\pm 0.1\%$
 - .5 Output: 4-20 mA flow rate transmitter with a three valve manifold for isolation and testing
 - .6 Square root extractors
 - .7 Remote mounted for systems operating at 93°C (200°F) and over
 - .8 NEMA 4 housing
 - .9 Power supply: 120 VAC
 - .4 Temperature sensors:
 - .1 Quantity: Two
 - .2 Three wire, 100 OHM platinum RTD
 - .3 4-20 mA output
 - .4 Accuracy: 0.2% of calibrated span
 - .5 Aluminum housing
 - .6 Power supply: 24 VDC
 - .5 Energy rate computer:
 - .1 Calculates Reynolds numbers, flow profiles, and energy flow rate
 - .2 Adjustable digital flow averaging
 - .3 Menu-driven software entered through face mounted keypad
 - .4 Two line x twenty character LCD display
 - .5 Output: RS-422 serial communication, dry contact, 2x 4-20 mA configurable
-

- .6 Lithium battery back-up
- .7 NEMA 4X enclosure
- .8 Power supply: 120 VAC
- .6 Acceptable Manufacturers:
 - .1 Annubar
 - .2 Elsag Bailey
 - .3 Rosemount
 - .4 Foxboro

2.6 **AUXILIARY EQUIPMENT**

- .1 Chart Recorders
 - .1 (Wall mounted) (Free standing) flow meter:
 - .1 Single pen recorder for measuring volume flow for water
 - .2 Two pen recorder for measuring mass flow and pressure for steam and natural gas
 - .3 Electronic seven day (circular) (or) (strip) chart
 - .4 One years supply of charts and ink
 - .2 Acceptable Manufacturers:
 - .1 Elsag Bailey Controls Limited
 - .2 Fisher Controls
 - .3 Dietrich Standard

3 Execution

3.1 **INSTALLATION**

- .1 Metering Devices
 - .1 Install flow measuring devices in horizontal straight pipe runs, free of valves and fittings.
 - .2 Provide isolating valve at each connection to transmitter.
 - .3 Length of straight pipe before and after metering elements.
 - .1 Not less than 1 m before and 1 m after or,
 - .2 As recommended by manufacturer.
 - .4 Mount meters and provide piping and wiring between measuring elements and meters.

.2 Remote Measuring Elements

- .1 Where measuring element is located more than 1.8 m above floor level, or is not otherwise readily accessible, locate transmitter at 1.2 m above floor in accessible location.
- .2 Run signal lines in Schedule 40 threaded steel pipe, except final connections to transmitter can be in type L copper with silver solder joints. Bronze quarter turn isolating valve may be used in place of a dielectric union to separate the copper and steel pipe.
- .3 Provide isolating valve at each connection to transmitter, and provide valved and capped drains at bottom of signal risers.
- .4 For remote transmitters on steam service, provide inverted loop from top of flow measuring element, and provide colour dyed water in downcomer leg to transmitter.

.3 Calibration

- .1 Provide services of manufacturer's service representative to calibrate and commission the equipment.
- .2 Make calibration checks on flow measuring instruments before attempting system balancing.
- .3 Return instrument systems failing to meet accuracy and repeatability criteria to the manufacturer for re-calibration and/or repair.

End of Section

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- 1 General
 - 1.1 **SUMMARY**
 - .1 Section Includes
 - .1 Labour, Products, equipment and services necessary to complete the Work of this section.
 - 1.2 **REFERENCE STANDARDS**
 - .1 Contractor Certification
 - .1 Contractors providing Work regulated under O.Reg. 220/01 Boilers and Pressure Vessels are to be holders of a Technical Standards and Safety Authority (TSSA) certificate of authorization to conduct this Work, including:
 - .1 Pressure piping fabrication and installation
 - .2 Boiler and pressure vessel repairs and alterations
 - .2 Registration
 - .1 Register with the TSSA, and pay associated registration and inspection costs, for pressure piping systems regulated under O.Reg. 220/01 Boilers and Pressure Vessels.
 - 1.3 **SUBMITTALS**
 - .1 Shop Drawings
 - .1 Submit valve Shop Drawings in accordance with Section 01 33 00.
 - 2 Products
 - 2.1 **BEDDING AND BACKFILL**
 - .1 Materials
 - .1 From bottom of trench to 300 mm above top of pipe:
 - .1 New Granular "A" material of bank run sand and gravel or crushed stone of non-organic nature.
 - .2 From 300 mm above top of pipe to underside of gravel sub base or landscaping soil:
 - .1 New granular material conforming to OPSS 1010 Granular "B" requirements.
 - .2 Samples
 - .1 Submit handcarry samples of backfill materials in heavy duty, clear plastic bags to the Consultant at the Job site prior to purchasing.
 - .2 Material delivered to the Job site will be inspected by the Consultant and any material considered unsuitable will be rejected.
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2.2 **ESCUTCHEON PLATES**

.1 Materials

- .1 Heavy chrome plated cast brass or stamped metal.
- .2 Two-piece construction fitted with substantial hinges and positive latches.
- .3 Fit all plates with tempered springs to ensure positive attachment to the pipe.

2.3 **PIPE AND FITTINGS - PRESSURE PIPING - FERROUS**

.1 General

- .1 Pressure class and pipe schedules as shown on piping data sheets unless specified herein.
- .2 Galvanized pipe and fittings: Where indicated on piping data sheets unless specified herein.
- .3 Grooved piping systems - acceptable manufacturers:
 - .1 Victaulic
 - .2 Anvill Gruvlok
 - .3 Shurjoint

.2 Pipe

- .1 Carbon steel - general use
 - .1 Black carbon steel: To ASTM A53 Grade B, seamless or ERW
 - .2 Black carbon steel, for fire protection systems: To ASTM A795, A53, A135
 - .3 Bevelled, plain or grooved ends as per piping data sheets
 - .4 For buried pipe: "Yellow Jacket" polyethylene jacket coating, minimum 22 mil thickness
- .2 Carbon steel - grooved - fire protection systems
 - .1 Black carbon steel: To ASTM A120, seamless or ERW
 - .2 Grooved ends
- .3 Stainless steel
 - .1 Type 304: To ASTM A312
 - .2 Bevelled ends

.3 Tubing

- .1 Stainless steel
 - .1 Type 316 seamless, fully annealed and welded, redrawn, fully annealed suitable for bending: To ASTM A269

- .2 Maximum hardness: Rockwell B80
 - .4 Fittings
 - .1 Threaded
 - .1 Black banded malleable iron threaded fittings: To ASTM A197 and ANSI B16.3
 - .2 Black cast iron threaded fittings: To ASTM A126 Class A and ANSI B16.1
 - .2 Flanged
 - .1 Galvanized cast iron, flanged flat face: To ASTM A126 Class A and ANSI B16.1
 - .2 Black cast iron flanged flat face: To ASTM A126 and ANSI B16.4
 - .3 Drainage
 - .1 Standard galvanized cast iron drainage fittings: To ANSI B16.12
 - .4 Socket welded
 - .1 Forged steel socket welding type: To ASTM A105 Grade 2 and ANSI B16.11
 - .2 For underground pipe: Protect joints and fittings with Shaw "Shrink-Sleeves" or a coating of Denso Paste wrapped with Denso Tape applied with at least 50% overlap
 - .5 Butt welded
 - .1 Seamless carbon steel butt weld fittings, with wall thickness to match pipe: To ASTM A234 WPB and ANSI B16.9
 - .2 For underground pipe: Protect joints and fittings with Shaw "Shrink-Sleeves" or a coating of Denso Paste wrapped with Denso Tape applied with at least 50% overlap
 - .3 Long radius elbows
 - .6 Grooved
 - .1 NPS 10 and less: Ductile iron to ASTM A536 Grade 65-45-12
 - .2 NPS 12 and over: Same material as pipe to ASTM A234, with grooved ends to CSA B242-M
 - .7 Stainless steel (pipe)
 - .1 Seamless stainless steel type 304/304L butt weld fittings, with wall thickness to match pipe: To ASTM A312 WPW 304/304L
 - .2 3000# stainless steel socket welded fittings: To ASTM A182
 - .3 Stainless steel threaded fittings
-

- .4 Grooved Fittings:
 - .1 ASTM A403 or factory-fabricated from ASTM A312 stainless steel pipe.
 - .2 NPS 2 and Smaller: Pressure-Sealed, cold drawn stainless steel with elastomer O-ring seals (grade to suit the intended service), suitable for operating pressure to 3450-kPa (500-psi).
 - .8 Stainless steel (tubing)
 - .1 Type 316: To ASTM A182
 - .2 Parker "Triple-Lok" 37 degree flared tube fittings, Swagelock two-ferrule four-piece joint, Union Carbide
 - .5 Unions
 - .1 General use
 - .1 Black malleable iron with brass ground joint and screwed ends: To ASTM A197 and ANSI B2.1
 - .6 Flanges
 - .1 Welded
 - .1 Forged steel raised face slip-on or weld neck type: To ASTM A181 Grade 1 and ANSI B16.5
 - .2 Provide flat faced flanges for connection to cast iron valves, or equipment having a flat faced flange
 - .2 Screwed
 - .1 Cast iron, galvanized, flat face, screwed: To ASTM A126 Class A and ANSI B16.1
 - .3 Grooved
 - .1 Hinged, two piece, shouldered or keyed cast ductile iron: To ASTM A536 Grade 65-45-12
 - .2 Synthetic rubber gaskets, selected for service: To ASTM D2000
 - .3 Lock bolt
 - .4 Stainless steel (pipe)
 - .1 1.6 mm raised face, forged stainless steel: To ASTM A182 and ANSI B16.5
 - .7 Flange Gaskets
 - .1 General service water < 94°C (200°F) maximum pressure: 1720 kPa (250 psig)
 - .1 1.6 mm thick red rubber, ring type for raised face flanges
 - .2 Full face type for flat faced flanges
-

- .2 Hot water 94°C - 152°C (200°F - 305°F) maximum pressure: 6890 kPa (1000 psig)
 - .1 1.6 mm thick Garlock No. 3000 with nitrile binder flat ring type, or equivalent asbestos-free material manufactured by Anchor or Phelps
 - .3 High temperature hot water 153°C - 232°C (306°F - 450°F) maximum pressure: 8200 kPa (1200 psig)
 - .1 1.6 mm thick Garlock No. 3500 PTFE gasket with silica binder flat ring type, or equivalent asbestos-free material manufactured by Anchor or Phelps
 - .4 Gas piping, coolant piping, waste oil piping, maximum pressure: 6890 kPa (1000 psig)
 - .1 1.6 mm thick Garlock No. 3000 with nitrile binder flat ring type, or equivalent asbestos-free material manufactured by Anchor or Phelps
 - .5 Stainless steel piping
 - .1 1.6 mm thick graphite with Type 316 stainless steel insert manufactured
 - .6 For Van Stone flanges increase gasket thickness to 3.2 mmthick.
 - .8 Flange Bolting
 - .1 General use
 - .1 Semi-finished hex head machine bolts, carbon steel: To ASTM A193 Grade B7
 - .2 Semi-finished hex nuts, carbon steel: To ASTM A194 Grade 2H
 - .2 High pressure piping
 - .1 Semi-finished hex head machine bolts, carbon steel: To ASTM A307 Grade A
 - .2 Semi-finished hex nuts, carbon steel: To ASTM A307 Grade A
 - .3 Stainless steel flanges
 - .1 Stainless steel bolt studs, hex head, machine finished: To ASTM A193, Grade B8 and ANSI B18.21
 - .2 Machine finished stainless steel heavy hex nuts: To ASTM A194, Grade 8 and ANSI B18.22
 - .9 Couplings
 - .1 Grooved for Carbon Steel Pipe
 - .1 Cast segmented ductile iron: To ASTM A536 Grade 65-45-12
 - .2 Grooved machine type: To CSA B242-M or similar
 - .3 Oval track-head bolts and heavy hex nuts: To ASTM A183 & A449
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- .4 Synthetic rubber gaskets, selected for service: To ASTM D2000
 - .1 Grade EHP EPDM gaskets suitable for water temperatures up to 120°C (250°F).
- .5 Rigid Type: Housings cast with offsetting, angle-pattern, bolt pads to provide system rigidity and support and hanging in accordance with ANSI B31.1 and B31.9. Installation-Ready for complete installation without field disassembly.
- .6 Flexible Type: For use in locations where vibration attenuation and stress relief are required. Standard of Acceptance:
- .7 Two-segment couplings for pipe sizes NPS 14 and larger, with lead-in chamfer on housing key.

	At pump connections and concealed piping	Mechanical rooms and exposed piping
Victaulic	Fig 77, 177 or W77	Fig 107N or W07
Anvil (Gruvlok)	Fig 7001	Fig 7401
Shurjoint	Fig 7705	Fig 7771

- .2 Grooved for Stainless Steel Pipe:
 - .1 Housings: Ductile iron to ASTM A536 Grade 65 45 12 or stainless steel to ASTM A351, Grade CF8M.
- .3 Grooved machine type: To CSA B242-M or similar
 - .1 NPS 12 and smaller Schedule 5S or 10S pipe shall be roll grooved using a grooving tool specifically designed for stainless steel pipe.
- .4 Rigid: Housing key shall engage the bottom of the groove:
 - .1 Victaulic Style 89 (ductile iron) or 489 (stainless steel)
 - .2 Anvil Gruvlok
 - .3 Shurjoint
- .5 Flexible Type: For use in locations where vibration attenuation and stress relief are required:
 - .1 Victaulic Style 77S and 77-DX
 - .2 Anvil Gruvlok
 - .3 Shurjoint
- .6 Two-segment couplings for pipe sizes NPS 14 and larger, with wide-width gasket and lead-in chamfer on housing key:
 - .1 Victaulic Style W89 (rigid)
 - .2 Anvil Gruvlok
 - .3 Shurjoint

- .10 Miscellaneous
 - .1 Plugs
 - .1 Class 3000, threaded, square head, machined from solid steel or forging: To ASTM A105 Grade 2
 - .2 Closures, welded
 - .1 Schedule 40 seamless butt welded caps, carbon steel, with wall thickness to match pipe: To ASTM A234 Grade B
 - .3 Thread compound
 - .1 General service: Teflon tape or Master metallic compound
 - .2 Petroleum based fluids service: Teflon base pipe thread compound
 - .3 Ammonia service: X-Pando or approved equal
- .11 Press Fitting System – Stainless Steel
 - .1 Pipe
 - .1 Schedule 10S stainless steel: To ASTM A312 Type [304/304L] [316/316L], with plain ends
 - .2 Size NPS ½ to NPS 2
 - .2 Fittings, couplings and adapters
 - .1 Housing: Type 304L [316L] stainless steel, minimum 1.65mm wall thickness
 - .2 Maximum working pressure 2068kPa (300PSI).
 - .3 Self contained Grade E EPDM O-ring seals for water services, up to +110°C (+230°F)
 - .4 Adapter fittings at valves and equipment connections
 - .5 Certified to NSF 61
 - .6 Acceptable manufacturers:
 - .1 Victaulic Vic-Press
 - .2 Anvil AnvilPress

2.4 **PIPE AND FITTINGS - PRESSURE PIPE - NON FERROUS**

- .1 Copper Tubing
 - .1 Tubing
 - .1 Type “L” hard drawn copper tubing: To ASTM B88
 - .2 Fittings
 - .1 Wrought copper, solder joint, pressure type

- .2 Solder to threaded adaptors as screwed valves or equipment
 - .3 Unions
 - .1 All bronze construction with ground joint
 - .2 Either solder joint or screwed ends as required
 - .3 Grooved Joint: Copper-tube dimensioned couplings, consisting of two ductile iron housings cast with offsetting angle-pattern bolt pads. Installation-Ready, for direct stab installation without field disassembly:
 - .1 Victaulic Style 607N.
 - .2 Anvil Gruvlok CTS COPPER SYSTEM
 - .3 Shurjoint
 - .2 Copper Pipe
 - .1 Pipe
 - .1 Seamless copper pipe standard sizes: To ASTM B42
OR
 - .2 Seamless red brass pipe standard sizes: To ASTM B43
 - .2 Fittings
 - .1 Brass or bronze threaded water fittings: To ANSI B16.15 "Cast Bronze Threaded Fittings (Classes 125 and 250)"
 - .2 Grooved: Wrought copper to ASME B16.22 or cast bronze to ASME B16.18, manufactured to copper-tube dimensions.
 - .1 Victaulic Copper Fittings
 - .2 Anvil Gruvlok CTS COPPER SYSTEM
 - .3 Shurjoint
 - .3 Flanges and flange fittings
 - .1 Brass or bronze flanges and flange fittings: To ANSI B16.24 "Bronze Pipe Flanges and Flanged Fittings (Class 150 and 300)"
 - .4 Flange gaskets
 - .1 1.6 mm thick red rubber, full face type
 - .5 Flange bolting
 - .1 Semi-finished hex head machine bolts, carbon steel: To ASTM A193 Grade B7
 - .2 Semi-finished hex nuts, carbon steel: To ASTM A194 Grade 2H
-

- .3 Copper - Refrigerant Piping
 - .1 Pipe
 - .1 Type ACR copper tubing, soft annealed or hard drawn
 - .2 Type ACR copper tubing, hard drawn: To ASTM B280
 - .3 Deoxidized and dehydrated, with ends factory sealed and identified by the manufacturer as being suitable for refrigeration service
 - .2 Fittings
 - .1 Heavy wrought copper, solder joint type
 - .2 Adapter fittings at screwed connections
 - .3 On NPS 5/8 and less, flareless compression type
 - .3 Unions
 - .1 Rating: 150°C (300°F) maximum temperature rating, 2760 kPa (400 psi) working pressure
 - .2 Brass tail piece adaptors for copper tubing, forged steel flanges, steel bolts, bronze nuts and asbestos-free fibre gasket
 - .3 Acceptable manufacturers: Henry Valve Company Type P30
 - .4 Flexible hose
 - .1 Bronze construction with braided wire exterior jacket and union connection on one end
 - .2 Minimum length: Six times the diameter of the hose
 - .3 Rating: suitable for 150°C (300°F) maximum temperature and 2760 kPa (400 psi) working pressure
 - .4 Acceptable manufacturers: Flexonics or Anaconda
 - .5 Coiled section of soft annealed tubing may be used instead of hose on lines not larger than NPS 5/8
 - .5 Sight glass
 - .1 Provided in refrigeration piping
 - .2 Combination moisture and liquid indicator feature and extended ends for solder joint connection
 - .6 Filter dryer
 - .1 Provided in refrigeration piping
 - .2 Replaceable cartridge type
 - .4 PVC Pipe
 - .1 Pipe and fittings
-

- .1 PVC with solvent welded socket fittings: To CSA B137.3
 - .2 Victaulic Company PGS-300 CPVC Piping system may be used on water and chemical services where IPS size Schedule 80 CPVC pipe is approved for use. Pipe and fittings shall be cut grooved to Victaulic's PGS-300 groove specification. Schedule 80 CPVC pipe shall meet the requirements of ASTM F441 and ASTM D1784 - minimum cell classification 23447 Pipe.
 - .5 Polyethylene Pipe
 - .1 Pipe and fittings
 - .1 Flexible polyethylene: Certified to CSA B137.1
 - 2.5 **PIPE AND FITTINGS - PRESSURE - BURIED**
 - .1 Copper - Buried
 - .1 Pipe
 - .1 Type "K" soft annealed tubing: To ASTM B88
 - .2 Fittings
 - .1 Wrought copper, solder joint pressure type
 - .2 Compression type or cold flared fittings as manufactured by Mueller or Emco
 - .2 Polyethylene - Buried - Water
 - .1 Pipe
 - .1 Series 160 psi polyethylene pipe: Certified to CSA B137.1
 - .2 Smooth finish free of imperfections such as grooves and ripples
 - .2 Fittings
 - .1 Nylon insert type, with serrated ends and insert adapters with threaded end where threaded connections are required: To ASTM D2609
 - .2 Secure pipe to insert fittings by using two stainless steel type clamps over each insert end of fitting
 - .3 Where water service enters building, provide transition from plastic to copper no more than 450 mm above the floor
 - .3 Polyethylene - Buried - Gas
 - .1 Pipe
 - .1 Series 120 psi polyethylene pipe: Certified to CSA B137.1
 - .2 Smooth finish free of imperfections such as grooves and ripples
-

- .2 Fittings
 - .1 Series 125 polyethylene socket welding type: Certified to CSA B137.1
 - .2 Heat fusion joints, installed in accordance with manufacturer's installation manuals
 - .3 Install in accordance with CSA Z184-M and Z184S1
 - .4 PVC - Buried
 - .1 Pipe
 - .1 Class 150 PVC DR18 pressure type, PVC resin: To ASTM D1784
 - .2 Class 200 PVC DR14 pressure type, PVC resin: To ASTM D1784
 - .2 Fittings
 - .1 Class 250 cast grey iron or ductile iron, mechanical joint ends to AWWA C110
 - .2 Tar coated outside
 - .3 Cement mortar lined: To AWWA C104
 - .4 Polyethylene encasement: To AWWA C105
 - .3 Joints
 - .1 To AWWA C-900 and CAN-B137.3
 - .2 Maximum working pressure: 1035 kPa at 23°C (150 psi at 74°F)
 - .5 Glass Fiber Reinforced Epoxy Resin - Buried
 - .1 Pipe
 - .1 Type 1 (Filament-Wound) Grade 1 (Glass Fibre Reinforced Epoxy Resin pipe) Class H (Thermoplastic Resin Liner) pipe: to ASTM D2996 classification 11HZ5001
 - .2 Pipe designed in accordance with ASTM D2992 and D2996
 - .3 Maximum working pressure: 2413 Pa at 23°C (350 psi at 73°F) or as approved by ULC
 - .4 Integral bell, push-on type joints
- 2.6 **PIPE AND FITTINGS - DRAINAGE SYSTEMS**
- .1 Cast Iron Soil Pipe
 - .1 Pipe and fittings
 - .1 Cast iron soil pipe: To CAN/CSA-B70-M
 - .2 Plain end pipe and fittings
-

- .2 Joints
 - .1 Bell and spigot, with lead and oakum joints
 - .2 NPS 8 and smaller: Neoprene sleeves with stainless steel gear type clamps, where approved by local authorities
 - .2 Acid Resistant Cast Iron Soil Pipe
 - .1 Pipe and fittings
 - .1 High silicon alloy acid resistant cast iron
 - .2 Sleeve couplings: Inner Teflon sleeve, outer neoprene sleeve and two bolt stainless steel sleeve clamp
 - .3 Bell and spigot joints, with acid proof rope packing and lead
 - .4 (Split flange joints with flange bolts) (Bell and spigot joints)
 - .5 (Gaskets for split flange joints: 1.6 mm thick, Garlock style 3000 with nitrile binder or equivalent asbestos-free material manufactured by Anchor)
 - .3 PVC Soil Pipe
 - .1 Pipe - below grade - sanitary and storm drainage
 - .1 All sizes: To CAN/CSA-B181.2 "PVC Drain, Waste and Vent Pipe and Pipe Fittings"
 - .2 Bell and spigot ends
 - .3 Rubber ring gaskets with bell
 - .2 Pipe - below grade - storm drainage (alternate)
 - .1 2" to 6": To CSA B182.1-M
 - .2 8" and up: To CSA B182.2-M
 - .3 Bell and spigot ends
 - .4 Rubber ring gaskets with bell
 - .3 Pipe - above grade - sanitary and storm drainage
 - .1 All sizes: To CAN/CSA-B181.2 "PVC Drain, Waste and Vent Pipe and Pipe Fittings"
 - .2 Plain end with solvent weld joints
 - .3 ABS or PVC solvent cement
 - .4 Pipe - above grade - storm drainage (alternate)
 - .1 NPS 2" to 6" ABS: To CSA B182.1-M
 - .2 8" and up: To CSA B182.2-M
-

- .3 Plain end with solvent weld joints
 - .4 ABS or PVC solvent cement
 - .5 Pipe – Concrete Embedded Gravity Drain:
 - .1 Schedule 40 solvent weld rigid PVC drain, waste and vent pipe and fittings in accordance with CSA B181.2.
 - .2 Fittings: PVC injection moulded, solvent weld type ends.
 - .6 Weeping tile (foundation drainage)
 - .1 Perforated PVC BDS solvent. Weld sewer and drain pipe in accordance with CSA B182.1 [or perforated high density polyethylene (HDPE) per ASTM D 3350].
 - .2 Minimum stiffness of 210 kPa at 5% deflection per ASTM D2412.
 - .7 Fire stop seal for combustible pipe
 - .1 Certification: to CAN4-S115-M tested at a pressure differential of 50 Pa (0.007 psi)
 - .2 Fire stop rating: Class F
 - .3 Fire resistance rating: Not less than that of the fire separation being penetrated
 - .8 Acceptable Manufacturers:
 - .1 3M - Ultra Plastic Pipe Device
 - .4 Copper - DWV
 - .1 Pipe
 - .1 Hard drawn copper drainage tube (DWV): To ASTM B306
 - .2 Drainage fittings
 - .1 Wrought copper solder joint: To ANSI B16.29
 - .2 Cast brass solder joint: To CSA B158.1
 - .3 Manufacturer standard heat fusion tool system
 - 2.7 **PIPE AND FITTING – ABOVEGROUND PRESSURIZED DRAIN (PUMP DISCHARGE):**
 - .1 Galvanized steel:
 - .1 NPS 2-1/2 and smaller:
 - .1 Schedule 40 galvanized steel pipe, in accordance with ASTM A53/A53M.
 - .2 Fittings: Malleable iron galvanized, screwed, in accordance with ANSI/ASME B16.3.
 - .3 Joints: Threaded, in accordance with ANSI/ASME B1.20.1.
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- .2 NPS 3 and larger:
 - .1 Schedule 40 galvanized steel pipe, in accordance with ASTM A53/A53M.
 - .2 Fittings:
 - .1 Flanged: Galvanized ductile iron, flanged, in accordance with ANSI/ASME B16.5.
 - .2 Grooved: Rigid grooved coupling, hot-dip galvanized, flush seal gaskets, and roll grooved piping.
 - .1 Victaulic Style 107
 - .2 Anvil Gruvlok, Fig. 7401
 - .3 Shurjoint
 - .3 Gasket: Styrene-Butadiene (SBR) or Ethylene - Propylene Diene Monomer (EPDM). [For oily waste use Nitrile].
 - .2 Copper:
 - .1 NPS 2 1/2 and smaller:
 - .1 Copper Type M hard copper pipe, in accordance with ASTM B88.
 - .2 Fittings: Wrought copper, solder joint, in accordance with ASME B16.29.
 - .1 Solder material: Lead free solder (tin-antimony or tin-silver).
 - .2 NPS 3 and larger:
 - .1 Copper Type M hard copper pipe, in accordance with ASTM B88. Roll grooved.
 - .2 Fittings: Wrought copper roll grooved
 - .3 Couplings: Flush seal gasket.
 - .1 Victaulic Style 606 or 607 Rigid grooved coupling
 - .2 Anvil Gruvlok, Fig 6400
 - .3 Shurjoint
 - .3 Gasket: EPDM. [For oily waste use Nitrile].
 - .3 PVC
 - .1 Schedule 40 solvent weld rigid PVC pressure pipe and fittings in accordance with CSA B 137.3, and ASTM D1785 or ASTM D2241.
 - .2 Fittings: PVC injection molded, solvent weld type ends, and friction fit
- 2.8 **PIPE AND FITTING – BURIED AND COMCRETE EMBEDDED PRESSURIZED DRAIN (PUMP DISCHARGE):**
- .1 PVC
-

- .1 Schedule 40 solvent weld rigid PVC pressure pipe and fittings in accordance with CSA B 137.3, and ASTM D1785 or ASTM D2241.

- .2 Fittings: PVC injection molded, solvent weld type ends, and friction fit

2.9 **VACUUM TRUCK CONNECTION:**

- .1 Above ground: Galvanized steel pipe, in accordance with ASTM A53/53M.

- .1 Fittings:

- .1 Flanged: Galvanized ductile iron, flanged, in accordance with ANSI/ASME B16.5.

- .2 Grooved: Rigid grooved coupling, hot-dip galvanized, flush seal gaskets, and roll grooved piping.

- .3 Couplings:

- .1 Victaulic Style 107 hot-dip galvanized couplings

- .2 Anvil Gruvlok, Fig. 7401

- .3 Shurjoint

- .4 Gasket: Nitrile [SBR or EPDM]

- .2 Buried and Concrete Embedded PVC

- .1 Schedule 40 solvent weld rigid PVC pressure pipe and fittings in accordance with CSA B 137.3, and ASTM D1785 or ASTM D2241.

- .2 Fittings: PVC injection molded, solvent weld type ends, and friction fit.

2.10 **VALVES**

- .1 General

- .1 Gate valves re-packable under pressure, when fully open

- .2 Plug valves packed with lubricant suitable for service

- .3 Globe and check valves provided with composition discs suitable for type of service

- .4 Renewable seats on iron body valves

- .5 Materials

ASTM B62	Bronze valves - gate, globe and check - steam rated 125 and 150 psig
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ASTM B61	Bronze valves - gate, globe and check - steam rated 200 and 350 psig
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ASTM B283 C3770	Brass valves - ball valves
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ASTM A126 Class B	Iron valves - gate, globe and check
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- .6 Markings
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	MSS-SP-25	Steam or WOG (water, oil and gas) rated pressure, manufacturer's trademark, size
.7	End Connections	
	ANSI B2-1	Threaded ends
	ANSI B16.18	Soldered ends
	ANSI B16.10	Face to face dimensions
.8	Testing and Materials	
	MSS-SP-80	Bronze valves, gate, globe and check
	MSS-SP-70	Iron gate valves
	MSS-SP-85	Iron globe valves
	MSS-SP-71	Iron check valves
	MSS-SP-67	Butterfly valves
.2	Gate Valves	
.1	GTV 1	
.1	Class 125 bronze body, threaded ends, solid or split wedge disc, rising stem	
.1	Crane	Fig 428
.2	Jenkins	Fig 990AJ
.3	Nibco	T-111
.4	Toyo Red-White	Fig 293
.5	Kitz	Fig 24
.2	GTV 2	
.1	Class 125 iron body, OS&Y bronze mounted, flanged ends	
.1	Crane	Fig 465 ½
.2	Jenkins	Fig 454J
.3	Nibco	F-617
.4	Toyo Red-White	Fig 421JA
.5	Kitz	Fig 72
.3	GTV 3	
.1	Class 125 bronze body, threaded ends, rising stem, wedge disc, screw-in bonnet	
.1	Crane	Fig 428
.2	Jenkins	Fig 990AJ

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- | | | | |
|----|-------|---|-----------------------|
| | .3 | Nibco | T-111 |
| | .4 | Toyo Red-White | Fig 293 |
| | .5 | Kitz | Fig 24 |
| .4 | GTV 4 | | |
| | .1 | 175 psi working pressure, to AWWA C-500, non-rising stem, iron body, bronze mounted, renewable seat rings, stuffing box and packing gland, mechanical joint ends. Valve box to grade, with guide plate and cover identifying the service. Valves and valve box finish: Two heavy coats of coal tar enamel. Provide one extension key for each valve box installed | |
| | .2 | Valve | |
| | | .1 | MAS W10-A-NL-FF-B-HW |
| | | .2 | Jenkins Fig 2397A |
| | .3 | Box | |
| | | .1 | Bibby VB Series |
| | | .2 | Canada Valve Fig 1322 |
| | | .3 | Mueller Fig A769 |
| .5 | GTV 5 | | |
| | .1 | 175 psi WOG, ULC and FM approved, iron body, bronze mounted, cast iron disc, resilient seat, mechanical joint ends, non-rising stem, square operating nut. Finish: Two heavy coats of coal tar enamel | |
| | | .1 | Clow |
| | | .2 | Mueller Canada |
| | | .3 | MAS W10-A-NL-FF-B-HW |
| .6 | GTV 6 | | |
| | .1 | 175 psi WOG, ULC and FM approved, iron body, bronze mounted, OS&Y, flanged ends | |
| | | .1 | Clow |
| | | .2 | Mueller Canada |
| | | .3 | Nibco F-607 |
| | | .4 | MAS W10-A-RS-FF-B-HW |
| .7 | GTV 7 | | |
| | .1 | Class 125, bronze body, wedge disc, non-rising stem, solder ends | |
| | | .1 | Crane Fig 13240 |
| | | .2 | Jenkins Fig 993AJ |
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	.3	Toyo Red-White	Fig 281
	.4	Kitz	Fig 41
	.5	Nibco	S-113
.8	GTV 13		
	.1	Main stop valve, service box of required length with ribbed cover brought up flush to finished grade or floor, shut-off key	
	.1	Mueller Corporation	
.3	Globe Valves		
	.1	GLV 1	
	.1	Class 125 bronze body, threaded ends, solid or split wedge disc, rising stem	
	.1	Crane	Fig 5TF
	.2	Jenkins	Fig 106BJ
	.3	Nibco	T-211
	.4	Toyo Red-White	Fig 221
	.5	Kitz	Fig 09
.2	GLV 2		
	.1	Class 125 iron body, bronze mounted, yoke bonnet, composition disc, renewable and regrindable bronze set ring, flanged	
	.1	Crane	Fig 351
	.2	Jenkins	Fig 2342J
	.3	Nibco	F-718-B
	.4	Toyo Red-White	Fig 400
	.5	Kitz	Fig 76
.3	GLV 3		
	.1	Class 125 bronze body, composition disc and solder ends	
	.1	Crane	Fig 1310
	.2	Jenkins	Fig 995AJ
	.3	Kitz	Fig 10
	.4	Nibco	S-211-Y

.4 GLV 10

.1 Class 450, maximum 3100 kPa (450 psi) working pressure, 135°C (275°F) maximum temperature rating, bronze body, forged brass wing cap seal, back seating, molded ring packing, forged brass bolted bonnet with bonnet seal, solder ends

.1 Henry Valve Co. Fig 203 – Globe style

.2 Henry Valve Co. Fig 216 – Angle style

.4 Ball Valves

.1 BV 1

.1 Class 150-600 WOG brass body, threaded ends, Teflon ends, Teflon seats, Teflon packing, bronze or chrome plated, solid ball and lever handle with plastic protector, AGA and CGA approved for gas service

.1 Crane Fig F9201

.2 Jenkins Fig 201J

.3 Worchester Econ-O-Mite Fig 4211T

.4 NCI TFP600

.5 NCI TFP601

.6 Neles-Jamesbury Fig 351

.7 Toyo Red-White Fig 5044A

.8 Kitz Fig 58

.9 M.A.S. Fig B-3

.10 Bray Flow-Tek SB5

.2 BV 2

.1 Class 150-600 WOG brass body, soldered ends, Teflon ends, Teflon seats, Teflon packing, bronze or chrome plated, solid ball and lever handle with plastic protector, AGA and CGA approved for gas service

.1 Crane Fig F9202

.2 Jenkins Fig 202J

.3 Worchester Econ-O-Mite Fig 4211

.4 NCI SFP600

.5 NCI SFP601

.6 Neles-Jamesbury Fig 341

.7 Toyo Red-White Fig 5044A or 5049A

.8 Kitz Fig 58 or 59

	.9	Apollo	Fig 77-100 or 77-200
	.10	MAS	Fig B-3 or B-4
	.11	Bray Flow-Tek	Triad SP
.5	Butterfly Valves		
	.1	BFV 1	
	.1	Class 150 full tapped lug type, cast iron body, bronze disc, 304 stainless steel shaft, EPDM seat, notched top plate	
	.2	Lever lock handle for valve sizes NPS 6 and smaller	
	.3	Worm gear operator with handwheel for valves NPS 8 and larger	
	.1	Crane	Fig 44 BXZ
	.2	Keystone	Fig FH12-CBJ-2
	.3	Jenkins	Fig 2232Elj
	.4	Nibco	LD-2000
	.5	Nibco	N-200
	.6	Centerline	Fig 200 Series
	.7	De Zurik	Fig BGS, L1/632
	.8	Victaulic	704Vic 300 MasterSeal and AGS
	.9	Apollo	Fig Series 143
	.10	Bray	Fig 31H-375
	.11	Challenger	Fig 20-CS4E
	.12	Kitz	Fig 6122EL/G
	.13	Toyo	Fig 918BESL/G
	.14	MAS	D-Series #LD4AE
	.2	BFV 2	
	.1	175 psi ULC and FM approved full lug, cast iron body, bronze disc, EPDM seat	
	.2	Lever lock handle for valve sizes NPS 6 and smaller	
	.3	Worm gear operator with handwheel for valves NPS 8 and larger	
	.4	Indicator flag painted "safety yellow" and provision for mounting supervisory switch	
	.1	MAS	W50-A-ED-LL
	.2	Grinnell	

.6 Plug Valves

.1 PV 1

.1 Class 175 WOG rating, lubricated plug valve, semi-steel body, tapered plug, screwed ends, wrench operated

.1 Rockwell-Nordstrom Fig 142

.2 Newman-Milliken Fig 170M

.3 Walworth Fig 1796

.2 PV 2

.1 Class 175 WOG rating, lubricated plug valve, semi-steel body, tapered pug, flat faced flanged ends drilled to 862 Pa (125 lb) ANSI

.2 Valves NPS 6 and less: Manual lever operated

.3 Valves NPS 8 and larger: Worm gear operated

.1 Rockwell-Nordstrom Fig 143

.2 Newman-Milliken Fig 172M

.3 Walworth Fig 1797F

.7 Check Valves

.1 CV 1

.1 Class 125 horizontal swing check valve, bronze body, screwed ends, screwed cap and regrindable bronze disc

.1 Crane Fig 37

.2 Jenkins Fig 996AJ

.3 Grinnell Fig 3300

.4 Nibco T-413

.5 Toyo Red-White Fig 236

.6 Kitz Fig 22

.7 Bray Rite 12CBT

.2 CV 2

.1 Class 125 horizontal check valve, iron body, bronze mounted, flat face flanged ends, renewable and regrindable bronze seat ring and disc

.1 Crane Fig 373

.2 Jenkins Fig 587J

.3 Grinnell Fig 6300A

-
- | | | | |
|--|----|----------------|-------------|
| | .4 | Nibco | F-918 |
| | .5 | Toyo Red-White | Fig 435JA |
| | .6 | Victaulic | Series 715 |
| | .7 | Gestra | "CB" Series |
| | .8 | Kitz | Fig 78 |
| | .9 | Bray Rite | 12CBT |
- .3 CV 3
- .1 Class 125 wafer type non-slam check valve, cast iron body, bronze plates and Buna-N seals
- .2 Install between two flat faced flanges as specified for piping NPS 4 and larger
- | | | |
|-----|---------------|--------------------|
| .1 | Mission Valve | "Duo-Chek" |
| .2 | Ritepro | "Check Rite" |
| .3 | Gestra | "RK" Series |
| .4 | Crane | Fig R-1-66-4-F-1-X |
| .5 | Centerline | 800 Series |
| .6 | Grinnell | Fig 300 |
| .7 | Jenkins | Fig R-1-66-4-F-1-X |
| .8 | Nibco | W-920-W |
| .9 | Mueller Steam | 71-AHH-3-H |
| .10 | Bray Rite | D15DBZ |
- .4 CV 4
- .1 Class 125 horizontal swing check, bronze body, screwed ends, screwed cap and regrindable bronze disc
- | | | |
|----|----------------|------------|
| .1 | Crane | Fig 37 |
| .2 | Jenkins | Fig 4092J |
| .3 | Grinnell | Fig 3300 |
| .4 | Nibco | S-413 |
| .5 | Toyo Red-White | Fig 236 |
| .6 | Victaulic | Series 712 |
| .7 | Kitz | Fig 22 |
-

- .5 CV 5
 - .1 Class 125 ULC and FM approved for 1200 Pa (175 psig) WOG, iron body, bronze mounted, horizontal swing check, bolted cap, flanged ends
 - .2 For above ground or in valve pit
 - .1 Clow
 - .2 Bray Rite 212ULC/FM
 - .3 MAS W30 Series
- .6 CV 19
 - .1 Class 450, 3100 kPa (450 psi) working pressure, 150°C (300°F) maximum temperature rating, floating piston, Teflon seat disc, bronze body, solder ends.
 - .1 Henry Valve Co. Fig 205.

3 Execution

3.1 **TRENCHING, BEDDING AND BACKFILL**

- .1 General
 - .1 Extent:
 - .1 For buried services inside building and to 1.5 m outside building wall.
 - .2 Trench depth:
 - .1 To 75 mm(150 mm) below the correct elevation and slope established for the bottom of the pipe.
 - .3 Bedding:
 - .1 Refill the bottom elevation of the trench with hand-placed bedding materials.
 - .2 Thoroughly compact to the approval of the Consultant.
 - .3 At pipe hubs or couplings, remove bedding in the bottom of the trench as necessary to provide for even and constant support for each length of pipe.
 - .4 Shoring:
 - .1 Provide adequate shoring, bracing and sheeting in pipe trenches.
 - .2 Place barriers and temporary crossings as necessary to ensure support, safety and protection at all times.
 - .5 Unstable soil conditions:
 - .1 When encountered, advise the Consultant.

- .2 Excavate pipe trenches to a depth as directed by the Consultant and then backfill to the correct grade with bedding material.
- .6 Backfill:
 - .1 Where joints occur, do not backfill until joint testing is approved by Consultant.
 - .2 Hand place backfill to 300 mm above the top of the pipe in 100 mm layers taking particular care to place and compact the backfill simultaneously on both sides of the pipe.
 - .3 From 300 mm above the top of the pipe backfill in 150 mm layers and mechanically compact.
- .7 Keep excavations dry at all times.
- .8 Compaction:
 - .1 Mechanically tamp and thoroughly compact each layer of new granular bedding and backfill material to 95 percent Modified Proctor Density.
- .9 In fill areas, allow a minimum clearance of 100 mm on all sides of the pipe passing under or through building grade beams to prevent possible damage from settling of building. If a greater settlement can be expected, increase the clearance to prevent possible damage.
- .10 Remove and dispose of excess excavated material off-site.

3.2

GENERAL PIPING CONSTRUCTION METHODS

- .1 General
 - .1 Standards:
 - .1 To ANSI sections B31.1 to B31.9 as applicable to service, unless specified otherwise herein.
 - .2 Do not use soldered joints in compressed air piping.
 - .2 Inserts, sleeves and anchors:
 - .1 Avoid unnecessary cutting of masonry.
 - .2 Supply inserts, sleeves and anchors to other trades for building in as the Work proceeds.
 - .3 Arrange with other trades to leave openings, slots and chases to accommodate later installation of mechanical Work.
 - .3 Inspect pipe and fittings for soundness and clean off all dirt and other foreign matter immediately prior to installation.
 - .1 Reject all damaged items.
 - .4 Pipe layout:
 - .1 Install piping in the most direct, straight and functional manner possible.

- .2 Except where otherwise shown, install all vertical lines plumb, and run horizontal lines parallel to building walls.
 - .3 Install piping close to walls, partitions and ceilings.
 - .4 On multiple runs of piping, space piping to allow for installation of insulation and for proper servicing of valves.
 - .5 Conceal piping in finished areas and rooms within walls or ceilings, and in furred spaces elsewhere.
 - .1 Provide access doors or panels as hereinafter specified for access to concealed piping specialties, etc.
 - .2 Expansion and Contraction
 - .1 Installation:
 - .1 Install all piping free from strain and distortion due to expansion and contraction: to section 6, Chapter 3 of ANSI B31.1, except as hereinafter modified.
 - .2 Allow for expansion and contraction by offsets, expansion U-bends or loops.
 - .3 Expansion joints of any type will not be allowed unless specifically indicated on the Drawings or specified under another section of this division for a particular installation.
 - .2 Expansion/contraction allowance criteria:
 - .1 Steel pipe: 25 mm movement per 30 m of pipe.
 - .2 Brass and copper pipe: 38 mm movement per 30 m of pipe
 - .3 Temperature difference: for each 55°C (100°F) temperature difference from 21°C (70°F) ambient.
 - .4 Fabricate expansion bends in steel pipe from pipe sections and long radius welding elbows.
 - .3 Swing and swivel joints:
 - .1 On steam or hot water heating piping for connections from mains to risers and from risers to radiation and other heating units.
 - .2 Use at least five fittings from main to riser including tee in main.
 - .3 Use at least four fittings from riser to heating unit including tee in riser.
 - .3 Lines, Grades and Slopes
 - .1 Install piping in conformity with elevations and grades indicated on the Drawings using axis lines and bench marks provided under general construction.
 - .1 Verify such axis lines and bench marks.
 - .2 Lay out Work and be responsible for lines, elevations, measurements, etc., required for installation of the Work.
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- .2 Slopes:
 - .1 Slope piping drains and sewers as indicated on the Drawings.
 - .2 Install so that slope between elevations shown on the Drawings is even and constant.
 - .3 Install liquid and air lines free of pockets and pitch to drain at low points in the line with valves or traps installed as required for drainage of the lines.
 - .3 Minimum slopes:
 - .1 As shown on Drawings; if not shown, then as follows.
 - .2 Drainage piping, NPS 3 and less: 1:50.
 - .3 Drainage piping, NPS 4 and larger: 1:100.
 - .1 In special circumstances as provided for under the codes and regulations and the express approval of the Consultant, drains of NPS 4 size and larger may be laid at a lesser slope.
 - .4 Domestic water lines: pitch to low points so that all lines may be completely drained.
 - .5 Hot water heating, chilled water and condenser water lines: Slope up 1:500 in direction of flow.
 - .4 Where pipe slope causes pipe to rise to top of ceiling space, or fall to bottom of structural members, ceiling space or defined service space, provide risers as follows:
 - .1 Domestic water lines: Provide drain valve at bottom of low point, and Provide riser to increase elevation of piping.
 - .2 Hot water heating, chilled water and condenser water lines: Provide automatic air vent, complete with drainage piping, at high point, Provide drain valve at bottom of low point and Provide riser to lower elevation of pipes.
 - .3 Natural gas: Provide a drip pocket with capped end, drain valve and Provide riser to increase elevation of piping. Pocket depth to be the greater of: 75 mm deep or equal to diameter of pipe. Pocket diameter to be the lesser of: NPS 2 or gas main pipe diameter.
 - .4 Immersion Wells and Sensing Bulbs
 - .1 Fitting size:
 - .1 Pipe size NPS 2½ size and less: Increase pipe length for 300 mm to minimum one pipe size larger to maintain equivalent unobstructed cross sectional area.
 - .2 Pack immersion wells in piping for liquids up to a temperature of 150°C (300°F) with a mineral type grease prior to installation of sensing bulb.
-

.5 Piping Connections to Mains

- .1 Make branch connections to respective horizontal piping of larger diameter to the upper quadrant of the larger pipe.
- .2 Water piping:
 - .1 Make down feed piping connections to horizontal supply and return mains to the bottom quadrant of the mains.

3.3 **SYSTEM REQUIREMENTS**

.1 Plumbing

- .1 Install complete plumbing, drainage and vent piping for washrooms, etc, in accordance with the Ontario Building Code.
- .2 Size vent lines based on developed pipe length and hydraulic load.
- .3 Arrange piping within pipe spaces behind washroom fixtures to allow unimpeded access to piping for servicing.

.2 Gas Piping - Buried - Cathodic Protection

- .1 Isolate buried piping between two buildings at both ends with dielectric unions or flanges.
- .2 Protect piping by at least one 1 kg magnesium sacrificial anode every 30 m of run, welded to the buried gas pipe, to manufacturer's installation instructions.
- .3 Provide dielectric unions on piping NPS 2½ and less and dielectric flanges on piping NPS 3 and larger.

.3 Copper Pipe - Type L

- .1 Provide dielectric unions or couplings at all connections between copper tubing and ferrous piping.

.4 Copper Pipe - Buried

- .1 Provide dielectric unions at connection between cast iron or ductile iron water main and copper tubing.
- .2 When required by municipal authority, provide 900 mm long copper gooseneck after corporation stop at connection to water main. Connection at water main to be at forty-five degrees and gooseneck to have minimum 160 mm radius bend.

.5 Refrigerant Piping

- .1 Install piping to conform to applicable requirements of ANSI B31.5 Code for Pressure Piping Section 5 "Refrigeration Piping" and CSA B52-M "Mechanical Refrigeration Code" latest issue.
 - .2 Make solder type joints with "sil-fos" silver solder or similar high melting point solder having a melting point of at least 538°C (1000°F). Remove all interior parts of refrigerant specialties and valves before applying heat to the joint.
-

- .3 Provide refrigerant hoses on refrigerant line connections to equipment with reciprocating or rotating elements.
 - .4 Test procedure and evacuation procedures: Conform to ANSI B31.5.
 - .5 Test pressure: In accordance with CSA Code B52-M.
 - .6 Provide all refrigerant required for testing and charging of the system.
 - .7 Purge refrigerant piping with anhydrous nitrogen prior to making connection to pre-evacuated equipment to ensure removal of all moisture and non-condensable gases.
 - .8 Completely evacuate to 0.5 torr (500 micron), seal and leave for twenty-four hours, re-evacuate to 0.5 torr, and charge all components of refrigeration system not evacuated by manufacturer, in accordance with manufacturer's printed recommendations.
 - .9 Do not use the refrigeration compressor to evacuate the system under any circumstances. Evacuation the system using a vacuum pump at an ambient temperature not less than 2°C (35°F) to ensure removal of all moisture and non-condensable gases.
 - .10 After testing, evacuation and charging is completed, allow system to operate under normal conditions for a minimum period of twenty-four hours, at which time, moisture indicator should indicate a dry system. If it does not so indicate, change dryer and operate unit for another twenty-four hours. Repeat this procedure until moisture indicator indicates a thoroughly dry system.
- .6 PVC - Buried - Pressure and Drainage Piping
- .1 Provide a tracer wire directly over PVC pipe.
- .7 PVC Drainage, Waste and Vent Piping
- .1 Below grade: Install in accordance with CSA B182.11 and manufacturer's recommendations.
 - .2 Above grade: Install in accordance with CSA B181.11 and B181.12 and manufacturer's recommendations.
 - .3 Provide fire stop seals on all fire separation penetrations, except at connections through concrete floor slabs to non-combustible water closets.
 - .4 Do not use combustible piping in return air ceiling plenums or vertical riser shafts.
- .8 Polypropylene - Laboratory Drainage
- .1 Make heat fusion joints in accordance with manufacturer's written instructions.
- .9 Polyethylene - Laboratory Drainage
- .1 Make heat fusion joints in accordance with manufacturer's written instructions.
- .10 Borosilicate Glass - Beaded End
- .1 Install and support piping system to manufacturer's written instructions.
-

- .2 Provide pipe hangers with padding material between hanger and glass pipe.
 - .11 Borosilicate Glass - Plain End
 - .1 Install and support piping system to manufacturer's written instructions.
 - .2 Provide pipe hangers with padding material between hanger and glass pipe.
 - 3.4 **SLEEVES**
 - .1 Installation Requirements
 - .1 Provide where piping passes through foundations, above grade floors and walls.
 - .2 Materials
 - .1 Schedule 40 black steel pipe or type "K" copper tubing for installation in foundations or floors
 - .2 1 mm (20 gauge) galvanized sheet steel where installed in above grade walls.
 - .3 Terminate sleeves flush with finished ceilings, walls and floors on grade.
 - .1 For piping passing through floors above grade extend sleeve a minimum of 75 mm above the floor.
 - .4 Sleeve sizes
 - .1 Large enough to pass full thickness of pipe covering where same is used.
 - .2 With sufficient clearance between pipe/insulation and sleeve to allow for any lateral movement of piping due to expansion and contraction.
 - .5 Assume responsibility for the setting of all sleeves necessary for this Work in masonry walls during construction or in concrete forms before concrete is poured.
 - .6 Coat exterior surface of all sleeves of ferrous material with a heavy asphalt emulsion.
 - .2 Foundation Sleeves
 - .1 For pipes entering structures from below grade, seal the annular space between sleeve and pipe with prefabricated seals.
 - .3 Firestopping
 - .1 Provide firestopping on pipes passing through firewalls, fire separation walls or through walls, partitions or floors which are considered as serving as firestops.
 - .1 Provide at partitions around washrooms.
 - .2 Seal the space around the pipe, in the sleeve, in accordance with Section 23 05 01 and Section 07 84 00.
-

- .4 Pipe Sleeves Through Roofs
 - .1 Supplied and installed under other Contracts or under roofing section, unless specifically shown otherwise on the Drawings.
 - .5 Future Services
 - .1 Fill sleeves for future use with lime mortar.
 - .6 Escutcheon Plates
 - .1 Place escutcheon plates on bare piping passing through finished walls or floors.
- 3.5 **JOINTS, UNIONS, FLANGES AND FITTINGS**
- .1 Pipe Joints
 - .1 Preparation
 - .1 Ream pipe ends and thoroughly clean all dirt, cuttings and foreign matter from pipe after cutting and threading.
 - .2 Thoroughly clean all fittings, valves and equipment before connections are made.
 - .3 Cut copper tubing with a tube cutter and clean the joining surfaces of the tubing and fitting with fine emery cloth. Wipe clean with a dry cloth.
 - .2 Cast iron pipe sleeve joints
 - .1 For cast iron plain end soil pipe, install sleeve type couplings such as Titan Foundry Type MJ, or Bibby MJ Series 2000 in strict accordance with manufacturer's printed instructions.
 - .3 Cast iron bell and spigot joints
 - .1 Make joints either neoprene compression type preformed gaskets such as Bibby "Bi-seal", and caulk in such a manner to produce a permanently tight joint.
 - .2 Cold caulking compound in cord form such as W.R. Meadows PC4 may also be used.
 - .3 Assemble preformed neoprene gaskets to manufacturer's printed instructions.
 - .4 Mechanical joints:
 - .1 Assemble mechanical joint on ductile iron pressure pipe with cast iron gland, rubber sealing gasket and high strength malleable iron bolts in accordance with the manufacturer's recommendations.
 - .5 Soldered joints:
 - .1 Make soldered joints on copper tubing in accordance with the following usage:
-

Service	Solder Type
Domestic hot and cold water	95/5 with matching flux
Drainage, waste, vent	50/50 with matching flux
Compressed air service	"Sil-Fos" silver solder or brazed

- .2 Do not use core type solder.
 - .6 Threaded joints:
 - .1 Use Teflon tape or Masters metallic compound with the compound applied to the male threads only and particular care taken to prevent the compound from reaching the interior of the pipe or fittings.
 - .7 Carbon steel welded joints:
 - .1 To ANSI B31.1 Section IX for welding.
 - .2 Fusion welded joints made by electric arc welding, gas metal arc welding, or oxy-acetylene gas welding.
 - .3 Ensure that supervisory staff, fitters and welders are fully conversant with the requirements laid down by that standard prior to the commencement of welding.
 - .4 Employ qualified welders holding a current up-to-date provincial certificate for the process and rating involved as required by the provincial regulations.
 - .5 Unless more stringent methods of inspections are specified the Consultant will visually inspect welded joints for fusion of metal, icicles, alignment, etc.
 - .1 Remove any defects and remake the joint to his satisfaction.
 - .6 For welding of materials other than carbon steel, conform to the requirements specified in the relevant section of the Specification.
 - .8 Grooved end piping systems:
 - .1 Install couplings, fittings, etc. in accordance with manufacturer's printed instructions.
 - .2 Unions and Flanges
 - .1 Provide unions or flanges in the following locations:
 - .1 For by-passes around equipment or control valves or devices in piping systems.
 - .2 At connection to steam traps and in by-passes around traps.
 - .3 At connections to equipment. Locate between shut-off valve and equipment.
 - .4 In screwed or solder joint drainage tubing at inlet side of trap.
 - .2 If unions are concealed in walls, partitions or ceilings, build access thereto.
-

- .3 Provide dielectric unions or isolating type companion flanges at all connections between copper tubing and ferrous piping.
 - .1 Brass body valves between ferrous piping and copper tubing is acceptable as a dielectric union.
 - .4 Flange joints
 - .1 Assemble joints with appropriate flanges, gaskets and bolting.
 - .2 Allow clearance between flange faces such that the connections can be gasketed and bolted tight without undue strain on the piping system, with flange faces parallel and bores concentric.
 - .3 Centre gaskets on the flange faces so as not to project into the bore.
 - .4 Lubricate bolts before assembly and provide two hardened steel washers under the head of each unit to assure uniform bolt stressing.
 - .5 Machine off raised face flanges when joining to a flat companion flange and use a full face gasket.
 - .6 Follow gasket manufacturer's instructions for correct bolting procedure.
 - .7 Use calibrated torque wrench and tighten bolts in recommended sequence in four equal steps to required final torque value.
 - .3 Fittings
 - .1 Couplings
 - .1 Minimize couplings on runs of pipes.
 - .2 Do not use running couplings in any pipeline.
 - .3 NPS 2 and smaller: Threaded coupling.
 - .4 NPS 2½ and larger: Welded joints.
 - .2 Fittings and ancillary items installed in systems operating at pressures in excess of 103 kPa (15 psig):
 - .1 Register in accordance with CSA B51-M.
 - .3 Eccentric reducer fittings
 - .1 To provide proper drainage or venting of the lines.
 - .2 At change of pipe sizes.
 - .3 At connections to equipment and control valves.
 - .4 Do not use bushings.
 - .4 Tee connections in welded piping
 - .1 Factory fabricated standard butt weld fittings.
 - .2 Bonney Forge "Weldolets", "Thredolets" or "Sockolets".
-

- .3 Mitering, notching or direct welding of branches to mains is not permitted.
- .5 Change of direction
 - .1 Use standard pipe fittings.
 - .2 Use long radius welded steel elbows unless short radius elbows are specifically authorized by the Consultant.
 - .3 Mitered joints or field fabricated pipe bends are not permitted.
- .6 Tees, copper tubing
 - .1 Direct connection of branch into main using "T-Drill" method may be used where allowed by the code, in lieu of manufactured tee fittings.

3.6

VALVES

- .1 Installation
 - .1 General
 - .1 Wherever possible, source valves from one manufacturer.
 - .2 Where required
 - .1 At locations shown on the Drawings.
 - .2 At all piping connections to equipment.
 - .3 At all connections to control valves or control devices.
 - .4 Where required for sectionalizing a system or floor.
 - .5 Check valves wherever required to ensure flow of liquid in one direction.
 - .3 Type
 - .1 Shut-off service: Gate, butterfly type, and ball (quarter-turn).
 - .2 Throttling service: Double regulating, globe or plug type for throttling purposes.
 - .4 Drain valves
 - .1 Hose thread outlet connection or valve with long nipple on outlet at all low points of each water system and above all riser or branch stop valves for proper drainage of lines.
 - .5 Valve chains
 - .1 Provide chain wheel operators and operating chain for valves located more than 2 m above floor or walkway.
 - .2 Provide chain of sufficient length to extend to within 2 m of operating platform or floor for free hanging chains, or to within 1.5 m of floor in locations where chain can be secured to wall or column. Secure chain to wall or column with a wall hook.

- .3 Chain wheels using rustproof chain complete with guide and of size recommended by valve manufacturer for proper operation of valve.

3.7 **INSPECTION AND TESTING**

.1 Pressure Leak Testing

- .1 Make specified pressure tests on all piping included in this Contract.
- .2 Furnish all pumps, compressors, gauges and connectors necessary for the tests.
- .3 Test sections as authorized by Consultant to accommodate construction schedule. However, test complete systems on completion of Work.
- .4 Conduct tests in the presence of:
 - .1 Consultant
 - .2 Personnel of governing authorities having jurisdiction
- .5 Notify above personnel in ample time to permit them to be present.
- .6 Conduct tests before piping is painted, covered or concealed.
- .7 Disconnect pumps or compressors used for applying the test pressure, during the test period.
- .8 Disconnect and/or remove equipment or specialties not designed to withstand the test pressure during the test and reconnect same after completion of test.
- .9 Promptly correct any defects that develop through tests and re-test to the complete satisfaction of the Consultant and other parties involved.
- .10 Forward copies of all final tests on all pressure and drainage piping and a copy of governing authority approvals to the Consultant immediately on acceptance of tests and/or approvals.
- .11 Final payment for the Work will not be made until the above has been received.

.2 Hydrostatic Tests

- .1 Conduct tests for a minimum period of two hours, or longer when requested by the Consultant or governing authority at the test pressure specified under the respective section of the Specifications.
- .2 Test requirements:
 - .1 Pressure to remain constant over test period to a pressure of one and one-half times the operating pressure but not to exceed the material pressure class rating.
 - .2 Exterior surfaces of pipe or fittings free of cracks or other form of leak.
 - .3 Tests to be performed at a constant ambient temperature.

.3 Pneumatic Tests

- .1 Initially pressurize the system with air to approximately one-half the specified operating pressure but not to exceed 345 kPa (50 psig).

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- .1 Examine joints for leaks with a soapsuds solution.
 - .2 Repair leaks as detected.
 - .3 Repeat test and repairs until soap test passes.
 - .2 Provide a final pressure test on the system with air to the test pressure specified under the respective section of the Specifications.
 - .4 Natural and Propane Gas Piping
 - .1 Conduct final tests in accordance with the requirements of the local utility or governing authority.
 - .2 If feasible, make tests when ambient air temperature is approximately constant.
 - .1 Corrections for pressure change due to temperature differential shall be allowed as approved by the Consultant.
 - .5 Drainage and Potable Water Testing
 - .1 Test drainage piping and potable water piping in accordance with requirements of the Ontario Building Code, latest edition, and any additional requirements of applicable local by-laws.
 - .6 Specific Test Requirements
 - .1 Test the following services with compressed air or inert gas at one and one-half times the working pressure, but in no event less than 345 kPa (50 psig).
 - .1 Natural gas piping
 - .2 Vacuum piping
- 3.8 **PRE-OPERATIONAL CLEANING**
- .1 Temporary Connections
 - .1 Make temporary cross-overs, blank-off equipment connections, install drain and fill lines for circulating cleaning fluid through piping.
 - .2 Flushing of Piping Systems
 - .1 Flush water piping with water flowing at a velocity of not less than 1.8 m/sec, for a period of fifteen minutes or longer as required to remove all dirt, scale, and cuttings from the entire length of the piping.
 - .2 Thoroughly clean, prior to fabrication, sections of new piping which cannot be isolated for flushing purposes.
 - .3 Thoroughly clean, insofar as possible, welded joints by swabbing interior of pipe with swabs soaked with a caustic solution.
 - .4 Flush stainless steel piping with water as described above, then immediately flush with design Product fluid. Do not leave city water or chlorinated water in piping.
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.3 Chilled Water, Condenser Water, Glycol and Heating Water Systems

- .1 Clean systems with neutral pH, non-chromate chemical cleaner to remove sludge oil and debris. Use cleansing compound at rate of 10 kg per 5000 litres of water in system.
- .2 Circulate cleaner for seventy-two hours at room temperature then drain and refill with water and inhibitor.
- .3 Circulate inhibitor treated water for an additional six hours and drain.
- .4 Refill each system with working fluid and add chemicals to provide protection against corrosion.
- .5 Recirculate fluid for four hours and test samples from system for iron content. Drain, refill, and add chemicals so that total iron content in system is less than 1 ppm. (When iron content of glycol system is satisfactory, add glycol to achieve design concentration.)

3.9 **PIPING SYSTEMS STANDARDS**

.1 Abbreviations

- .1 The Mechanical Pipe Standards (MPS) include the following abbreviations:

End Treatment		Material	
B&S	Bell and Spigot	ARCI	Acid Resisting Cast Iron
BDE	Beaded End	CB	Cast Bronze
BE	Beveled End	CBR	Cast Brass
BW	Butt Weld	CGI	Cast Grey Iron
CJ	Compression Joint	CI	Cast Iron
FE	Flange End	CK	Copper type "K" soft annealed
GE	Groove or Rolled End	CL	Copper Type "L" hard drawn
HFJ	Heat Fusion Joint	CS	Carbon Steel
LUG	Full Tapped Lug	CTSL	Cast Steel
MJ	Mechanical Joint	Cu	Copper
PE	Plain End	DWV	DWV Copper
SJ	Solder Joint	FS	Forged Steel
SO	Slip On	Galv	Galvanized
SW	Socket Weld	MI	Malleable Iron
SWJ	Solvent Weld Joint	PET	Polyethylene
TE	Threaded End	PPE	Polypropylene
WFR	Wafer	PVC	PVC
WN	Weld Neck	SMS	Semi-Steel
		SS	Stainless Steel
		TBS	Tempered Borosilicate Glass
		WC	Wrought Copper

.2 Mechanical Pipe Standards

- .1 The following piping system standards are bound at the end of this section.

2000	
2060	Industrial Vacuum - Copper
3000	
3010	Fire Protection - Buried - 4" and Larger - Ductile Iron
3011	Fire Protection - Carbon Steel - Threaded, Cut Groove
3012	Fire Protection - Galvanized Steel (FM - Note 4) - Threaded, Cut Groove
3021	Fire Protection - Industrial - Carbon Steel - Welded, Roll Groove
3022	Fire Protection - Commercial - Carbon Steel - Welded, Roll Groove
3023	Fire Protection - Galvanized Steel (FM - Note 4) - Welded, Roll Groove
3031	Fire Protection - Buried - Ductile Iron
4000	
4011	Drainage and Vent - Buried - Cast Iron
4012	Drainage and Vent - Buried - PVC
4020	Pumped Sanitary - Pumped Storm - Above Ground
4031	Sanitary Drainage and Vent - Above Ground - DWV and Cast Iron
4032	Sanitary Drainage and Vent - Above Ground - PVC
4041	Storm Drainage - Above Ground - Steel - Drainage Fittings
4042	Storm Drainage - Above Ground - Steel - Grooved
4043	Storm Drainage - Above Ground - Cast Iron
4044	Storm Drainage - Above Ground - PVC
4052	Process Drain and Vent - Buried - PVC
4053	Process Drain and Vent - Above Ground - Cast Iron
4054	Process Drain and Vent - Above Ground - PVC
4055	Process Drain and Vent - Above Ground - Acid Resistant
4056	Process Wastewater Piping - Above & Below Ground - FRP
4100	
4111	City Water - Buried - Copper
4112	City Water - Buried - Polyethylene
4113	City Water - Buried - Ductile Iron
4114	City Water - Buried - PVC
4130	Domestic Water - Above Ground - Copper
5000	
5011	Service Water - Carbon Steel - Threaded and Welded
5012	Service Water - Carbon Steel - Threaded and Grooved End
5013	Service Water - Carbon Steel - Socket Weld and Welded
5014	Service Water - Carbon Steel - Socket Weld and Grooved End
5015	Service Water - Copper
5021	Service Water - Carbon Steel - Buried
5022	Service Water - Copper - Buried
5200	
5211	Natural Gas - Buried - Carbon Steel
5212	Natural Gas - Buried - Polyethylene

5221	Natural Gas - Above Grade - Steel
5222	Natural Gas - Above Grade - Steel - Socket Weld
5240	Fuel Oil - Above Grade - Socket Weld and Welded
6000	
6020	Refrigerant

End of Section

Item	Size	End Treatment	Mat'l	ASTM		ANSI (CSA)	Schedule Class	Remarks	Line Reference	Service
				Spec	Grade					
Pipe	3" & DN	PE	CL	B88						
Fittings	3" & DN	SJ	WC					Note 2		
Flanges										
Unions	3" & DN	SJ	CB					Note 1		
Couplings	3" & DN							Note 1		

Item	Size	End Treatment	Mat'l	Stem	Type	Approvals	Schedule Class	Remarks
Gate	3" & DN	SJ	CB		GTV 10		125	
Globe	2" & DN	CJ	CB		GLV 6		125	
Needle	2" & DN	CJ	SBR		NV 1		3000	
Butterfly								
Ball	3" & DN	SJ	SBR		BV 8		3000	
Check	3" & DN	SJ	CBR		CV 9		125	
Strainers								

Notes		IBI Group	
1. Dielectric unions or couplings at connections to ferrous pipe or equipment 2. Sil-Fos solder	PIPING SPECIFICATION		Maximum Temperature 180°F
	Industrial Vacuum Copper		Maximum Pressure 125
	Revised	5/30/00	Checked PS
	Rev:	1	Appr'd PS
MPS-2060			

Item	Size	End Treatment	Mat'l	ASTM		AWWA (CSA)	Schedule , Class	Remarks
				Spec	Grade			
Pipe	4" & UP	MJ	DI			C150, C151,	250	Note 2, 3
	4" & UP	B&S	DI			C111, C104	250	Note 2, 3
Fittings	4" & UP	MJ	CGI			C110	250	Note 2, 3
	4" & UP	MJ	DI			C110	250	Note 2, 3
Flanges								
Unions								
Couplings								

Item	Size	End Treatment	Mat'L	Stem	Type	Approvals	Schedule Class	Remarks
Gate	4 & UP	FE	CI		GTV 4	AWWA C-500	175	
Globe								
Angle								
Butterfly								
Ball								
Check								
Strainers								

Line Reference	Service
F	Fire Main

Notes		IBI Group	
1. For buried piping within building and up to 5' (1.5m) from building 2. Cement mortar lined 3. Wrap pipe with polyethylene to AWWA C105 4. Provide adaptors for connection to buried PVC fire main		PIPING SPECIFICATION	
		Maximum Temperature 100°F	
		Maximum Pressure 175 PSIG	
		MPS-3010	
		Revised 6/10/2002	Checked RW
		Rev: 1	Appr'd CD

Item	Size	End Treatment	Mat'l	ASTM		ANSI (CSA)	Schedule Class	Remarks
				Spec	Grade			
Pipe	2 1/2" & DN	PE,BE	CS	A53	B		40	
	3" <> 6"	GE	CS	A53	B		40	
	8" & UP	GE	CS	A53	B		30	
Fittings	2 1/2" & DN	SE	MI	A197	A	B16.3	150	
	1 1/4" <> 8"	GE	DI	A536	654512		175	
Flanges	10" & DN	SO, WN	CI	A126	A	B16.1	125	
	12" & UP	SO, WN	CS	A181	II	B16.5	150	
Unions								
Couplings								

Item	Size	End Treatment	Mat'l	Stem	Type	Approvals	Schedule Class	Remarks
Gate	14" & DN	MJ	CI	OS&Y	GTV 5	ULC/FM	175	
	14" & DN	FE	CB		GTV 6	ULC/FM	175	
Globe	3" & DN	SE	CB		GLV 1	ULC/FM	150	
Angle								
Butterfly	12" & DN	Lug	CI		BFV 2	ULC/FM	175	
Ball								
Check	12" & DN	FE	CI		CV 5	ULC/FM	125	
Strainers								

Line Reference	Service
F SP SPR FP	Combined Fire Mains Standpipe Sprinklers Fire Pump (discharge) Fire Pump (test line) Fire Pump (relief line)

Notes			
1. Fire protection systems designed for 175 psig working pressure 2. Threaded joints usually used for smaller size piping (less than 2 1/2")			
IBI Group PIPING SPECIFICATION Fire Protection Carbon Steel Threaded, Cut Groove		Maximum Temperature 250°F Maximum Pressure 175 PSIG	MPS-3011
Revised	6/29/01	Checked PS	
Rev:	3	Appr'd PS	

Item	Size	End Treatment	Mat'l	ASTM		ANSI (CSA)	Schedule Class	Remarks
				Spec	Grade			
Pipe	2 1/2" & DN	PE,BE	CS	A795			40	Note 3
	3" <> 6"	GE	CS	A795			40	Note 3
	8" & UP	GE	CS	A795			30	Note 3
Fittings	2 1/2" & DN	SE	MI	A197	A	B16.3	150	
	1 1/4" <> 8"	GE	DI	A536	654512		175	
Flanges	10" & DN	SO, WN	CI	A126	A	B16.1	125	
	12" & UP	SO, WN	CS	A181	II	B16.5	150	
Unions								
Couplings								

Item	Size	End Treatment	Mat'l	Stem	Type	Approvals	Schedule Class	Remarks
Gate	14" & DN	MJ	CI	OS&Y	GTV 5	ULC/FM	175	
	14" & DN	FE	CB		GTV 6	ULC/FM	175	
Globe	3" & DN	SE	CB		GLV 1	ULC/FM	150	
Angle								
Butterfly	12" & DN	Lug	CI		BFV 2	ULC/FM	175	
Ball								
Check	12" & DN	FE	CI		CV 5	ULC/FM	125	
Strainers								

Line Reference	Service
F SP SPR FP	Combined Fire Mains Standpipe Sprinklers Fire Pump (suction)

Notes			
1. Fire protection systems designed for 175 psig working pressure 2. Threaded joints usually used for smaller size piping (less than 2 1/2") 3. Galvanized piping 4. For Factory Mutual approved Dry Valve and Pre-Action systems only, and Fire Pump suction lines			
IBI Group PIPING SPECIFICATION Fire Protection Galvanized Steel (FM - Note 4) Threaded, Cut Groove		Maximum Temperature 250°F Maximum Pressure 175 PSIG	MPS-3012
Revised	7/7/03	Checked PS	
Rev:	3	Appr'd PS	

Item	Size	End Treatment	Mat'l	ASTM		ANSI (CSA)	Schedule Class	Remarks
				Spec	Grade			
Pipe	2 1/2" & UP	GE	CS	A53	B		NFPA-13	Note 2
	2 1/2" & UP	BE	CS	A53	B		NFPA-13	Note 2, 3
Fittings	2 1/2" & UP	GE	DI	A536	654512		175	
	2 1/2" & UP	BW	CS	A234	WPB	B16.9	150	Note 3
Flanges	2 1/2" & UP	GE	MI	A47	32510		125	
	4" & UP	WN,SO	FS	A181	1	B16.5	150	Note 3
Unions								
Couplings			MI					CSA B242-M

Item	Size	End Treatment	Mat'l	ASTM	ANSI	Approvals	Schedule Class	Remarks
Gate	14" & DN	MJ	CI	OS&Y	GTV 5	ULC/FM	175	
	14" & DN	FE	CB		GTV 6	ULC/FM	175	
Globe	3" & DN	SE	CB		GLV 1	ULC/FM	150	
Angle								
Butterfly	12" & DN	Lug	CI		BFV 2	ULC/FM	175	
Ball								
Check	12" & DN	FE	CI		CV 5	ULC/FM	125	
Strainers								

Line Reference	Service
F SP SPR	Combined Fire Mains Standpipe Sprinklers

Notes			
1. Fire protection systems designed for 175 psig working pressure 2. Risers to be Schedule 40 between floor level and first horizontal main 3. Shop welded assemblies only			
<div> <div> IBI Group PIPING SPECIFICATION Fire Protection - Industrial Carbon Steel Welded, Roll Groove </div> <div> Maximum Temperature 250°F Maximum Pressure 175 PSIG </div> </div>			
Revised	7/7/03	Checked	PS
Rev:	2	Appr'd	PS
MPS-3021			

Item	Size	End Treatment	Mat'l	ASTM		ANSI (CSA)	Schedule Class	Remarks
				Spec	Grade			
Pipe	2 1/2" & UP	GE	CS	A53	B		NFPA-13	
	2 1/2" & UP	BE	CS	A53	B		NFPA-13	Note 2
Fittings	2 1/2" & UP	GE	DI	A536	654512		175	
	2 1/2" & UP	BW	CS	A234	WPB	B16.9	150	Note 2
Flanges	2 1/2" & UP	GE	MI	A47	32510		125	
	4" & UP	WN,SO	FS	A181	1	B16.5	150	Note 2
Unions								
Couplings			MI					CSA B242-M

Item	Size	End Treatment	Mat'l	ASTM	ANSI	Approvals	Schedule Class	Remarks
Gate	14" & DN	MJ	CI	OS&Y	GTV 5	ULC/FM	175	
	14" & DN	FE	CB		GTV 6	ULC/FM	175	
Globe	3" & DN	SE	CB		GLV 1	ULC/FM	150	
Angle								
Butterfly	12" & DN	Lug	CI		BFV 2	ULC/FM	175	
Ball								
Check	12" & DN	FE	CI		CV 5	ULC/FM	125	
Strainers								

Line Reference	Service
F SP SPR	Combined Fire Mains Standpipe Sprinklers

Notes			
1. Fire protection systems designed for 175 psig working pressure 2. Shop welded assemblies only			
IBI Group PIPING SPECIFICATION Fire Protection - Commercial Carbon Steel Welded, Roll Groove		Maximum Temperature 250°F Maximum Pressure 175 PSIG	MPS-3022
Revised	7/7/03	Checked PS	
Rev:	2	Appr'd PS	

Item	Size	End Treatment	Mat'l	ASTM		ANSI (CSA)	Schedule Class	Remarks
				Spec	Grade			
Pipe	2 1/2" & DN	PE,BE	CS	A795			NFPA-13	Note 3
	3" <> 6"	GE	CS	A795			NFPA-13	Note 3
	8" & UP	GE	CS	A795			NFPA-13	Note 3
Fittings	2 1/2" & DN	SE	MI	A197	A	B16.3	150	
	1 1/4" <> 8"	GE	DI	A536	654512		175	
Flanges	10" & DN	SO, WN	CI	A126	A	B16.1	125	
	12" & UP	SO, WN	CS	A181	II	B16.5	150	
Unions								
Couplings								

Item	Size	End Treatment	Mat'l	Stem	Type	Approvals	Schedule Class	Remarks
Gate	14" & DN	MJ	CI	OS&Y	GTV 5	ULC/FM	175	
	14" & DN	FE	CB		GTV 6	ULC/FM	175	
Globe	3" & DN	SE	CB		GLV 1	ULC/FM	150	
Angle								
Butterfly	12" & DN	Lug	CI		BFV 2	ULC/FM	175	
Ball								
Check	12" & DN	FE	CI		CV 5	ULC/FM	125	
Strainers								

Line Reference	Service
F SP SPR	Combined Fire Mains Standpipe Sprinklers

Notes			
1. Fire protection systems designed for 175 psig working pressure 2. Threaded joints usually used for smaller size piping (less than 2 1/2") 3. Galvanized piping 4. For Factory Mutual approved Dry Valve and Pre-Action systems only			
IBI Group PIPING SPECIFICATION Fire Protection Galvanized Steel (FM - Note 4) Welded, Roll Groove		Maximum Temperature 250°F	MPS-3023
Revised 7/7/03 Checked PS		Maximum Pressure 175 PSIG	
Rev: 2 Appr'd PS			

Item	Size	End Treatment	Mat'l	ASTM		AWWA (CSA)	Schedule Class	Remarks
				Spec	Grade			
Pipe	4" & UP	MJ	DI			C150, C151, C111, C104	250	Note 2, 3
	4" & UP	B&S	DI				250	Note 2, 3
Fittings	4" & UP	MJ	CGI			C110	250	Note 2, 3
	4" & UP	MJ	DI			C110	250	Note 2, 3
Flanges								Note 4
Unions								
Couplings								

Item	Size	End Treatment	Mat'l	Stem	Type	Approvals	Schedule Class	Remarks
Gate	4 & UP	FE	CI		GTV 4	AWWA C-500	175	
Globe								
Angle								
Butterfly								
Ball								
Check								
Strainers								

Line Reference	Service
F	Fire Mains (Buried)

Notes			
1. For buried piping within building, and up to 5' (1.5m) from building 2. Cement mortar lined 3. Wrap pipe with polyethylene to AWWA C105 4. Provide mating flange/adaptor to suit site service piping			
IBI Group PIPING SPECIFICATION Fire Protection Buried Ductile Iron		Maximum Temperature 250°F Maximum Pressure 175 PSIG	MPS-3031
Revised	4/17/01	Checked PS	
Rev:	0	Appr'd CD	

Item	Size	End Treatment	Mat'l	ASTM		ANSI (CSA)	Schedule Class	Remarks
				Spec	Grade			
Pipe	8" & DN	PE	CI			B70-M		Note 1, 2
	10" & UP	PE	CI			B70-M		Note 3
Fittings	8" & DN	PE	CI			B70-M		Note 1, 2
	10" & UP	PE	CI			B70-M		Note 3
Unions								
Couplings								

Item	Size	End Treatment	Mat'l	Stem	Type	Approvals	Schedule Class	Remarks
Gate								
Globe								
Angle								
Butterfly								
Ball								
Check								
Strainers								

Line Reference	Service
SAN ST	Sanitary Storm

Notes				IBI Group			
1. Rubber ring gaskets integral with bell 2. Neoprene sleeve and stainless steel gear type clamp (MJ joint) 3. Lead and oakum joints 4. For buried piping within building, and up to 5' (1.5m) from building				PIPING SPECIFICATION		Maximum Temperature 140°F	
				Drainage and Vent Buried Cast Iron		Maximum Pressure -	
				Revised	6/28/2000	Checked	PS
				Rev:	1	Appr'd	CD
				MPS-4011			

Item	Size	End Treatment	Mat'l	ASTM		ANSI (CSA)	Schedule Class	Remarks
				Spec	Grade			
Pipe	6" & DN	B&S	PVC			(B181.2-M)		Note 2, 3, 4
	8" & UP	B&S	PVC			(B181.2-M)		Note 2, 3, 4
Fittings	6" & DN	B&S	PVC			(B181.2-M)		Note 2, 3, 4
	8" & UP	B&S	PVC			(B181.2-M)		Note 2, 3, 4
Unions								
Couplings								

Item	Size	End Treatment	Mat'l	Stem	Type	Approvals	Schedule Class	Remarks
Gate								
Globe								
Angle								
Butterfly								
Ball								
Check								
Strainers								

Line Reference	Service
SAN ST	Sanitary Storm

Notes				IBI Group			
1. For buried piping within building, and up to 5' (1.5m) from building 2. Rubber ring gaskets integral with bell 3. Install in accordance with CSA B182.11 and manufacturers literature 4. Alternate for storm drainage: CSA B182.1-M in PVC				PIPING SPECIFICATION		Maximum Temperature 140°F	
				Drainage and Vent Buried PVC		Maximum Pressure -	
				Revised	1/10/2003	Checked	PS
				Rev:	2	Appr'd	CD
				MPS-4012			

Item	Size	End Treatment	Mat'l	ASTM		ANSI (CSA)	Schedule Class	Remarks
				Spec	Grade			
Pipe	3" & DN	PE	Galv CS	A53	B		40	
Fittings	3" & DN	SE	Galv MI	A197		B16.3	150	
	3" & DN	FE	Galv CI	A126	A	B16.1	125	
Flanges	2" & DN	FE	Galv CI	A126	A	B16.1	125	
Unions	3" & DN	SE	Galv MI	A197		B2.1	150	Brass to Iron
								ground joint

Item	Size	End Treatment	Mat'l	ASTM	ANSI	Spec Type	Schedule Class	Remarks
Gate	3" & DN	SE	CB	Rising	GTV 1		125	
Globe								
Angle								
Butterfly								
Ball								
Check	3" & DN	SE	CI		CV 3		125	Non-slam
Strainers								

Line Reference	Service
PSW PST	Pumped Sanitary Pumped Storm

Notes	
1. Gaskets: 1/16" (1.6 mm) red rubber, full face type	
<div> <div> <div>IBI Group</div> <div> <div>PIPING SPECIFICATION</div> <div> <div>Pumped Sanitary</div> <div>Pumped Storm</div> <div>Above Ground</div> </div> </div> <div> <div>Maximum Temperature</div> <div>140°F</div> <div>Maximum Pressure</div> <div>-</div> </div> </div> <div> <div>Revised 6/29/2000</div> <div>Checked PS</div> </div> <div> <div>Rev: 1</div> <div>Appr'd CD</div> </div> </div>	
<div>MPS-4020</div>	

Item	Size	End Treatment	Mat'l	ASTM		ANSI (CSA)	Schedule Class	Remarks
				Spec	Grade			
Pipe	3" & DN	PE	DWV	B306				
	4" & UP	PE	CI			B70-M		Note 1
Fittings	3" & DN	SJ	WC/CBR	B16.29		B16.29 (B158.1)		
	4" & UP	MJ	CI			B70-M		Note 1
Unions								

Item	Size	End Treatment	Mat'l	ASTM	ANSI	Spec Type	Schedule Class	Remarks
Gate								
Globe								
Angle								
Butterfly								
Ball								
Check								
Strainers								

Line Reference	Service
SAN	Sanitary Sanitary Vent

Notes	
1. Neoprene sleeves with stainless steel gear type clamps (MJ joints)	IBI Group PIPING SPECIFICATION Sanitary Drainage and Vent Above Ground DWV and Cast Iron
	Maximum Temperature 140°F
	Maximum Pressure -
	MPS-4031
	Revised 6/29/2000 Checked PS Rev: 1 Appr'd CD

Item	Size	End Treatment	Mat'l	ASTM		ANSI (CSA)	Schedule Class	Remarks	Line Reference	Service
				Spec	Grade					
Pipe	6" & DN	PE	PVC			(B181.2-M)				
	8" & UP	PE	PVC			(B181.2-M)				
Fittings	6" & DN	SWJ	PVC			(B181.2-M)		Note 1		
	8" & UP	SWJ	PVC			(B181.2-M)				
Unions										
Item	Size	End Treatment	Mat'l	ASTM	ANSI	Spec Type	Schedule Class	Remarks		
Gate										
Globe										
Angle										
Butterfly										
Ball										
Check										
Strainers										

Notes				IBI Group			
1. Solvent cement to CSA B181.11				PIPING SPECIFICATION		Maximum Temperature 140°F	
				Sanitary Drainage and Vent Above Ground PVC		Maximum Pressure -	
				Revised	1/10/2003	Checked	PS
				Rev:	2	Appr'd	CD
				MPS-4032			

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Item	Size	End Treatment	Mat'l	ASTM		ANSI (CSA)	Schedule Class	Remarks
				Spec	Grade			
Pipe	18" & DN	B&S	PVC			(B181.2-M)		
Fittings	18" & DN	SWJ	PVC			(B181.2-M)		Note 2
Flanges								
Unions								
Couplings								

Item	Size	End Treatment	Mat'l	ASTM	ANSI	Spec Type	Schedule Class	Remarks
Gate								
Globe								
Angle								
Butterfly								
Ball								
Check								
Strainers								

Line Reference	Service
PW	Process Waste Process Vent

Notes			
1. For buried piping within building, and up to 5' (1.5m) from building 2. Solvent welding as per manufacturer's recommendations			
IBI Group PIPING SPECIFICATION Process Drain and Vent Buried PVC		Maximum Temperature 140°F Maximum Pressure	MPS-4052
Revised	1/10/2003	Checked PS	
Rev:	2	Appr'd CD	

Item	Size	End Treatment	Mat'l	ASTM		ANSI (CSA)	Schedule Class	Remarks
				Spec	Grade			
Pipe	8" & UP	PE	CI			(B70-M)		
Fittings	8" & UP	MJ	CI			(B70-M)		Note 2
Flanges								
Unions								
Couplings								

Item	Size	End Treatment	Mat'l	ASTM	ANSI	Spec Type	Schedule Class	Remarks
Gate								
Globe								
Angle								
Butterfly								
Ball								
Check								
Strainers								

Line Reference	Service
PW	Process Waste Process Vent

Notes	
2. Neoprene sleeve and stainless steel gear type clamp (MJ joint)	IBI Group PIPING SPECIFICATION Process Drain and Vent Above Ground Cast Iron
	<div>Maximum Temperature 140°F</div> <div>Maximum Pressure</div>
	MPS-4053
	Revised 6/29/2000 Checked PS Rev: 1 Appr'd CD

Item	Size	End Treatment	Mat'l	ASTM		ANSI (CSA)	Schedule Class	Remarks
				Spec	Grade			
Pipe	6" & DN	PE	PVC			(B181.2-M)		Note 1
Fittings	6" & DN	SWJ	PVC			(B181.2-M)		Note 1
Flanges	6" & DN	SWJ	PVC				125	Note 2
Unions								
Couplings								

Item	Size	End Treatment	Mat'l	ASTM	ANSI	Spec Type	Schedule Class	Remarks
Gate								
Globe								
Angle								
Butterfly								
Ball								
Check								
Strainers								

Line Reference	Service
PW	Process Waste Process Vent

Notes			
1. Solvent welding as per manufacturer's recommendations 2. Flanges finished and drilled to ANSI standard			
IBI Group PIPING SPECIFICATION Process Drain and Vent Above Ground PVC		Maximum Temperature 140°F Maximum Pressure	MPS-4054
Revised	1/10/2003	Checked PS	
Rev:	2	Appr'd CD	

Item	Size	End Treatment	Mat'l	ASTM		ANSI (CSA)	Schedule Class	Remarks
				Spec	Grade			
Pipe	All	BE	ARCI					
	All	BE	ARCI					
Fittings	All	FE	ARCI					
Flanges	All	WN	ARCI					Note 2, 3,
Unions								
Couplings	All	MJ	ARCI					Note 1

Item	Size	End Treatment	Mat'l	ASTM	ANSI	Spec Type	Schedule Class	Remarks
Gate								
Globe								
Angle								
Butterfly								
Ball								
Check								
Strainers								

Line Reference	Service
PW	Process Waste Process Vent

Notes				IBI Group			
1. Inner Teflon sleeve, neoprene outer sleeve and two bolt stainless steel sleeve clamp 2. Flanges finished and drilled to ANSI standard 3. Split flange style				PIPING SPECIFICATION		Maximum Temperature 140°F	
				Process Drain and Vent Above Ground Acid Resistant		Maximum Pressure	
				Revised	6/29/2000	Checked	PS
				Rev:	1	Appr'd	CD
				MPS-4055			

Item	Size	End Treatment	Mat'l	ASTM		ANSI (CSA)	Schedule Class	Remarks
				Spec	Grade			
Pipe	18" & DN	B&S	FRP	D2996				
Fittings	18" & DN	B&S	FRP					
Flanges						B16.5		
Unions								
Couplings								

Item	Size	End Treatment	Mat'l	ASTM	ANSI	Spec Type	Schedule Class	Remarks
Gate								
Globe								
Plug								
Butterfly	4" & UP	FE	DI			BFV 5	150	
Ball	3" & DN	FE	SS			BV 12	150	
Check	18" & DN	WFR	SS			CV 18	150	
Strainers								

Line Reference	Service
IW	Industrial Waste
EDW	Industrial Waste

Notes	
	IBI Group PIPING SPECIFICATION Process Wastewater Piping Above & Below Ground FRP
	Maximum Temperature 225°F
	Maximum Pressure 150°F
	MPS-4056
	Revised 5/13/2003 Checked Rev: 0 Appr'd

Item	Size	End Treatment	Mat'l	ASTM		ANSI (CSA)	Schedule Class	Remarks
				Spec	Grade			
Pipe	2" & DN	PE	CK	B88				
Fittings	2" & DN	SJ	WC					
Flanges								
Unions								
Couplings								

Item	Size	End Treatment	Mat'l	Stem	Type	Approvals	Schedule Class	Remarks
Gate								
Globe								
Angle								
Butterfly								
Ball								
Check								
Strainers								

Line Reference	Service
CW	City Water

Notes			
1. For buried piping within building, and up to 5' (1.5m) from building			
IBI Group PIPING SPECIFICATION City Water Buried Copper		Maximum Temperature 74°F Maximum Pressure 150 PSIG	
Revised	6/29/2000	Checked	PS
Rev:	1	Appr'd	CD
MPS-4111			

Item	Size	End Treatment	Mat'l	ASTM		ANSI (CSA)	Schedule Class	Remarks
				Spec	Grade			
Pipe	2" & DN	PE	PET			(B137.1-M)		Note 2
Fittings	2" & DN	MJ-I	Nylon	D2609				
Flanges								
Unions								
Couplings								

Item	Size	End Treatment	Mat'l	Stem	Type	Approvals	Schedule Class	Remarks
Gate								
Globe								
Angle								
Butterfly								
Ball								
Check								
Strainers								

Line Reference	Service
CW	City Water

Notes			
1. For buried piping within building, and up to 5' (1.5m) from building 2. Inside smooth finish free of imperfections including grooves and ripples			
		IBI Group PIPING SPECIFICATION City Water Buried Polyethylene	Maximum Temperature 74°F Maximum Pressure 160 <div>MPS-4112</div>
Revised	6/29/2000	Checked	PS
Rev:	1	Appr'd	CD

Item	Size	End Treatment	Mat'l	ASTM		AWWA (CSA)	Schedule Class	Remarks
				Spec	Grade			
Pipe	4" & UP	MJ	DI			C150, C151, C111, C104	250	Note 2, 3
	4" & UP	B&S	DI				250	Note 2, 3
Fittings	4" & UP	MJ	CGI			C110	250	Note 2, 3
	4" & UP	MJ	DI			C110	250	Note 2, 3
Flanges								
Unions								
Couplings								

Item	Size	End Treatment	Mat'l	Stem	Type	Approvals	Schedule Class	Remarks
Gate	4 & UP	FE	CI		GTV 4	AWWA C-500	175	
Globe								
Angle								
Butterfly								
Ball								
Check								
Strainers								

Line Reference	Service
CW	City Water

Notes			
1. For buried piping within building, and up to 5' (1.5m) from building 2. Cement mortar lined 3. Wrap pipe with polyethylene to AWWA C105			
IBI Group PIPING SPECIFICATION City Water Buried Ductile Iron		Maximum Temperature 74°F Maximum Pressure 150 PSIG	MPS-4113
Revised	11/1/2000	Checked PS	
Rev:	2	Appr'd CD	

Item	Size	End Treatment	Mat'l	ASTM		ANSI (CSA)	Schedule Class	Remarks
				Spec	Grade			
Pipe	4" & UP	B&S	PVC	D1784		(CAN3-B137.3-M)	150	AWWA C-900
Fittings	4" & UP	MJ	CGI DI				250	AWWA C110 Note 2, 3
Flanges								
Unions								
Couplings								

Item	Size	End Treatment	Mat'l	Stem	Type	Approvals	Schedule Class	Remarks
Gate	4 & UP	FE	CI		GTV 4	AWWA C-500	175	
Globe								
Angle								
Butterfly								
Ball								
Check								
Strainers								

Line Reference	Service
CW	City Water

Notes				IBI Group			
1. For buried piping within building, and up to 5' (1.5m) from building 2. Tar coated outside, cement mortar lined to AWWA C104 3. Wrapped with a polyethylene encasement to AWWA C105				PIPING SPECIFICATION		Maximum Temperature 74°F	
				City Water Buried PVC		Maximum Pressure 150 PSIG	
				Revised	6/29/2000	Checked	PS
				Rev:	1	Appr'd	CD
				MPS-4114			

Item	Size	End Treatment	Mat'l	ASTM		ANSI (CSA)	Schedule Class	Remarks	Line Reference	Service
				Spec	Grade					
Pipe	3" & DN	PE	CL	B88						
	4" & UP	GE	Cu, CB	B42, B43				Seamless		
Fittings	3" & DN	SJ	WC							
	4" to 8"	GE	Cu, CB							
Flanges										
	4" to 8"	GE	CB,CBR			16.24				
Unions	3" & DN	SJ, SE	CB							
Couplings	4" to 8"	GE	MI	A47	32510 35018			Note 1		

Item	Size	End Treatment	Mat'l	Stem	Type	Approvals	Schedule Class	Remarks
Gate	3" & DN	SE	CB	Rising	GTV 1		125	
	3" & DN	SJ	CB		GTV 7		125	
	4" & UP	FE	CI	OS&Y	GTV 2		125	
Globe	2" & DN	SJ	SB	Rising	GLV 3		125	
	3" & UP	FE	CI		GLV 2		125	
Angle								
Butterfly								
	4" & UP	LUG	CI		BFV 1		150	
Ball	3" & DN	SJ	CB		BV 2		150	
Check	3" & DN	SE/SJ	CB		CV 1		125	
	4" & UP	FE	CI		CV 2		125	
Strainers								

Notes						IBI Group			
1. Copper plated malleable iron couplings						PIPING SPECIFICATION			Maximum Temperature 180°F
						Domestic Water Above Ground Copper			Maximum Pressure 125
									MPS-4130
						Revised	9/14/2000	Checked PS	
						Rev:	2	Appr'd CD	

Item	Size	End Treatment	Mat'l	ASTM		ANSI (CSA)	Schedule Class	Remarks
				Spec	Grade			
Pipe	2 1/2" & DN	PE	CS	A53	B		40	
	3" to 10"	GE	CS	A53	B	(B242-M)	40	Note 6
	12" & UP	GE	CS	A53	B	(B242-M)	30	
Fittings	2 1/2" & DN	SE	MI	A197		B2.1	150	
	3" to 10"	GE	MI	A47	32510	(B242-M)		
					35018			
	12" & UP	GE	CS	A234		(B242-M)	30	
Flanges	3" & UP	GE	MI	A47	32510			Hinged, two piece
Unions	2 1/2" & DN	SE	MI	A197		B2.1	150	Note 3
Plugs	2 1/2" & DN	SE	CS	A105	2		3000	Note 4
Couplings	3" & UP	GE	MI	A47	32510 35018	B242-M	150	Note 7,8

Item	Size	End Treatment	Mat'l	Stem	Type	Approvals	Schedule Class	Remarks
Gate	2 1/2" & DN	SE	CB	Rising	GTV 3		125	
	3" & UP	FE	CI	OS&Y	GTV 2		125	
Globe	2 1/2" & DN	SE	CB		GLV 1		150	
	3" & UP	FE	CI		GLV 2		125	
Plug	2 1/2" & DN	SE	SMS		PV 1		175	Lubricated
	3" & UP	FE	SMS		PV 2		175	Lubricated
Butterfly								
	3" & UP	LUG	CI		BFV 1		150	
Ball	2 1/2" & DN	SE	CB		BV 1		150	
Check	2 1/2" & DN	SE	CB		CV 4		125	
	2 1/2" & DN	WFR	CI		CV 3		125	Non Slam
	3" & UP	FE	CI		CV 2		125	

Line Reference	Service
WWS / R	Welding Water
CHWS / R	Chilled Water
CWS / R	Condenser Water
PCHWS / R	Process Cooling Water
HS / R	Constant Temp Heating
HST / R	Scheduled Heating
GHS / R	Glycol Heating
GCS / R	Glycol Cooling
HCS / R	Combined Heat/Cool

Notes				IBI Group			
1. Piping to conform to ASME B31.9 2. Minimum operating temperature: -20°F 3. Brass to iron ground joint 4. Machined from solid steel or forged 5. Raised face, slip-on or weld neck for steel-to-steel flanges 6. Flat face for connection to cast iron valves				PIPING SPECIFICATION		Maximum Temperature 250°F	
				Service Water Carbon Steel Threaded and Grooved End		Maximum Pressure 150 PSIG	
				Revised	4/9/2001	Checked	PS
				Rev:	3	Appr'd	CD
				MPS-5012			

Item	Size	End Treatment	Mat'l	ASTM		ANSI (CSA)	Schedule Class	Remarks
				Spec	Grade			
Pipe	2 1/2" & DN	PE	CS	A53	B		40	
	3" to 10"	BE	CS	A53	B		40	
	12" & UP	BE	CS	A53	B		30	
Fittings	2 1/2" & DN	SW	FS	A105	2	B16.11	2000	
	3" to 10"	BW	CS	A234	WPB	B16.9		Seamless
Flanges								
	3" & UP	WN,SO	FS	A181	1	B16.5	150	Note 5, 6
Unions	2 1/2" & DN	SE	MI	A197		B2.1	150	Note 3, 7
Plugs	2 1/2" & DN	SE	CS	A105	2		3000	Note 4, 7

Item	Size	End Treatment	Mat'l	Stem	Type	Approvals	Schedule Class	Remarks
Gate	2 1/2" & DN	SE	CB	Rising	GTV 3		125	
	3" & UP	FE	CI	OS&Y	GTV 2		125	
Globe	2 1/2" & DN	SE	CB		GLV 1		150	
	3" & UP	FE	CI		GLV 2		125	
Plug	2 1/2" & DN	SE	SMS		PV 1		175	Lubricated
	3" & UP	FE	SMS		PV 2		175	Lubricated
Butterfly								
	3" & UP	LUG	CI		BFV 1		150	
Ball	2 1/2" & DN	SE	CB		BV 1		150	
Check	2 1/2" & DN	SE	CB		CV 4		125	
	2 1/2" & DN	WFR	CI		CV 3		125	Non Slam
	3" & UP	FE	CI		CV 2		125	
Strainers								

Line Reference	Service
WWS / R	Welding Water
CHWS / R	Chilled Water
CWS / R	Condenser Water
PCHWS / R	Process Cooling Water
HS / R	Constant Temp Heating
HST / R	Scheduled Heating
GHS / R	Glycol Heating
GCS / R	Glycol Cooling
HCS / R	Combined Heat/Cool

Notes				IBI Group			
1. Piping to conform to ASME B31.9 2. Minimum operating temperature: -20°F 3. Brass to iron ground joint 4. Machined from solid steel or forged 5. Raised face, slip-on or weld neck for steel-to-steel flanges 6. Flat face for connection to cast iron valves 7. Backseal weld threaded unions, plugs, etc				PIPING SPECIFICATION		Maximum Temperature 250°F	
				Service Water Carbon Steel Socket Weld and Welded		Maximum Pressure 150 PSIG	
				Revised	4/9/2001	Checked	PS
				Rev:	3	Appr'd	CD
				MPS-5013			

Item	Size	End Treatment	Mat'l	ASTM		ANSI (CSA)	Schedule Class	Remarks
				Spec	Grade			
Pipe	2 1/2" & DN	PE	CS	A53	B		40	
	3" to 10"	GE	CS	A53	B	(B242-M)	40	Note 6
	12" & UP	GE	CS	A53	B	(B242-M)	30	
Fittings	2 1/2" & DN	SW	FS	A105	2	B16.11	2000	
	3" to 10"	GE	MI	A47	32510	(B242-M)		
					35018			
	12" & UP	GE	CS	A234		(B242-M)	30	
Flanges	3" & UP	GE	MI	A47	32510			Hinged, two piece
Unions	2 1/2" & DN	SE	MI	A197		B2.1	150	Note 3, 7
Plugs	2 1/2" & DN	SE	CS	A105	2		3000	Note 4, 7
Couplings	3" & UP	GE	MI	A47	32510	B242-M	150	
					35018			

Item	Size	End Treatment	Mat'l	Stem	Type	Approvals	Schedule Class	Remarks
Gate	2 1/2" & DN	SE	CB	Rising	GTV 4		125	
	3" & UP	FE	CI	OS&Y	GTV 2		125	
Globe	2 1/2" & DN	SE	CB		GLV 1		150	
	3" & UP	FE	CI		GLV 2		125	
Plug	2 1/2" & DN	SE	SMS		PV 1		175	Lubricated
	3" & UP	FE	SMS		PV 2		175	Lubricated
Butterfly								
	3" & UP	LUG	CI		BFV 1		150	
Ball	2 1/2" & DN	SE	CB		BV 1		150	
Check	2 1/2" & DN	SE	CB		CV 4		125	
	2 1/2" & DN	WFR	CI		CV 3		125	Non Slam
	3" & UP	FE	CI		CV 2		125	

Line Reference	Service
WWS / R	Welding Water
CHWS / R	Chilled Water
CWS / R	Condenser Water
PCHWS / R	Process Cooling Water
HS / R	Constant Temp Heating
HST / R	Scheduled Heating
GHS / R	Glycol Heating
GCS / R	Glycol Cooling
HCS / R	Combined Heat/Cool

Notes			
1. Piping to conform to ASME B31.9 2. Minimum operating temperature: -20°F 3. Brass to iron ground joint 4. Machined from solid steel or forged 5. Raised face, slip-on or weld neck for steel-to-steel flanges 6. Flat face for connection to cast iron valves 7. Backseal weld threaded unions, plugs, etc			
IBI Group PIPING SPECIFICATION Service Water Carbon Steel Socket Weld and Grooved End			Maximum Temperature 250°F
Revised 4/9/2001 Checked PS Rev: 3 Appr'd CD			Maximum Pressure 150 PSIG
			MPS-5014

Item	Size	End Treatment	Mat'l	ASTM		ANSI (CSA)	Schedule Class	Remarks
				Spec	Grade			
Pipe	3" & DN	PE	CL	B88				
Fittings	3" & DN	SJ	WC					
Flanges								
Unions	3" & DN	SJ	CB					Note 2

Item	Size	End Treatment	Mat'l	Stem	Type	Approvals	Schedule Class	Remarks
Gate	3" & DN	SE	CB	Rising	GTV 1		125	
	2" & DN	SJ	CB		GTV 7		125	
	4" & UP	FE	CI	OS&Y	GTV 2		125	
Globe	3" & DN	SE	CB		GLV 1		150	
	2" & DN	SJ	CB	Rising	GLV 3		125	
	4" & UP	FE	CI		GLV 2		125	
Plug	3" & DN	SE	SMS		PV 1		175	Lubricated
	4" & UP	FE	SMS		PV 2		175	Lubricated
Butterfly								
	4" & UP	LUG	CI		BFV 1		150	
Ball	2" & DN	SJ	CBR		BV 2		150	
Check	3" & DN	SE	CB		CV 1		125	
	3" & DN	WFR	CI		CV 3		125	Non Slam
	4" & UP	FE	CI		CV 2		125	
Strainers								

Line Reference	Service
CHWS, CHWR	Chilled Water
HS, HR	Constant Temp Heating
HTS, HTR	Scheduled Heating
GHS, GHR	Glycol Heating
GCS, GCR	Glycol Cooling
HCS, HCR	Heating/Cooling

Notes				IBI Group			
1. Piping to conform to ASME B31.9 2. Ground joint, with either solder joint or screwed ends 3. Optional material spec for final connections to unitary equipment, unit heaters, etc				PIPING SPECIFICATION		Maximum Temperature 250°F	
				Service Water Copper		Maximum Pressure 125 PSIG	
				Revised	6/29/2000	Checked	PS
				Rev:	1	Appr'd	CD
				MPS-5015			

Item	Size	End Treatment	Mat'l	ASTM		ANSI (CSA)	Schedule Class	Remarks
				Spec	Grade			
Pipe	2 1/2" & DN	PE	CS	A53	B		40	Note 8
	3" to 10"	BE	CS	A53	B		40	Note 8
	12" & UP	BE	CS	A53	B		30	Note 8
Fittings	2 1/2" & DN	SW	FS	A105	2	B16.11	2000	
	3" & UP	BW	CS	A234	WPB	B16.9		Seamless
Flanges								
	3" & UP	WN,SO	FS	A181	1	B16.5	150	Note 5, 6
Unions	2 1/2" & DN	SE	MI	A197		B2.1	150	Note 3, 7
Plugs	2 1/2" & DN	SE	CS	A105	2		3000	Note 4, 7

Item	Size	End Treatment	Mat'l	ASTM	ANSI	Spec Type	Schedule Class	Remarks
Gate	2 1/2" & DN	SE	CB	Rising	GTV 3		125	Located in Pit
	3" & UP	FE	CI	OS&Y	GTV 2		125	Located in Pit
Globe								
Angle								
Butterfly								
	4" & UP	LUG	CI		BFV 1		150	Located in Pit
Ball	3" & DN	SE	CB		BV 1		150	Located in Pit
Check								
Strainers								

Line Reference	Service
WWS / R	Welding Water
CHWS / R	Chilled Water
CWS / R	Condenser Water
PCHWS / R	Process Cooling Water
HS / R	Constant Temp Heating
HST / R	Scheduled Heating
GHS / R	Glycol Heating
GCS / R	Glycol Cooling
HCS / R	Combined Heat/Cool

Notes				IBI Group			
1. Piping to conform to ASME B31.9 2. Minimum operating temperature: -20°F 3. Brass to iron ground joint 4. Machined from solid steel or forged 5. Raised face, slip-on or weld neck for steel-to-steel flanges 6. Flat face for connection to cast iron valves 7. Backseal weld threaded unions, plugs, etc 8. Complete with "Yellow Jacket" polyethylene jacket coating				PIPING SPECIFICATION		Maximum Temperature 250°F	
				Service Water Carbon Steel Buried		Maximum Pressure 150 PSIG	
				Revised	4/9/2001	Checked	PS
				Rev:	3	Appr'd	CD
				MPS-5021			

Item	Size	End Treatment	Mat'l	ASTM		ANSI (CSA)	Schedule Class	Remarks
				Spec	Grade			
Pipe	3" & DN	PE	CK	B88			40	Note 2,3
Fittings								
Flanges								
Unions								
Plugs								

Item	Size	End Treatment	Mat'l	ASTM	ANSI	Spec Type	Schedule Class	Remarks
Gate								
Globe								
Angle								
Butterfly								
Ball								
Check								
Strainers								

Line Reference	Service
HS, HR	Constant Temp Heating
HTS, HTR	Scheduled Heating
GHS, GHR	Glycol Heating
GCS, GCR	Glycol Cooling
HCS, HCR	Heating/Cooling

Notes				IBI Group		
1. Piping to conform to ASME B31.9 2. No joints beneath floor 3. Tubing to be bent using approved tube bender 4. Optional material spec for final connections to unitary equipment, unit heaters, etc				PIPING SPECIFICATION		Maximum Temperature 250°F
				Service Water Copper Buried		Maximum Pressure 125 PSIG
				Revised 6/29/2000	Checked Name	MPS-5022
				Rev: 1	Appr'd	

Item	Size	End Treatment	Mat'l	ASTM		ANSI (CSA)	Schedule Class	Remarks
				Spec	Grade			
Pipe	2 & DN	PE	CS	A53	B		40	Note 1
	2 1/2 & UP	BE	CS	A53	B		40	Note 1
Fittings	2 & DN	SW	FS	A105	2		2000	Note 2
	2 1/2 & UP	BW	CS	A234	B	B16.9	40	Note 2
Flanges								
Unions								
Couplings								

Item	Size	End Treatment	Mat'l	Stem	Type	Approvals	Schedule Class	Remarks
Gate								
Globe								
Angle								
Butterfly								
Ball								
Check								
Strainers								

Line Reference	Service
G CNG	Natural Gas Compressed Natural Gas (125 psi max)

Notes		IBI Group			
1. Shaw "Yellow Jacket", 22 mil thick covering 2. Protect joints and sleeves with Shaw "Shrink Sleeves", refer to Specification	PIPING SPECIFICATION			Maximum Temperature 140°F	
	Natural Gas Buried Carbon Steel			Maximum Pressure -	
				MPS-5211	
	Revised 6/29/2000		Checked	PS	
Rev: 1		Appr'd	CD		

Item	Size	End Treatment	Mat'l	ASTM		ANSI (CSA)	Schedule Class	Remarks
				Spec	Grade			
Pipe	All	PE	PET			(CAN3-B137.4-M)	125	
Fittings	All	SW	PET			(CAN3-B137.4-M)	125	Note 1
Flanges								
Unions								
Couplings								

Item	Size	End Treatment	Mat'l	Stem	Type	Approvals	Schedule Class	Remarks
Gate								
Globe								
Angle								
Butterfly								
Ball								
Check								
Strainers								

Line Reference	Service
G	Natural Gas

Notes	
1. Heat fusion joints	IBI Group
	PIPING SPECIFICATION
	Natural Gas
	Buried
	Polyethylene
Revised 6/29/2000	Checked PS
Rev: 1	Appr'd CD
<div> <div>Maximum Temperature 140°F</div> <div>Maximum Pressure -</div> <div>MPS-5212</div> </div>	

Item	Size	End Treatment	Mat'l	ASTM		ANSI (CSA)	Schedule Class	Remarks
				Spec	Grade			
Pipe	2" & DN	PE	CS	A53	B		40	Note 1
	2 1/2" & UP	BE	CS	A53	B		40	
Fittings	2" & DN	SE	MI	A197		B16.3		Note 1
	2 1/2" & UP	BW	CS	A234	B	B16.9		
Flanges								
	2 1/2" & UP	WN,SO	CS	A181	1	B16.5	150	
Unions	2" & DN	SE	MI				250	
Couplings								

Item	Size	End Treatment	Mat'l	Stem	Type	Approvals	Schedule Class	Remarks
Gate								
Globe								
Plug	3" & DN	SE	SMS		PV 1	CGA, AGA	175	Lubricated, Note 2
	4" & UP	FE	SMS		PV 2	CGA, AGA	175	Lubricated, Note 2
Butterfly								
Ball	2" & DN	SE	CBR		BV 1	CGA, AGA	150	
Check								
Strainers								

Line Reference	Service
G P	Natural Gas Propane

Notes			
1. Use socket weld fittings for piping in "concealed" spaces 2. Use plug valves on gas piping located outdoors			
IBI Group PIPING SPECIFICATION Natural Gas Above Grade Steel		Maximum Temperature 140°F Maximum Pressure -	MPS-5221
Revised	12/5/2002	Checked PS	
Rev:	2	Appr'd CD	

Item	Size	End Treatment	Mat'l	ASTM		ANSI (CSA)	Schedule Class	Remarks	Line Reference	Service
				Spec	Grade					
Pipe	2" & DN	PE	CS	A53	B		40			
	2 1/2" & UP	BE	CS	A53	B		40			
Fittings	2" & DN	SW	FS	A105	2	B16.11	2000			
	2 1/2" & UP	BW	CS	A234	B	B16.9				
Flanges										
	2 1/2" & UP	WN,SO	CS	A181	1	B16.5	150			
Unions	2" & DN	SE	MI				250			
Couplings										
Item	Size	End Treatment	Mat'l	Stem	Type	Approvals	Schedule Class	Remarks		
Gate										
Globe										
Plug	3" & DN	SE	SMS		PV 1	CGA, AGA	175	Lubricated		
	4" & UP	FE	SMS		PV 2	CGA, AGA	175	Lubricated		
Butterfly										
Ball	2" & DN	SE	CBR		BV 1	CGA, AGA	150			
Check										
Strainers										

Notes		IBI Group	
		PIPING SPECIFICATION	
		Maximum Temperature 140°F	
		Maximum Pressure 150	
		MPS-5222	
		Revised 10/16/2000	Checked PS
		Rev: 1	Appr'd CD

Item	Size	End Treatment	Mat'l	ASTM		ANSI (CSA)	Schedule Class	Remarks
				Spec	Grade			
Pipe	2" & DN	PE	CS	A53	B		40	
	2 1/2" & UP	BE	CS	A53	B		40	
Fittings	2" & DN	SW	FS	A105	2	B16.11	2000	Note 1
	2 1/2" & UP	BW	CS	A234	B	B16.9	40	
Flanges								
	2 1/2" & UP	WN,SO	FS	A181	1	B16.5	150	
Unions	2" & DN	SE	MI	A197		B2.1	250	
Couplings								

Item	Size	End Treatment	Mat'l	Stem	Type	Approvals	Schedule Class	Remarks
Gate								
Globe								
Plug	2" & DN	SE	CS		PV 3		150	Non-lubricated
	2 1/2" & UP	FE	CS		PV 3		150	Non-lubricated
Butterfly								
Ball	2" & DN	SE	CS		BV 4		150	
Check	2" & DN	SE	CI		CV 11		150	
	2 1/2" & UP	FE	CI		CV 12		150	
Strainers								

Line Reference	Service
FOS / R	Fuel Oil
FOF	Fuel Oil Fill
FOV	Fuel Oil Vent

Notes	
1. Cast iron fittings will not be accepted	IBI Group
	PIPING SPECIFICATION
	Fuel Oil
	Above Grade
	Socket Weld and Welded
Revised 6/29/2000	Checked PS
Rev: 1	Appr'd CD
<div> <div>Maximum Temperature 140°F</div> <div>Maximum Pressure -</div> <div>MPS-5240</div> </div>	

Item	Size	End Treatment	Mat'l	ASTM		ANSI (CSA)	Schedule Class	Remarks	Line Reference	Service
				Spec	Grade					
Pipe	3/4" & DN	CJ	ACR	B280		B31.5 (B52-M)		Note 1, 3		
	1" & UP	SJ	ACR	B280		B31.5 (B52-M)				
Fittings	3/4" & DN	CJ	CL or CK	B280		B31.5 (B52-M)				
	1" & UP	SJ	CL or CK	B280		B31.5 (B52-M)				
Flanges	All	SJ	FS							
Unions	All	SJ	CBR				500	Note 2		
Couplings										
Item	Size	End Treatment	Mat'l	Stem	Type	Approvals	Schedule Class	Remarks		
Gate										
Globe	All	SJ	CBR	B31.5	GLV 10					
Angle										
Butterfly										
Ball										
Check	All	SJ	CBR	B31.5	CV 19					
Strainers										

Notes				IBI Group			
1. De-oxidize and dehydrate tubing, with ends factory sealed and identified by the manufacturer as being suitable for refrigeration service 2. Brass tail piece adaptor for copper tubing, forged steel flanges, steel bolts, bronze nuts and asbestos-free fibre basket 3. Can be soft annealed or hard drawn to ASTM B280				PIPING SPECIFICATION		Maximum Temperature 300°F	
				Refrigerant		Maximum Pressure 400 PSIG	
				Issue	12/18/2002	Checked	PS
				Rev:	1	Appr'd	CD
				MPS-6020			

- 1 General
 - 1.1 **SUMMARY**
 - .1 Section Includes
 - .1 Labour, Products, equipment and services necessary to complete the Work of this section.
 - 1.2 **SUBMITTALS**
 - .1 Shop Drawings
 - .1 Submit Shop Drawings in accordance with Section 01 33 00.
 - .2 Operation and Maintenance Data
 - .1 Submit printed operation instructions and maintenance data in accordance with Section 01 33 00.
 - 2 Products
 - 2.1 **THERMOMETERS AND PRESSURE GAUGES**
 - .1 General
 - .1 To match existing thermometers and pressure gauges
 - .2 Scale Reading Units
 - .1 Thermometers to read (both Fahrenheit and Celsius) (Fahrenheit) (Celsius) scale.
 - .2 Pressure gauges to read (both psi and kPa) (psi) (kPa) scale.
 - .3 Gauge stems and separable sockets of sufficient length to provide for proper insertion in piping or equipment in which they are installed.
 - .3 Products are identified by model designations from H.O. Trerice Co. and to be used as a guide to establish standard of construction. Comparable Products are acceptable from the following manufacturers:
 - .1 H.O. Trerice Company
 - .2 Dresser Canada Inc. - Ashcroft
 - .3 Weiss
 - .4 Weksler - Baker Instruments
 - .5 Winter's Thermogauges Limited
 - .2 Direct Reading Thermometers
 - .1 Industrial 230 mm scale length, variable angle type, liquid filled, aluminum case
 - .1 H.O. Trerice Company - A400 series
-

- .2 Bi-metal dial type, 125 mm diameter, variable angle, stainless shell type 300 series case and stem with calibration screw.
 - .3 H.O. Trerice Company - B85600 series
 - .3 Remote Reading Thermometers
 - .1 115 mm diameter, liquid filled or gas activated type, braided bronze armour over copper capillary, stainless steel bulb and cast aluminum case for surface mounting.
 - .1 H.O. Trerice Company - Series No. L80300 (liquid filled)
 - .4 Thermometer Wells
 - .1 Provide wells in pipelines as follows:
 - .1 For copper pipe: Brass.
 - .2 For steel pipe: Brass or stainless steel.
 - .5 Conversion Kit
 - .1 Retrofit kit for converting wells of straight liquid filled thermometers to accept bi-metal dial thermometers.
 - .6 Direct Reading Pressure Measurement
 - .1 Dial type, 100 mm diameter, glycerine liquid filled
 - .1 Case: Stainless steel type 304
 - .2 Movement: Stainless steel
 - .3 Tube and socket: Stainless steel type 304
 - .4 Adjustable pointer
 - .5 Two-way gauge cock
 - .6 Operating temperature range, glycerine: -17°C to +115°C (0°F to 240°F)
 - .7 Operating temperature range, silicone: -34°C to +115°C (-30°F to 240°F)
 - .8 Accuracy: ASME B40.1 Grade 1A $\pm 1\%$ full scale
 - .9 H.O. Trerice Company - Series 700
 - .7 Differential pressure measurement at pumps, refrigeration machines and where shown
 - .1 Same as for direct reading pressure measurement, and:
 - .1 Maximum registering pointer
 - .2 Impulse snubber
 - .3 Three way switching valve
-

- .8 Sanitary Direct Reading Pressure Measurement
 - .1 Dial type, 100 mm diameter, food grade glycerine liquid filled
 - .1 Case and ring: Polished stainless steel type 316
 - .2 Movement: Stainless steel type 316
 - .3 Capsule and socket: Stainless steel type 316
 - .4 Adjustable pointer
 - .5 Operating temperature range, glycerine: -20°C to +100°C (-4°F to +212°F)
 - .6 Accuracy: ASME B40.1 Grade 1A $\pm 1\%$ full scale
 - .7 Approvals: 3A and USDA
 - .8 H.O. Trerice Company - Series 700TALF
- .9 Test wells. For use with partial immersion laboratory type thermometers.
 - .1 Manufactured from bar stock or forged brass with cap and chain, compatible with thermometers used.
 - .2 Registered with Technical Standards and Safety Association, Boiler and Pressure Vessel Safety Branch, and have C.R.N. Registration number.
 - .1 H.O. Trerice Company

2.2 **STRAINERS AND FILTERS**

- .1 "Y" Pattern Strainers
 - .1 NPS 2 and under:
 - .1 "Y" pattern
 - .2 Class 125 (860 kPa) bronze body
 - .3 Screwed ends and screwed cleanout.
 - .2 NPS 3 and larger:
 - .1 "Y" pattern
 - .2 Class 125 (860 kPa) cast iron body
 - .3 Flanged ends and bolted cleanout cap
 - .4 Blow-off drain connection.
 - .3 Screen material: 20 mesh stainless steel unless otherwise noted
 - .4 Manufacturers:
 - .1 Erwel
 - .2 Spirax Sarco

- .3 Streamflo
 - .4 Brooks – Hart
 - .5 Mueller
 - .2 Basket Strainers
 - .1 NPS 2 to 12, WOG service
 - .1 Single basket
 - .2 Class 150 (1033 kPa) cast iron body with quick release cover
 - .3 Bottom blow down valve
 - .2 NPS 2 to 12, steam service
 - .1 Single basket
 - .2 Class 125 (860 kPa) cast iron body with bolted cover
 - .3 Bottom blow down valve
 - .3 Basket Screens
 - .1 Stainless steel
 - .2 NPS 2 and 3: 1.15 mm perforation mesh
 - .3 NPS 4 and over: 3.2 mm perforation mesh
 - .4 Manufacturers
 - .1 Erwel
 - .2 Spirax Sarco
 - .3 Streamflo
 - .4 Brooks – Hart
 - .5 Mueller
 - 2.3 **FLEX CONNECTIONS AND EXPANSION COMPENSATION**
 - .1 Flexible Metal Hose Connections
 - .1 Size Application
 - .1 Steel piping: NPS ½ to NPS 14
 - .2 Construction
 - .1 Corrugated inner hose of bronze or stainless steel.
 - .2 Outer jacket of bronze or stainless steel braided wire mesh.
 - .3 Screwed or female soldered end connections up to NPS 2.
-

- .4 Forged steel raised face flanged NPS 2½ and above.
 - .5 Selected for 1034 kPa (150 psi) working pressure and 93°C (200°F) working temperature.
 - .6 Designed to absorb 150 mm transverse movement.
 - .7 Flexible length not less than six times nominal size.
 - .3 Manufacturer
 - .1 Senior Flexonics (Canada) Limited
 - .2 Piping Accessories Canada Ltd.
 - .3 SSI Equipment Inc.
 - .4 Anaconda Flexpipe
 - .5 United Flexible Metallic Tubing (Canada) Limited
 - .2 Flexible Rubber Expansion Joints
 - .1 Size Application
 - .1 Steel piping: NPS 1½ to NPS 12
 - .2 Construction
 - .1 Double arch, sphere design bellows
 - .2 Composite three layer EPDM or neoprene with nylon reinforcement construction
 - .3 Floating flanges complete with control units.
 - .4 Operating pressure: Minimum 860 kPa (125 psig)
 - .5 Operating temperature: -10°C to +100°C (14°F to 212°F)
 - .3 Manufacturer
 - .1 Senior Flexonics (Canada) Ltd - Style 102
 - .2 SSI - model ATM
 - .3 UniRoyal Rubber - Style 4140
 - .3 Expansion Compensators (bellows type)
 - .1 Size Application
 - .1 Steel piping: NPS ¾ to NPS 2
 - .2 Copper piping: NPS ¾ to NPS 3
 - .2 Construction
 - .1 Pressure external to bellows.
-

- .2 Internal guides, limit stops and anti-torque device.
 - .3 Copper pipe installation: Bronze construction with female solder type ends.
 - .4 Steel pipe installation: Steel construction with stainless steel bellows and screwed ends.
 - .5 Selected for 1035 kPa (150 psi) (1380 kPa (200 psi)) working pressure.
 - .3 Manufacturers
 - .1 Senior Flexonics (Canada) Limited
 - .2 Badger
 - .3 Hyspan
 - .4 Uncontrolled Type Expansion Joints
 - .1 Size Application
 - .1 Steel piping: NPS 2 to NPS 24
 - .2 Construction
 - .1 Stainless steel bellows
 - .2 Flanged ends
 - .3 Suitable for axial extension and compression, lateral off-set, and angular rotation
 - .4 Temperature rating: -29°F to +426°C (-20°F to +800°F)
 - .5 Selected for 1035 kPa (150 psi) (1380 kPa (200 psi)) steam working pressure.
 - .3 Manufacturers
 - .1 Senior Flexonics (Canada) Limited
 - .2 Adsco Division - Yuba Industries Inc.
 - .3 Hyspan
 - .5 Ring Controlled Type Expansion Joints
 - .1 Size Application
 - .1 Steel piping: NPS 3 to NPS 24
 - .2 Construction
 - .1 Stainless steel bellows, limit stops and guides
 - .2 Reinforcing control rings
 - .3 Flanged ends
-

- .4 Anchor type bases where required
 - .5 Temperature rating: -29°F to +426°C (-20°F to +800°F)
 - .6 Selected for 1035 kPa (150 psi) (1380 kPa (200 psi) 2070 (300 psig)) steam working pressure.
 - .3 Manufacturers
 - .1 Senior Flexonics (Canada) Limited
 - .2 Adsco Division - Yuba Industries Inc.
 - .3 Hyspan
 - .6 Slip Type Expansion Joints
 - .1 Size Application
 - .1 Steel piping: NPS 1½ to NPS 24
 - .2 Construction
 - .1 Packing chamber, limit stops, lubrication fittings, or lubricant impregnated packing rings
 - .2 Adjustable packing gland or fixed packing gland arrangement with a packing injection assembly
 - .3 Slip pipe of hard chrome plated carbon steel to ASTM A53-82
 - .4 Anchor base
 - .3 Manufacturers
 - .1 Senior Flexonics (Canada) Ltd.
 - .2 Rockwell
 - .3 Yarway
 - .4 United Flexible Metallic Tubing (Canada) Limited
 - .5 Adsco
 - .6 Hyspan
- 2.4 **MISCELLANEOUS**
- .1 Pressure Relief Valves
 - .1 ASME rated, selected of relieving flow at 25% above the working pressure.
 - .2 Body construction and trim: To suit specific service.
 - .3 Manufacturers
 - .1 STM Specialty Sales
 - .2 Watts
-

- .3 Fisher
 - .4 Consolidated
 - .2 Drain Valves
 - .1 NPS ½ brass sediment faucets with hose outlets
 - .2 Manufacturers
 - .1 Emco 10740
 - .2 Cambridge Brass 32W201
 - 3 Execution
 - 3.1 **INSTALLATION - THERMOMETERS AND PRESSURE GAUGES**
 - .1 General
 - .1 Installation height: Not greater than 3 m from floor or platform.
 - .2 Installation heights exceeding 3 m from floor or platform: Install remote reading thermometers and gauges, with dial mounted at 1500 mm above floor or platform, on steel or aluminum plate.
 - .2 Thermometers
 - .1 Install thermometers in wells.
 - .2 Install wells with extension necks in piping or equipment that is to be insulated.
 - .3 Provide thermometers at inlet and outlet of:
 - .1 Domestic hot water tanks
 - .2 Water heating and cooling coils
 - .3 Water boilers
 - .4 and as shown
 - .4 Thermometer Ranges

SYSTEM	SCALE RANGE
City water	(-5° to 40°C) (25° to 100°F)
Domestic cold water	(-5 °to 40°C) (25°to 100°F)
Domestic hot water	(5° to 120°C) (40° to 180°F)
Hot water heating (scheduled & constant temperature)	(5° to 115°C) (40° to 240°F)
 - .3 Pressure Gauges
 - .1 Selection
-

- .1 Normal operating reading: Between one-half and two-thirds of full scale or range and expected maximum and minimum readings are within range.
 - .2 Provide pressure gauges at inlet and outlet of:
 - .1 Domestic water heaters
 - .2 Water heating and cooling coils
 - .3 Water boilers
 - .4 Water filters
 - .5 Pressure reducing valves
 - .6 Pumps (pressure differential)
 - .7 and as shown
 - .3 For direct pressure measurement, provide for each gauge:
 - .1 One-quarter turn bronze ball valve complete with lever handle
 - .2 Pressure snubber
 - .3 Syphons for gauges in steam service
 - .4 Isolation diaphragms where shown for gauges in corrosive service
 - .4 For differential pressure measurement, provide for each gauge:
 - .1 Three-way three position (left-off-right) switching valve with lever handle
 - .2 Pressure snubber
 - .3 Impulse dampener
 - .4 Syphons for gauges in steam service
 - .5 Isolation diaphragms where shown for gauges in corrosive service
- .4 Test Plugs
 - .1 Provide test plugs for temporary insertion of thermometers and pressure gauges at locations shown on Drawings.

3.2 **INSTALLATION - STRAINERS AND FILTERS**

- .1 "Y" Strainers
 - .1 Horizontal installation: Install with minimum 300 mm clearance between bottom of strainer and any obstruction.
 - .2 Vertical installation: Install with basket drain pointing down, and with minimum 300 mm clearance between bottom of strainer and any obstruction.
 - .3 Provide drain valve complete with chain and cap on NPS 3 and larger strainers.
 - .4 Remove baskets, clean and replace at time of building handover.
-

.2 Basket Strainers

- .1 Install basket strainers with minimum of 450 mm clearance above strainer.
- .2 Provide pipe supports on piping immediately adjacent to strainer; do not directly support strainer, or have adjacent piping supported through the strainer.
- .3 Remove baskets, clean and replace at time of building handover.

.3 Automatic Back-Wash Filters

- .1 Install automatic backwash filters in accordance with manufacturer's recommendations.
- .2 Provide drain to back-wash drain connection and pipe to floor drain. (Pipe-up domestic cold water connection).

3.3 **INSTALLATION - FLEX CONNECTIONS AND EXPANSION COMPENSATION**

.1 Selection Criteria

- .1 Provide manufactured expansion compensation units where shown on Drawings.
- .2 Provide expansion loops where shown on Drawings.
- .3 Select expansion joints to compensate for thermal expansion in pipe between anchors with not less than 25% safety factor calculating expansion from -18°C (0°F) ambient up to maximum possible operating fluid temperature, but not less than 93°C (200°F).

.2 Provision of expansion joints and flex connections:

.1 Flexible Metal Hoses

- .1 On suction and discharge connections of domestic water booster pumps.
- .2 On suction and discharge connections of base mounted double suction pumps.
- .3 On discharge connections of sump and sewage pumps.
- .4 In steam, hot water, chilled water, or glycol piping connections to coils and humidifiers in air supply units when units, or sections of units to which piping is connected, are supported or suspended by means of springs or isolation pads.
- .5 On piping connections to domestic hot water tanks.
- .6 Cooling tower supply and return connections at tower.

.2 Flexible Rubber Expansion Joint

- .1 Cooling tower supply and return piping connections at pump.
 - .2 Above ground drainage piping where shown on Drawings.
-

- .3 Expansion Compensators
 - .1 Domestic hot water supply and recirculation piping up to and including NPS 3.
 - .2 Heating system piping up to and including NPS 2 size.
 - .3 Compressed air, maximum 860 kPa (125 psig).
- .4 Uncontrolled Type Expansion Joints
 - .1 Domestic hot water and recirculating water piping NPS 3½ size and larger.
 - .2 Heating system piping NPS 2½ size and larger.
- .5 Ring Controlled Type Expansion Joints Slip Type
 - .1 High pressure steam piping over 100 kPa (15 psig).
- .6 Slip Joints
 - .1 High temperature hot water over 100°C (212°F).
- .7 Expansion joint installation:
 - .1 Provide pipe guides for each expansion joint using two guides on each side of and adjacent to joint.
 - .2 Refer to Section 15060 for pipe guides.
 - .3 Guide may be omitted between joint and anchor where an anchor is located within 900 mm of expansion joint.
 - .4 Provide anchors consisting of structural steel angles, channels, or plates secured to building structure.
- .8 Flexible metal hose connection installation:
 - .1 Support or guide piping firmly adjacent to flexible connections and prevent pipes from swaying.
 - .2 At steam coils locate hoses between control valve and coil on steam supply side and on main condensate line leaving coil or bank of coils on return side.
 - .3 At chilled and/or hot water coils locate hoses on supply side between strainer and coil and on return side between coil and control valve.

3.4 **INSTALLATION - MISCELLANEOUS**

- .1 Pressure Relief Valves
 - .1 Install relief valves downstream of pressure reducing valves, and on pressure vessels where shown.
 - .2 Provide discharge elbow drain, and pipe drain with NPS ¾ pipe to nearest floor drain.
-

- .3 Terminate relief vent up through roof, at height as follows:
 - .1 900 mm for water systems below 92°C (200°F).
 - .2 1800 mm for water and steam systems above 92°C (200°F).
- .2 Drain Valves
 - .1 Provide at:
 - .1 Low points of water piping systems in order to completely drain each system.
 - .2 Cooling and heating coils.
 - .3 Reheat coils where detailed on Drawings.
 - .4 Other locations as shown.

End of Section

-
- 1 General
 - 1.1 **SUMMARY**
 - .1 Section Includes
 - .1 Labour, Products, equipment and services necessary to complete the Work of this section.
 - 1.2 **SUBMITTALS**
 - .1 Shop Drawings
 - .1 Submit Shop Drawings in accordance with Section 01 33 00.
 - .2 Submit Layout Drawings showing each type and placement of manufactured, pre-fabricated roof piping support system. Submit details for fixing roofing pad to roof.
 - 2 Products
 - 2.1 **MATERIALS**
 - .1 Acceptable Manufacturers
 - .1 Hangers:
 - .1 Anvil
 - .2 Myatt
 - .3 Carpenter & Paterson
 - .4 Hunt
 - .5 B-Line
 - .6 Taylor Pipe Supports
 - .2 Insulation shields:
 - .1 Anvil
 - .2 Myatt
 - .3 Pipe Shields Inc.
 - .4 Taylor Pipe Supports
 - .2 Lower Attachment
 - .1 Clevis hanger – steel pipe
 - .1 Standard weight black steel clevis hangers with level adjustment and locknut.
 - .2 Anvil figures 260 and 300.
 - .3 For figure 260, provide clevis bolt spacer on insulated piping.
-

- .2 Clevis hanger – copper pipe
 - .1 Light weight black steel clevis hangers with copper colored finish and plastic insert to suit local authority requirements, with level adjustment and locknut (double bottom locknut).
 - .2 Anvil figure CT-65.
 - .3 Roller hanger
 - .1 Adjustable roller type hangers with locknuts.
 - .2 Rollers of sufficient width to clear the outside diameter of the insulation on the piping.
 - .3 Support rollers at both ends, either by a yoke, swivel type hanger or by two adjustable rods with locknuts (double locknuts).
 - .4 Anvil figure 177 or 171 as applicable.
 - .3 Insulation Protection
 - .1 Insulation saddles, for welding to pipe:
 - .1 Anvil figure 160-165 as applicable.
 - .2 Insulation shields
 - .1 Either shop fabricated, or manufactured plates of the size required to properly fit the outside diameter of the pipe insulation.
 - .2 Anvil figure 167, modified with holes at each end to suit 12 mm wide. Stainless steel band clamps.
 - .3 Shop-fabricate bearing plates conforming to the following table for various pipe sizes:

Pipe Size (NPS)	Length of Plate mm	Thickness of Plate mm (gauge)
½ to 2	300	1.2 (18)
3 to 4	300	1.52 (16)
6	450	1.52 (16)
8 and over	600	1.9 (14)
 - .4 Form the bearing plates to the O.D. of the adjoining pipe insulation and extend the plate up to the horizontal centre line of the pipe.
 - .4 Middle Attachment
 - .1 Machine threaded rods
 - .1 Black steel finish in concealed areas.
 - .2 Galvanized finish in mechanical rooms and exposed areas.
-

.5 Upper Attachments

.1 Beam clamps:

- .1 Malleable iron C-clamp with retaining clip, FM approved: Anvil figure 87, NPS ½ to NPS 2; maximum load: 180 kg.
- .2 Malleable beam clamp FM approved: Anvil figure 218, NPS 2½ to NPS 8; maximum load: 540 kg.
- .3 For pipes NPS 10 and larger, Provide supplementary steel members supported from structural steel.
- .4 Do not use top beam clamps.

.2 Concrete inserts (new construction):

- .1 Single hanger: Malleable iron body and nut, universal nut style: Anvil figure 282, to NPS 8.
- .2 Continuous hanger: Cold formed hot dipped galvanized strip steel with end caps: Power-Strut PS 449.

.3 Concrete clevis plates (existing concrete):

- .1 Carbon steel plate, with clevis attachment.
- .2 Anvil figure 49.
- .3 Do not use explosive driven anchors.

.6 Rooftop Pipe Supports

.1 Prefabricated pipe support system:

- .1 Bases: (Injection moulded plastic or polycarbonate resin, with UV inhibiting additive) (Stainless steel) (Hot dipped galvanized steel).
- .2 Framing: Channel strut system of size suitable for the load involved.
- .3 Hangers: As specified above.
- .4 Clamps, bolts, nuts and washers to suit installation, same material as framing members.
- .5 Roof pads to suit roof construction.

.2 Acceptable Manufacturers:

- .1 Portable Pipe Hangers
- .2 Taylor Ecofoot
- .3 Miro Industries Inc.

.7 Riser Clamps

- .1 Black steel double clamp: Anvil figure 261, supported at floors; Anvil figure 240, supported by hanger rods.
-

- .8 Pipe Guides
 - .1 Outer hinged housing with sliding spider clamp.
 - .1 Carbon steel, black steel finish.
 - .2 Anvil figure 256.
 - 3 Execution
 - 3.1 **INSTALLATION**
 - .1 General
 - .1 Support or suspend piping with necessary hangers, structural supports and/or brackets, to prevent sagging, warping and vibration and to allow for movement due to expansion and contraction.
 - .2 Place hangers and supports close to fittings, elbows, valves and/or other heavy parts.
 - .3 Do not allow loads of any nature to be transmitted through the piping connections to equipment not specifically designed for such loads.
 - .1 Where flexible connections are not called for at connections to equipment, support the pipe by stands attached to both pipe and supporting structure so that force in any direction is not transmitted to the equipment.
 - .4 Place suitably dampened spring hangers at the first three supports from the equipment connection on piping subject to excessive movement or shock from any source, thermal expansion and contraction.
 - .1 Where it is evident that no undue loads will be transmitted to the equipment by the system concerned, i.e. small bore connections to comparatively large equipment, cold service piping not subject to shock, etc., then spring hangers may be omitted and standard hangers used.
 - .5 Use trapeze type hangers where pipes are grouped together, unless specifically indicated otherwise on the Drawings.
 - .1 Suspend horizontal member by adjustable rods with locking feature for maintaining level and slope.
 - .2 Space trapeze type hangers based on the closest interval required by any pipe supported thereon.
 - .3 Provide any auxiliary steel required to support trapeze between building steel.
 - .6 Do not hang pipe from another pipe unless specifically shown on the Drawings.
 - .2 Hanger Selection
 - .1 Select lower attachment and insulation protection based on the following, unless otherwise shown on drawings:
-

Pipe Size NPS	Operating Temperature		
	Less than 21°C (70°F)	Between 21°C (70°F) and 43°C (110°F)	Greater than 43°C (110°F)
	Insulated	Non-insulated	Insulated
2 and less, steel	Clevis and shield	Clevis only	Clevis
2½ to 6, steel	Clevis and shield	Clevis only	Roller and saddle
8 and over, steel	Roller and saddle	Roller only	Roller and saddle
½ to 4, copper	Clevis and shield	Clevis	Clevis and shield

- .2 Install temporary spacers between the insulation shield and the pipe equal to the thickness of insulation specified. Refer to Section 23 07 19.
- .3 Saddles and Roller Supports
 - .1 Place saddles at roller supports for piping carrying liquids at 43°C (110°F) or higher.
 - .2 Weld saddles to black or galvanized steel piping.
 - .3 Refinish galvanized surfaces destroyed by the welding with a zinc rich paint such as W.R. Meadows "Galvafroid", Kerry Industries "ZRC" or Niagara Paint Inc. "PL052898".
- .4 Insulation Shields
 - .1 Place insulation shields at pipe supports for pipes carrying liquids at 21°C (70°F) or less.
 - .2 Field or factory punch a hole at each end of the shield to allow a 12 mm stainless steel band clamp to pass through opening.
 - .3 Secure shields with two @ 12 mm stainless steel band clamps per shield.
- .5 Hanger Spacing - General
 - .1 Horizontal runs of plumbing and drainage piping: To hanger spacing requirements of the Ontario Building Code.
 - .2 Place additional hangers in locations where there are concentrated loads such as valves, specialties, etc.
- .6 Hanger Spacing - Black Steel and Galvanized Pipe
 - .1 For horizontal runs of black or galvanized steel pipe, other than for plumbing service.

- .2 Maximum distances between supports and with minimum diameter rods as follows:

Pipe Size NPS	Rod Size mm	Spacing	
		Water Service m	Gas, Steam or Air m
Thru 1	10	2.0	2.7
1¼	10	2.0	2.7
1½	10	2.7	3.6
2	10	3.0	3.9
2½	12	3.3	4.2
3	12	3.6	4.5
4	16	4.2	5.0
6	19	5.0	6.4
8	19	5.7	7.3
10	22	5.7	7.3
12	22	7.0	7.9
14	25	7.6	9.7
16	25	8.2	10.6
18	25	8.5	11.2
20	32	9.0	11.8
24	38	9.7	12.8
30	51	10.0	13.4
36	51	13.7	18.0

.7 Hanger Spacing - Copper Tubing

- .1 For horizontal runs of copper tubing for services other than plumbing:
- .2 Maximum distances between supports and with minimum diameter rods as follows:

Pipe Size NPS	Rod Size mm	Spacing	
		Water Service m	Gas, Steam or Air m
Thru ¾	10	1.5	1.8
1	10	1.8	2.4
1¼	10	2.0	2.7
1½	10	2.4	3.0
2	10	2.4	3.3
2½	12	2.7	3.9
3	12	3.0	4.2
4	16	3.6	4.8

.8 Hanger Spacing - PVC or CPVC

- .1 For horizontal runs of PVC or CPVC for services other than plumbing.

- .2 Maximum distances between supports and with minimum rods sizes for un-insulated pipe as follows.

Pipe Size NPS	Rod Size mm	Pipe Schedule			
		PVC 40	CPVC 40	PVC 80	CPVC 80
1/2	10	1.2	1.2	1.2	1.2
3/4	10	1.2	1.2	1.2	1.5
1	10	1.2	1.5	1.5	1.8
1 1/4	10	1.2	1.5	1.5	1.8
1 1/2	10	1.5	1.8	1.8	1.8
2	10	1.5	1.8	1.8	2.0
2 1/2	12	1.8	2.0	1.8	2.4
3	12	1.8	2.0	2.0	2.4
4	16	1.8	2.0	2.0	2.7
6	19	2.0	2.4	2.7	3.0
8	19	2.4	2.4	2.7	3.0
10	22	2.7	-	3.3	-
12	22	3.0	-	3.6	-

- .3 For insulated pipe, reduce spacing by 30%.
- .4 Do not restrain axial movement.
- .5 Spacing based on fluids with specific gravity of 1.0 and 26°C (80°F). For other conditions, use other published data approved by Consultant.

.9 Vertical Piping Supports

- .1 Vertical plumbing and drainage piping:
- .1 To the Ontario Building Code, unless more stringent requirements are specified herein.
- .2 Vertical support spacing:
- .1 Cast iron soil pipes: At every floor with riser clamps.
- .2 Other piping: At every other floor with riser clamps, unless otherwise required by expansion conditions or otherwise specified.
- .3 Support bottom of riser with base fitting set on concrete pier or by hanger located at top of riser pipe as close to riser as possible.
- .4 Riser clamps:
- .1 Bolted securely to pipes.
- .2 Rest ends of clamp on the pipe sleeve or on the floor.
- .3 Weld shear lugs to pipe to transfer load to riser clamp.

- .5 Stabilize vertical piping laterally by fabricated brackets or malleable iron, extension type split hangers.
 - .6 Run vertical piping at columns in the column webs, on either or both sides of the column, unless otherwise directed by the Consultant.
 - .10 Anchors and Guides
 - .1 Use anchors where shown on the Drawings and/or as required to maintain permanent location of pipe lines.
 - .1 Construct anchors for steel or galvanized pipe of approved steel straps and/or rods.
 - .2 For anchoring copper lines, use copper plated anchors, or use insulation bands between tubing and clamps if steel straps or rods are used.
 - .2 Provide minimum two pipe guides on each side of an expansion joint and expansion compensator.
 - .1 1.2 m between each guide.
 - .2 Not more than 900 mm between last guide and start of expansion joint or expansion compensator.
 - .3 For special expansion joint/compensator or for special applications, where more than two guides on each side are required, follow manufacturer recommendations for location of guides.
 - .11 Inserts
 - .1 In new construction, set inserts onto formwork prior to pouring of concrete.
 - .1 Provide a 200 mm length of rebar and wire through insert.
 - .2 Mechanical rooms and other areas of multiple pipe runs.
 - .1 Provide continuous type insert channels at 1.8 m intervals along route of piping.
 - .2 Provide a 200 mm length of rebar and wire through insert.
 - .12 Upper Attachments - Structural Steel
 - .1 For pipe size NPS 10 and larger supported from structural steel:
 - .1 Provide supplementary structural steel and weld or bolt to structural steel.
 - .2 Submit Plan Drawings and details to the Structural Engineer for review.
 - .13 Roof Mounted Piping
 - .1 Manufacturer site responsibilities:
 - .1 Provide on site assistance and inspection as required for installation.
 - .2 Provide Layout Drawing, located positions of each hanger.
-

- .2 Hanger system installation:
 - .1 Remove roofing ballast and debris from areas of base.
 - .2 Adhere roofing pad to roof membrane with adhesion system as recommended by manufacturer.
 - .3 Adhere base to roofing pad with adhesion system as recommended by manufacturer.
 - .4 Set frame legs in to bases and assemble hangers.
 - .5 Remove excess adhesive from frame, bases and pads.
 - .6 Replace roof ballast up to edge of base.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **DESIGN CRITERIA – NOISE AND VIBRATION**

.1 General

- .1 Limit noise and vibration levels of equipment and systems within design intent.
- .2 If noise or vibration levels created by any mechanical equipment and systems and transmitted to occupied portions of building or other mechanical Work, or are over the limits, make all necessary changes without additional cost.
- .3 Install equipment, piping and ductwork in accordance with good noise and vibration control engineering practice in order to meet the requirements specified below.
- .4 Maximum sound levels, combined internal background and mechanical equipment generated noise:

Room	N.C. Levels
Open Plan Offices	35-38
Cellular Offices	33-35
Service/Plant Areas	50

- .1 Exclude environmental transient noise (traffic, etc).
- .5 Meet the seismic requirements for the region as listed in the latest edition of the Ontario Building Code.

.2 Vibration Limits of Mechanical Equipment

.1 Equipment classification:

- .1 One of three categories defined in ISO standard 2372.
- .2 Vibration severity limits corrected for hard and soft support as defined by ISO standard 3945.
- .3 Maximum vibration severity, as measured: Not to exceed category A (Good).

.2 Summary of the standards:

- .1 Hard support: The fundamental frequency of the machine on its support is higher than its main excitation frequency (in general, rigidly mounted machine).
- .2 Soft support: The fundamental frequency of the machine on its support is lower than its main excitation frequency (in general, machines on vibration isolators).

- .3 Vibration severity: The largest of all the rms values of vibration velocity of a machine measured at three perpendicular axes at main support bearings of the rotor.

- .3 Vibration severity limits:

- .1 For equipment on hard support.

Type of Machine	Class	Vibration Severity Limit mm/s
Small Equipment (up to 20 HP)	I	0.71
Medium Equipment (21-100 HP)	II	1.11
Large Equipment (over 100 HP)	III	1.80

- .2 For soft support the limits are 1.6 times higher:

- .4 These limits apply for all normal running conditions of the equipment.

- .5 Measurement equipment: To ISO standard 2954.

- .1 Carry out measurements by a technically competent person.

- .3 Minimum Requirements

- .1 Refer to Mechanical Drawings and schedules for the minimum requirements of vibration isolation and sound attenuation.

1.3 **SUBMITTALS**

- .1 Shop Drawings

- .1 Submit in accordance with Section 01 33 00.

2 Products

2.1 **MANUFACTURERS**

- .1 Acceptable manufacturers of noise and vibration control hardware are:

- .1 Vibron

- .2 Vibro-Acoustics

- .3 Korfund-Sampson

- .2 Noise and vibration control hardware: Supplied by a single Supplier.

- .1 Exception: Where vibration isolation is supplied as an internal component as part of a manufactured Product.

2.2 **MATERIALS**

- .1 Pad Isolators

- .1 Rubber in shear, minimum 13 mm thick, bonded to 6 mm steel plates.

- .2 Neoprene Isolators
-

- .1 Captured mount design with threaded insert and hold down bolts.
 - .2 Double deflection isolator refers to mounts with design static deflection of 13 mm.
 - .3 Selection: Not loaded beyond its design limit, but not less than 60% of its design value.
 - .3 Spring Isolators
 - .1 Colour coded stable springs, levelling devices and neoprene insert or pad for acoustical isolation.
 - .2 Lateral spring stiffness: Minimum 0.8 times vertical stiffness.
 - .3 Mounting hardware: Zinc chromate plated.
 - .4 Bolt holes for hold down bolts and suitably stepped rubber washers.
 - .5 Stable spring types for open spring mounts.
 - .6 Steel spring operating load rating: Load to between 50% and 70% of the SOLID spring deflection.
 - .7 Rubber spring operating load rating: Between 60% to 100% of rated maximum.
 - .8 Neoprene pads: Size pads at the base of the steel spring mounts to deflect between 1.5 to 2.5 mm at the operating load (for acoustical isolation above the first spring resonance).
 - .4 Resilient Hangers
 - .1 Captured mount design with threaded insert and hold down bolts.
 - .2 Capable of tolerating vertical misalignment for a total of plus or minus ten degrees with the specified hanger rod and at the rated deflection.
 - .3 Double deflection isolator refers to mounts with design static deflection of 13 mm.
 - .4 Selection: Not loaded beyond its design limit, but not less than 60% of its design value.
 - .5 Structural Steel Fan Bases
 - .1 Continuous integral box section structural steel base, reinforced as necessary to withstand the belt tension without drive misalignment or distortion.
 - .2 Drill holes in the structural base to correspond with anchor bolt holes of fan base.
 - .3 Provide built-in motor slide rails in each base.
 - .4 Beams and brackets, flange and web thickness: Minimum of 5 mm.
 - .5 Use height saving brackets in all mounting locations to provide a base clearance of 25 mm.
 - .6 Minimum depth: 1/10th of the longer dimension, but not less than 125 mm.
 - .7 Maximum depth: 300 mm unless specifically advised by the Consultant.
-

- .8 Beam stiffness: Maximum deflections in between the support points (at the isolators) do not exceed 1/8th of the deflection of the isolators.
 - .9 Overall stiffness: Withstand the reaction torque of the drive without relative deflection at the corners of more than 1/8th the isolator deflection.
 - .6 Thrust Restraints
 - .1 Design: Similar to open spring restricted mount for intake, and precompressed hanger for discharge.
 - .2 Specified precompression complete with attachment rods and angle brackets.
 - .3 Stiffness: Less than one-fifth of the horizontal stiffness of the main isolation system.
 - .7 Concrete Inertia Bases
 - .1 Continuous integral box section structural steel base, reinforced as necessary to withstand the belt tension without drive misalignment or distortion.
 - .1 T-shaped base to support piping elbows for base mounted pumps.
 - .2 Drill holes in the structural base to correspond with anchor bolt holes of fan base.
 - .3 Provide built-in motor slide rails in each base.
 - .4 Beams and brackets, flange and web thickness: minimum of 5 mm.
 - .5 Form with full depth perimeter frames with flanges pointed to the centre of base.
 - .6 Base reinforcement: Reinforcing rods at maximum 250 mm centres in both directions and minimum 38 mm up from the bottom of the steel channels, or place additional steel as required by structural condition or by code.
 - .7 Metal pans: Minimum 1.6 mm (16 gauge) welded sheet metal.
 - .8 Use height saving gusseted brackets in all mounting locations to provide a base clearance of 25 mm from housekeeping pad.
 - .9 Minimum base depth: 1/12th of the longer dimension, but not less than 125 mm.
 - .10 Maximum base depth: 300 mm unless specifically advised by the Consultant.
 - .11 Stiffness: Deflection in between the support points (at the isolators) does not exceed 1/40th deflection of the isolators.
 - .12 Overall base stiffness: Sufficient to withstand the reaction torque of the drive without relative deflection of the corners of base of more than 1/40th isolator deflection.
 - .13 Concrete fill: 30 MPa concrete.
 - .8 Isolated Rooftop Equipment Rail Support
 - .1 Continuous support roof rails.
 - .1 Upper aluminum channel frame construction: Minimum height 120 mm.
-

- .2 Distributed open springs, designed to suit equipment load distribution.
- .3 Lower aluminum channel plate, continuous contact to roof curb.
- .4 Elastomeric air and weather seal on outside edge of frame (concealing springs).
- .5 Aluminum weather seal flashing.
- .6 Internal levelling system.

3 Execution

3.1 **INSTALLATION**

.1 General

- .1 Carry out the Work of this section in accordance with manufacturer's instructions (and supervision where required) and only by workers experienced in the installation of such systems.

.2 Noise Control

- .1 Select and install isolation equipment to ensure that the mechanical equipment does not produce undue amounts of noise and vibration induced noise.

.2 Oversized pipe sleeves:

- .1 Location: At wall or floor within the first one hundred times diameter length from a noise/vibration source.
- .2 Sleeve size: At least 50 mm larger than the pipe diameter.
- .3 Sleeve sealing: Pack the periphery with firestopping, or high density mineral wool (greater than 5 lb/cu.ft.) at not more than 50% compression.
- .4 Caulk the ends of the packing and seal with non-hardening caulk such as Tremco Dymeric (with colourpak if weatherproof quality is required).

.3 Duct sealing:

- .1 Pack and seal all spaces and cracks around ducts passing through mechanical room walls or floor, as described above for pipes.

.3 Vibration Control

.1 Types of vibration isolation hardware:

.1 Isolation mount types (xx specifies static deflection)

CSxx	Closed spring mount
OSxx	Open spring mount
OSRxx	Open spring restricted mount
OSRIxx	Open spring restricted mount with internal levelling devices
ERxx	Elastomer rubber mount

.2 Rubber isolation pads types

R	Single layer rubber waffle pad
N	Single layer neoprene waffle pad
RSR	Multiple layers of rubber and steel as indicated
NSN	
RSRSR, etc	

.3 Isolation hangers types

SH	Spring hanger
SHR	Spring hanger with rubber isolator
SHP	Either of above spring hangers with precompressed spring rubber isolator hanger
SHRP	
RH	Rubber isolator hanger

.4 Base types

IS	Integral steel base
CI	Concrete inertia base
IR	Isolated rooftop equipment curb

.2 Minimum vibration isolation requirements for all motor driven equipment: type R

.1 Refer to equipment schedules for isolation requirements.

.2 Use neoprene in potentially oily areas or outdoors.

.3 IS bases

.1 Use IS base type structural steel frame as required for the support rigidity of the installation of the isolators.

.2 Maximum isolation frequency: Not to exceed one-third of the lowest speed of the rotating equipment unless specified otherwise.

.4 Floor mounted equipment

.1 Install on a housekeeping concrete pad.

.2 Adjust and level the isolators for a 50 mm clearance unless otherwise noted.

.4 Isolator Requirements

.1 Vibration isolation supplier to examine and conform to the overall requirements for the Project in accordance with the requirements specified herein.

.2 Include:

.1 Consider RPM of equipment in determining the disturbing frequency on all fans, pumps, compressors, etc.

.2 Establish vibration isolation requirements from equipment manufacturer's certified Shop Drawings and performance data.

- .3 Select spring isolators from the manufacturer's catalogue inventory wherever possible.
- .4 Should deflection requirements warrant the use of special springs, provide complete design data to the Consultant with the Review Drawings.
- .5 Equip base type spring isolators with 9 mm thick neoprene or neoprene composition anti-vibration pads bonded to the base and with combination levelling bolts.
- .6 Equip hanger type spring isolators with neoprene or composition pads at both ends of the spring.

.5 Equipment Isolation

- .1 Mount equipment as follows, unless otherwise shown on Equipment Schedules.

Equipment	Remarks	Base Type	Isolation Type	Minimum Deflection mm
Centrifugal fans floor mounted suspended slab	up to 30 HP	IS	OS	25
	over 30 HP	CI	OS	45
Centrifugal fans - suspended	-	None	S4	45
Base mounted pumps	Basement or slab-on-grade	None	R	6
	Suspended slab	CI	OS	25
Refrigeration machines	Basement or slab-on-grade	None	RSR	6
	Suspended slab	None	OSRI	25
Cooling towers		Supplemental Steel	OSR	64
Air compressors	Up to 10 HP	None	CS	25
	Over 10 HP	CI	CS	25
Boilers	Basement or slab-on-grade	None	R	-
	Suspended slab	None	R	-
Propeller fans and roof exhausters		None	R	-
Air handling units	Fans internally isolated as above	None	R	-
Packaged rooftop equipment	Fans internally isolated as above	None	R	-

.6 Thrust Restraints

- .1 Required locations:

- .1 Fan intakes in excess of 1 kPa (4" W.G.) static vacuum.

- .2 Fan discharge other than vertical, in excess of 1 kPa (4" W.G.) static gauge pressure.
- .3 On hanger supported, horizontally mounted axial fans with more than 34 kg thrust due to static pressure.
- .2 Unless specified otherwise, attach horizontal restraints at the centreline of thrust and symmetrically on either side of the unit.
- .3 If horizontal thrust restraints are used, adjust same after installation for a maximum of 6 mm movement at start and stop.

3.2 **INSPECTION AND REPORTING**

- .1 Supervision of Installation
 - .1 Manufacturer/Supplier of hardware to provide on-site technical supervision of installation during construction.
 - .2 Hardware Supplier to inspect and report in writing that the installation has been carried out to their satisfaction.
- .2 On-Site Testing
 - .1 If, after the start-up of mechanical equipment, the Consultant is not satisfied that noise and vibration goals have been met, the Consultant retains the option of asking for a sound and vibration test report of all areas under question.
 - .2 Carry out measurements by a competent person using equipment meeting general requirements of international standards following measurement methods that follow similar standards.
- .3 Remedial Work
 - .1 If Consultant finds any installation of equipment and piping, and fabrication and installation of ductwork to be unsound or poor with regard to sound and vibration requirements, refabricate and reinstall such works as required at no increase in Contract Price.

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the work of this section.
- .2 This section includes, but is not limited to, the following:
 - .1 Design, selection and provision of materials, installation instructions, installation and inspection of seismic restraint of mechanical piping, ductwork, fire protection and equipment.
 - .2 Design, selection and provision of materials, installation instructions, installation and inspection of seismic restraints of electrical conduits, cable trays, equipment and lighting fixtures under electrical Divisions 26, 27 and 28.
- .3 The requirements under this section are in addition to the requirements for equipment, piping and duct supports and vibration isolation specified in other sections.
- .4 Where Specifications of materials of this section differ from those in other sections of the mechanical divisions, this section governs, including but not limited to vibration isolation devices.

1.2 **REFERENCE STANDARDS**

- .1 Comply with the latest edition of the following:
 - .1 SMACNA - "Seismic Restraint Manual Guidelines for Mechanical Systems"
 - .2 ASHRAE - "HVAC Applications, Seismic and Wind Restraint Design"

1.3 **DESIGN CRITERIA**

- .1 Design seismic restraint systems to conform to the Ontario Building Code
- .2 Building Data
 - .1 Calculate SMACNA SHL Class for location, site factor and importance factor indicated above.
 - .2 The vertical uplift force is restrained by the systems as identified in SMACNA standard.

1.4 **SUBMITTALS**

- .1 Shop Drawings
 - .1 Submit Shop Drawings in accordance with Section 01 33 00.
 - .2 Submit test certificates for each seismic restraint device, identifying maximum tested load capacities.
-

.2 Calculations

- .1 Submit calculations for each piece of restrained equipment, piping, ductwork and conduit, including seismic forces and restraint selection.
- .2 Include worst case combination of tension and shear loads at each snubber and restraint location.
- .3 Include anchor bolt diameters, embedment depth, full welding details including type and length for field welds, and required housekeeping base dimensions.
- .4 Calculations to be sealed by a Professional Engineer licensed in the province of Ontario.

1.5 **QUALITY ASSURANCE**

.1 Pre-Construction Meeting

- .1 Request and arrange a meeting with the Consultant to review seismic restraint approach, prior to any restraint insulation. Obtain approval from the Consultant before commencing Work.

.2 Testing and Review

- .1 Install the first three lateral and three longitudinal braces, for each of the fire protection, one building service piping system and one ductwork system, and request and arrange for a review of the installation by the Consultant. Obtain approval of the installation before commencing remainder of the Work.
- .2 Provide services of the manufacturer's technical representative to conduct site inspections of the Work in progress, and to conduct a final inspection of the Work. Provide a copy of the final inspection report to the Consultant for review.
- .3 Request and arrange for a construction review by the Consultant of the completed seismic restraint installation, before any ceilings are installed.

2 Products

2.1 **GENERAL**

- .1 Manufacturer to be a member of VISCMA (Vibration Isolation and Seismic Control Manufacturers Association).
- .2 Acceptable Manufacturers
 - .1 Vibro Acoustics
 - .2 Kinetics Noise Control Inc.
 - .3 Cooper B-Line

2.2 **SEISMIC RESTRAINTS**

.1 Seismic Snubber Restraints

- .1 Impact surfaces: High quality elastomeric facing to prevent metal-to-metal contact.
 - .2 Easily accessible resilient material, for inspection and replacement.
-

- .3 Resilient material, snubber assemblies: Minimum 6 mm thick.
 - .4 Resilient material, snubber grommets: Minimum 3 mm thick.
 - .5 Restraint axis: All three principle directions unless otherwise specified or shown.
 - .6 Maximum clearance between resilient material and restrained equipment surface: 6 mm.
 - .7 Verify seismic restraint capacities by independent test laboratory, or certified by a Professional Engineer licensed in the province of Ontario.
 - .2 Type "S-OSA" – Restrained Spring Isolator – Constant Load
 - .1 Colour coded seismic-controlled spring isolator, single or multiple spring coils, with minimum 6 mm neoprene pad.
 - .1 Removable coil spring element without having to disturb supported equipment.
 - .2 Lateral stiffness greater than 1.2 times rated vertical stiffness.
 - .3 Minimum 50% overload capacity
 - .4 Non-welded spring elements: Epoxy coated, with a minimum one thousand hour rating when tested in accordance with ASTM B-117.
 - .2 Steel housing design to limit lateral and vertical movement of the supported equipment.
 - .3 Neoprene snubber to limit maximum equipment movement in any direction to 6 mm.
 - .4 Adaptor base suitable sized for larger anchors, when required to suit anchorage capacity.
 - .5 Kinetics Noise Control model FHS.
 - .3 Type "S-OSB" – Restrained Spring Isolator – Variable Load
 - .1 Colour coded seismic-controlled spring isolator, single or multiple spring coils, with minimum 6 mm neoprene pad.
 - .1 Removable coil spring element without having to disturb supported equipment.
 - .2 Lateral stiffness greater than 1.2 times rated vertical stiffness.
 - .3 Minimum 50% overload capacity.
 - .4 Non-welded spring elements: Epoxy coated, with a minimum one thousand hour rating when tested in accordance with ASTM B-117.
 - .2 Steel housing design to limit lateral and vertical movement of the supported equipment.
 - .1 Top load plate with adjustable and leveling bolts.
 - .2 Adjustable vertical restraints.
-

- .3 Isolation washers.
 - .4 Bottom load plate with internal non-skid isolation pads and anchor holes.
 - .5 Hot dipped galvanized for outdoor installations.
 - .3 Neoprene snubber to limit maximum equipment movement in any direction to 6 mm.
 - .4 Adaptor base suitable sized for larger anchors, when required to suit anchorage capacity.
 - .5 Kinetics Noise Control model FLSS.
 - .4 Type "S-OSC" – Modular Spring Isolator with Integral Seismic Restraint
 - .1 Colour coded seismic-controlled spring isolator, single or multiple spring coils, with minimum 6 mm neoprene pad.
 - .1 Integral lateral and vertical seismic restraints.
 - .2 Removable coil spring element without having to disturb supported equipment.
 - .3 Lateral stiffness greater than 1.2 times rated vertical stiffness.
 - .4 Minimum 50% overload capacity.
 - .5 Non-welded spring elements: Epoxy coated, with a minimum one thousand hour rating when tested in accordance with ASTM B-117.
 - .2 Steel housing design to limit lateral and vertical movement of the supported equipment.
 - .1 Designed to accept coil springs of different sizes and capacities.
 - .2 All spring forces isolated from seismic housing under non-seismic events.
 - .3 Replaceable elastomeric elements at all dynamic contact points.
 - .3 Neoprene snubber to limit maximum equipment movement in any direction to 6 mm.
 - .4 Adaptor base suitable sized for larger anchors, when required to suit anchorage capacity.
 - .5 Kinetics Noise Control model FMS
 - .5 Type "S-SA" – All Direction Neoprene Isolator
 - .1 Molded, oil resistant neoprene compound, with encapsulated cast-in-place top steel load plate, and steel base plate with anchor holes.
 - .2 Designed for seismic loads in all directions with no metal-to-metal contact.
 - .3 Kinetics Noise Control model RQ.
-

- .6 Type "S-SB" – Multi-Axis Limit Stop Snubber Assemblies
 - .1 Interlocking steel construction, attached to equipment structure and equipment, maximum of 6 mm seismic movement.
 - .2 Designed to restrict movement in two or three axis.
 - .3 Minimum 6 mm thick resilient neoprene pads to prevent metal-to-metal impact.
 - .4 Minimum two snubbers for each piece of equipment.
 - .5 Kinetics Noise Control model HS series.
 - .7 Type "S-SC" – Single-Axis Limit Stop Snubber Assemblies
 - .1 Steel construction, attached to equipment structure and equipment, maximum of 6 mm seismic movement.
 - .2 Designed to restrict movement in one axis.
 - .3 Minimum 6 mm thick resilient neoprene pads to prevent metal-to-metal impact.
 - .4 Minimum four snubbers for each piece of equipment.
 - .5 Kinetics Noise Control model HS-1.
 - .8 Type "S-CR" – Cable Restraints for Suspended Piping and Ductwork
 - .1 Steel wire strand cables.
 - .1 Rope connections: Overlap wire "U" clips or tool-less wedge insert lock connectors.
 - .2 Connector strength rating equal to 90% of cable breaking strength rating.
 - .3 Kinetics Noise Control model KSBC / KWRC / KWGC
 - .2 Building and equipment attachment brackets: Designed to permit free cable movement in all directions up to a forty-five degree misalignment.
 - .1 Protective thimbles at sharp corners to protect against cable wear.
 - .2 Selected to exceed the cable working design load by 50%.
 - .3 Single sided "C" beam clamps are not acceptable.
 - .4 Kinetics Noise Control model KSCA / KCAB Wedge / KUAB Undercut.
 - .3 Vertical Suspension Rods
 - .1 Braced to avoid potential for buckling due to vertical up-lift forces.
 - .2 Structural steel angle or formed channel brace selected to prevent support rod buckling.
 - .3 Brace attached to support rod with a series of adjustable clips, without the use of hand-tools.
 - .4 Kinetics Noise Control model KHRC.
-

3 Execution

3.1 **INSTALLATION**

- .1 Install seismic restraint devices in accordance with manufacturer's instructions.
- .2 Install snubber devices only after equipment is installed and operating, to ensure no metal-to-metal contact.
- .3 Seismic restraint manufacturer to provide training to the Installation Contractor on installation methods.
- .4 Anchors on piping systems used for thermal expansion may be used as both a lateral and longitudinal restraint where they are designed for concurrent thermal and seismic loadings.
- .5 Pipe and duct penetrations through floors are acceptable as a lateral restraint, provided sleeves and firestopping materials are installed correctly.
- .6 Racked piping systems may have the rack braced (laterally, longitudinally, or combination thereof), provided each pipe supported by the rack is restrained to the rack.
- .7 Each lateral or longitudinal brace must be secured to the building structure, and not any other building service.
- .8 Pipe and duct penetrations through masonry and poured concrete wall partitions are acceptable as a lateral restraint, provided sleeves and firestopping materials are installed correctly.
 - .1 Drywall partitions, including demountable partitions, are not to be used for lateral restraint.

3.2 **SYSTEMS**

- .1 Seismically restrain the following systems:
 - .1 Ductwork
 - .1 Rectangular and oval ductwork with cross sectional area 0.55 m² and greater.
 - .2 Round ducts with diameters 710 mm and larger.
 - .2 Electrical conduit
 - .1 Conduit 64 mm I.D. and larger.
 - .2 Cable trays supporting conduit which is sized 64 mm I.D. and larger.
 - .3 Static equipment (both mechanical and electrical)
 - .1 Anchor equipment to equipment supports. Anchor equipment supports to structure.
 - .2 Suspended equipment, including lighting fixtures:
 - .1 Use one or more of following methods depending upon Site conditions:

- .1 Install tight to structure.
 - .2 Cross brace in every direction.
 - .3 Brace back to structure.
 - .4 Cable restraint system.
- .2 Seismic restraints:
 - .1 Cushioning action gentle and steady.
 - .2 Never reach metal-like stiffness.
- .4 Vibration isolated equipment (both mechanical and electrical)
 - .1 Seismic control measures not to jeopardize noise and vibration isolation systems. Provide 6 to 9 mm clearance during normal operation of equipment and systems between seismic restraint and equipment.
 - .2 Incorporate seismic restraints into vibration isolation system to resist complete isolator unloading.

3.3 **EXEMPTIONS**

- .1 The following systems do not require additional seismic restraint other than as specified for regular piping and duct supports:
 - .1 Piping
 - .1 Natural gas, vacuum, petroleum based liquid, and compressed air piping less than NPS 1 size.
 - .2 Piping inside of mechanical service rooms less than NPS 1¼ size.
 - .3 All other piping less than NPS 2½ size.
 - .4 Piping suspended from hangers at a distance of 305 mm or less, measured from the top surface of the pipe, to the underside of the supporting structure above.
 - .2 Ductwork
 - .1 Rectangular and oval ductwork with cross sectional area less than 0.55 m².
 - .2 Round ducts with diameters less than 710 mm.
 - .3 Ductwork suspended by hangers at a distance of 305 mm or less, measured from the top surface of the duct to the underside of the supporting structure above.
 - .3 Electrical conduit
 - .1 Conduit less than 64 mm I.D.
 - .2 Cable trays supporting conduit which is sized less than 64 mm I.D.

.3 Electrical conduit or cable trays suspended by hangers at a distance of 305 mm or less, measured from the top surface of the conduit / tray to the underside of the supporting structure above.

.4 Lighting fixtures suspended by hanger at a distance of 305 mm or less, measured from the top surface of the fixture to the underside of the supporting structure above.

3.4 **INSPECTION**

.1 Provide services of the manufacturer's technical representative to conduct site inspections of the Work in progress, and to conduct a final inspection of the Work. Provide a copy of the final inspection report to the Consultant for review.

End of Section

-
- 1 General
 - 1.1 **SUMMARY**
 - .1 Section Includes
 - .1 Labour, Products, equipment and services necessary to complete the Work of this section.
 - 1.2 **SUBMITTALS**
 - .1 Shop Drawings
 - .1 Submit Shop Drawings in accordance with Section 01 33 00.
 - .2 Submit schedule of equipment identification nameplates for review.
 - .2 Samples
 - .1 Submit samples of piping, valve and ductwork identification markers.
 - 2 Products
 - 2.1 **MATERIALS**
 - .1 Equipment Nameplates
 - .1 Laminated phenolic plastic with white finish and minimum 10 mm high black letters.
 - .2 Three rows of text, based as shown in equipment schedules.
 - .1 Line 1: Equipment ID (e.g. P-1)
 - .2 Line 2: Equipment name (e.g. northwest zone heating pump)
 - .3 Line 3: Optional, up to fifteen characters (e.g. standby pump)
 - .3 This identification is in addition to manufacturer's nameplate data.
 - .2 Ductwork Identification
 - .1 Painted stencil lettering: 50 mm high.
 - .2 Paint colour:
 - .1 Black paint on canvas covered insulated ductwork
 - .2 Black paint on metal covered insulated ductwork
 - .3 Black paint on uninsulated ductwork
 - .3 Two levels of text in accordance with designations shown on schedules:
 - .1 Level 1: Abbreviated name of air handling system for supply systems (e.g. AHU-1), or fan number for exhaust or ventilation only systems (e.g. F-1)
 - .2 Level 2: System name (e.g. general supply)
-

- .4 Direction arrows: 65 mm high
- .3 Pipe Identification – Type 1: Adhesive Labels
 - .1 Pre-printed 6 mil thick vinyl cloth, plastic coated with pressure sensitive self-adhesive backing surface. On insulated pipe, use adhesive suitable for this application.
 - .1 Pipe diameter (including insulation) 75 mm or less: 29 mm width, 25 mm high lettering. Length of labels as dictated by legend.
 - .2 Pipe diameter (including insulation) greater than 75 mm: Minimum width of 64 mm and with 50 mm high letters.
 - .3 Primary label colour: To CAN/CGSB-24.3.
 - .4 Pipe label to include service pressure for steam, compressed air, natural gas (if more than one gas service pressure inside of building), and vacuum.
 - .5 Legend: Black with the legend printed in full wherever feasible.
 - .2 Direction arrow banding tape: Colour coded vinyl tape with pressure sensitive adhesive backing, 50 mm wide, with directional arrows.
 - .3 Acceptable Manufacturers:
 - .1 Brady
 - .2 Safety Supply Co.
 - .3 S.M.S
 - .4 Revere-Seton
- .4 Pipe Identification – Type 2: Coil Wrap Labels
 - .1 Reversible direction, semi-rigid plastic vinyl, with subsurface printing, and integral direction arrows.
 - .1 Up to 150 mm diameter: Coil wrap six rows of printing
 - .2 Over 150 mm diameter: Saddle type with two rows of printing, fastened with stainless steel springs
 - .3 Lettering Size:

Outside Diameter	Letter Height
Less than 5/8"	1/4"
3/4" – 1 1/4"	1/2"
1 1/8" – 2 3/8"	3/4"
2 1/2" – 4 1/2"	1 1/4"
 - .4 Primary label colour: To CAN/CGSB-24.3.
 - .5 Pipe label to include service pressure for, natural gas and vacuum.
 - .6 Legend: Black with the legend printed in full wherever feasible.

- .2 Acceptable Manufacturers:
 - .1 Brady
 - .2 Safety Supply Co.
 - .3 S.M.S
 - .4 Revere-Seton
 - .5 Valve Identification
 - .1 Laminated phenolic plastic with minimum 10 mm high lettering, with brass keychain.
 - .2 Minimum two lines of text:
 - .1 Line 1: Valve designation
 - .2 Line 2: Valve position instruction
 - .3 Acceptable manufacturers
 - .1 S.M.S.
 - .2 Brady
 - .3 Safety Supply Co.
 - .4 Revere-Seton
 - 3 Execution
 - 3.1 **INSTALLATION**
 - .1 Equipment Nameplates
 - .1 Identify mechanical and electrical equipment installed under this division with nameplates describing the function or use of the particular equipment involved.
 - .2 Do not commence fabrication of nameplates until after receipt of Consultant's review.
 - .3 Equipment includes, but not limited to:
 - .1 Equipment as shown on schedules and specified
 - .2 Motor starters
 - .3 Motor control centres
 - .4 Pushbutton stations
 - .5 Control panels
 - .6 Time switches
 - .7 Disconnect switches
 - .8 Contactors or relays in separate enclosures
-

- .4 Equipment nameplates for building automation system components are specified under Section 25 05 00.
 - .5 Securely fasten nameplates to the equipment with round-head cadmium plated steel self-tapping screws.
 - .2 Ductwork Identification
 - .1 Label ductwork installed under this division to indicate the content and direction of flow.
 - .2 Locate labels as follows:
 - .1 Within 1.5 m of air handling units and free standing fans.
 - .2 Within 3 m of divisions in exposed ductwork.
 - .3 On each exposed duct passing through a wall, partition or floor (one on each side of such wall, partition or floor).
 - .4 At intervals not to exceed 15 m along every exposed duct run exceeding 15 m in length.
 - .5 On every concealed duct where it enters a floor area that it serves.
 - .3 Labels to be visible from 1.5 m above the adjacent floor or platform.
 - .4 Clean surfaces with a trisodium phosphate solution before application of paint.
 - .3 Piping Identification
 - .1 Label all piping installed under this division to indicate the content and direction of flow with Type 1 or Type 2 labeling system.
 - .2 For piping carrying steam, compressed air and vacuum, show on label the pressure or vacuum, and working units as applicable.
 - .3 Locate labels as follows:
 - .1 At every end of pipe run, adjacent to the valve or item of equipment serviced.
 - .2 At valves, tees and changes of direction.
 - .3 On each exposed pipe passing through a wall, partition or floor (one on each side of such wall, partition or floor).
 - .4 At intervals not to exceed 15 m along every exposed pipe run exceeding 15 m in length.
 - .5 At every access point on concealed piping.
 - .4 Labels to be visible from 1.5 m above the adjacent floor or platform.
 - .5 Type 1 Labels;
 - .1 Clean surfaces before application of labels.
-

- .2 Secure label with direction arrow banding tape for full circumference of pipe, at each end of label.
- .6 Natural gas piping: In addition to pipe labels specified above, paint all piping and tubing with one coat oil alkyd primer and one top coat of alkyd enamel, bright yellow.
- .7 Natural gas piping: As specified above except provide labels every 6 m.
- .4 Valve Tags
 - .1 Provide valve tags on all valves, except as follows:
 - .1 At plumbing fixtures.
 - .2 On balancing valves at equipment being served.
 - .3 On isolation valves around control valves
 - .2 Provide a valve identification directory for each system.
 - .1 Quantity: Two copies of valve identification directories for each system
 - .2 Documented as follows (example given):

Valve No.	Service	Valve Location	Nearest Column
HV-1	Northwest Zone Heating	Penthouse, North Side	A-8

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

.1 Labour, Products, equipment and services necessary to complete the Work of this section.

.2 Section Excludes

.1 The following items are not to be insulated, or are factory insulated.

.1 Ductwork:

.1 Variable volume terminal boxes

.2 Internal acoustically insulated ductwork, except overlap thermal insulation 300 mm over acoustic insulation section

.3 Supply ductwork which is exposed to the occupied space, unless otherwise noted

1.2 **REFERENCE STANDARDS**

.1 General

.1 Provide insulation materials and adhesives of fire retardant type with flame spread and smoke developed ratings not exceeding ULC, government, or municipal standards.

.2 Fire retardant materials with flame spread/smoke developed ratings not exceeding 25/50 when tested in accordance with CAN/ULC-S102, and complying with the requirements stated in the building code having jurisdiction.

.3 Identify insulation, coverings and adhesives where required by federal and/or provincial health and safety WHMIS legislation.

.4 Asbestos-free materials.

.2 Reference Standards

.1 Comply with the latest edition of:

.1 NFPA 90-A, Standard for the Installation of Air-Conditioning and Ventilating Systems

.2 NFPA 255, Standard Method of Test of Surface Burning Characteristics of Building Materials

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

.4 ASTM C-411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation

1.3 **SUBMITTALS**

.1 Samples

- .1 Submit in accordance with Section 01 33 00.
- .2 Before ordering insulation materials prepare sample board on which mount cross-section sample of types of insulation, including exterior jacket, properly identified for various services and equipment on Project. State types of adhesives.
- .3 Submit sample board to Consultant for review. After review and acceptance keep sample board in Consultant's Site office for duration of Project, for reference. No deviation from accepted samples will be allowed.

1.4 **PRODUCT DELIVERY, STORAGE AND HANDLING**

- .1 General
 - .1 Retain insulation materials in original cartons or containers until immediately prior to application and store in dry location.
- .2 Keep adhesives in their original containers with manufacturer's name and catalogue number clearly stated. Protect contents against freezing.

1.5 **DEFINITIONS**

- .1 For the purposes of this section, the following definitions apply:
 - .1 "Conditioned supply ducts": Ductwork conveying air which has either been heated or cooled.
 - .2 "Concealed": Mechanical services and equipment located in ceiling spaces above solid drywall and T-bar ceilings; space beneath raised floors; vertical service shafts; trenches; and non-accessible chases and furred spaces.
 - .3 "Exposed": Mechanical services and equipment in all other spaces not considered to be "concealed" as defined above. Services in tunnels are to be treated as "Exposed".

2 **Products**

2.1 **DUCTWORK INSULATION**

- .1 Type D1
 - .1 Fiberglass: To ASTM C553
 - .2 Flexible blanket
 - .3 Laminated kraft-aluminum foil facing jacket
 - .4 Operating temperatures: 4°C to 121°C (40°F to 250°F)
 - .5 Density: 12 kg/m³
 - .6 k value: 0.051 W/m°C @ 24°C (0.35 BTUH•in/ft²°F @ 75°F)
 - .7 Acceptable Manufacturers
 - .1 Johns Manville - Microlite
 - .2 Knauf Fibreglass

- .2 Type D2
 - .1 Fiberglass: To ASTM C553
 - .2 Semi-rigid board
 - .3 Laminated kraft-aluminum foil facing jacket
 - .4 Operating temperatures: 4°C to 121°C
 - .5 Density: 48 kg/m³
 - .6 k value: 0.044 W/m°C @ 24°C
 - .7 Acceptable Manufacturers
 - .1 Owens Corning - 703/AF530
 - .2 Johns Manville - Spin-Glas Series 814
 - .3 Knauf Fibreglass
- .3 Type D3
 - .1 Inorganic mineral fibre: To ASTM C518
 - .2 Flexible blanket or rigid board
 - .3 ULC approved ductwork fire rating: To two hours
 - .4 Laminated kraft-aluminum foil facing jacket
 - .5 Maximum operating temperature: -173°C to +1260°C
 - .6 Acceptable manufacturers
 - .1 3M Ceramics Materials - Firemaster Duct Wrap
Firemaster Grease Duct
Firemaster Board

2.2 **INSULATION FINISH**

- .1 Canvas Jacket
 - .1 ULC listed plain weave cotton fabric
 - .2 Weight: 220 gm/m²
 - .3 Acceptable manufacturers
 - .1 Fattal's Thermocanvas
 - .2 PVC (Polyvinyl Chloride) Jacket
 - .1 Minimum thickness: 20 mil
 - .2 Maximum permeability: 0.09 perms
 - .3 Premoulded one-piece fitting covers
-

- .4 Tape: Vinyl, pressure sensitive, colour matched
- .5 Acceptable manufacturers
 - .1 Johns Manville - Manville Zeston 2000
 - .2 ACWIL Insulations
 - .3 Sure Fit Systems
- .3 Metal Jacket
 - .1 Aluminum: Stucco embossed, minimum 0.45 mm thick
 - .2 Stainless steel: Corrugated, minimum 0.25 mm thick
 - .3 Fittings: Custom made, swaged ring or lobster back style on bends, die shaped over fittings, valves, strainers and flanges
 - .4 Bands: 13 mm wide stainless steel with mechanical fasteners
 - .5 Acceptable manufacturers
 - .1 Alcan Canada Products - Thermaclad Type 1
 - .2 Childers Products Inc - Fab straps

2.3 **ADHESIVES**

- .1 Contact Bond Cement
 - .1 Quick setting for metal surfaces
 - .2 Acceptable manufacturers:
 - .1 Henry - 200-37
 - .2 Foster - 85-75
- .2 Lap Seal Adhesive
 - .1 For joints and lap sealing of vapour barriers
 - .2 Acceptable manufacturers:
 - .1 Henry - 230-39
 - .2 Foster - 85-75
- .3 Contact Adhesive
 - .1 Acceptable manufacturers:
 - .1 Foster - 85-20
- .4 Lagging Adhesive
 - .1 Acceptable manufacturers:
 - .1 Henry - 120-18

.2 Foster - 30-36

2.4 **MASTIC**

.1 Interior

.1 Acceptable manufacturers:

.1 Henry - 120-19

.2 Foster - 30-35

.2 Exterior, With Vapour Barrier

.1 Acceptable manufacturers:

.1 Henry - 130-11

.2 Foster - 65-07

.3 Exterior, Breather Type

.1 Acceptable manufacturers:

.1 Childers - CP-10

.4 Exterior - Aluminum Colour Finish

.1 Acceptable manufacturers:

.1 VentureClad 1579CW

.2 Alumaguard All-weather

.5 Cutback Asphalt

.1 Acceptable manufacturers:

.1 Henry - 700-01

.2 Foster - 60-25

2.5 **MISCELLANEOUS PRODUCTS**

.1 Sealants

.1 Acceptable manufacturers:

.1 Henry - 230-39

.2 Foster - 30-80

.2 Vapour Barrier Tape

.1 Colour matched, foil faced vapour barrier tape

.2 75 mm wide

.3 Vinyl backed or foil backed to suit insulation

- .4 Acceptable manufacturers:
 - .1 Johns Manville - Zeston Z-tape
 - .2 MacTac Canada Ltd - Vinyl Scrim or Foil Scrim Kraft
 - .3 Compac Corp
 - .4 Fattal Canvas Inc
 - .3 Bands
 - .1 Stainless steel or galvanized metal, 12 mm wide with mechanical cinch locks.
 - .4 Insulation Cement
 - .1 Acceptable manufacturers:
 - .1 Partek - Hilcote
 - .5 Vapour Barrier Insulation Coating
 - .1 Acceptable manufacturers:
 - .1 Henry - 130-11
 - .2 Foster - 60-38
 - .6 Weld Pins, Studs and Clips
 - .1 Acceptable manufacturers:
 - .1 Midwest Fasteners Inc
 - .2 Continental Studwelding
 - .3 AGM
 - .7 Caulking
 - .1 Fast-drying colour matched flexible butyl elastomer based vapour barrier sealant.
 - 3 Execution
 - 3.1 **APPLICATION**
 - .1 General
 - .1 Perform insulation work using qualified insulating applicators, in accordance with latest trade application methods and to the Consultant's approval.
 - .2 Clean all surfaces to be insulated to remove grime, grease, oil, moisture or other matter to ensure that insulation is applied to clean and dry surfaces.
 - .3 Apply insulation under ambient temperature conditions in accordance with insulation or adhesive manufacturer's recommendations.
 - .4 Do not apply insulation until such time as installation and testing of piping, ductwork and equipment has been inspected, verified, and accepted by General Contractor.
-

- .5 Apply insulation neatly and tightly in unbroken lengths and with ends of sections firmly and squarely butted together. Lap canvas (or other specified wrapping) well over joints and cement down well with adhesive.
 - .6 At wall sleeves: Extend insulation through to make insulation continuous.
 - .7 At fire walls: Terminate insulation at wall, and pack space between wall sleeve and duct or pipe as specified in Section 23 05 01.
 - .2 Treatment of Existing Insulation
 - .1 Where new piping or ductwork systems connect to existing and where existing insulation is damaged through installation of new work, remove damaged sections of insulation for a minimum of 1 m and replace and finish to match existing.
 - .3 Ductwork
 - .1 General
 - .1 Insulate access doors or removable panels in ductwork as separate units to permit opening or removal without damage to adjoining insulation.
 - .2 Type D1
 - .1 Fasten insulation with adhesive, applied in 150 mm wide strips at 300 mm centres.
 - .2 Tightly butt all edges and joints and seal with interior mastic and scrim foil tape.
 - .3 Tying cord may be used to temporarily hold insulation until adhesive has set.
 - .3 Type D2
 - .1 Secure insulation with welded pins and speed washer type fasteners at 300 mm centres. Provide a minimum of two rows of fasteners on each side of duct.
 - .2 In addition to mechanical fasteners, adhere insulation with adhesive applied in 150 mm strips on 450 mm centres.
 - .3 Tightly butt all edges and joints and seal with interior mastic and scrim foil tape.
 - .4 Cut off protruding ends of welded pins and cover speed washers with same tape.
 - .4 Type D3
 - .1 Install fire rated insulation in strict accordance with manufacturer's recommendations and ULC listing requirements.
 - .2 Provide the services of the manufacturer's technical representative to inspect the installation prior to inspection by the Consultant. Submit inspection certificate from the manufacturer.
-

3.2 INSULATION SELECTION

.1 HVAC Ductwork

.1 Insulate the following systems:

System	Size	Max. Op. Temp °C (°F)	Insulation Type	Insulation Thickness mm
Conditioned air supply ducts	Exposed Concealed	65 (150)	D2 D1	25 38
Fresh air intake plenums and ducts	Exposed Concealed	38 (100)	D2 D1	25 38
Return air ducts (as noted)	Exposed Concealed	38 (100)	D2 D1	25 38
Exterior supply and return ductwork	All	65 (150)	D2	50
Exhaust duct behind registers in high humidity areas, minimum 3 m long	Concealed	38 (100)	D1	38
Exhaust air plenums and ducts, between outside wall and motorized damper	Exposed Concealed	38 (100)	D1 D1	38 38
Fabricated steam boiler breeching and hot water boiler stacks	Round Rectangular	454 (850)	E3 E4	50 Note 1
Fire rated ducts, two hour	All	-	D3	Note 2

Note 1: Two layers of 25 mm thickness, overlapped butt joints.

Note 2: Thickness and installation in strict accordance with ULC listing requirements.

3.3 FINISH

.1 Ductwork

.1 Finish exposed ductwork in accordance with the following:

System	Equipment
D1 (round)	Canvas
D2	(Canvas) (Metal)
D3	None

.2 General

.1 Canvas installation:

- .1 Do not apply canvas to elastomeric closed cell foam insulation.
- .2 Securely paste canvas on with a two coat application of fire resistive lagging adhesive over the entire surface. Apply canvas between coats of adhesive, while first coat is still wet. Stretch canvas tightly and smoothly with overlapping seams located where least visible. Apply second coat of adhesive immediately following application of canvas. Do not use metal bands.

- .3 Seal canvas with off-white sizing to leave a smooth non-porous surface ready to receive paint application.
- .2 Outdoor ductwork:
 - .1 Non-winter application: Finish with one layer of glass fabric applied between two full mop coats of outdoor mastic with all laps completely sealed.
 - .2 Winter application: Finish insulated ductwork with one layer of glass fibre fabric applied between two full mop coats of exterior mastic, aluminum colour. Topcoat with aluminum coating in accordance with manufacturer's direction. Store materials in a heated space prior to application.
- .3 Do not allow mastic materials to come in contact with single ply membrane roofs.
 - .1 Clean up accidental spills immediately.
 - .2 Provide temporary drop sheets to protect the roof.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

.1 Labour, Products, equipment and services necessary to complete the Work of this section including, but not limited to, the following:

.1 Thermal insulation to piping, ductwork and equipment.

.2 Section Excludes

.1 The following items are not to be insulated, or are factory insulated:

.1 Piping:

.1 Compressed air piping

.2 Natural gas piping

.3 Fire protection piping (except where heat traced)

.4 Vertical sections of rainwater leaders (except where running exposed or concealed within high humidity areas including shower rooms, locker rooms, kitchens, etc.)

.5 Vertical sections of exposed sanitary drainage piping

.6 Condenser water supply and return piping inside of building

1.2 **REFERENCE STANDARDS**

.1 General

.1 Provide insulation materials and adhesives of fire retardant type with flame spread and smoke developed ratings not exceeding ULC, government, or municipal standards.

.2 Fire retardant materials with flame spread/smoke developed ratings not exceeding 25/50 when tested in accordance with CAN/ULC-S102, and complying with the requirements stated in the building code having jurisdiction.

.3 Identify insulation, coverings and adhesives where required by federal and/or provincial health and safety WHMIS legislation.

.4 Asbestos-free materials.

.2 Reference Standards

.1 Comply with the latest edition of:

.1 NFPA 90-A, Standard for the Installation of Air-Conditioning and Ventilating Systems

.2 NFPA 255, Standard Method of Test of Surface Burning Characteristics of Building Materials

- .3 CAN/ULC-S102, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
- .4 ASTM C-411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation

1.3 SUBMITTALS

- .1 Samples
 - .1 Submit in accordance with Section 01 33 00.
 - .2 Before ordering insulation materials prepare sample board on which mount cross-section sample of types of insulation, including exterior jacket, properly identified for various services and equipment on project. State types of adhesives.
 - .3 Submit sample board to Consultant for review. After review and acceptance keep sample board in Consultant's Site office for duration of Project for reference. No deviation from accepted samples will be allowed.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- .1 General
 - .1 Retain insulation materials in original cartons or containers until immediately prior to application and store in dry location.
 - .2 Keep adhesives in their original containers with manufacturer's name and catalogue number clearly stated. Protect contents against freezing.

1.5 DEFINITIONS

- .1 For the purposes of this section, the following definitions apply:
 - .1 "Conditioned supply ducts": Ductwork conveying air which has either been heated or cooled.
 - .2 "Concealed": Mechanical services and equipment located in ceiling spaces above solid drywall and T-bar ceilings; space beneath raised floors; vertical service shafts; trenches; and non-accessible chases and furred spaces.
 - .3 "Exposed": Mechanical services and equipment in all other spaces not considered to be "concealed" as defined above. Services in tunnels are to be treated as "Exposed".
 - .4 "Cold piping": Piping carrying fluids at temperatures below 16°C (60°F).

2 Products

2.1 PIPE INSULATION

- .1 Type P1
 - .1 Fiberglass: To ASTM C547
 - .2 Rigid, split formed with pressure sensitive longitudinal adhesion strip

- .3 Reinforced all service vapour retarder jacket:
 - .4 Operating temperatures: -40°C to +454°C (-40°F to +850°F)
 - .5 k value: 0.042 W/m°C @ 93°C
 - .6 Acceptable Manufacturers
 - .1 Owens Corning - SSL-II
 - .2 Johns Manville - Micro-Lok with AP-T plus jacket
 - .3 Manson Alley - K with all purposed APT jacket
 - .4 Knauf Pipe Insulation with ASJ-SSI jacket
 - .2 Type P2
 - .1 Inorganic mineral fibre: To ASTM C547
 - .2 Rigid, split formed, moulded insulation
 - .3 Maximum operating temperature: 648°C (1200°F)
 - .4 k value: 0.058 W/m°C @ 176°C
 - .5 Tie wire: 0.045 mm (16 gauge) stainless steel with twisted ends, on maximum 300 mm centres
 - .6 Acceptable manufacturers
 - .1 Johns Manville - Thermo 12 Gold
 - .2 Calsilite
 - .3 Type P3
 - .1 Closed cell elastomeric: To ASTM C534
 - .2 Preformed, with self closing adhesion strips
 - .3 k value: 0.04 W/m°C @ 82°C
 - .4 Maximum operating temperature: 82°C (180°F)
 - .5 Acceptable manufacturers:
 - .1 Armstrong - AP/Armaflex Self Seal Pipe Insulation
 - .2 Rubatex - 25-50
 - .3 Nomaco - IMC04 Polyolefin Foam
 - .4 Type P4
 - .1 CFC-free rigid phenolic insulation: To ASTM C1126
 - .2 Rigid, split formed and sidewall segmented, depending on size
 - .3 Reinforced all service low permeance vapour retarder jacket
-

- .4 Operating temperatures: -180°C to +120°C (-290°F to +250°F)
 - .5 K value: 0.019 W/mK @ 24°C
 - .6 Density: 35 kg/m³
 - .7 Acceptable manufacturers:
 - .1 Kingspan - Koolphen K
 - .5 Type P5 - Cold Piping Support Inserts
 - .1 CFC-free rigid phenolic insulation: To ASTM C1126
 - .2 Rigid, split formed and sidewall segmented, depending on size
 - .3 Reinforced all service low permeance vapour retarder jacket
 - .4 Operating temperatures: -180°C to +120°C (-290°F to +250°F)
 - .5 K value: 0.019 W/mK @ 24°C
 - .6 Density, up to NPS 10: 60 kg/m³
 - .7 Density, NPS 12 and over: 80 kg/m³
 - .8 Acceptable manufacturers:
 - .1 Kingspan - Koolphen K Pipe Support Inserts
- 2.2 **INSULATION FINISH**
- .1 Canvas Jacket
 - .1 ULC listed plain weave cotton fabric
 - .2 Weight: 220 gm/m²
 - .3 Acceptable manufacturers
 - .1 Fattal's Thermocanvas
 - .2 PVC (Polyvinyl Chloride) Jacket
 - .1 Minimum thickness: 20 mil
 - .2 Maximum permeability: 0.09 perms
 - .3 Premoulded one-piece fitting covers
 - .4 Tape: Vinyl, pressure sensitive, colour matched
 - .5 Acceptable manufacturers:
 - .1 Johns Manville - Manville Zeston 2000
 - .2 ACWIL Insulations
 - .3 Sure Fit Systems
-

.3 Metal Jacket

- .1 Aluminum: Stucco embossed, minimum 0.45 mm thick
- .2 Stainless steel: Corrugated, minimum 0.25 mm thick
- .3 Fittings: Custom made, swaged ring or lobster back style on bends, die shaped over fittings, valves, strainers and flanges
- .4 Bands: 13 mm wide stainless steel with mechanical fasteners
- .5 Acceptable manufacturers:
 - .1 Alcan Canada Products - Thermaclad Type 1
 - .2 Childers Products Inc - Fab straps

2.3 **ADHESIVES**

.1 Contact Bond Cement

- .1 Quick setting for metal surfaces
- .2 Acceptable manufacturers:
 - .1 Henry - 200-37
 - .2 Foster - 85-75

.2 Lap Seal Adhesive

- .1 For joints and lap sealing of vapour barriers
- .2 Acceptable manufacturers:
 - .1 Henry - 230-39
 - .2 Foster - 85-75

.3 Contact Adhesive

- .1 Acceptable manufacturers:
 - .1 Foster - 85-20

.4 Lagging Adhesive

- .1 Acceptable manufacturers:
 - .1 Henry - 120-18
 - .2 Foster - 30-36

.5 Mastic Interior

- .1 Acceptable Manufacturers
 - .1 Henry - 120-19
 - .2 Foster - 30-35

- .6 Exterior, With Vapour Barrier
 - .1 Acceptable manufacturers:
 - .1 Henry - 130-11
 - .2 Foster - 65-07
- .7 Exterior, Breather Type
 - .1 Acceptable manufacturers:
 - .1 Childers - CP-10
- .8 Exterior - Aluminum Colour Finish
 - .1 Acceptable manufacturers:
 - .1 USE Hickson Hydroshield Mastic 451 with "Stormking" aluminum coating
- .9 Cutback Asphalt
 - .1 Acceptable manufacturers:
 - .1 Henry - 700-01
 - .2 Foster - 60-25

2.4 **MISCELLANEOUS PRODUCTS**

- .1 Sealants
 - .1 Acceptable manufacturers:
 - .1 Henry - 230-39
 - .2 Foster - 30-80
 - .2 Vapour Barrier Tape
 - .1 Colour matched, foil faced vapour barrier tape
 - .2 75 mm wide
 - .3 Vinyl backed or foil backed to suit insulation
 - .4 Acceptable manufacturers:
 - .1 Johns Manville - Zeston Z-tape
 - .2 MacTac Canada Ltd - Vinyl Scrim or Foil Scrim Kraft
 - .3 Compac Corp
 - .4 Fattal Canvas Inc
 - .3 Bands
 - .1 Stainless steel or galvanized metal, 12 mm wide with mechanical cinch locks.
-

- .4 Insulation Cement
 - .1 Acceptable manufacturers:
 - .1 Partek - Hilcote
 - .5 Vapour Barrier Insulation Coating
 - .1 Acceptable manufacturers:
 - .1 Henry - 130-11
 - .2 Foster - 60-38
 - .6 Weld Pins, Studs and Clips
 - .1 Acceptable manufacturers:
 - .1 Midwest Fasteners Inc
 - .2 Continental Studwelding
 - .3 AGM
 - .7 Caulking
 - .1 Fast-drying colour matched flexible butyl elastomer based vapour barrier sealant.
- 3 Execution
- 3.1 **APPLICATION**
- .1 General
 - .1 Perform insulation Work using qualified insulating applicators, in accordance with latest trade application methods and to the Consultant's approval.
 - .2 Clean all surfaces to be insulated to remove grime, grease, oil, moisture or other matter to ensure that insulation is applied to clean and dry surfaces.
 - .3 Apply insulation under ambient temperature conditions in accordance with insulation or adhesive manufacturer's recommendations.
 - .4 Do not apply insulation until such time as installation and testing of piping, ductwork and equipment has been inspected, verified, and accepted by General Contractor.
 - .5 Apply insulation neatly and tightly in unbroken lengths and with ends of sections firmly and squarely butted together. Lap canvas (or other specified wrapping) well over joints and cement down well with adhesive.
 - .6 At wall sleeves: Extend insulation through to make insulation continuous.
 - .7 At fire walls: Terminate insulation at wall, and pack space between wall sleeve and duct or pipe as specified in Section 23 05 01.
-

.2 Treatment of Existing Insulation

- .1 Where new piping or ductwork systems connect to existing and where existing insulation is damaged through installation of new Work, remove damaged sections of insulation for a minimum of 1 m and replace and finish to match existing.

.3 Piping

.1 General

- .1 Neatly finish insulation at pipe hangers, supports, sensors and interruptions.
- .2 At expansion joints in piping: Apply insulation over sleeve of 1.6 mm metal, fabricated to fit around expansion joint without restricting movement of joint.
- .3 Provide sleeves which can be removed without damage to adjoining insulation to allow repacking and lubrication of expansion joint.
- .4 Provide sleeves minimum of 75 mm longer than expansion joint and fitted with insulation retaining flanges and with means for maintaining position of sleeve over expansion joint.
- .5 At heat traced piping: Make allowance in sizing inside diameter of insulation for tracing cable which will be provided under Electrical Contract.

.2 Type P1

- .1 Lap and seal all joints (longitudinal and transverse). Use vapour barrier tape on transverse joints. Locate longitudinal joints on top of pipe.
- .2 Insulate fittings, unions, flanges and valves with preformed block insulation or with segments cut from insulation of same type and thickness as pipe insulation.
- .3 Form insulation on fittings and valves without voids. Secure in place with galvanized metal bands.

.3 Type P2

- .1 Seal all joints (longitudinal and transverse). Secure in place with metal bands at 230 mm centres. Use vapour barrier tape on transverse joints.
- .2 Insulate fittings, and flanges with preformed block insulation or with segments cut from insulation of same type and thickness as pipe insulation.
- .1 Exception: Steam valves NPS 2 and smaller in low pressure steam piping.
- .2 Form insulation on fittings and valves without voids. Secure in place with metal bands.
- .3 Finish with insulating and finishing cement.
-

- .3 Insulate valves with removable “box” insulation blocks. Ensure top spindle and wheel/lever are free running and clear of insulation and covering.
 - .4 Stop insulation on each side of unions and at connections to equipment.
 - .4 Type P3
 - .1 Lap and seal all joints (longitudinal and transverse). Use vapour barrier tape on transverse joints. Locate longitudinal joints on top of pipe.
 - .5 Type P4 and P5
 - .1 Lap and seal all joints (longitudinal and transverse). Use vapour barrier tape on transverse joints. Locate longitudinal joints on top of pipe.
 - .2 Seal ends of insulation with mastic matching finish colour of insulation.
 - .6 Drainage systems
 - .1 Apply insulation on roof drain bodies with 100% coverage of adhesive.
 - .2 Insulate above ground sanitary drainage systems (above finished ceiling areas).
 - .3 Insulate above ground storm horizontal rainwater leaders, located beneath roofs.
 - .7 Insulation termination points
 - .1 Terminate 75 mm from fittings.
 - .2 Bevel insulation at forty-five degree angle away from fitting.
 - .3 Finish exposed face with insulating and finishing cement.
 - .8 Insulation protection inserts - cold piping systems under 15°C (60°F)
 - .1 Place an insert between support with insulation shield and pipe on cold piping NPS 1½ and larger
 - .2 Fabricate insert from Type P5 insulation
 - .3 Insert length: Extending a minimum 150 mm beyond each end of insulation shield
 - .4 Insert circumference: 360 degrees
 - .5 Insulation shield: To Section 23 05 29
 - .6 Where insert material actual thickness is different from the actual thickness of the adjacent insulation, shave the insert to an equal thickness of the adjacent insulation
 - .7 Bond the insulation shield to the insulation insert with adhesive and finish and seal complete assembly with vapour barrier insulation coating to form an unbroken vapour barrier, or,
-

- .8 Finish insulation insert as part of the main pipe insulation, and provide two metal band clamps for each insulation shield and strap the shield to the finished pipe insulation.

3.2 INSULATION SELECTION

.1 HVAC piping:

.1 Insulate the following systems:

System	Maximum Op. Temp °C (°F)	Pipe Size NPS	Insulation Type	Insulation Thickness mm
Equipment drain lines, safety valve vents, relief valve vents, etc.	110 (230)	All	P1	25
Dual temperature cooling/heating piping	93 (200)	All	P1, P4	38
Hot water heating piping	93 (200)	All	P1	38
Low temperature heating piping	60 (140)	Up to 4 5 and over	P1 P1	25 38
Refrigerant piping	60 (140)	All	P3, P4	19
Condensate water piping (exterior)	40 (105)	All	P1, P4	38

Note 1: Two layers of 25 mm thickness, overlapped butt joints.

.2 Plumbing Piping

.1 Insulate the following systems:

System	Maximum Op. Temp °C (°F)	Pipe Size	Insulation Type	Insulation Thickness mm
City water piping	27 (80)	All	P1, P4	25
Domestic cold water piping, including piping downstream of backflow preventers	27 (80)	All	P1, P4	25
Domestic hot and recirculating water piping, including piping downstream of backflow preventers	82 (180)	Up to 2 2½ and over	P1 P1	25 38
Storm and sanitary drainage piping	38 (100)	All	P1	25
Hot water supplies to barrier free use lavatories	82 (180)	All	P1	12

3.3 FINISH

.1 Piping

.1 Finish exposed piping in accordance with the following:

System	Pipe	Fittings, Valves, etc
P1	ASJ (Canvas) (PVC) (Metal)	(Canvas) (PVC) (Metal)
P2	(Canvas) (PVC) (Metal)	(Canvas) (PVC) (Metal)
P3	None	None
P1 Barrier Free Use	Canvas	Canvas

.2 General

.1 Canvas installation

- .1 Do not apply canvas to elastomeric closed cell foam insulation.
- .2 Securely paste canvas on with a two coat application of fire resistive lagging adhesive over the entire surface. Apply canvas between coats of adhesive, while first coat is still wet. Stretch canvas tightly and smoothly with overlapping seams located where least visible. Apply second coat of adhesive immediately following application of canvas. Do not use metal bands.
- .3 Seal canvas with off-white sizing to leave a smooth non-porous surface ready to receive paint application.

.2 Piping insulated with elastomeric foam insulation (P3):

- .1 Indoors and outdoors: Finish with one coat of white acrylic latex as recommended by insulation manufacturer.

.3 Outdoor piping:

- .1 Finish insulated piping with a field or factory applied aluminum jacket. Fasten and caulk butt joints and secure with sheet metal screws. Locate longitudinal joints on bottom of pipe.
- .2 Alternatively, finish with two coats of outdoor type mastic (outdoor mastic - aluminum colour finish).

.4 Do not allow mastic materials to come in contact with single ply membrane roofs.

- .1 Clean up accidentally spills immediately.
- .2 Provide temporary drop sheets to protect the roof.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

.1 Labour, Products, equipment and services necessary to complete the Work of this section including but not limited to the following:

- .1 Performance testing and balancing of heating, ventilating, air conditioning and liquid systems
- .2 Measuring and reporting all specified space noise levels
- .3 Measuring and reporting all specified vibration isolation levels
- .4 Rechecking of testing and balancing during the alternate (heating/cooling) season

.2 Section Excludes

.1 The following systems do not require air and water balancing:

- .1 Domestic cold water
- .2 Domestic hot water (except balancing valve on connections to hot water recirculation piping)
- .3 Steam and condensate systems (except steam flow meters at steam plant as part of heating equipment performance test)
- .4 Natural gas (except natural gas metering as part of heating equipment performance test)

.2 The following equipment does not require air and water balancing:

- .1 Hydronic and electric convection heaters (baseboards)
- .2 Hydronic and electric unit heaters
- .3 Hydronic radiant panel heating units

1.2 **RELATED WORK IN OTHER SECTIONS**

.1 Factory testing, and calibrating of equipment or control systems.

.2 Testing and checking of equipment supplied by other divisions, except where such equipment forms an integral part of the mechanical systems.

1.3 **QUALIFICATIONS**

.1 Perform testing and balancing of air and water systems by an accredited testing and balancing firm who is a member of the Associated Air Balance Council (AABC).

.1 Acoustic and vibration measurements may be performed by a specialist Sub-contractor to the testing and balancing firm.

1.4 **PERFORMANCE STANDARDS**

- .1 Perform testing and balancing in accordance with the current issue of:
 - .1 Associated Air Balance Council Standards for Total System Balance.
 - .2 SMACNA "Testing, Adjusting and Balancing" guidelines.
- .2 Instruments: Recently calibrated; state date of calibration in the report.

1.5 **COORDINATION**

- .1 General
 - .1 Review with affected trades before fabrication, the location of balancing devices, test connections and access openings and report conditions which could affect optimum system performance.
 - .2 By inspection, assure that all testing, balancing and metering devices are installed properly and in pre-selected locations.
 - .3 The Mechanical Contractor will obtain the approval of the testing and balancing firm before relocating these devices due to field conditions.
 - .4 Coordinate efforts so that items requiring replacement and/or delivery time (sheaves, motors, etc.) are tested as early as possible.
 - .2 The Mechanical Contractor and/or associated Subcontractors will provide the following assistance and/or services to the testing and balancing firm.
 - .1 Schedule sufficient time so that initial testing and balancing can be completed before occupancy begins and coordinate with trades involved.
 - .2 Keep testing and balancing firm informed of any major changes made during construction and furnish same with a set of Project Drawings and reviewed Shop Drawings.
 - .3 Furnish balancing devices, test connections access openings, balancing probe inlets and plugs.
 - .4 Clean and pre-run all equipment, filters, etc. and place all heating, ventilating and air conditioning systems into full operation and continue same during each Working Day of testing and balancing.
 - .5 Provide immediate labour from pertinent mechanical trades and tools, equipment and materials to make equipment and system alterations and adjustments as required, including control adjustments.
 - .6 Building Management System technical representative to operate the BMS during air and water balancing testing.
 - .7 Make available all equipment data (Shop Drawing performance data and operating instructions) to the testing and balancing firm.
 - .8 Refrigeration machine manufacturer service representative for performance testing of the refrigeration equipment. Testing and balancing firm witnesses and records all test results.
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- .9 Fuel fired heating equipment manufacturer service representative, or other qualified service company technical representative, for performance testing of heating equipment. Testing and balancing firm witnesses and records all test results.
 - .3 As part of the coordination effort, the Mechanical Contractor will be fully responsible for systems constructed, installed and adjusted to provide optimum performance as required by design intent. Any re-adjusting required as the result of spot checks by the Consultant shall be done at no increase in Contract Price.
 - 1.6 **DEFINITIONS**
 - .1 "Balancing"
 - .1 To proportion and regulate flows within the distribution system (subsystems, branches, mains, terminals, etc.) at appropriate pressures in accordance with the design intent. This includes setting discharge volume and patterns of terminal devices, and individual return and exhaust air volumes.
 - .2 "Testing"
 - .1 To measure, interpret and report in writing, such parameters as may be required to verify design compliance and as specified herein.
 - 1.7 **SUBMITTALS**
 - .1 Submit in accordance with Section 01 33 00.
 - .2 Submit layout drawings and report format a minimum fourteen days prior to start of air and water balancing on-site.
 - .1 Layout Drawings
 - .1 Identify specific locations of all adjusting, balancing and permanent measuring devices, neatly marked on a set of plans for approval by the Consultant. A set of reproducible drawings will be furnished by the Consultant for this purpose.
 - .2 Propose, for review by the Consultant, additional devices deemed advisable for satisfactory operation and completion of the Work of mechanical division.
 - .2 Report Format
 - .1 Submit proposed format of initial report.
 - .2 Include a complete list of instruments and tests for which they are to be used as they relate to this Project, including date of last calibration
 - 2 Products
 - 2.1 **NOT APPLICABLE**
 - 3 Execution
 - 3.1 **REQUIRED REPORTS**
 - .1 Provide the following start-up and performance testing reports:
-

- .1 Air and water balancing report
- .2 Acoustic survey report
- .3 Alternate season test report
- .2 Report Format
 - .1 Prepare test forms in MS Excel or Word format.
 - .2 Include the following header information for each test report:
 - .1 Owner name
 - .2 Project name
 - .3 Contractor name
 - .4 Consultant name
 - .5 Name of test report

- .3 Submit the above tests in a hardcopy form, separately bound from the Operations and Maintenance Manuals, and in Adobe Acrobat PDF format, in accordance with Section 01 33 00.

3.2 **AIR AND WATER BALANCING**

- .1 Site Visits
 - .1 Visit the Site as required prior to testing and balancing systems and advise respective trades of this section's requirements for probe inlets, etc. Submit a report to the Consultant after each site visit.
- .2 Balancing Tolerances
 - .1 Balance all systems to the performance parameters indicated on Drawings and in the Specifications.
 - .2 If interpretation, clarification or additions to performance parameters are required, request such information from the Consultant.

- .3 Balancing Tolerances

- .1 Air Flow Rates

Under 70 L/S	10% of flow
Over/at 70 L/S	5% of flow

- .2 Water Flow Rates

Hydronic Heating	5% of flow
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- .3 Heat Flow Rates

Air Coils	5% of design capacity
Heat Exchangers	5% of design capacity
Water Heaters	5% of design capacity

.4 Drawing Review

- .1 Review all pertinent plans, specifications, Shop Drawings, interference drawings and other documentation to become fully familiar with the systems and their specified and intended performance.

.5 Air Systems

- .1 Test relative barometric pressures in various building areas, as deemed necessary by the Consultant and at least in all areas served by different systems.
- .2 Operate, test and balance all air systems over their entire design range of operation including minimum and maximum fresh air, return air and supply air.
- .3 Simulate full heating and cooling conditions. Record sufficient data to verify compliance with design requirements.
- .4 Balance air systems within acceptable tolerances before water systems are balanced.

.6 Hydronic Systems

- .1 Operate, test and balance all water systems over their entire design range of operation.
- .2 Simulate full heating and cooling conditions. Record sufficient data to verify compliance with design requirements.
- .3 Balance water systems within acceptable tolerances before air systems are balanced.

.7 Continuous Recording

- .1 Set-up trend logs on the Building Management System to record on a temperature and humidity levels on a twenty-four hour basis, in areas as directed by the Consultant.

.8 Data Required

- .1 Submit the following data as a minimum. If Contractor's standard forms provide for additional data, also submit such additional data. Indicate if tests were not specifically made. Do not repeat design data or other values not specifically tested.
 - .2 Hydronic heating equipment (boilers, heaters, etc.)
 - .1 Manufacturer and model
 - .2 Gas and fuel oil input flow rating
 - .3 Gas and fuel oil input pressure rating
 - .4 Gas pressure regulator inlet and outlet pressure
 - .5 Entering and leaving water temperature - design and actual
 - .6 Entering and leaving water pressure - design and actual
 - .7 Water flow rate - design and actual
-

- .8 Steam flow rate and pressure - design and actual
 - .9 Combustion efficiency test at maximum rated capacity; including flue gas analysis
 - .10 Combustion efficiency test - as per Ministry of Environment Guideline A-9, corrected to 3% O₂, for fuel input ratings exceeding 10 MMBtu/h (2932 kW)
 - .11 Thermal efficiency, based on ASME short form power test code, for fuel input ratings exceeding 10 MMBtu/h (2932 kW)
 - .3 Motors:
 - .1 Manufacturer
 - .2 Model or serial number
 - .3 Rated amperage and voltage
 - .4 Rated horsepower
 - .5 Rated RPM
 - .6 Corrected full load amperage
 - .7 Measured amperage and voltage
 - .8 Calculated BHP (kW)
 - .9 Measured RPM
 - .10 Sheave size, type and manufacturer
 - .4 Fans:
 - .1 Manufacturer
 - .2 Model or serial number
 - .3 Rated CFM (L/S)
 - .4 Rated RPM
 - .5 Rated pressures (suction and discharge)
 - .6 Measured CFM (L/S)
 - .7 Measured RPM
 - .8 Measured pressures (suction and discharge)
 - .9 Pulley size, type and manufacturer
 - .10 Belt size and quantity
 - .5 Pumps:
 - .1 Manufacturer
-

- .2 Model or serial number
- .3 Rated GPM (L/S)
- .4 Rated Head
- .5 Rated pressures
- .6 Measured discharge pressure (full flow and no flow)
- .7 Measured suction pressure (full flow and no flow)
- .8 Measured gpm (L/s) at operating conditions
- .9 Operating head
- .10 Operating RPM
- .6 Air systems (Including inlets and outlets):
 - .1 Grille, register or diffuser reference number and manufacturer
 - .2 Grille, register or diffuser location
 - .3 Design velocity
 - .4 Design cfm (L/s)
 - .5 Effective (or free) area factor and size
 - .6 Measured velocity
 - .7 Measured cfm (L/s)
- .7 Heat transfer equipment:
 - .1 Manufacturer and type
 - .2 Design inlet and outlet temperatures
 - .3 Design pressure drop
 - .4 Design flow rate
 - .5 Measured inlet and outlet temperatures
 - .6 Measured pressure drop
 - .7 Measured flow rate

3.3 **ACOUSTIC SURVEY**

- .1 Test Locations
 - .1 Provide acoustic noise measurements in locations agreed with the Consultant. As a minimum, the following areas are to be tested:
 - .1 Service rooms: Electrical and mechanical - one location per room
 - .2 Open office areas: Minimum one test per 500 m²

- .3 Enclosed office areas: Minimum 20% of all offices
 - .4 Boardrooms and meeting rooms: One location per room
 - .5 Kitchens, cafeterias and seating areas: One location per space
 - .2 Test Methods
 - .1 Test noise levels on the dBA weighting scale over eight bandwidths.
 - .2 Report results in tabular and graphical plots, including NR curves for each space tested.
 - .3 Conduct two tests per test location:
 - .1 Background ambient: Building ventilation and air conditioning systems turned OFF.
 - .2 Operating: Building ventilation and air conditioning systems turned ON, but building otherwise not occupied, and process equipment turned off.
 - .4 Report any objectionable noise or vibration and be prepared to locate cause by instrumentation and analysis (including octave band and analysis)
 - 3.4 **VIBRATION SURVEY**
 - .1 Measure and record test results to Section 23 08 19.
 - 3.5 **ALTERNATE SEASON TESTING**
 - .1 Requirements
 - .1 Re-check testing and balancing of the heating, ventilating and air conditioning systems and water flow conditions at flow meter locations at approximately six months after initial testing and balancing has been performed and accepted, as advised by the Consultant.
 - .2 Include items which, because of their seasonal character could not be adequately completed during the initial balancing.
 - .3 Include the reading and recording of temperatures and pressures at all gauges, as well as outdoor and indoor conditions.
 - .4 Measure and record the motor amperages and drive RPM of all fans and pumps during re-checking.
 - .2 Report
 - .1 Provide an addendum report to the original balancing report, in accordance with the reporting requirements described herein.
 - 3.6 **DEFICIENCIES**
 - .1 Immediately report to Consultant, any deficiencies in the systems or equipment performance resulting in design requirements being unobtainable.
-

3.7 DRAFT REPORT

- .1 On completion of the start-up, testing, adjusting and balancing of all systems, submit to the Consultant, two typewritten copies of a full report on all tests, adjustments, and balancing performed, including the following:
 - .1 Summary of all systems
 - .2 Testing methods and instrumentation
 - .3 Air systems testing and balancing data
 - .4 Liquid systems testing and balancing data
 - .5 Acoustic survey report
 - .6 Attachments including systems schematics with numbered terminals for referring to data above.
- .2 After review by the Consultant and at the Consultants direction, retest up to 10% of all measurements in locations as directed by the Consultant, at no cost extra to the Contract.

3.8 INTERIM REPORT

- .1 After completion of any retesting described above, submit three typewritten copies of the interim report, in a three-hole "D" style binder, and two CD-R electronic copies in Adobe Acrobat ver.6 PDF format.
- .2 This report is required to obtain Substantial Performance of the Contract.

3.9 FINAL REPORT

- .1 Submit to Consultant following completion of alternate season testing and balancing. Submit three typewritten copies and two CD-R Adobe PDF in the same formats as the initial report specified above.

3.10 SPOT CHECKS

- .1 Before acceptance of the air and water balancing report, the Consultant may request to witness spot-checks of the report results.
- .2 If results indicate unusual testing inaccuracy, omissions, or incomplete balancing/adjustment, in the opinion of the Consultant, re-balance entire affected system(s) at no increase in Contract Price.

3.11 ACCEPTANCE

- .1 The Substantial Performance of the mechanical Work will be considered reached when the initial start-up and performance testing report is accepted by the Consultant and in the opinion of the Consultant all systems have been satisfactorily installed, operated, tested, balanced, and adjusted to meet the specified and intended performance.
 - .2 The Substantial Performance will not depend upon alternate season testing, however, make such relevant repairs or modifications deemed necessary during this re-checking as part of the guarantee of the Work.
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- .3 The total performance of the Mechanical Subcontract (Contract) will not be considered reached until the alternate season testing and balancing is completed and the final report submitted and accepted by the Consultant.

3.12 **ADDITIONAL TESTING**

- .1 The Consultant may request such additional testing in connection with this Project as he deems necessary.
- .2 Additional testing and balancing shall be performed at the rates quoted and costs shall be withdrawn from the Mechanical Subcontractor's (Contractor's) allowance for the testing and balancing Work as approved by the Consultant.

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **GENERAL**

- .1 Provide Work of this section in accordance with the Contract Documents, and in accordance with Section 01 18 10 Commissioning General Requirements.

- .2 This Specification covers commissioning of mechanical systems which are part of the Work.

- .3 Commissioning Work shall be a team effort to ensure that all equipment and systems have been completely and properly installed and function correctly to meet the design intent, and to document system performance parameters for fine tuning of control sequences and operational procedures.

- .1 Refer to Section 01 18 10 regarding roles and responsibilities of all parties involved in the commissioning process.

- .4 The commissioning process develops, coordinates, and documents the following:

- .1 Equipment start-up
- .2 Control system calibration
- .3 Testing and balancing
- .4 Verification and performance testing
- .5 Operation documentation
- .6 Operator training

- .5 Mechanical system installation, start-up, testing, balancing, preparation of O&M Manuals, and operator training are the responsibility of the Mechanical Contractors, with the coordination of the commissioning process the responsibility of the Commissioning Authority in conjunction with the Construction Manager.

- .6 The commissioning program is divided into four parts:

- .1 Part 1: Verification testing
- .2 Part 2: Performance testing
- .3 Part 4: Operator training

1.3 **SUBSTANTIAL COMPLETION**

- .1 Substantial completion of the Division 23 Work requires the following parts of the commissioning program to be completed and accepted by the Owner:

- .1 Part 1: Verification testing
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.2 Part 4: Operator training

- .2 Part 2 - Performance Testing may begin before Substantial Completion and extend upwards of nine months after Substantial Completion, based on seasonal conditions required to obtain test load conditions.

1.4 **WORK INCLUDED**

- .1 Commissioning Work of Division 23 includes, but is not limited to:

- .1 Testing and start-up of equipment.
- .2 Testing, adjusting and balancing of hydronic and air systems.
- .3 Cooperation with the commissioning authority in developing and implementation of the commissioning plan.
- .4 Providing qualified personnel for participation in commissioning tests, including seasonal testing required after the initial testing.
- .5 Providing equipment, materials, and labour as necessary to correct construction and/or equipment deficiencies found during the commissioning process.
- .6 Providing Operation and Maintenance Manuals and As-Built Drawings to the Commissioning Authority for verification.
- .7 Providing training and demonstrations for the systems specified in this division.

- .2 Conduct complete and thorough evaluation and documentation of the operation and performance of all components, systems, and sub-systems, including the following equipment and systems:

- .1 Automatic temperature control
 - .2 Air handling systems
 - .3 Cooling generation systems
 - .4 Heating generation systems
 - .5 Hydronic distribution systems
 - .6 Process cooling systems
 - .7 Compressed air systems
 - .8 Electric heating systems
 - .9 Air distribution and exhaust systems
 - .10 Domestic hot water systems
 - .11 Domestic cold water systems
 - .12 Fire protection systems/suppression systems
 - .13 Variable frequency drives
 - .14 Building Management Systems
-

- .15 Indoor air quality (IAQ) systems
 - .16 Smoke venting/control systems
 - .17 IT/data AC and process cooling systems
 - .18 Kitchen HVAC systems, including fire suppression systems
 - .19 Fuel systems
 - .3 Commissioning documentation includes but is not limited to:
 - .1 Progress and status reports, including deficiency lists
 - .2 Verification of pre-start and start-up procedures and results
 - .3 Performance testing procedures and results
 - .4 Training agenda and materials
 - .5 As-built records
 - .6 Final commissioning report
 - .7 Systems operating manuals
 - .8 Operation and Maintenance Manuals
 - 1.5 **RELATED WORK**
 - .1 Section 23 08 13 – Start-Up and Performance Testing
 - 1.6 **REFERENCE STANDARDS**
 - .1 Comply with the latest edition of the following:
 - .1 ASHRAE Guideline 1, The HVAC Commissioning Process, as amended herein.
 - 1.7 **REPORTING SOFTWARE**
 - .1 Commissioning documentation to be developed and recorded using the following software:
 - .1 MS Word
 - .2 MS Excel
 - .3 MS Access
 - .4 Adobe Acrobat version 6 – for scanned documents
 - .5 Photos – scanned or digital - *.jpg format
 - 1.8 **DOCUMENTATION DELIVERABLES**
 - .1 Identify documents including test documents, binder covers, etc. using equipment ID numbers provided on equipment schedules.
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- .2 Scan original signed test reports, including verification and performance test reports, manufacturers service reports, etc. in Adobe Acrobat *.pdf version 6 format. For original document chapters, provide Adobe chapter referencing.
 - .3 Digital File Naming Convention
 - .1 Store documents with filenames which include the equipment type, ID number, and type of document.
 - .2 Equipment type:
 - .1 PS – Process Systems, piping, compressed air
 - .2 FP – Fire Protection
 - .3 PD – Plumbing and Drainage
 - .4 HG – Heating Generation
 - .5 CG - Cooling Generation
 - .6 HV – HVAC
 - .7 BMS – Building Management System
 - .3 Equipment ID:
 - .1 As per equipment schedules / drawings
 - .4 Document type:
 - .1 VT – Verification Test
 - .2 PT – Performance Test
 - .3 SOM – Systems Operating Manual
 - .4 TM – Training Manual/Material
 - .5 Example: A verification test report for air conditioning unit No. 1
 - .1 HV-AC1-VT.*
 - .4 Submit three copies of each verification and functional performance test report, both preliminary and final issues.
 - .1 Collate final, accepted and signed test results in separate binders as follows:
 - .1 Fire protection
 - .2 Plumbing and drainage
 - .3 HVAC systems
 - .4 Building Management Systems
 - .5 Provide three CD-R or DVD-R copies of all commissioning documentation. File the documents in directories as follows:
 - .1 Primary directories: Verification / Performance / SOMS / Training
-

.2 Sub-directories: Fire / Plumbing / HVAC / BMS

1.9 **SUBMITTALS**

.1 Report Samples

.1 Provide sample test documentation for each type of equipment and system for review by the commissioning authority prior to the start of the verification process

.1 Pre-start and start-up procedure check list form

.2 Verification test method and results form

.3 Functional performance test method and results form

.4 Operating and Maintenance Manual

2 Products

2.1 **TEST EQUIPMENT - GENERAL**

.1 Furnish all special tools and equipment required during the commissioning process.

.2 Submit a list of tools and equipment to be used during the commissioning process to the commissioning authority for approval.

.3 Utilities (water, gas, fuel oil, electrical power) will be provided by the Owner.

2.2 **TEST EQUIPMENT - PROPRIETARY**

.1 Provide any proprietary test equipment and software required by any equipment manufacturer for programming and/or start-up, whether specified or not.

.2 The manufacturer shall provide the test equipment, demonstrate its use, and assist in the commissioning process as needed.

.3 Proprietary test equipment and software shall become the property of the Owner upon completion of the commissioning process.

3 Execution

3.1 **GENERAL**

.1 Complete all phases of Work so that the systems can be started, tested, balanced, and Owner's acceptance procedures be undertaken.

.2 Participate and assist in the development of the commissioning plan by the commissioning authority, by providing all necessary information pertaining to the equipment and installation. Provide commissioning schedule information to be incorporated into the overall commissioning plan schedule.

.3 Acceptance procedures may begin prior to completion of a system and/or sub-system. Start of acceptance procedures before system completion does not relieve the Contractor from completing those systems in accordance with the commissioning and construction schedule.

3.2 **COMMISSIONING MEETINGS**

.1 Pre-Construction

- .1 Participate in a pre-construction meeting of all commissioning team members, to familiarize all parties with the commissioning process, and to ensure that the responsibilities of each party are clearly understood.

- .2 Construction and Post-Construction

- .1 Participate in commissioning meetings as scheduled by the commissioning authority and Construction Manager. Identify to the commissioning group problems relating to the commissioning schedule, identification of start-up issues, etc., and participate in the resolution of these problems.

3.3 **PARTICIPATION IN ACCEPTANCE PROCEDURES**

- .1 Provide skilled technicians to start-up and debug all systems within the mechanical scope of Work. Include for labour, materials, and subsistence costs for these same technicians to assist the commissioning authority in completing the commissioning program.
- .2 Provide details regarding work schedules, time commitments, work sequence programming, etc., to the commissioning authority, to permit the development and monitoring of a coordinated commissioning schedule.
- .3 Ensure the qualified technician(s) are available and present during commissioning testing to complete the tests, make adjustments and to assist in problem resolutions.
- .4 Should any equipment or system experience performance problems and/or reconstruction or replacement of components is required, include for additional technician time for subsequent retesting of systems until required system performance is achieved.
- .5 The commissioning authority reserves the right to approve proposed technicians with regard to the technical skill level required for each type of equipment and/or system, and a willingness by the individual(s) to work within the commissioning group.

3.4 **PROBLEM RESOLUTION**

- .1 In the event that additional work is required to correct systems, misapplied equipment, and/or deficient performance under varying load conditions, this work will be carried out under the direction of the Owner. Assist the Owner and commissioning authority in developing an acceptable resolution to the problem, including the resources of equipment suppliers.
- .2 The Owner and/or the Consultant has final jurisdiction over any additional work required to achieve the required level of performance.
- .3 Complete corrective Work in a timely fashion to permit the completion of the commissioning process.

3.5 **ADDITIONAL COMMISSIONING**

- .1 Additional commissioning activities may be required after completion of system performance testing. Include in the tender cost a reasonable reserve to complete this work, including assistance from manufacturers' service technicians.

3.6 **SEASONAL COMMISSIONING**

- .1 Commence initial performance testing commissioning at the completion of the installation Work and verification testing phase. Conduct performance testing, which is weather dependent, as applicable to current seasonal conditions. Complete performance testing
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on non-weather dependant systems in accordance with the agreed commissioning plan schedule.

- .2 For out-of-season system performance testing, conduct initial performance tests to demonstrate off-peak load performance. Schedule peak load performance testing over the succeeding nine months to ensure all equipment is tested at peak load prior to the expiry of the construction contract warranty.
 - .1 Test heating equipment/systems during winter design extremes.
 - .2 Test cooling systems during summer design extremes with a fully occupied building.
 - .3 Alternatively, provide temporary equipment (load banks, etc) to simulate full load conditions. Submit proposed methodology for review by the commissioning authority and Consultant.

3.7 **REPORT FORMAT**

- .1 Provide separate checklists for each piece of equipment and system tested, including interfaces, interlocks, etc.
 - .1 For checklists generated in MS Excel format, provide a separate file for each piece of equipment; do not store multiple pieces of equipment on separate worksheets in the same file.
- .2 Each item to be checked will be recorded on a separate entry line and include the following information, reading from left to right across the entry:
 - .1 Checklist item number
 - .2 Test description
 - .3 Test status – “Pass”, “Fail”, “Not Applicable”
 - .4 Deficiency status – “Major”, “Minor”
 - .5 Comments
- .3 Deficiency definitions:
 - .1 “Major”: An item which if not corrected renders the equipment or system unsuitable or unsafe for use by the Owner. Major deficiencies must be corrected as a condition for achieving Substantial Completion.
 - .2 “Minor”: An item which does not impact on the operation of the equipment or system and will allow the Owner to use the system safely. Minor deficiencies may be corrected before or after Substantial Completion, but will not prevent certification of Substantial Completion of the Work.

3.8 **VERIFICATION TESTS (PART 1)**

- .1 Scope of Work
 - .1 Conduct operating tests and checks to verify that all components, equipment, systems, and interfaces between systems, operate in accordance with Contract Documents.
-

- .2 Tests to demonstrate and verify all operating modes, interlocks, specified control sequences, specific responses to abnormal or emergency conditions, and verification of the proper response of the Building Automation System.

- .3 Validate the results of the TAB report.

- .1 Roles and responsibilities:

Verification Testing	
Organized by:	Commissioning Authority
Test sheets provided by:	Mechanical Contractors
Testing conducted by:	Mechanical Contractors
Testing recorded by:	Mechanical Contractors
Tests witnessed by:	Commissioning Authority Design Consultant (optional) Owner (optional)
Reports reviewed by:	General Contractor/Construction Manager Commissioning Authority Design Consultant
Reports accepted by:	Owner

- .2 Submittals

- .1 Submit a copy of each type of equipment and system verification report for approval by the Owner prior to commencement of the verification tests.
- .2 Include any specific test requirements provided by the Owner and/or Consultant in the test reports. These requirements will be provided in MS Word or Excel format.

- .3 Participants in Verification Tests

- .1 Commissioning authority: Schedules tests and assembles commissioning team members who are responsible for the implementation, witnessing and documentation of the tests.
- .2 Mechanical Contractor: Provide the services of qualified technician(s) who are familiar with the construction and operation of the system. Provide access to the Contract plans, Shop Drawings, and equipment cut sheets of all installed equipment.
- .3 Controls Contractor: Provide the services of qualified technician(s) who are familiar with the Work. Provide details of the control system, schematics, and a narrative description of control sequences of operation.
- .4 Electrical Contractor: Provide a foreman electrician familiar with the electrical interlocks, interfaces with emergency power supply, and interfaces with alarm and life-safety systems. Provide access to the contract plans, and all as-built schematics of sub-systems, interfaces and interlocks.
- .5 Equipment Suppliers: Provide the services of manufacturers' service personnel to provide assistance with pre-start and initial start-up of the equipment, as required.
-

- .4 Documentation and Reporting Requirements
 - .1 Provide separate test records for each piece of equipment and system.
 - .2 Information used to develop the check lists are to include material from the following sources:
 - .1 Manufacturers installation requirements
 - .2 Contractor's own checklists
 - .3 Design consultants checklists
 - .4 Owners checklists
 - .3 Checklists to include the following information:
 - .4 Front cover sheet: Project name, Owner name, equipment ID and name, test date(s), and space for sign-off signatures and dates as follows:
 - .1 Mechanical Contractor: "Submitted by"
 - .2 General Contractor/Construction Manager: "Reviewed by"
 - .3 Design Consultant "Reviewed by"
 - .4 Commissioning Authority: "Reviewed by"
 - .5 Owner: "Accepted by"
 - .5 Second and subsequent pages to include tests as defined below.
 - .6 Equipment Checklists:
 - .1 Motor, power and drives
 - .2 Equipment piping, between equipment isolation valves
 - .3 Installation pre-start tests specific to the class of equipment
 - .4 Equipment start-up tests specific to the class of equipment
 - .5 Electrical audit for CSA label or ESA field approval label
 - .6 Gas and fuel fired equipment audit for CSA/CGA approvals, or TSSA field approvals
 - .7 Expansion tank installation and settings
 - .8 Operator training, including attendee names and dates, and details of manufacturers equipment demonstrations
 - .9 Status of as-built documentation, and Operating and Maintenance Manuals reviews
 - .7 Piping System Checklists:
 - .1 Hydrostatic and/or pneumatic pressure tests, including date of test, duration, starting and ending pressures, and TSSA inspection reports where required
-

- .2 Municipal plumbing inspector reports attached
 - .3 NFPA certificates attached (sprinklers and standpipe systems)
 - .4 Flushing and cleaning records, including date of cleaning, chemical treatment contractors test reports, volume of fluid in the system and amount of cleaner used
 - .5 Chemical treatment added; type and quantity, chemical treatment contractor's test reports included
 - .6 Piping installation, including supports, insulation, vibration isolation, piping identification, valve tagging, valve chains, etc.
 - .7 TAB balancing report, by system
 - .8 Operator training, including attendee names and dates, and details of manufacturers equipment demonstrations
 - .9 Status of as-built documentation, and Operating and Maintenance Manuals reviews
 - .8 Ductwork System Checklists:
 - .1 Ductwork pressure test results
 - .2 Inspection of fire damper linkages by area/floor
 - .3 TAB balancing report, by system
 - .4 Operator training, including attendee names and dates, and details of manufacturers equipment demonstrations
 - .5 Status of as-built documentation, and Operating and Maintenance Manuals reviews
 - .9 Building Management System:
 - .1 Operating check of each I/O and control loop
 - .2 Operating check of each control sequence
 - .3 Operating check of motorized control dampers for full open and full close stroke/spring return positions
 - .4 Operating check of motorized fire dampers for full open and full close stroke/spring return positions
 - .5 Temperature and humidity survey report, identifying date and time for each reading at each transmitter/sensor device
 - .6 Graphics display and report generation - provide display screen "snapshots"
 - .7 Operator training, including attendee names and dates, and details of manufacturers equipment demonstrations
 - .8 Status of as-built documentation, and Operating and Maintenance Manuals reviews
-

- .10 Specialty Systems
 - .1 Refrigeration system compliance check to CSA B52-99, Mechanical Refrigeration Code
 - .5 Instrumentation
 - .1 Provide all measurement instrumentation for conducting the verification tests. Include hand-held "HART" instrument testing units or similar test equipment.
 - .2 All instruments will have been calibrated within the six month period prior to the start of the tests.
 - .6 Verification Procedures
 - .1 The commissioning authority shall direct and witness, as required, the verification operating tests and checks for selected or all equipment and systems.
 - .2 Set the system equipment into operating mode to be tested including but not limited to:
 - .1 Normal shut-down
 - .2 Normal auto position
 - .3 Normal manual position
 - .4 Unoccupied cycle
 - .5 Emergency power operation, including transition states
 - .6 Alarm conditions
 - .3 Inspect and verify the position of each device and interlock identified on the checklist.
 - .4 Repeat the above tests for each operating cycle that applies to the system being tested.
 - .5 Check the operating condition of the following elements during all modes of operation of the system:
 - .1 Safety interlocks
 - .2 Alarms
 - .3 Smoke control and smoke venting interlocks
 - .4 Life safety systems
 - .6 For failed test items, provide appropriate comments to the checklist data sheet and identify whether it is a "Major" or "Minor" deficiency.
 - .1 The Consultant retains the right to make the final decision regarding classifications of deficiencies
 - .7 Verify the operational control of the systems through the Building Management System as follows:
-

- .1 TAB airflow rates and calibrate terminal boxes in all modes of operation
 - .2 Equipment operation in both heating and cooling modes
 - .3 Minimum outdoor air intake positions, air-side economizer cycles, and multi-set outdoor air damper positions as required for each operating sequence and mode
 - .4 Building pressurization and other specialty programs
 - .8 Verify the proper responses of instrumentation and control devices (actuators) as follows:
 - .1 For each controller or sensor, record the indicated monitoring and control system reading, and the test instrument reading
 - .2 If the initial test indicates that the test reading is outside of the control range of the installed device, check the calibration of the installed device and adjust as required. Re-test the deficient device and record the results on the checklist data sheets
 - .9 The commissioning authority shall direct and witness the field verification of the final TAB report as follows:
 - .1 Select, at random, 10% of the report data for verification
 - .2 The TAB Contractor will be provided advance notice of the date of retesting, but not the equipment to be tested
 - .3 The TAB to provide and use the same equipment and instruments used for collecting the original data
 - .4 Test failure is defined as:
 - .1 For all readings other than sound, a deviation of more than 10% from the TAB report results
 - .2 For sound pressure readings, a deviation of 3 dB at any bandwidth, not including differences in background noise readings
 - .5 A failure rate greater than 10% of the selected items (1% of all TAB test results) will result in rejection of the final TAB report
 - .7 Acceptance
 - .1 The final reports will be reviewed by the Commissioning Authority and the Consultant, to determine if verification is complete and the operating systems are functioning in accordance with the Contract Documents.
 - .2 The Commissioning Authority, in conjunction with the Consultant, shall review and make final classification of all noted deficiencies. Deficiencies classified as "Major" shall be corrected before acceptance of the verification stage.
- 3.9 **PERFORMANCE TESTING (PART 2)**
- .1 Scope of Work
-

- .1 Conduct performance tests and checks to verify that all equipment and system components are providing the required heating and cooling performance (capacity) in accordance with the Contract Documents, including but not limited to:
 - .1 Capability of the chilled water system to deliver the required flow rate, and water temperature at design conditions.
 - .2 Capability of the hydronic and domestic water heating systems to deliver the required flow rate, and temperature.
 - .3 Capacity of electric heating systems at design temperatures.
 - .4 Confirm the ability of the HVAC systems to deliver the required cooling/heating services, at the design supply air temperature, required static pressure, and proper outside air ventilation rate.

.2 Roles and Responsibilities:

Functional Performance Testing	
Organized by:	Commissioning Authority
Test sheets provided by:	Mechanical Contractors
Testing conducted by:	Mechanical Contractors
Testing recorded by:	Mechanical Contractors
Tests witnessed by:	Commissioning Authority Design Consultant (optional) Owner (optional)
Reports reviewed by:	General Contractor/Construction Manager Commissioning Authority Design Consultant
Reports accepted by:	Owner

.2 Submittals

- .1 Submit detailed test procedures and methodology to the commissioning authority for review and acceptance. Include samples of data record sheets.

.3 Participants

- .1 Participants are the same as that described for the verification stage.

.4 Documentation and Reporting Requirements

- .1 Provide separate test records for each piece of equipment and system.
- .2 Checklists to include the following information:
 - .1 Front cover sheet: Project name, Owner name, equipment ID and name, test date(s), and space for sign-off signatures and dates as follows:
 - .1 Mechanical Contractor: "Submitted by"
 - .2 General Contractor/Construction Manager: "Reviewed by"

- .3 Design Consultant: "Reviewed by"
 - .4 Commissioning Authority: "Reviewed by"
 - .5 Owner: "Accepted by"
 - .2 Second and subsequent pages to include tests as defined below:
 - .1 Description of test methodology, including reference standards (SMACNA, ARI, ASME, etc).
 - .2 Permanent and temporary resource requirements to implement the test (power, temporary drains, etc).
 - .3 Summary of results.
 - .4 Test data sheets and measured data.
 - .5 Ambient temperature conditions at time of test.
 - .6 Load simulation method used, if required.
 - .3 Provide a preliminary test report for review by the commissioning authority and the Consultant prior to conducting the performance test.
 - .5 Instrumentation
 - .1 Refer to the instrumentation requirements for the verification stage.
 - .6 Functional Performance Test Procedures
 - .1 The Commissioning Authority shall direct and witness, as required, the performance tests for selected or all equipment and systems.
 - .2 For each test, provide instrumentation required to calculate the total capacity of the system for each mode of operation under test.
 - .3 Special testing requirements:
 - .1 Test heating boiler and steam boiler performance in accordance with ASME Power Test Code 4.1 (short form), for thermal efficiency, and combustion efficiency.
 - .2 Test water chillers in accordance with ARI 590 and 591, at design conditions for full load ratings, and IPLV ratings.
 - .7 Acceptance
 - .1 Any identified deficiencies will be reviewed by the Consultant in conjunction with the General Contractor/Construction Manager to determine if correction of the deficiency is part of the Contractor's or Subcontractor's contractual obligations.
 - .2 If it is determined the performance deficiency is part of the Contract Documents, the Contractor will rectify the deficiency and repeat the performance test until the required performance levels are achieved.
 - .3 If it is determined the mechanical system is constructed in accordance with the Contract Documents, and the performance deficiency is not part of the Contract Documents, the Owner will decide whether to accept the performance as is, or,
-

direct the Installation Contractor to make changes to the system as required to obtain performance levels which meet the design intent.

- .4 Should remedial Work to correct the not-in-contract deficiency be implemented, the Owner will decide whether all or part of the performance testing is to be repeated. If repeated, complete the retesting and submit a revised report.

3.10 **OPERATING AND MAINTENANCE TRAINING (PART 4)**

.1 Scope of Work

- .1 Provide systems training in addition to the requirements of Sections 21 05 00, 22 05 00 and 23 05 01.

.2 Roles and responsibilities:

Systems Operating Manuals	
Organized by:	Mechanical Contractor
Lecture material provided by:	Mechanical Contractor
Systems training provided by:	Mechanical Contractor
Resource material by:	Sub-Contractors Manufacturers Design Consultant
Training manuals reviewed by:	Commissioning Authority Design Consultant
Manuals accepted by:	Owner

.2 Equipment Training

- .1 Provide equipment training in accordance with Sections 21 05 00, 22 05 00 and 23 05 01.
- .2 The manufacturer's representative training will emphasize operating instructions and preventative maintenance.

.3 Systems Training

- .1 In addition to the equipment training described above, provide additional training to describe the operational requirements and design intent of each system.
- .2 Include classroom instruction, delivered by competent instructors, based upon the contents of the SOM manuals. Place emphasis on overall systems diagrams and descriptions, and design criteria and conditions.
- .3 If required, obtain and pay for the services of the Design Consultant to provide the instructor services and to provide lecture material for inclusion in the training manual.
- .4 Training topics to include:
 - .1 Types of installed systems
 - .2 Design intent and design criteria

- .3 Design constraints
 - .4 Different operating modes - occupied, unoccupied, emergency conditions, etc.
 - .5 Seasonal operating modes
 - .6 IAQ
 - .7 Energy efficiency
 - .8 System operation
 - .9 Automatic controls
 - .10 Service, maintenance, diagnostics and repairs
 - .11 Use of reports and logs
 - .12 Troubleshooting
 - .5 Structure each session to start with the classroom instruction for the overall system, followed by hands-on instruction for each equipment, with the services of the manufacturers' representative as required. Demonstrate the start-up and shut-down of each system.
 - .6 Organize and schedule each training session to deliver the required instruction in an efficient and effective manner on a schedule agreed upon with the Owner. Allow for three training sessions for each topic, separated by approximately one week each, to allow for shift coverage.
 - .7 Structure each training session based on type of maintenance personnel attending the training session, i.e. plumbers, fitters, general maintenance, controls technicians, etc. Develop the proposed training plan and obtain approval from the Owner before commencing the training.
 - .8 Complete the training as close to Substantial Completion as possible, so that the Owner's operations staff are prepared to operate the system after Substantial Completion is certified.
 - .4 Training Manuals
 - .1 Provide training material hand-outs for each session. This information will be abstracted from the SOM's and shall be presented in abbreviated form (i.e. bullet points).
 - .2 Collect training material and bind into separate binders in accordance with the requirements for the SOM manuals.
 - .5 Recording of Training Sessions
 - .1 Record training sessions typical for each training topic. Provide one DVD for each training topic.
 - .2 Provide three DVD copies of each training topic, appropriately labeled.
- End of Section
-

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **SUBSTANTIAL PERFORMANCE**

- .1 Complete the Substantial Performance checklist and submit with required documentation when applying for Substantial Performance of the Work.

- .1 Where the Work is sub-divided into separate scopes of Work, each requiring a separate Substantial Performance application, provide a separate checklist for each application.

- .2 Prepare and submit to the Consultant a comprehensive deficiency list of items to be completed or corrected, as part of the application for a review by the Consultant to establish Substantial Performance of the Work, or designated portion of the Work.

- .1 Failure to include an item on the list does not alter the Contractor's responsibility to complete the Work.

- .3 Within five Working Days of the Consultant's review report which indicates that Substantial Performance of the Work has been achieved, provide a detailed schedule for completion and/or correction of the Work of all items described in the Contractors' and the Consultants' deficiency list.

1.3 **TOTAL PERFORMANCE**

- .1 Complete the Total Performance checklist and submit required documentation when applying for Substantial Performance of the Work.

- .2 Submit the following documentation with the application for Total Performance. Application for Total Performance cannot be submitted any earlier than the date of alternate season testing.

- .3 The following documentation is included with this application for Total Performance, or, has already been submitted to the Owner and a copy of the transmittal is included with this application.
-

2

SUBSTANTIAL PERFORMANCE APPLICATION CHECKLIST

Project Information		
Project Name:		
Contract:		
Contract Scope:		
Application Date:		
Signed:		
Required Documentation		
No.	Item	Included
1.	Contractor has compiled and submitted a detailed deficiency list, identifying work still to be completed, incomplete, or requires correction.	
2.	Equipment start-up reports (interim)	
3.	Authorities report (interim)	
4.	Air and water balancing reports (interim)	
5.	Acoustic survey report (interim)	
6.	Vibration survey report (interim) - <i>if specified</i>	
7.	Controls / BMS operation report (interim)	
8.	Operating and Maintenance Manuals, draft, submitted	
9.	Training, completed	
10.	Commissioning report – verification and training (if part of Contract)	
Reviewed by Consultant		
Status	<input type="checkbox"/> Reviewed <input type="checkbox"/> Incomplete or deficient - resubmit	
Signed:		
Date:		

3

TOTAL PERFORMANCE APPLICATION CHECKLIST

Project Information		
Project Name:		
Contract:		
Contract Scope:		
Application Date:		
Signed:		
Required Documentation		
No.	Item	Included
1.	Contractor submits a statutory declaration that all known deficiencies have been corrected, including latent deficiencies reported by the Owner.	
2.	Equipment start-up reports – updated and final	
3.	Authorities report – updated and final	
4.	Air and water balancing reports – updated and final	
5.	Acoustic survey report – updated and final	
6.	Vibration survey report – updated and final - <i>if specified</i>	
7.	Controls / BMS operation report – updated and final	
8.	Operating and Maintenance Manuals – updated and final	
9.	As-Built Drawings – final	
10.	Commissioning report – performance testing (if part of Contract)	
Reviewed by Consultant		
Status	<input type="checkbox"/> Reviewed <input type="checkbox"/> Incomplete or deficient - resubmit	
Signed:		
Date:		

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section
- .2 Section includes, but is not necessarily limited to, the following:
 - .1 Hot water heating systems, all types

1.2 **REFERENCE STANDARDS**

.1 Comply with the following:

- .1 Technical Standards and Safety Act
- .2 Boiler and Pressure Vessels O.Reg. 220/01
- .3 CSA B51-97: Boiler, Pressure Vessel, and Pressure Piping Code, as amended

	B31.1	B31.9
Liquids	> 350 psig, or > 250°F	≤ 350 psig, and ≤ 250°F
Vacuum	< -1 atm, or > 200°F	≥ -1 atm, and ≤ 200°F
Gas	> 150 psig, or > 200°F	≤ 150 psig, and ≤ 200°F

- .4 ANSI/ASME B31.9 - Building Services Piping Code, as specified
- .5 ANSI/ASME B31.1 - Power Piping Code, as specified
- .6 Technical Standards and Safety Authority (TSSA), Pressure Vessels Safety Division, inspection requirements for registered systems.

.2 Materials

- .1 To CSA B51 - M1991 with:
 - .1 Cast iron to ASTM A-278-84, Class 30 or ASTM A-126-84 Class B.
 - .2 Bronze to ASTM B62-82a.
 - .3 Stainless steel to ASTM A351-84b, ASTM A-167-84, ASTM A-276-84 or ASTM A-564-79.
- .2 Bolting requirements:
 - .1 To ASTM A307-84.

1.3 **PERMITS, EQUIPMENT REGISTRATION AND FEES**

.1 Contractor Certification

- .1 Contractors providing Work regulated under the Boilers and Pressure Vessels O.Reg. 220/01 are to be holders of a TSSA Certificate of Authorization to conduct this Work, including:
 - .1 Pressure piping fabrication and installation

- .2 Boiler and pressure vessel repairs and alterations
 - .2 Equipment Certification
 - .1 Equipment and fittings designated as pressure vessels or Class "H" fittings as per CSA B51-97, Part 1, require:
 - .1 ASME stamp
 - .2 CRN registration
 - .3 Registration
 - .1 Register the following pressure vessel and pressure piping systems:
 - .1 Building heating and cooling water systems operating at: pressures exceeding 1100 kPag (160 psig); or temperatures exceeding 121°C (250°F).
 - 1.4 **DESIGN CRITERIA**
 - .1 Hot Water Heating Systems (Constant Temperature)
 - .1 Operating Temperatures:
 - .1 Supply: 93°C (200°F)
 - .2 Return: 77°C (170°F)
 - .2 Design pressures: 860 kPa (125 psig)
 - .2 Hot Water Heating Systems (Scheduled Temperature)
 - .1 Operating Temperatures:
 - .1 Supply: 88°C (190°F)
 - .2 Return: 71°C (160°F)
 - .2 Design pressures: 860 kPa (125 psig)
 - 1.5 **SUBMITTALS**
 - .1 Shop Drawings
 - .1 Submit Shop Drawings in accordance with Section 01 33 00.
 - .2 Operation and Maintenance Data
 - .1 Submit printed operation instructions and maintenance data in accordance with Section 01 33 00.
 - 1.6 **TESTING**
 - .1 General
 - .1 Test piping in Consultant's presence, in accordance with testing requirements specified in Section 23 05 23 and with tests and test pressures hereinafter specified for various services.
-

- .2 Lines may be tested in sections as authorized by the Consultant to accommodate construction schedule. However, test complete systems on completion.
 - .2 Hydronic Systems
 - .1 Hydrostatically test hydronic (water) piping at 862 kPa (125 psig) pressure.
 - 2 Products
 - 2.1 **PIPELINE SPECIALTIES**
 - .1 Automatic Air Vents
 - .1 Construction:
 - .1 Float operated with brass or cast iron body
 - .2 Rated working pressure: (10 kPa (45 psi)) (690 kPa (100 psi) 1035 kPa (150 psi)) (2070 kPa (300 psi))
 - .2 Acceptable Manufacturers:
 - .1 Maid-O-Mist No. 7 (75 to 150 psi)
 - .2 Taco Hy-Vent (35 to 150 psi, 240 F)
 - .3 Braukmann EA 122 (90 psi, 230 F)
 - .4 Spirax Sarco 13 WS (150 psi, 200 F)
 - .5 Spirax Sarco 13 W (150 psi, 450 F)
 - .6 Armstrong Machine Works No. 2-AV (250 psi, 450 F)
 - .2 Circuit Balancing Valves
 - .1 Construction:
 - .1 Positive shut-off calibrated balancing valves with handwheel and division ring scale
 - .2 Flow measuring disconnects
 - .3 Metal tag with chain listing design flow rate, metered fluid, and meter reading for design flow rate
 - .4 Minimum working pressure: 1035 kPa (150 psig)
 - .5 Combined accuracy of valve and meter: Manufacturer certified to be within $\pm 2\%$ of actual flow
 - .6 NPS 2 and smaller: Brass body with screwed ends
 - .7 NPS 2½ and larger: Cast iron body with flanged ends
 - .2 Meters:
 - .1 Digital direct reading type calibrated in (both) (L/s) (USgpm) of flow
 - .2 Carrying case, hoses, installation and operating instructions
-

- .3 Minimum working pressure: 1035 kPa (150 psig)
 - .3 Acceptable Manufacturers:
 - .1 Taco - MPV
 - .2 Armstrong - CBV
 - .3 Tour & Anderson
 - .3 Radiation Temperature Control Valves
 - .1 Construction:
 - .1 Angle or straightway valves with type RA-6 control units
 - .2 Acceptable Manufacturers:
 - .1 Danfoss
 - .2 Braukmann equivalent
 - .4 Radiator Valves
 - .1 Construction:
 - .1 Packless type radiator valves for installation on supply and return lines at each convactor-radiator and finned tube element
 - .2 Angle or straightway, with union nipple and wheel handle
 - .2 Supply side installation:
 - .1 Spirax Sarco RP-6 or RP-7
 - .2 Dahl 11041 or 11042F
 - .3 Return side installation:
 - .1 Spirax Sarco RP-6 or RP-7
 - .2 Dahl 13012 or 13013

2.2 **HYDRONIC SPECIALTIES**

- .1 Closed Expansion Tanks
 - .1 Construction:
 - .1 Black welded steel fabricated in accordance with ASME Code Section VIII requirements.
 - .2 Material: ASTM A516/A516M-82 pressure vessel carbon steel plate with dished ends.
 - .3 Working pressure: (690) (862) (1034) kPa ((100) (125) (150) psi) and bearing ASME stamp.
 - .4 Manhole 275 mm x 375 mm on end or as shown on Drawings.
-

- .5 Water expansion tanks: Hot dip galvanized after fabrication.
 - .6 (Glycol expansion tanks: Black steel primed on outside only).
 - .7 Sizes as scheduled.
 - .2 Tank accessories:
 - .1 Gauge glasses with isolating valves to indicate water level in tank from 75 mm above bottom to 75 mm below the top of (straight side of) tank.
 - .2 ASME code rated relief valve.
 - .3 Saddles with horizontally mounted tanks.
 - .4 Structural steel legs for vertical tanks, with bottom of tank 300 mm above floor level.
 - .5 Armstrong or Taco combination drain valve and air charger.
 - .3 Tank connections:
 - .1 Expansion pipe connection at bottom.
 - .2 Make-up connection at bottom.
 - .3 NPS 1 drain connection at bottom.
 - .4 Vent connection at top.
 - .5 Relief valve connection near bottom.
 - .6 Schraeder valve connection for compressed air at top.
 - .4 Manufacturers:
 - .1 John Wood
 - .2 Bell & Gossett
 - .3 Drummond Welding & Steel Works Limited
 - .4 O'Connor Tanks Limited
 - .5 Clemmer Industries Limited
 - .2 Diaphragm Type Expansion Tanks
 - .1 Construction:
 - .1 Cylindrical galvanized steel pressurized type with diaphragm sealed in elastomer suitable for 115°C (240°F) operating temperature.
 - .2 Working pressure: 860 kPa (125 psi) with ASME stamp and certification.
 - .3 Air precharged to 84 kPa (12 psi).
 - .4 Schraeder tank valve for compressed air located above diaphragm.
 - .5 Saddles for horizontal installation or base mount for vertical installation.
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- .2 Manufacturers:
 - .1 Amtrol Extrol
 - .2 Taco Tacotrol
 - .3 Bell & Gossett
 - .3 Air Separators
 - .1 Construction:
 - .1 Size as indicated on Drawings.
 - .2 Working pressure: (690) (862) (1034) kPa ((100) (125) (150) psi) bearing ASME stamp.
 - .3 Furnish mounting legs or brackets as required.
 - .4 Up to NPS 2: Cast iron body and threaded connections.
 - .5 NPS 2½ and over: With shell heads and flanged connections.
 - .2 Acceptable Manufacturers:
 - .1 Armstrong
 - .2 Taco
 - .3 Bell & Gossett
 - .4 Thrush
 - .5 Amtrol
 - .4 Centrifugal Separation Type
 - .1 Construction:
 - .1 Designed as unfired pressure vessel
 - .2 ASME stamped
 - .3 Working pressure: 860 kPa (125 psi)
 - .2 Manufacturers:
 - .1 Taco Air Separator
 - .2 Bell & Gossett Rolairtrol
 - .3 Amtrol Tangential Air Separator
 - .4 Armstrong VA
 - .5 Amtrol
 - .5 Hydronic System Pressure Safety Relief Valves
 - .1 Construction:
-

- .1 Brass or iron body
 - .2 ASME stamped
 - .3 Adjustable pressure setting from 55 to 172 kPa (8 to 25 psi) above system operating pressure at point of connection
 - .4 Operating differential pressure from open to close not more than 20 kPa (3 psi)
 - .6 Suction Diffuser
 - .1 Construction:
 - .1 NPS 2 and under: Cast iron body with screwed connections
 - .2 NPS 2½ and over: Cast iron body with flanged connections
 - .3 Disposable fine mesh screen
 - .4 Screen blow down connection
 - .5 Permanent magnet particle trap
 - .6 Full length straightening vanes
 - .7 Pressure gauge tapings
 - .2 Acceptable Manufacturers:
 - .1 Bell & Gossett FTP screwed, FLG-flanged
 - .2 Taco Series "SD"
 - .3 Armstrong Suction Guide
 - .4 Victaulic Suction Fitting
 - .7 Water Pressure Reducing Valves
 - .1 Construction:
 - .1 Self-contained hydraulic pilot controlled type
 - .2 Single seated with resilient disc in iron body
 - .3 Bronze seat for pressure drops below 480 kPa (70 psi)
 - .4 Stainless steel seat for pressure drops 480 kPa (70 psi) and over
 - .5 Diaphragm suitable for 120°C (250°F) service
 - 3 Execution
 - 3.1 **CONNECTIONS TO EXISTING SERVICES**
 - .1 Tie-Ins
 - .1 Make arrangements with the Owner and obtain permission to tie into existing services at a time acceptable to all parties.
-

.2 Insulation Repair

- .1 Repair or replace any insulation or covering removed from existing lines to permit tie-ins. Use only new materials as specified for new work.

3.2 **PIPELINE SPECIALTIES**

.1 Air Vents

- .1 Install automatic air vents at high points of water piping systems and also in any other location noted on Drawings.
- .2 Install automatic air vent with 150 mm high, line size or NPS 4 size air pocket, whichever is smaller, and NPS ¾ isolating gate valve and piping to inlet connection of air vent.
- .3 Connect discharge to nearest funnel or hub drain or as shown on Drawings.
- .4 Provide manual air vents in locations noted on Drawings.

.2 Drain Valves

- .1 Install drain valves at low points of water and compressed air piping systems in order to completely drain each system, and also in any other location noted on Drawings.

.3 Circuit Balancing Valves

- .1 Provide balancing valves at all locations shown on the Drawings and as required to result in accurate flow balancing.
- .2 Install valves in accordance with Supplier's instructions.
- .3 Make meters available to the Testing and Balancing Contractor during the balancing of the systems.
- .4 Turn over meters to Owner at Substantial Completion.

.4 Radiation Temperature Control Valves

- .1 Provide radiation temperature control valves to control hot water convactor-radiators and finned tube linear convectors, sized and located as noted on Drawings.

.5 Radiator Valves

- .1 Provide packless type radiator valves on supply and return lines at each convactor-radiator and finned tube element.

3.3 **HYDRONIC SPECIALTIES**

.1 Expansion Tanks

.1 Tank type:

- .1 Diaphragm type for closed water systems not including glycol systems.
- .2 Closed type for glycol systems.
-

- .2 System piping and auxiliaries:
 - .1 Provide an equalizer line from piping system to bottom of each expansion tank.
 - .2 Provide domestic cold water line with globe valve, strainer, and line size backflow preventer with isolating valves.
 - .3 Provide water make-up assembly on water line to each tank past backflow preventer.
 - .4 Provide manual air relief valve at each tank.
 - .5 Provide pressure gauge to show pressure in tank.
 - .6 Provide compressed air line from control air system to each tank or group of tanks with globe valve and check valve and terminate 1.2 m above finished floor near tanks with 6 m length of hose and hose end fitting compatible with Schraeder connection on tank.
- .3 Safety valves:
 - .1 Provide code rated water relief valve, located in piping near bottom of each tank. Set relief pressures to maintain 70 kPa (10 psi) at highest point in system with pumps off.
 - .2 Relief valve for steam generated hot water system to be same model and size as relief valve used on heating convertor in system.
 - .3 Relief valve of chilled water system expansion tank: minimum 20 mm size.
- .4 Drains:
 - .1 Pipe relief valve, relief connection on backflow preventer, and relief connection on make-up assembly to nearest open drain.
- .2 Pressure Safety Relief Valves
 - .1 Install on hot water boilers, heating convertors, expansion tanks and other pressure vessels in accordance with relevant codes.
 - .2 Pipe outlets to drain.
- .3 Pressure Reducing Valves
 - .1 Install pressure reducing valve stations with shut-off valve on either side of assembly and 115 mm pressure gauges on upstream and downstream sides of station

3.4 **FLUSHING OF PIPING SYSTEMS**

- .1 Applicable Systems
 - .1 Flush hydronic piping systems in accordance with Section 23 05 23.
 - .1 Flush water piping with water flowing at a velocity of not less than 1.8 m/sec, for a period of fifteen minutes or longer as required to remove all dirt, scale, and cuttings from the entire length of the piping.

- .2 Thoroughly clean, prior to fabrication, sections of new piping which cannot be isolated for flushing purposes
- .3 Thoroughly clean, insofar as possible, welded joints by swabbing interior of pipe with swabs soaked with a caustic solution.

End of Section

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- 1 General
 - 1.1 **SUMMARY**
 - .1 Section Includes
 - .1 Labour, Products, equipment and services necessary to complete the Work of this section.
 - 1.2 **SUBMITTALS**
 - .1 Shop Drawings
 - .1 Submit Shop Drawings in accordance with Section 01 33 00.
 - .2 Operation and Maintenance Data:
 - .1 Submit printed operation instructions and maintenance data in accordance with Section 01 33 00.
 - 2 Products
 - 2.1 **MATERIALS**
 - .1 Minimum General Requirements
 - .1 The following are minimum construction requirements, unless specified elsewhere.
 - .2 Pump casings:
 - .1 Close grained cast iron or cast bronze as specified.
 - .2 Fitted with casing or impeller wear rings, or both.
 - .3 Impellers:
 - .1 Enclosed bronze or duralloy.
 - .2 Dynamically balanced.
 - .3 Mounted on carbon steel shaft fitted with stainless steel or bronze sleeves.
 - .4 Seals:
 - .1 Suction pressures less than 700 kPa (100 psi): Fitted with mechanical seals.
 - .2 Stuffing box pressure in excess of 690 kPa (100 psig): Balanced type seals.
 - .3 Pumps with packing glands: Fitted with stainless steel shaft sleeves for full length of stuffing box.
 - .5 Performance:
 - .1 Characteristic curve to be continuously rising to from run-out to shut-off.
-

- .2 Select pump to operate within flow range from 30% below point of maximum efficiency to 10% above that point for impeller diameter chosen.
- .3 Installed impeller diameter not to exceed 90% of maximum impeller diameter catalogued for pump casing.
- .4 Motors to be sized for continuous operation without motor overload at runout condition for impeller size and rotational speed selected.

2.2 **IN-LINE STANDARD DUTY CIRCULATING PUMPS (IN-LINE CIRCULATORS)**

.1 Construction

- .1 Volute: Cast iron or bronze, with screwed or flanged suction and discharge connections.
- .2 Impeller: (cast bronze,) (stamped brass,) (alloy steel) (or cast iron).
- .3 Shaft: Alloy steel or stainless steel with bronze sleeve bearing and integral thrust collar.
- .4 Seal assembly: Mechanical.
- .5 Flexible self-aligning coupling.
- .6 Resilient mounted, drip proof, sleeve bearing motor.

.2 Manufacturer

- .1 S.A. Armstrong Models "S" and "H"
- .2 ITT Fluid Products - Bell & Gossett Series 100
- .3 Taco 110

2.3 **IN-LINE COMMERCIAL DUTY CIRCULATING PUMPS (HIGH FLOW IN-LINE CIRCULATORS)**

.1 Construction

- .1 Volute: Cast iron or bronze, with tapped openings for venting, draining, pressure gauges, and with screwed or flanged suction and discharge connections.
- .2 Impeller: (Cast bronze,) (Stamped brass,) (Alloy steel) (Cast iron).
- .3 Shaft: Alloy steel or stainless steel with bronze sleeve bearing and integral thrust collar.
- .4 Seal assembly: Mechanical.
- .5 Flexible self-aligning coupling.
- .6 Resilient mounted, drip proof, sleeve bearing motor.

.2 Manufacturer

- .1 S.A. Armstrong Series 1020, 1050
-

.2 ITT Fluid Products - Bell & Gossett Series 60

.3 Taco Series 1600

2.4 **SINGLE SUCTION CENTRIFUGAL PUMP**

.1 Construction

.1 (Bronze fitted) (All iron) (All bronze) (All stainless steel) type.

.2 Common cast iron or fabricated steel base with drip rim and tapping for drain connection.

.3 Impeller: Bronze, cast iron, or stainless steel enclosed dynamically balanced, keyed to shaft and secured with locking nut or screw.

.4 Alloy steel or stainless steel shaft with two point support and sleeve bearings.

.5 Bronze, cast iron, or stainless steel enclosed dynamically balanced impeller keyed to shaft and secured with locking nut or screw.

.6 Cast iron, bronze or stainless steel radially split end suction volute with flanged suction and discharge, drain plug, vent cock and suction and discharge pressure gauge tapings.

.7 Mechanical seal or packing gland with hardened wear rings and drip pocket piped to base gutter.

.8 Positive seal flushing system with valved copper piping from pump discharge to stuffing box and cyclone separators for pump heads up to 2400 kPa (800 ft) or 50 micron filters on pumps subject to dynamic heads of less than 160 kPa (55 ft) and ball type flow indicators.

.9 Flexible self-aligning coupling.

.2 Manufacturers:

.1 S.A. Armstrong

.2 ITT Bell & Gossett

.3 Aurora

.4 Taco-Leitch

2.5 **SINGLE SUCTION CLOSE COUPLED VERTICAL-IN-LINE CENTRIFUGAL PUMP**

.1 Construction

.1 (Bronze fitted) (All iron) type.

.2 Cast iron casing with motor mounting flange and drip rim and tapping for drain connection.

.3 Alloy steel or stainless steel shaft.

.4 Bronze, cast iron, or stainless steel enclosed dynamically balanced impeller keyed to motor shaft and secured with locking nut or screw.

- .5 Cast iron radially split end suction volute with flanged suction and discharge, drain plug, vent cock and suction and discharge pressure gauge tapings.
 - .6 Mechanical seal with positive seal flushing system consisting of valved copper piping from pump discharge to stuffing box and cyclone separators for pump heads up to 2400 kPa (800 ft) or 50 micron filters on pumps subject to dynamic heads of less than 160 kPa (55 ft) and ball type flow indicators.
 - .2 Manufacturer
 - .1 S.A. Armstrong
 - .2 ITT Bell & Gossett
 - .3 Aurora
 - .4 Taco-Leitch
 - 2.6 **SPECIAL APPLICATIONS:**
 - .1 Hot Water Heating
 - .1 End suction, close coupled type.
 - .2 May use packing gland provided gland, nuts are of bronze construction, gland bolts are stainless steel.
 - .3 Packing suitable for application temperature.
 - .4 Rotary type mechanical seals must be rated for 104°C (220°F) operating temperature.
 - .2 Condensate Pump
 - .1 Centrifugal type.
 - .2 Seal ratings: 100°C (212°F).
 - .3 Pump impeller hydraulically balanced.
 - 3 Execution
 - 3.1 **INSTALLATION**
 - .1 General
 - .1 Make piping and electrical connections to pumps.
 - .2 Check pump rotation.
 - .3 Set up and adjust controls.
 - .4 Pipe drain tapping to drain.
 - .5 Install gauges.
-

.2 Base Mounted Pumps

- .1 Supply templates for anchor bolt placement, dimension layouts for pump bases and furnish anchor bolts with sleeves.
- .2 Place pumps level on concrete base; dowel, shim and grout with minimum 13 mm grout.
- .3 Fill hollow portion of bases with concrete.
- .4 Align couplings before and after piping connections have been made.
- .5 Check oil level and lubricate.
- .6 Tighten glands after run-in.

.3 In-Line Circulators

- .1 Install with fluid flow direction as indicated by flow arrows on pump body.
- .2 Support piping and pump at flanges or near unions on connections to unit.
- .3 Install with bearing lubrication points accessible.
- .4 Check pump rotation.

.4 Vertical In-Line Pumps

- .1 Support pump from stanchions or hangers on suction and discharge piping.
- .2 Install volute venting pet cock in accessible location.
- .3 Check pump rotation.

End of Section

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- 1 General
 - 1.1 **SUMMARY**
 - .1 Section Includes
 - .1 Labour, Products, equipment and services necessary to complete the Work of this section.
 - 1.2 **SUBMITTALS**
 - .1 Shop Drawings
 - .1 Submit Shop Drawings in accordance with Section 01 33 00.
 - 1.3 **COORDINATION**
 - .1 Prepare coordination and fabrication drawings at a minimum scale of 1:50 and coordinate with other trades affected by this Work to ensure access to other portions of the Work is not impeded by the duct work systems.
 - .2 Maintain these Drawings on site and make them available for review by the Owner's Representative when requested.
 - 1.4 **PROJECT CONDITIONS**
 - .1 Environmental Requirements
 - .1 Maintain a space work temperature not less than the minimum ambient working temperature as required by the duct sealant manufacturer requirements. Any duct work sealant installed where the space temperature is less than these recommendations will be removed and replaced.
 - .2 Field Measurements
 - .1 In existing buildings, make detailed field measurements for routing of new duct work, and provide all offsets and transitions which may be required to accommodate the new work with existing and new services.
 - .3 Protection
 - .1 Temporarily cap-off duct work openings to protect against dirt accumulation inside the duct work.
 - 2 Products
 - 2.1 **DUCT WORK**
 - .1 Materials
 - .1 Galvanized steel sheet
 - .1 Z275 (G90) for unpainted duct work, indoor
 - .2 Z275 (G90) for outdoor duct work
 - .3 ZF075 (A25) designation zinc coating to ASTM A653/A653M for painted duct work
-

- .2 Stainless steel sheet
 - .1 Type 304L / Type 316L to ASTM A167
- .3 Flexible duct work
 - .1 ULC approved, insulated double wall polymeric liner bonded to mechanical lock spiral joints
 - .1 Thermoflex M-KE
 - .2 Flexmaster
- .4 Metal duct sealant – high velocity duct sealer
 - .1 3M EC800
 - .2 Foster #30-02
 - .3 Hardcast Iron Grip #601
 - .4 Duro-Dyne S-2
 - .5 Transcontinental Equipment "MP".

3 Execution

3.1 **DUCT WORK**

.1 General

- .1 Install duct work in arrangement shown on Drawings in accordance with standards and recommended practices of ASHRAE and SMACNA. Provide required offsets and transitions, whether specifically indicated or not, to facilitate duct installation and to avoid interference with building structure, piping, equipment and services.
 - .2 Duct sizes as shown on Drawings. Where ducts are to have internal acoustical liner, adjust duct size to accommodate acoustic liner thickness; clear inside dimensions as shown on Drawings.
 - .3 Fabricate duct work free from vibration, rattle or drumming under operating conditions; reinforce, brace, frame, place gaskets, etc. to comply with performance criteria.
 - .4 Place galvanized screens of 13 mm x 13 mm mesh x 2.7 mm diameter wire for air intakes, exhausts and open ends of duct work.
 - .5 Install duct work in locations and at elevations appropriate to ceiling heights shown on Drawings. Where required to be concealed, install duct work in furred spaces provided in walls and ceilings. Where there is no provision for concealment install duct as close as possible to walls, partitions and overhead structures to attain maximum headroom and clearance.
 - .6 Where shape of duct changes, install transition piece so that angle of side of transition piece does not exceed fifteen degrees from straight run of duct being connected, unless shown otherwise on Drawings.
-

.2 Pressure Class/Seal Class

.1 Fabricate duct work to SMACNA pressure classification as follows unless otherwise noted on Drawings.

.2 Seal duct work in accordance with SMACNA sealing requirements as follows:

.1 Seal Class "A": All transverse joints, longitudinal seams, and duct wall penetrations.

.2 Seal Class "B": All transverse joints, and longitudinal seams only.

.3 Seal Class "C": Transverse joints only.

.4 Seal Class "D": None.

System	Pressure Class	Sealing Class
Constant Volume Supply	+3" (750 Pa)	A
Variable Volume Supply, upstream of VAV boxes	+3" (500 Pa)	A
Variable Volume Supply, downstream of VAV boxes	+1" (250 Pa)	A
Building Return Air	+/-2" (500 Pa)	A
Building Exhaust (washroom exhaust, general exhaust)	+/-2" (500 Pa)	A
Fire Rated (exhaust)	+/-3" (750 Pa)	A
Kitchen Exhaust	-4" (1000 Pa)	A
Other Process Exhaust Systems	-4" (1000 Pa)	A

.3 Sleeves

.1 Install sleeves where ducts pass through walls or floors. Pack space between duct and sleeve with mineral wool and seal both ends with non-flammable fire resistant sealing compound. Install sheet metal closure plates on each side of wall to cover sleeve.

.2 Sleeves: Of the same sheet material and thickness as for duct work.

.4 Air Intakes and Exhausts

.1 Install removable galvanized screens securely fastened in place at air intakes, exhausts and open ends in duct work.

.5 Equipment Connections

.1 Install neoprene gasketed flanged joints at duct connections to air conditioning units, coils, etc. Fabricate flanges from mild steel angles to match equipment flanges.

.2 Install air terminal units (TU) and silencers (S) independent of duct work, with rods or angles of sizes adequate to support load.

.6 Paint Finish and Touch-Up

.1 In office areas paint interior of duct work for at least 300 mm behind supply and exhaust grilles with matte black paint to render duct work invisible from occupied space.

- .2 Touch-up galvanized steel damaged as a result of fabrication, including welding, with zinc dust galvanized primer.
- .7 Supports and Hangers
 - .1 Support intervals:
 - .1 Ducts up to 1.5 m in width: Minimum 2.4 m centres.
 - .2 Ducts 1.5 m in width and over: 1.2 m centres.
 - .2 Strap hangers:
 - .1 For duct size up through 760 mm width.
 - .2 3 mm x 25 mm mild steel bar stock. Bend strap hanger around bottom of duct for a minimum of 38 mm and attach to sides and bottom of duct.
 - .3 Steel angle hangers:
 - .1 For duct sizes over 760 mm in width.
 - .2 Mild steel rod hangers of 10 mm diameter minimum size, with 38 mm x 38 mm x 3 mm steel angle across bottom of duct and attach hanger to angle (not the duct).
 - .4 Install miscellaneous steel angles or channels as required between joists or building steel for structural support of duct where building framing spacing does not coincide with the required hanger spacing.

3.2 **RECTANGULAR DUCT WORK**

- .1 General
 - .1 Material: Galvanized steel for unpainted duct work, unless otherwise shown on Drawings.
 - .2 Metal thickness and construction methods as specified herein for various size ranges of ducts.
 - .3 Cross-break flat surfaces of uninsulated duct between joints, or between joints and intermediate reinforcements, to prevent vibration or buckling.
 - .4 Seal joints on all rectangular duct work with high velocity duct sealer. Duct-tape will not be allowed.
 - .2 Joints
 - .1 Longitudinal joints: Pittsburgh Lock joints tightly closed along full length of seam.
 - .2 Transverse joints: Ductmate, Nexus or TDC connections of class to suit size of duct and pressure of system.
 - .3 Fittings
 - .1 Elbows, transition sections and take-off fittings: Use metal one gauge heavier than thickness specified for duct in which they are installed.
-

- .2 Radius elbows: Standard radius design with inner radius equal to width of elbow unless shown otherwise, Pittsburgh Lock seams, and with ends to match transverse joints of duct.
- .3 Square elbows: Where elbows are shown as square type, fit elbows with air turning vanes of double blade construction.

3.3 **ROUND DUCT WORK**

.1 General

- .1 Shop-fabricate round duct work from helically wound galvanized steel sheet strips with spiral lock seam, of following thicknesses:

Duct Diameter	Thickness of Sheet Metal
200 mm or less	0.5 mm (26 ga.)
228 mm to 560 mm	0.6 mm (24 ga.)
600 mm to 810 mm	0.8 mm (22 ga.)
860 mm to 1010 mm	1 mm (20 ga.)
1060 mm and up	1.3 mm (18 ga.)

- .2 In lieu of standard spiral lock seam duct work, "Uni-Rib" duct as manufactured by United Sheet Metal may be furnished for above floor installations in sizes 375 mm and larger.
- .3 Secure joints with sheet metal screws and seal with approved sealant.

.2 Joints

- .1 Longitudinal seam: Spiral wound seam type RL-1 (grooved lock) or RL-4 (butt weld)
- .2 Transverse seam: Van Stone flange joint RT-2 or RT-2A
 - .1 Exception: Downstream of VAV boxes flange joint type RT-1 (beaded sleeve joint) may be used, with minimum three mechanical fasteners each side of joint.
- .3 Seal joints in round duct work with high velocity duct sealer as specified for rectangular duct work.

.3 Fittings

- .1 Ninety degree elbows: Smooth centre line radius of one and one-half times duct diameter. Alternatively, use elbows of five piece construction, subject to prior approval of Consultant.
- .2 Forty-five degree elbows: Use three piece construction.
- .3 Branch connections to mains: Eccentric conical configuration.

3.4 **SPECIALTY DUCT WORK SYSTEMS**

.1 Flexible Type Round Ducts

- .1 Provide flexible duct work as follows:
-

- .1 Between trunk supply duct and air terminal units, VAV boxes.
 - .2 At connection to certain ceiling diffusers.
 - .3 Where shown on Drawings.
 - .2 Use insulated type flexible duct work in non-return air plenums.
 - .3 Use non-insulated type flexible duct work in return air plenums.
 - .4 Seal joints between flexible duct and rigid duct work or equipment with non-flammable high velocity duct sealer, applied in accordance with duct manufacturer's recommendations, and make secure with gear type nylon strap connectors.
 - .2 Fire Rated Duct Work
 - .1 Construct and support fire rated duct work in strict conformance with the ULC listing requirements for two-hour fire rating.
 - .2 Where duct construction or support is not covered by ULC listing requirements, construct and support duct work as for rectangular duct work, specified herein.
 - .3 Waterproof Duct Work
 - .1 Slope fresh air intake ducts down at 1:100 to permit moisture induced by air intake to be drained. Install 38 mm drain flange in bottom of duct at low point. Continuously solder or seal joints in exterior air intake duct to prevent dripping of moisture through joints.
 - .2 In areas having high humidity, fabricate exhaust duct work without seams in bottom of duct for at least 3 m of duct run behind register and slope duct up away from register.
 - .4 Kitchen Exhaust Hood Duct Work
 - .1 Fabricate duct work, access door and cleanouts in accordance with NFPA 96.
 - .2 Material: 1.6 mm (16 gauge) black steel (or stainless steel) with externally welded seams, and flanged and gasketed joints at hood and fan.
 - 3.5 **INSPECTION, TESTING AND BALANCING**
 - .1 Cleaning
 - .1 Prior to start-up of fans, blow out complete systems of duct work with high velocity air for not less than two hours using, where possible, the installed air handling equipment to full capacity and by blanking off duct sections to achieve required velocity. Do not install air filters prior to blow-out of duct work systems. Use auxiliary portable blowers for cleaning where installed fan systems are not adequate to blow out complete system free from dust and dirt.
 - .2 After duct systems have been blown out, clean interior of plenums, coils, and register, grille or diffuser outlet collars with industrial type vacuum cleaner. On completion of cleaning process, install filters before placing systems in final operation.
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.2 Balancing of Air Systems

.1 Balance air handling systems in accordance with Section 23 08 16.

End of Section

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- 1 General
 - 1.1 **SUMMARY**
 - .1 Section Includes
 - .1 Labour, Products, equipment and services necessary to complete the Work of this section.
 - 1.2 **RELATED SECTIONS**
 - .1 Division 25: Integrated automation:
 - .1 Automatic control damper operators
 - .2 Automatic control dampers
 - 1.3 **SUBMITTALS**
 - .1 Shop Drawings
 - .1 Submit Shop Drawings in accordance with Section 01 33 00.
 - 2 Products
 - 2.1 **DUCT WORK ACCESSORIES**
 - .1 Flexible Duct Connections
 - .1 Material:
 - .1 Heavy glass fabric double coated with neoprene and attached to 0.6 mm (24 ga) metal strips 75 mm wide.
 - .2 Fabric length between metal strips:
 - .1 Minimum 75 mm for ducts of maximum size in either dimension or diameter of 750 mm or less
 - .2 150 mm for ducts of 775 mm size and larger.
 - .2 Acceptable Manufacturers:
 - .1 Duro-Dyne "Grip-Loc Type SMFN"
 - .2 Ventfabrics "Ventglas"
 - .2 Turning Vanes
 - .1 Material: Hollow airfoil type, fabricated of same material as duct in which they are installed.
 - .2 Acceptable Manufacturers:
 - .1 Duro-Dyne
 - .3 Access Doors in Duct Work and Plenums
 - .1 Hand door:
-

- .1 Construction: 0.7 mm (24 ga) galvanized steel, double flanged frame and insulated door complete with insulation backing plate.
- .2 Fasteners: Zinc plated cam-lock fasteners, minimum two per door, with safety retaining chain.
- .2 Equipment and man doors:
 - .1 Minimum size, equipment: Where motors are installed within unit or duct, use an access door large enough to permit removal of motor.
 - .2 Minimum size, man door: 450 mm x 1.2 m or as shown on Drawings.
 - .3 Construction: 0.8 mm (22 ga) thick galvanized steel sheet double panel construction with approved 25 mm thick insulating filler, mounted in flanged die-formed collar flush with face of finished insulation, with flanged door frames welded in place.
 - .4 Hinges: Heavy zinc plated continuous hinge.
 - .5 Fasteners: Three heavy sash fasteners and neoprene gaskets.
- .4 Probe Inlets
 - .1 Material:
 - .1 Ventlok No. 699 or Duro-Dyne IP-1 or IP-2 Test Opening Enclosures complete with locking cap, chain, gaskets, insulating plug and extensions for insulated duct work.

2.2 **OPERATING DAMPERS**

- .1 Automatic Control Dampers
 - .1 General:
 - .1 Modulating control dampers: Opposed blades.
 - .2 Two position control dampers: Parallel blades.
 - .2 Damper blades and frames:
 - .1 Extruded aluminum 6063-T5
 - .2 Maximum blade length: 1.2 m without internal frame support.
 - .3 Maximum blade length: 1.2 m without internal frame support.
 - .4 Blade edge seals: EPDM gaskets.
 - .5 Frame side seals: Extruded TPE or cambered stainless steel.
 - .6 Frame style: Flanged to duct.
 - .7 Jack shaft: Extendable, combination of aluminum, and zinc/nickel coated steel.
 - .8 Damper leakage: 50 L/s per m² damper face area at 1 kPa differential static pressure.

- .3 Bearings:
 - .1 Thermal plastic resin copolymer, nylon or oil impregnated bronze.
 - .2 At blade axles, linkage devices, etc.
 - .4 Damper blades and frame for outside exhaust and intake air applications:
 - .1 As above.
 - .2 Operating temperature: -40°C to +100°C (-40°F to +212°F).
 - .3 Thermally broken and insulated blades; expanded polyurethane foam insulation.
 - .4 Damper leakage: 21 L/s per m² damper face area at 1 kPa differential static pressure.
 - .5 Acceptable Manufacturer:
 - .1 Tamco - Series 1000
 - .2 Nailor Industries - Series 2000
 - .3 Tamco - Series 9000 (exhaust and air intake applications)
 - .4 Nailor - Series 2000IBF (exhaust and air intake applications)
 - .5 Ventex Alumavent
 - .2 Manual Balancing Dampers
 - .1 Rectangular duct work:
 - .1 Galvanized channel type frames, non-binding pre-lubricated type interconnecting and operating linkages.
 - .2 Blades: Minimum 1.6 mm (16 ga) thick material, opposed blade style.
 - .3 Manual operator and locking type quadrant as required for synchronous operation and setting of blades.
 - .4 Blade width: Maximum 200 mm.
 - .5 Blade length: Length coinciding with frame opening on horizontal plane to maximum length of 1.2 m.
 - .6 Locking quadrant: Galvanized steel locking quadrant with "Open – Closed" labels, 50 mm insulation stand-off.
 - .7 Acceptable Manufacturers:
 - .1 Nailor – Series 1810/1820 with HL2 quadrant
 - .2 Ventex Alumavent
 - .2 Round duct work - medium pressure butterfly damper:
 - .1 Galvanized steel frame 0.9 mm (22 ga) with stiffening beads up to 300 mm diameter; 0.9 mm (20 ga) over 300 mm duct size.
-

- .2 Blade: Laminated galvanized steel 0.9 mm (22 ga), or single layer of 1.6 mm (16 ga), open and closed end stops, Celcon bearings, polyethylene blade edge seal, 13 mm diameter drive shaft.
- .3 Locking quadrant: Galvanized steel locking quadrant with "Open – Closed" labels, 50 mm insulation stand-off.
- .4 Acceptable Manufacturers:
 - .1 Nailor – Series 1000 with HL2 quadrant
- .3 Round duct work - low pressure butterfly damper:
 - .1 Galvanized steel frame 0.9 mm (22 ga) with stiffening beads up to 300 mm diameter; 0.9 mm (20 ga) over 300 mm duct size.
 - .2 Blade: Galvanized steel 0.9 mm (22 ga) up to 300 mm diameter; 0.9 mm (20 ga) over 300 mm duct size, 6 mm diameter drive shaft.
 - .3 Locking quadrant: Galvanized steel locking quadrant with "Open – Closed" labels, 50 mm insulation stand-off.
 - .4 Acceptable Manufacturers:
 - .1 Nailor – Series 1890 with HLQ-SB quadrant
- .4 Splitter damper:
 - .1 Material: Same material and thickness as ducts in which they are to be installed, minimum of 0.8 mm (22 ga).
 - .2 Form splitters of double thickness of metal and with rounded surface at air entering edge.
 - .3 Splitter length: At least one and one-half times width of smaller branch duct, but in no case less than 300 mm.
 - .4 Provide with locking type quadrant.
- .3 Volume Extractors in Duct Work:
 - .1 Use where noted on Drawings
 - .2 Acceptable Manufacturers
 - .1 Titus Model AG225 with #3 manual operator.

2.3 **FIRE AND SMOKE DAMPERS**

- .1 Fire Dampers
 - .1 ULC labelled fire dampers of hinged, fusible link type with channel frames, blades and housing and conforming to NFPA 90A and UL555 requirements. Use "Type B" fire dampers for rectangular or square duct work and "Type C" fire dampers for round duct work.
 - .2 Dynamic dampers: Designed to close while the system fans are operating.
 - .3 Static dampers: Designed to close with no airflow through damper.
-

-
- .4 Closure link: Fusible link which can be released, tested and relatched for testing.
 - .5 Construct fire dampers and frames of same material as duct in which they are installed.
 - .6 Acceptable Manufacturers:
 - .1 Nailor – “D” series
 - .2 Ruskin
 - .3 Ventex Alumavent
 - .2 Smoke Dampers
 - .1 ULC labelled fire dampers of airfoil parallel blade type, with extruded aluminum channel frames and sleeve housing and conforming to NFPA 90A and 92A, and UL555S, leakage class I rating at 176°C (350°F).
 - .2 Blades: Extruded aluminum airfoil blade with concealed linkage outside of airstream, with self lubricating bronze type bearings, stainless steel camber style jamb seals, and mechanically locked in extruded edge seals
 - .3 Dampers designed to operate while the system fans are operating.
 - .4 Operator: Externally mounted, factory installed 120 VAC electric actuator with spring return, fail close position. Built-in high limit thermostat switch opens at 73°C (163°F).
 - .5 Accessories: 120 VAC proof-of-closure and proof-of-open end-switch, with two SPDT switches.
 - .6 Acceptable Manufacturers: Damper
 - .1 Nailor – Series 1280
 - .2 Ruskin
 - .3 Ventex Alumavent
 - .7 Acceptable Manufacturers: Operator
 - .1 Belimo – Model FSNF-120 US
 - .3 Combination Smoke and Fire Dampers
 - .1 ULC labelled fire dampers of airfoil parallel blade type, with extruded aluminum channel frames and sleeve housing and conforming to NFPA 90A and 92A, and UL 555 and UL555S, leakage Class I rating at 176°C (350°F).
 - .2 Blades: Extruded aluminum airfoil blade with concealed linkage outside of airstream, with self lubricating bronze type bearings, stainless steel camber style jamb seals, and mechanically locked in extruded edge seals
 - .3 Dampers designed to operate while the system fans are operating.
 - .4 Operator: Externally mounted, factory installed 120 VAC electric actuator with spring return, fail close position. Built-in high limit thermostat switch opens at 73°C (163°F).
-

- .5 Accessories: 120 VAC proof-of-closure and proof-of-open end-switch, with two SPDT switches.
- .6 Acceptable Manufacturers: Damper
 - .1 Nailor – Series 1220
 - .2 Ruskin
- .7 Acceptable Manufacturers: Operator
 - .1 Belimo – Model FSNF-120 US

2.4 **ACOUSTIC TREATMENT**

- .1 Acoustic Duct Insulation
 - .1 Material:
 - .1 Rigid coated duct liner conforming to NFPA 90A and 90B, 25 mm thick and 72 kg/m³ density.
 - .2 In duct work at velocities over 15 m/s, provide a perforated or expanded metal inner liner over acoustic insulation.
 - .2 Fasteners:
 - .1 Fasten acoustic liner to inside of duct with plate type impaling pins and self-locking washers, by Eckels Industries "Stic-Klips", "Tactoo Series T", or Continental Stud Welding weld pins and self locking washers.
 - .2 Use fasteners or securing pins of size and length as required by insulation weight, thickness, fastener spacing and design.
 - .3 In addition to mechanical type fasteners, adhere insulation to inside of duct with Foster No. 81-99 or Henry No. 230-04 fire retardant adhesive. Seal all joints with Foster No. 30-36 or Henry No. 120-09 mastic sealant.
 - .3 Acceptable Manufacturers:
 - .1 Owens Corning
 - .2 Manson
 - .3 Knauf
 - .4 Manville

2.5 **ACOUSTIC SILENCERS (S)**

- .1 Rectangular and Elbow Silencers
 - .1 Material:
 - .1 Housing: Hot dip galvanized steel sheet, one gauge heavier than adjacent duct work but not less than 0.9 mm (20 ga).
 - .2 Duct size: External silencer dimension to match adjacent duct dimensions, unless otherwise shown.

- .3 Inner liner: Hot dip galvanized perforated steel sheet, 0.8 mm (22 ga).
 - .4 Insulation: Glass fibre or mineral wool to ASTM E-84, class 1.
 - .2 Performance
 - .1 Silencers have been selected on basis of sound power levels of first listed equipment. Ensure that equipment of any other named manufacturer proposed for use has sound power levels equal to or lower than first listed equipment.
 - .2 Be responsible for reducing noise levels to below acceptable maximum without additional cost to Owner.
 - .2 Circular Silencers
 - .1 Same as for rectangular silencers and as follows:
 - .1 Internal bullet: Spun head and tapered tail, with airflow straightening vanes.
 - .2 Duct size: Duct flange connection same size as adjacent duct size.
 - .3 Acceptable Manufacturers
 - .1 Vibron
 - .2 Vibro-Acoustics
 - .3 Woods
 - 3 Execution
 - 3.1 **GENERAL**
 - .1 Refer to and comply with applicable requirements specified in Section 23 05 01.
 - .2 Install miscellaneous steel framing, supports, braces, etc. as required to hang or support equipment and duct work as specified herein, and as shown on Drawings.
 - 3.2 **FLEXIBLE DUCT CONNECTIONS**
 - .1 Use flexible duct connections between fans and/or air handling units and connecting duct work, between unit components, in ducts at building expansion joints, and in other locations shown on Drawings
 - .2 Install flexible connectors with fabric in folds, not drawn tight.
 - .3 Install internal guides to prevent flexible connection from collapsing on suction side of fans.
 - .4 For installation between sections of air handling units, install flexible connectors suitable for connecting to flanges of casings where so provided.
 - 3.3 **TURNING VANES**
 - .1 Provide hollow airfoil type turning vanes in duct work where shown on Drawings and in ninety degree square duct elbows, fabricated of same material as duct in which they are installed.
-

3.4 ACCESS DOORS

- .1 Provide access doors in duct work and for plenums to allow servicing, maintenance, and inspection of:
 - .1 Control dampers
 - .2 Fire dampers
 - .3 Smoke dampers
 - .4 Fire detectors
 - .5 Control elements
 - .6 Sprinkler heads mounted in duct work
 - .7 Motors
 - .8 Bearings
 - .9 As shown on Drawings

- .2 Provide "Hand Doors" in duct work of sizes as follows:

Access Type	Duct Dimension	Access Door Size
One hand and sight	Less than 400 mm	300x150 mm
Two hands and sight	Between 400 mm and 500 mm	450x250 mm
Head and shoulders	Between 500 mm and 760 mm	530x356 mm
Body plus ladder	Between 760 mm and 1320 mm	635x430 mm

- .3 Provide "Equipment and Man Doors" as follows:
 - .1 In duct work with duct dimension over 1320 mm.
 - .2 In plenums.
 - .3 As shown.

3.5 BALANCING DAMPERS

- .1 Use rectangular opposed blade dampers at the following locations:
 - .1 At floor connections to riser shafts/ducts.
 - .2 In supply and return duct work where main ducts are split into two more trunks.
 - .3 At rectangular branch duct connections to main or trunk ducts.
 - .4 As shown.
 - .2 Use splitter dampers only where specifically shown on Drawings.
 - .3 Use medium pressure butterfly dampers at the following locations:
 - .1 At floor connections to supply air riser ducts.
 - .2 In supply and return duct work where main ducts are split into two more trunks.
-

- .3 At branch duct connections to main or trunk ducts.
 - .4 At branch duct upstream of terminal box.
 - .5 As shown.
 - .4 Use low pressure butterfly dampers at the following locations:
 - .1 At branch connections on the downstream side of terminal boxes.
 - .2 At individual branch outlets serving grilles or diffusers.
 - .5 Dampers supplied with diffusers or grilles are to be used to balance $\pm 10\%$ of indicated airflow, are NOT in lieu of branch dampers.
- 3.6 **VOLUME EXTRACTORS IN DUCT WORK**
- .1 Use where noted on Drawings.
- 3.7 **FIRE AND SMOKE DAMPERS**
- .1 Install fire dampers in accordance with Suppliers instructions, and with retaining angles on both sides of wall or floor and fastened to damper collars.
 - .2 Install fire dampers with adjacent access door as required to permit re-opening of damper and replacement of fusible link.
 - .3 Provide dynamic fire dampers on all systems, unless otherwise shown on Drawings and specified below.
 - .4 Provide static dampers on return air transfer openings.
- 3.8 **PROBE INLETS**
- .1 Install probe inlets in duct work at locations as follows:
 - .1 In main supply and return ducts.
 - .2 Inlet and outlet side of fans.
 - .3 Other locations as required by testing and balancing trade, to permit testing, balancing and measurement of air quantities and static pressure in air handling systems.
 - .2 Locate probe inlets a sufficient distance from elbows or transition sections to ensure stable readings of non-turbulent air and install 75 mm from corners and at 150 mm centres across long side of duct.
- 3.9 **ACOUSTIC DUCT INSULATION AND SILENCERS**
- .1 Install internal acoustic insulation in specific sections of duct work and/or plenums as shown on Drawings as follows:
 - .1 Adhere insulation to duct work or plenums by bedding in strips of adhesive supplemented by impaling clips or weld pins spaced at 300 mm centres with self-locking washers.
 - .2 Apply adhesive at 50% coverage, in 150 mm strips.
-

- .3 Cut off ends of welded impaling pins after application of self-locking washers.
- .4 Seal butt joints of insulation with mastic sealant applied to edges of insulation.
- .5 Coat joints and self-locking washers after installation with two coat application of mastic sealant, and with open mesh glass fabric embedded in mastic between first and second coat.
- .6 In high velocity duct work install perforated or expanded metal inner liner over acoustic lining.
- .2 Use silencers in duct work where shown on Drawings, to attenuate airborne noise generated in air distribution systems.
- .3 Fabricate cross talk silencers:
 - .1 Housing: Galvanized steel, to SMACNA pressure class 1" standard.
 - .2 Liner: Rigid coated duct liner.
 - .3 Size: As shown on drawings.
 - .4 Shape: As shown on drawings.
 - .5 Provide a sheetmetal nosing at open ends of duct to close off cut edge of liner.

End of Section

-
- 1 General
 - 1.1 **SUMMARY**
 - .1 Section Includes
 - .1 Labour, Products, equipment and services necessary to complete the Work of this section.
 - 1.2 **REFERENCE STANDARDS**
 - .1 Comply with the latest edition of the standards referenced herein:
 - .1 Fans: Designed and constructed in strict conformity with the AMCA Standards and bearing the "Certified Rating Seal".
 - .2 Applicable sections of CSA C22.2 No. 113 for fan construction and installation.
 - .3 Occupational Health and Safety Act, O.Reg 851.
 - 1.3 **SUBMITTALS**
 - .1 Shop Drawings
 - .1 Submit Shop Drawings in accordance with Section 01 33 00.
 - .2 Submit manufacturer's certified Shop Drawings to the Consultant and include:
 - .1 Complete information on fan construction and performance.
 - .2 Performance curves over full range from shut-off to free delivery.
 - .3 Drive details.
 - .4 Make, type and catalogue number of bearings.
 - .5 State hour rating of bearings when specified.
 - .2 Operation and Maintenance Data
 - .1 Submit printed operating instructions and maintenance data in accordance with Section 01 33 00.
 - .3 Maintenance Materials
 - .1 Provide and turn-over to Owner at time of Substantial Completion one V-belt set for each size used.
 - .1 Where more than one fan uses the same set size, provide only one set.
 - 2 Products
 - 2.1 **GENERAL REQUIREMENTS**
 - .1 Performance Ratings
 - .1 Type, size and capacity shown on Drawings for each specific application and conforming to requirements of manufacture, operation and performance as specified.
-

- .2 Select fan size, operating rpm and rating point on stable head flow curve with smooth characteristics.
 - .3 Operating at least 20% below first critical speed when operating at maximum speed for class of construction.
 - .4 Dynamically and statically balance wheels of free standing or unitary fans to acceptable tolerances relative to size and speed.
 - .2 Cleaning and Metal Protection
 - .1 Thoroughly clean interior and exterior surfaces of fans including screens, at factory with approved de-greasing agent to CGBS 1-GP-181M+ Amdt-Mar-78.
 - .2 Apply a coating of red oxide or zinc chromate primer unless special protective coating is specified.
 - .1 Exception: Fans constructed of galvanized steel or aluminum.
 - .3 Materials
 - .1 Fan casings: Heavy gauge steel or spun aluminum construction, as specified by model number.
 - .1 Explosion proof construction (non-sparking) where listed in schedules.
 - .4 Bearings
 - .1 Service life
 - .1 To L10 life standard in accordance with latest AFBMA code.
 - .2 Unitary, axial and free standing fans: 200,000 (60,000) (80,000) (100,000) hour service.
 - .3 Other fan bearings: 8,000 hour service.
 - .2 Type
 - .1 Grease lubricated ball or roller type fan bearings with ample thrust provision to prevent end play during normal life of bearings.
 - .2 Smaller than 36 mm diameter: Cartridge type.
 - .3 36 mm diameter and larger: Shaft adapter sleeve type bearings utilizing horizontally split pillow blocks and mechanical flinger type grease valves.
 - .4 Shafts smaller than 56 mm diameter, interference fit bearings may be used in lieu of adapter sleeve type.
 - .3 Bearings in air stream
 - .1 Well secured extended grease lubricating lines unless bearing is easily accessible through man-size access door.
 - .2 Pack bearings with low temperature grease in factory.
-

- .4 Axial flow fans
 - .1 Conform to these Specifications except where inner cylinder mounting methods are used or dimensions do not permit it and special or flange mounted type bearings are required.
 - .5 Grease fittings, for fans driven by motors 0.375 kW (1/2 HP) and larger
 - .1 Provide bearings with Zerk or Alemite grease fittings, with provision for automatic relief of lubricant pressure to outside of fan, away from wheel and visible from maintenance location.
 - .2 Use service fittings and relief fittings easily accessible from maintenance locations and at separate and opposite sides of bearing housing.
 - .5 Motors and Drives
 - .1 Motor ratings
 - .1 To Section 23 05 13.
 - .2 Type, kW (HP) rating, motor speed and electrical characteristics shown on Drawings.
 - .3 Capable of satisfactory operation over range of performance from shut-off to run-out at 110% of rated rpm at point of selection.
 - .2 Drive and belt guards: To Section 23 05 01.
 - .6 Accessories
 - .1 Fans with variable inlet vanes
 - .1 Operating mechanisms to provide simultaneous adjustment of vanes.
 - .2 Motor operated mechanisms to be suitable for adaptation of motor operator provided under Division 25.
 - .3 Quick opening access doors in scroll casing.
 - .4 On DWDI fans interconnect vanes in each inlet to operate in unison.
 - .5 Provide locking device for manual operation.
 - .2 Casing drains
 - .1 Fans discharging vertically through roof: Fitted with 38 mm casing drains.
 - .3 Roof mounted fans
 - .1 Factory mounted unfused disconnect switches wired to motor terminals.
 - .2 Conduit or wiring post running through fan housing so that wiring may be run to line side of disconnect switch from below roof without disturbing roof construction.
-

- .4 Roof curbs for roof mounted fans and ventilators
 - .1 Prefabricated insulated galvanized steel sheet curbs for mounting to roof deck.
 - .2 Prefabricated insulated galvanized steel sheet curbs for mounting to roof deck.
 - .3 Minimum curb height: 300 mm on every side, or as dimensioned on Drawings.

2.2

FAN TYPES

.1 Centrifugal Fans

.1 Arrangements

Fan Type	Arrangement
Belt driven single inlet single width (SWSI) fans up to and including 915 mm wheel diameter	#1 or #2
Belt driven single inlet single width (SWSI) fans with wheel diameter larger than 915 mm diameter	#3
Belt driven double width double inlet (DWDI) fans	#3
Belt drive plenum (plug) fans, single width single inlet (SWSI) fans	#3
Direct connected double width double inlet (DWDI) fans	#7
Direct connected single inlet single width (SWSI) fans	#8
Utility sets	#10
Tubular single width single inlet (SWSI) fans	#1 or #9

.2 Fan wheels

- .1 Backward curved or backward inclined for fan wheels less than 686 mm diameter.
- .2 Single or double thickness backward curved air foil blades for fan wheels 686 mm diameter and larger.

.3 Fan casing

- .1 Continuous seam welded.
- .2 Inlet mounting collar.
- .3 Outlet flanged collar.

.4 Plenum (plug) fans

- .1 Safety screen enclosure around fan and motor fabricated from steel angle and expanded metal mesh.
- .2 Access covers to fan and motor shaft ends for speed measurements.

.5 In-line cabinet fans

- .1 Single wheel SWSI centrifugal fans with motor and V-belt drive.
- .2 Removable panels for access to internal parts.

- .3 Internally lined cabinet with 50 mm thick rigid acoustic insulation.
 - .4 Expanded metal mesh over insulation on floor.
 - .5 Motor pre-wired to external junction box.
 - .6 Mounting ring or brackets for vertical or horizontal suspension from overhead structure.
 - .7 Belt guard, motor and drive.
 - .8 Hanger brackets.
 - .9 Inlet and outlet cones.
 - .10 Quick-opening access door.
 - .11 External grease and relief fittings to each bearing.
 - .12 Variable inlet vanes and linkage where noted.
 - .6 Ceiling cabinet fan / in-line cabinet fan
 - .1 Fan wheel
 - .1 Centrifugal direct drive type.
 - .2 High strength polymer material.
 - .3 Forward curved.
 - .2 Motor
 - .1 Continuous duty, permanently lubricated, thermally protected.
 - .2 Resilient motor mounts to eliminate vibration.
 - .3 Casing
 - .1 Heavy gauge steel.
 - .2 Acoustic lining.
 - .3 Painted for corrosion resistance.
 - .4 Built-in backdraft damper.
 - .5 Outlet connection for round duct.
 - .6 Integral mounting flanges to allow for ceiling installation.
 - .7 Tubular centrifugal fans
 - .1 Characteristics and construction as for centrifugal fan wheels.
 - .2 (Direct drive motor) (Belt drive assembly).
 - .3 Smooth rounded inlet, and stationary guide vanes.
-

.2 Tube and Vane Axial Fans

.1 Fan

- .1 Fabricated of welded steel with welded motor support.
- .2 Quick-opening access door.
- .3 External grease and relief fittings to each bearing.
- .4 Streamlined inlet cone and discharge bell sections.
- .5 Integral silencer casing.
- .6 Reinforced legs for floor mounted units.
- .7 Hanger brackets.
- .8 Support bracket welded to side of casing for suspended units.

.2 Drives

- .1 Direct driven: (Adjustable pitch) (Fixed pitch) (Fan blade with totally enclosed "air-over" motors and diameter of wheel hub at least equal to that of motor frame.
- .2 Belt driven: (Fixed) (Adjustable) blade wheels with externally mounted open drip proof motors, internal belt fairing, external belt guards and adjustable motor mounts.

.3 Roof Top Fans and Ventilators

.1 Upblast exhaust and downward supply air fans

- .1 Suitable for mounting on curbed roof openings.
- .2 Heavy gauge galvanized steel housing and windband.
- .3 Finished inside and outside with sprayed asphalt.
- .4 Heavy gauge curb cap.
- .5 Gravity or spring assisted steel dampers as required, with magnetic catches to dampers to prevent rattling in closed position.
- .6 TEAO motor.
- .7 Weatherproof protective motor cover and belt-drive.
- .8 Supply fans complete with 25 mm throwaway filters.

.2 Spun aluminum dome type fans

- .1 Belt or direct driven as indicated in schedules.
 - .2 Spun aluminum housing.
 - .3 Hinged or completely removable hood for access to motor and fan.
 - .4 Non-overloading centrifugal fan wheel.
-

- .5 Multi-blade gravity backdraft damper and aluminum 13 mm mesh birdscreen.
 - .3 Gravity relief vents
 - .1 Spun aluminum cover.
 - .2 Welded aluminum curb cap.
 - .3 Galvanized bird screen.
 - .4 Exhaust air outlets complete with backdraft dampers.
 - .4 Penthouse type intake and exhaust hoods
 - .1 Extruded aluminum fixed louvres with birdscreens on inside.
 - .2 Insulated metal roof.
 - .3 Welded base to suit curbed opening and prefinished to later colour selection.
 - .4 Ceiling Fans
 - .1 Multi-bladed propellers of sheet or airfoil shape.
 - .2 Permanently lubricated ball bearings suited for operation in any position.
 - .3 Direct driven, variable speed, with EC motor complete with controllers.
 - .4 Acceptable manufacturers:
 - .1 Big Ass Fans
 - .2 Altra Air (Envira North)
 - .3 MacroAir
 - .5 Propeller Fans
 - .1 Wall type belt or direct driven propeller fans
 - .1 Multi-bladed propellers of sheet or airfoil shape steel within bell mouth entrance.
 - .2 Grease lubricated ball bearings suited for operation in any position.
 - .3 (Direct) (or) (belt) driven, with motor as indicated.
 - .4 Bird screen (and automatic backdraft dampers with gasketted edges).
 - .5 Wire guard on motor side.
 - .6 Support motor with substantial brackets or frame. Motors supported integrally with wire guard will not be accepted.
-

- .6 Acceptable Manufacturers
 - .1 Industrial Type Construction (In-line, Propeller Utility Sets, Upblast, Fume)
 - .1 Twin City Fan
 - .2 Chicago Blower
 - .3 New York Blower
 - .4 Northern Blower
 - .5 Barry Blower
 - .6 Carnes
 - .7 Aeroflow
 - .8 Aerovent
 - .9 Howden Fan Co.
 - .10 American Fan Company (Flakt Woods)
 - .11 Wood Fans
 - .12 Canada Blower
 - .2 Ceiling Cabinet Fans
 - .1 Greenheck
 - .2 Twin City
 - .3 Carnes
 - .4 Aerovent
 - .5 PennBarry
 - .6 Loren Cook
 - .3 Small Propeller Fans
 - .1 Howden Fan Co.
 - .2 Greenheck
 - .3 Carnes
 - .4 American Fan Company (Flakt Woods)
 - .5 Wood Fans
 - .4 Spun Aluminum Fans
 - .1 Greenheck
 - .2 Jenn Air
 - .3 Carnes
-

- .4 American Fan Company (Flakt Woods)
- .5 Intake and Exhaust Hoods, Penthouses, Relief Vents
 - .1 Greenheck
 - .2 Jenn Air
 - .3 Carnes
 - .4 Loren-Cook
 - .5 American Fan Company (Flakt Woods)

3 Execution

3.1 **GENERAL**

.1 Fan Installation

- .1 Install fans complete with resilient mountings and restraining snubbers in accordance with Section 23 05 48.
- .2 Provide flexible connections on inlet and outlet ductwork in accordance with Section 23 33 00.
- .3 Align shafts, belt drive and motor, adjust belt tension and check motor rotation before start-up.
- .4 Protect motors and fans during construction and rotate fans, by hand, every month between delivery and acceptance of building.

.2 Air Balancing

- .1 Adjust variable pitch fan/motor sheaves during balancing to achieve specified air quantities.
- .2 Provide sheaves and belts for final air balance.

3.2 **FABRICATED GOOSENECK TYPE FRESH AIR INTAKE AND EXHAUST AIR HOODS**

- .1 Fabrication: Black steel construction.
- .2 Size, shape and arrangement as shown on Drawings.
- .3 Finish interior and exterior surfaces finished with rust inhibitive primer.

End of Section

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- 1 General
 - 1.1 **SUMMARY**
 - .1 Section Includes
 - .1 Labour, Products, equipment and services necessary to complete the Work of this section.
 - 1.2 **REFERENCE STANDARDS**
 - .1 Comply with the latest edition of the following:
 - .1 Insulation systems
 - .1 UL 181 (Air Erosion)
 - .2 UL 181 (Mold Growth and Humidity)
 - .3 UL 723 (25/50) (Flame and Smoke)
 - .4 ASTM E 84 (25/50) (Flame and Smoke)
 - .5 ASTM C665 (Fungi Resistance)
 - 1.3 **SUBMITTALS**
 - .1 Shop Drawings
 - .1 Submit Shop Drawings in accordance with Section 01 33 00 and provide the following:
 - .1 Airflow and sound power data
 - .2 Motor load data
 - .3 Control systems
 - .2 Operation and Maintenance Data
 - .1 Submit printed operating instructions and maintenance data in accordance with Section 01 33 00.
 - 1.4 **CODES AND REGULATIONS, PERMITS, COSTS AND FEES**
 - .1 Comply with municipal or provincial codes, rules and regulations and/or authorities having jurisdiction.
 - .1 Electrical certification
 - .1 CSA labeled or field approval
 - 2 Products
 - 2.1 **LOW PRESSURE TERMINAL UNITS - TO 750 PA (3" WG)**
 - .1 General
 - .1 Type, model and size as shown on Drawings
-

- .2 Acceptable Manufacturers:
 - .1 E.H. Price
 - .2 Titus
 - .3 Trane
 - .4 Kreuger Division of Phillips Air Distribution Ltd.
 - .5 Nailor Industries Inc.
 - .6 Carnes
 - .7 Tuttle & Bailey
 - .3 Operating pressure
 - .1 Maximum inlet air pressure: 750 Pa (3" wg).
 - .2 Minimum inlet air pressure: 75 Pa (0.3" wg).
 - .3 Maximum pressure drop across unit including attenuator, at 10 m/s inlet velocity: 40 Pa (0.15" w.g.)
 - .4 Air leakage, close damper position: maximum 2% of nominal catalogue rating at an air inlet pressure of 750 Pa (3" w.g.)
 - .4 Acoustic ratings
 - .1 Maximum room NC sound pressure level (2×10^{-4} microbar reference) at maximum inlet pressure: Less than forty at discharge and forty-two radiated for box with attenuator mounted exposed (without ceiling).
 - .5 Performance ratings
 - .1 ARI 880 certified.
 - .2 Maintain air quantity within $\pm 5\%$ of set value, between zero and specified rating, and sound level below specified values when operating from minimum to maximum inlet static pressure as given above.
 - .6 Materials
 - .1 Stainless steel: 20 gauge type 316L stainless steel.
 - .2 Fibreglass insulation: 20 mm thick (unless otherwise specified), dual density fibreglass. Exposed/cut edges sealed with NFPA-90A approved sealant, or metal caps as specified.
 - .2 Single Duct Terminal Units (TU)
 - .1 Variable volume or constant volume as per equipment schedules
 - .2 Casing construction
 - .1 Casing: 22 gauge galvanized steel.
-

- .2 Insulation Type 1: Fiberglass encapsulated in woven fabric liner, and wrapped edges.
 - .3 Insulation Type 2: Fiberglass with aluminum foil liner and sealed edges.
 - .4 Insulation Type 3: Fiberglass encapsulated in woven fabric liner, and galvanized steel perforated liner, and metal cap edges.
 - .5 Insulation Type 4: Fiberglass with galvanized steel solid liner, and metal edge caps.
 - .6 Insulation Type 5: Fiberglass with galvanized steel perforated liner, with metal edge caps.
 - .3 Control elements
 - .1 Pressure independent type.
 - .2 Velocity sensor, cross tree type, with an accuracy within 5% with a ninety degree elbow connected at the inlet to the assembly.
 - .3 Damper: Heavy gauge metal, with edge gasket, self-lubricating bearings, and adjustable minimum stop.
 - .4 Damper arranged "normally open" for morning warm-up.
 - .5 Controls and damper actuator as specified below.
 - .4 Discharge section
 - .1 Open end or multiple outlet attenuator on box discharge acoustically treated with insulation as described above for the unit casing.
 - .2 Reheat coils where scheduled, complete with access door in bottom of attenuator on inlet side of coil.
 - .3 Fan Powered Variable Air Volume Terminal Units (TUF)
 - .1 Type
 - .1 Variable volume primary air flow and constant volume supply air through fan operation.
 - .2 Casing construction
 - .1 Casing: 22 gauge galvanized steel up to 900 mm wide; 20 gauge minimum galvanized steel over 900 mm wide.
 - .2 Internal sound reduction baffle.
 - .3 Bottom access door with cam-lock fittings, for fan removal.
 - .4 Insulation Type 1: Fiberglass encapsulated in woven fabric liner, and wrapped edges.
 - .5 Insulation Type 2: Fiberglass with aluminum foil liner, galvanized steel perforated liner and metal cap edges.
-

- .6 Insulation Type 3: Fiberglass encapsulated in woven fabric liner, and galvanized steel perforated liner, and metal cap edges.
 - .7 Insulation Type 4: Fiberglass with galvanized steel solid liner, and metal edge caps.
 - .8 Insulation Type 5: Fiberglass with galvanized steel perforated liner, with metal edge caps.
 - .3 Control elements
 - .1 Pressure independent type primary air regulator.
 - .2 Velocity sensor, cross tree type, with an accuracy within 5% with a ninety degree elbow connected at the inlet to the assembly.
 - .3 Damper: Heavy gauge metal, with edge gasket, and self-lubricating bearings and adjustable minimum stop.
 - .4 Single point electrical and control connection, in a single control box with access panel, sealed from the primary air section.
 - .5 Controls and damper actuator as specified below.
 - .4 Fan and motor assembly
 - .1 Forward curved, direct drive, statically and dynamically balanced centrifugal fan suspended on rubber in shear isolators.
 - .2 Electrically commutated motor, brushless DC design, with built-in inverter and microprocessor based motor controller, to maintain supply air volume independent of system static pressure, permanently lubricated ball bearings.
 - .3 Field manual adjustment of fan speed.
 - .4 4-20 mA or 0-10 VDC input for remote BMS fan speed reset.
 - .5 115 V, 1 phase, 60 Hz.
 - .5 Discharge section
 - .1 Open end or multiple outlet attenuator on box discharge acoustically treated with rigid acoustic insulation held in place with adhesive and pins.
 - .2 Open end secondary air inlet silencer acoustically treated with rigid acoustic insulation held in place with adhesive and pins.
 - .3 Reheat coils where scheduled, complete with access door in bottom of attenuator on inlet side of coil.
 - .6 Performance
 - .1 Maintain primary air quantity within $\pm 5\%$ of set value, between zero and specified rating.
 - .2 Radiated and discharge sound levels below values specified above when operating with maximum primary air, an inlet static pressure of 375 Pa (1.5" wg) and fan running on medium speed.
-

.4 Fan Powered Variable Air Volume Terminal Units - Low Noise, High Capacity (TUFQ)

.1 Type

- .1 Variable volume primary air flow and constant volume supply air through fan operation.

.2 Acoustic performance

- .1 Not to exceed the following radiated sound power levels at 250 Pa (1" w.c.) inlet pressure, and 60 Pa (0.25" w.c.) discharge pressure.

Airflow L/s	Sound Power Levels					
	2	3	4	5	6	7
425	62	56	46	39	37	36
570	64	59	47	42	40	39
750	68	62	51	45	43	42
940	68	63	53	48	44	43

.3 Casing Construction

- .1 Casing: 20 gauge galvanized steel.
- .2 Internal sound reduction baffle.
- .3 Bottom access door with cam-lock fittings, for fan removal.
- .4 Insulation Type 1: 50 mm thick fibreglass encapsulated in woven fabric liner, and wrapped edges.
- .5 Insulation Type 2: Fiberglass with aluminum foil liner, galvanized steel perforated liner and metal cap edges.
- .6 Insulation Type 3: Fiberglass encapsulated in woven fabric liner, and galvanized steel perforated liner, and metal cap edges.
- .7 Insulation Type 4: Fiberglass with galvanized steel solid liner, and metal edge caps.
- .8 Insulation Type 5: Fiberglass with galvanized steel perforated liner, with metal edge caps.

.4 Control elements

- .1 Pressure independent type primary air regulator.
- .2 Velocity sensor, cross tree type, with an accuracy within 5% with a ninety degree elbow connected at the inlet to the assembly.
- .3 Damper: Heavy gauge metal, with edge gasket, and self-lubricating bearings and adjustable minimum stop.
- .4 Controls and damper actuator as specified below.

.5 Fan and motor assembly

- .1 Forward curved, direct drive, statically and dynamically balanced centrifugal fan suspended on rubber in shear isolators.
 - .2 Electrically commutated motor, brushless DC design, with built-in inverter and microprocessor based motor controller, to maintain supply air volume independent of system static pressure, permanently lubricated ball bearings.
 - .3 Field manual adjustment of fan speed.
 - .4 4-20 mA or 0-10 VDC input for remote BMS fan speed reset.
 - .5 115 V, 1 phase, 60 Hz.
 - .6 Discharge section
 - .1 Open end or multiple outlet attenuator on box discharge acoustically treated with rigid acoustic insulation held in place with adhesive and pins.
 - .2 Open end secondary air inlet silencer acoustically treated with rigid acoustic insulation held in place with adhesive and pins.
 - .3 Reheat coils where scheduled, complete with access door in bottom of attenuator on inlet side of coil.
 - .7 Return air section
 - .1 Acoustic return air section, to same construction as casing construction.
 - .8 Performance
 - .1 Maintain primary air quantity within $\pm 5\%$ of set value, between zero and specified rating.
 - .5 Reheat Coils
 - .1 Heating capacities: As shown in schedules
 - .2 Coil conditions:
 - .1 Entering air temperature: 18°C (65°F).
 - .3 Hot water coil construction
 - .1 Factory mounted.
 - .2 Serpentine, copper tube mechanically expanded into aluminum fins.
 - .3 Hydraulically pressure tested to 1550 kPa (225 psig).
 - .4 Galvanized steel coil casing.
 - .5 S-cleat flanges.
 - .6 Reheat coil positioned at downstream end of attenuator section.
 - .4 Electric reheat coils
 - .1 Factory mounted.
-

- .2 CSA certified.
 - .3 Heater frame and cabinet: heavy gauge galvanized steel.
 - .4 Heating elements: 80/20 nickel-chromium wire, low density to limit hot spots and cycling of thermal protectors.
 - .5 Element insulation: Floating ceramic bushings.
 - .6 Primary protection: Automatic reset thermal cut-out.
 - .7 Secondary protection: Manual reset cut-out.
 - .8 Capacity control: Proportional pulsed output control using 4-20 mA, 0-10 VDC or pulsed input from thermostat or BMS system.
 - .9 Modulating control: Solid state switching with zero cross-over.
 - .10 Electronic air flow sensor to limit heater output dependant on volume of air supply.
- .6 Controls
- .1 Direct Digital Control (DDC)
 - .1 Provided by the terminal unit manufacturer.
 - .2 Dedicated microprocessor based controller, with integral damper actuator.
 - .3 Electronic flow transducer.
 - .4 Standalone operation, capable of interfacing with a Building Management System, and hand-held portable operator interface device.
 - .5 Actuator: 24 VDC bi-directional, direct coupled to the damper shaft.
 - .6 Factory wired, calibrated and pre-tested, for maximum and minimum air flows.
 - .7 Zone temperature sensor: Temperature setpoint adjustment, and access for connection of a hand-held operator terminal.
- .7 Single Point Power Supply
- .1 Provide single point power wiring for terminal units, at highest voltage and phases as shown on equipment schedules.
 - .2 Main control panel with power distribution:
 - .1 Fused primary/24 VAC secondary transformers for controls power, with internal disconnect switch.
 - .2 Fused primary/120 VAC secondary transformers for fan power, for fan powered terminal units, with internal disconnect switch.
 - .3 Fused disconnect switch for electric reheat coil.
-

.4 Clear Lexan plastic cover over live terminals on line-side of main disconnect switch.

.5 Note: electric heating coil control panel may be used as the main control panel.

.3 Provide power wiring to fan motor and DDC control unit.

3 Execution

3.1 **INSTALLATION**

.1 General

.1 Install air terminal units with at least four duct diameters of straight duct upstream of inlet.

.2 Support terminal boxes from building structure with angles, hangers and supplementary steel before installation of piping and connecting ductwork.

.3 Connect supply and return piping to reheat coils with swing joints to allow for pipe expansion and contraction.

.4 Install isolating valve on supply and lock shield globe valve and automatic control valve on return of each reheat coil.

.5 Provide manual air vent with isolating cock at high point of piping to each coil.

.2 Electric and DDC Controls

.1 Provide 120 VAC and 24 VDC wiring, as required, from junction box provided under Division 26, near each terminal unit, and wire to terminal box fan and controls.

.3 Testing and Adjustment

.1 Adjust fan speed on fan powered terminal boxes to obtain final flow volumes, to minimize use of balancing dampers on downstream ductwork and diffusers.

End of Section

- 1 General
 - 1.1 **SUMMARY**
 - .1 Section Includes
 - .1 Labour, Products, equipment and services necessary to complete the Work of this section.
 - 2 Products
 - 2.1 **DIFFUSERS, REGISTERS AND GRILLES**
 - .1 General
 - .1 Neck size, dimensions and capacity as shown on Drawings. Catalogue numbers of first named Supplier are listed on Drawings to show required type and style.
 - .2 Acoustic and airflow performance is based on catalogued information of the indicated manufacturer and model as shown on Drawings or schedules. Other named manufacturer Products must match these implied performance criteria.
 - .3 Border and frame as required to suit wall and ceiling construction.
 - .2 Linear Diffusers and Grilles
 - .1 Extruded aluminum construction, unless otherwise shown on Drawings.
 - .2 Linear supply and return diffusers to have either natural anodized aluminum finish or baked enamel finish as listed on Drawings.
 - .3 Complete with engineered distribution plenum and internal opposed blade damper. Black finish on inside of plenums.
 - .4 Curved and custom shapes and finishes as detailed on Drawings.
 - .3 Square and Circular Pattern Diffusers
 - .1 Steel construction with baked white enamel finish, unless otherwise shown.
 - .2 True imperial or metric sizes.
 - .3 Radial opposed blade damper.
 - .4 Grilles
 - .1 Steel construction with baked white enamel finish, unless otherwise shown.
 - .2 Blade orientation parallel to the long dimension.
 - .3 Opposed blade damper in black finish.
 - .5 Door Grilles
 - .1 Door grilles will be supplied and installed by general trades.
 - .6 Acceptable Manufacturers:
 - .1 E.H. Price
-

- .2 Nailor Industries Inc.
- .3 Titus
- .4 Carnes
- .5 Tuttle & Bailey

3 Execution

3.1 **GENERAL**

- .1 Supply diffusers and registers to deliver indicated air quantities shown with throw to reach intended space limits without increasing the sound level of room. Provide blank-off baffles where required and equalizing deflectors on diffusers and in other locations as shown or required.
- .2 Coordinate placing of diffusers, registers and grilles in ceilings with electrical and ceiling installation trades and exact location to final approval of Consultant.
- .3 For connection to specific light-air troffers in flat ceilings provide boots to connect flexible duct to lighting fixtures.
- .4 For connection of air supply to coffered ceilings provide boots suitable for attachment to air slot on coffered ceilings as required and where shown on Drawings. Connect flexible supply air duct to neck of boot.

End of Section

-
- 1 General
 - 1.1 **SUMMARY**
 - .1 Section Includes
 - .1 Labour, Products, equipment and services necessary to complete the Work of this section.
 - 1.2 **SUBMITTALS**
 - .1 Shop Drawings
 - .1 Submit Shop Drawings in accordance with Section 01 33 00.
 - 2 Products
 - 2.1 **ELECTRIC COOL/GAS HEAT ROOFTOP UNITS (1.5 TO 5 TONS)**
 - .1 General
 - .1 Roof mounted self-contained constant volume unit with DX refrigeration and gas burner. Unit shall bear CSA, CGA, and ULC labels.
 - .2 Completely factory assembled, piped, wired, tested and shipped to site in one piece. Units specifically designed for outdoor application.
 - .3 Ship units fully charged with refrigerant R410A.
 - .2 Construction
 - .1 Casing:
 - .1 Minimum 1 mm (20 gauge), zinc coated steel panels with backed enamel finish.
 - .2 Easily removable panels.
 - .3 Internally insulated cooling section panels with minimum 13 mm thick aluminum foil faced cleanable insulation.
 - .4 Unit casing with a sloped condensate pan.
 - .2 Fans:
 - .1 Double inlet type, forward curved, centrifugal type direct drive evaporator fan.
 - .2 Evaporator fan with steel construction and corrosion resistant finish.
 - .3 Propeller type, direct drive, aluminum blades condenser fan.
 - .4 Statically and dynamically balanced.
 - .3 Refrigeration system:
 - .1 Fully hermetic compressor with factory installed vibration isolation.
-

- .2 Compressor safety controls including internal high pressure and overcurrent protection, short cycle protection, crankcase heater, and high/low pressure switches.
 - .3 Evaporator and condenser coils with aluminum plate fins mechanically bonded to seamless copper tubes.
 - .4 All interconnecting piping and accessories.
 - .4 Motors:
 - .1 Totally enclosed condenser fan motor.
 - .2 Refrigerant cooled compressor motor complete with line break thermal and overcurrent protection.
 - .3 Permanently lubricated evaporator motor with bearing and automatic reset thermal overload protection.
 - .5 Heating section:
 - .1 20 gauge, aluminized steel single stage heat exchanger.
 - .2 Direct spark ignition system.
 - .3 Aluminum coated steel burners.
 - .4 Induced draft combustion blower.
 - .5 All integrated controls.
 - .6 Provide gas pressure regulators in gas train to suit existing gas distribution pressure.
 - .6 Accessories:
 - .1 Factory mounted condenser coil guard.
 - .2 Single stage heat/cool thermostat with "Auto-On" fan and "Heat-Auto-Cool" system switching functions.
 - .3 Electronic seven-day programmable thermostat with setback and setup provisions.
 - .4 Prefabricated roof curb.
 - .5 Economizer with controls and relief damper.
 - .6 Manual outside air damper.
 - .7 25 mm thick fiberglass throwaway filters.
 - .8 Weatherproof factory-installed, externally accessible, 115 volt convenience outlet with independent fuse protection.
 - .7 Acceptable Manufacturers
 - .1 Johnson Controls
-

- .2 Carrier
- .3 Trane
- .4 McQuay
- .5 Lennox

2.2 **ELECTRIC COOL/GAS HEAT ROOFTOP UNITS (7.5 TO 20 TONS)**

.1 General

- .1 Roof mounted self-contained constant volume unit with complete DX refrigeration system and gas burner.
 - .1 CSA, CGA, and ULC labels.
 - .2 Rated in accordance with ARI standards.
 - .3 Insulation and adhesives: To NFPA 90A requirements.
- .2 Factory assembled, piped, wired, tested and shipped to site in one piece. Units specifically designed for outdoor application.
- .3 Ship units fully charged with refrigerant R410A.

.2 Construction

- .1 Casing:
 - .1 Minimum 1 mm (20 gauge), galvanized steel panels with backed enamel finish.
 - .2 Easily removable panels with gaskets.
 - .3 Internally insulated cooling section panels with minimum 13 mm thick, high density, neoprene coated, flexible fiberglass insulation.
 - .4 Internally insulated heating section compartment with high density, aluminum foil faced fiberglass insulation.
 - .5 Insulation to be permanently fastened to the cabinet interior.
 - .6 Heavy gauge, full perimeter base rail.
 - .7 Fully insulated sloped condensate pan.
 - .2 Evaporator fan:
 - .1 Steel, double inlet wheel with corrosion resistant finish.
 - .2 Belt driven, forward curved with adjustable-pitch motor pulley and adjustable base.
 - .3 Sealed and permanently lubricated bearings.
 - .4 Statically and dynamically balanced.
-

- .3 Condenser fans:
 - .1 Aluminum blade, propeller type.
 - .2 Direct drive with totally enclosed, permanently lubricated ball bearings.
 - .3 Vertical or horizontal discharge.
 - .4 Statically and dynamically balanced.
 - .4 Refrigeration system:
 - .1 Two compressors with two independent refrigeration circuits and factory installed vibration isolation.
 - .2 Sequenced unloading and hot gas bypass system for each compressor.
 - .3 Compressor safety controls including internal high temperature and over current protection, short cycle protection, crankcase heater, and independent high/low pressure switches for each circuit.
 - .4 Evaporator and condenser coils with aluminum plate fins mechanically bonded to seamless copper tubes.
 - .5 All interconnecting piping and accessories.
 - .5 Motors:
 - .1 Totally enclosed condenser fan motors with thermal overload protection.
 - .2 Refrigerant cooled compressor motor complete with line break thermal and over current protection.
 - .3 Permanently lubricated evaporator motor with bearing and automatic reset thermal overload protection.
 - .6 Heating section:
 - .1 Indirect fired two-stage heating system.
 - .2 Twenty gauge, aluminized steel heat exchanger.
 - .3 Direct spark ignition system.
 - .4 Aluminum coated steel burners.
 - .5 Gas valve with internal pressure regulator.
 - .6 Induced draft combustion blower.
 - .7 High temperature limit switch.
 - .8 Flame proving control.
 - .9 Anti-cycle protection.
 - .10 Ventor motor speed sensor and flame rollout switch.
 - .11 Gas pressure regulators in gas train to suit existing gas distribution pressure.
-

- .7 Roof curb:
 - .1 350 mm high curb constructed of galvanized steel and wood nailer.
 - .2 Duct support members and continuous gasket for weatherproof installation.
- .8 Economizer:
 - .1 Factory or site installed.
 - .2 Fully modulating 0-100 percent with minimum position setting.
 - .3 Modulating dampers actuator of the spring return type.
 - .4 Capable of simultaneous operation with compressor.
 - .5 Barometric relief damper) or (power exhaust).
 - .6 All wiring and fixed dry bulb control.
- .9 Filters:
 - .1 50 mm thick, fiberglass throwaway filters.
- .10 Thermostats:
 - .1 Electronic seven-day programmable thermostat with setback and setup provisions.
 - .2 Lockable cover guard.
- .11 Acceptable Manufacturers
 - .1 Johnson Controls
 - .2 McQuay
 - .3 Carrier
 - .4 Trane

2.3 **ELECTRIC COOL/GAS HEAT ROOFTOP UNITS (25 TO 135 TONS)**

- .1 General
 - .1 Roof mounted self-contained unit with micro-processor based control system, two DX refrigeration systems, gas heating section, outside air system, return air system, filters, switches, supply air fan, return air fan, and all standard safety and operating controls.
 - .1 CSA, CGA, and ULC labels.
 - .2 Rated in accordance with ARI standards.
 - .3 Insulation and adhesives: to NFPA 90A requirements.
 - .2 Factory assembled, piped, wired, tested and shipped to site in one piece. Units specifically designed for outdoor application.
-

- .3 Shipped fully charged with refrigerant R410A.
 - .4 Units shall be variable air volume.
 - .2 Construction
 - .1 Casing and frame:
 - .1 Fourteen gauge galvanized steel base with formed recess, lifting brackets and lifting holes.
 - .2 Seventeen gauge or heavier, galvanized steel panels painted with a baked-on enamel.
 - .3 Insulated cabinet with 25 mm neoprene coated glass fiber insulation secured to all panels with adhesive and mechanical fasteners.
 - .4 Floor with double wall construction and 50 mm neoprene coated fiberglass insulation sandwiched between inner and outer liners.
 - .5 Unit cabinet designed to operate at total static pressure up to 5.5" w.g.
 - .6 Hinged access doors with flush mounted, single lever latching mechanisms, stainless steel hinges and vinyl gasketting.
 - .7 Minimum one access door for each unit section.
 - .8 1.2 m long empty section between standard filter and supply fan sections to house variable speed drive.
 - .2 Supply and return fans:
 - .1 Double width double inlet.
 - .2 Centrifugal forward curved type or Class II airfoil type.
 - .3 Cold rolled steel or continuous galvanized steel forward curved wheel and housing.
 - .4 Aluminum airfoil fan wheel with blades continuously welded to back plate and end rim.
 - .5 Solid steel fan shaft mounted in heavy duty 200,000 hour greaseable ball bearings.
 - .6 Completely isolated fan assembly from unit bulkhead.
 - .7 Fan assembly mounted on 50 mm. Deflection spring isolators.
 - .8 High efficiency motors, open drip-proof type with greaseable ball bearings.
 - .9 Motors with variable pitch sheaves and mounted on adjustable base.
 - .10 Statically and dynamically balanced.
-

- .3 Condensing section:
 - .1 Heavy duty compressors with reversible positive displacement oil pump, suction and discharge service valves, crankcase heaters and solid state thermal overload protection.
 - .2 Independent refrigeration circuit for each compressor.
 - .3 Spring isolators for each compressor.
 - .4 Pump down on all refrigerant circuits.
 - .5 Hot gas bypass with solenoid valve and hot gas bypass valve.
 - .4 Each refrigeration circuit:
 - .1 Sight glass and filter dryer.
 - .2 Vibration line isolators.
 - .3 Manual shut off valve.
 - .4 Spring type high pressure relief valve.
 - .5 Each compressor control:
 - .1 Liquid line solenoid valve.
 - .2 Oil pressure switch.
 - .3 High/low pressure switches.
 - .4 Compressor control circuit switch.
 - .5 Pumpdown switch.
 - .6 Adjustable timer lockout.
 - .7 Minimum stages of refrigeration system capacity control as follows:

Unit size (Tons)	Stages
25, 30, 35	100/66/33/0
40, 45, 50, 60	100/75/50/25/0
70, 75, 80, 90	100/83/67/50/33/10/0
105, 115, 125, 135	100/88/75/63/50/38/25/12/0
 - .8 Multi-row type condenser coil fabricated from seamless copper tubing mechanically bonded to aluminum fins.
 - .9 Direct drive, steel construction, propeller type condenser fans.
 - .10 Heavy duty condenser fan motors, inherently protected, three-phase non reversing type, with permanently lubricated ball bearings and rain shield.
-

- .6 Cooling coil section:
 - .1 Multi-row type evaporator coil fabricated from seamless copper tubing mechanically bonded to aluminum fins.
 - .2 Adjustable thermal expansion valve per refrigeration circuit.
 - .3 Mastic coated primary drain pan extended underneath the coil connections.
 - .4 Secondary mastic coated drain pan connected to primary drain pan.
 - .7 Gas heating section:
 - .1 Welded stainless steel primary and secondary heat exchangers.
 - .2 Flame observation port opposite the burner.
 - .3 Condensate drain for the heat exchanger.
 - .4 Factory fired and tested burner suitable for final site adjustments.
 - .5 Fully modulating forced draft burner with minimum 3:1 turndown.
 - .6 Burner accessories to include flame supervision, combustion air proving switch, integral prepurge timing, intermittent pilot with spark ignition and a complete gas train.
 - .7 Complete gas train to include main gas valve, main pressure regulator, main shut off cock, pilot gas valve, pilot gas pressure, pilot cock, and electronic flame supervision.
 - .8 Burner and controls housing vestibule with hinged access door.
 - .9 Gas pressure regulators in gas train to suit existing gas distribution pressure.
 - .8 Filter section:
 - .1 Galvanized steel filter racks as an integral part of the unit.
 - .2 Accessible from both sides on unit.
 - .3 Refer to schedules on Drawings.
 - .9 Economizer and return air section:
 - .1 Outside, return, and exhaust air dampers sized to handle 100% outside air.
 - .2 Dampers of low leakage type with gasketed blade to blade contact and spring side seals.
 - .3 Adjustable potentiometer and adjustable enthalpy control.
 - .4 Modulating spring return type damper motor.
-

- .10 Roof curb:
 - .1 Minimum 400 mm high manufactured by the unit manufacturer.
 - .2 Twelve gauge galvanized steel with 50 x 100 mm wood nailer.
 - .3 Suitable for complete air handling section support and condensing section rail support.
 - .4 Continuous gasket for weatherproof installation.
 - .3 Controls
 - .1 Variable speed drive control system:
 - .1 Factory wired, mounted and adjusted system.
 - .2 Heavy duty, reversible, electric type actuators with feedback capability.
 - .3 Microprocessor controlled system.
 - .4 Factory mounted high pressure switch with programmable pressure setpoint.
 - .5 Duct high limit safety switch.
 - .6 Remote static pressure sensor(s).
 - .2 Morning warm-up cycle:
 - .1 Fully controlled by the rooftop unit DDC controller.
 - .4 Unit Mounted DDC Controls
 - .1 Standalone DDC microprocessor based, bi-directional communicating control system to operate the cooling, heating, minimum outside air and economizer operation as shown on the control sequence.
 - .1 A thirty-two character display.
 - .2 Keypad access to all information and controls.
 - .3 Capability to accept a remote 4-20 mA signal for air temperature reset and demand limit.
 - .4 Fourteen day time clock.
 - .5 Current and past alarm storage capability.
 - .6 Night set back control.
 - .7 Adjustable override timer.
 - .8 A setback sensor (room sensor) with override button for field installation.
 - .2 Monitor the following conditions:
 - .1 Refrigerant high pressure.
 - .2 Loss of charge.
-

- .3 Loss of air flow.
 - .4 Dirty filters.
 - .5 Minimum outside air.
 - .6 Furnace status.
 - .7 Compressor short cycle.
 - .8 Low pressure.
 - .9 High or low voltage.
 - .10 Air and refrigerant temperature.
 - .11 Phase loss or reversal.
 - .12 Supply and return fans VSD status.
 - .13 Duct static pressure.
 - .3 Unit controller communicates directly with building management system to monitor the following:
 - .1 Discharge and return temperature.
 - .2 Space and outside air temperature.
 - .3 Filter differential pressure.
 - .4 Fan, compressor run hours.
 - .5 Unit status.
 - .6 Outside air damper position.
 - .7 Mixed air temperature.
 - .8 Alarm status.
 - .9 Supply and return fans VSD status.
 - .10 Duct static pressure.
 - .4 Unit controller to permit change in setpoint or status of the following:
 - .1 Discharge air temperature setpoint and reset parameters.
 - .2 Minimum outdoor air setpoint.
 - .3 Occupied heat/cool setpoint.
 - .4 Control mode.
 - .5 Space temperature setpoint.
 - .6 Filter differential pressure setpoint.
 - .7 Unoccupied override.
-

- .8 Unit status - start/stop/clear fault.
 - .9 Static pressure setpoints.
 - .10 VSD and fan tracking setpoints.
 - .5 Remote Monitoring Panel
 - .1 One panel per rooftop unit complete with:
 - .1 Heat-Off-Cool system switch.
 - .2 On-Off switch.
 - .3 Supply fan operation signal light.
 - .4 Cooling and heating malfunction signal lights.
 - .5 Clogged filters signal light
 - .6 Two additional indicating lights for field hook-up.
 - 3 Execution
 - 3.1 **INSTALLATION**
 - .1 Install rooftop units as per manufacturer's instructions on roof curbs provided by the manufacturer.
 - .2 Manufacturer to certify installation, supervise start-up and commission units.
 - .3 Install and wire all accessories shipped loose with units for fully operating systems.
- End of Section
-

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- 1 General
 - 1.1 **SUMMARY**
 - .1 Section Includes
 - .1 Labour, Products, equipment and services necessary to complete the Work of this section.
 - 1.2 **REFERENCE STANDARDS**
 - .1 Comply with the latest edition of the following:
 - .1 ANSI/ASHRAE/IESNA 90.1
 - .2 ANSI/ARI Standard 390
 - .3 CSA C22.2
 - 1.3 **SUBMITTALS**
 - .1 Shop Drawings
 - .1 Submit Shop Drawings in accordance with Section 01 33 00.
 - .2 Operation and Maintenance Data
 - .1 Submit printed operation instructions and maintenance data in accordance with Section 01 33 00.
 - 2 Products
 - 2.1 **SPLIT-SYSTEM HEAT PUMP UNIT**
 - .1 Capacity, performance requirements, and configuration shall be as scheduled and specified.
 - .2 Provide fully packaged and factory tested indoor evaporator unit complete with control system, DX refrigeration system, supply air fan, filters.
 - .3 Provide fully packaged and factory tested remote outdoor condensing unit complete with built-in starter, contactors, controls, transformers, and weatherproof disconnect switch.
 - .4 Compressor to be inverter.
 - .5 Ship units fully charged with refrigerant R410A.
 - .6 Interconnect indoor evaporator unit and outdoor condensing unit with liquid and suction refrigerant lines. Refrigerant lines shall be insulated with cellular elastomer.
 - .7 Provide wired controller. Controller to be interlocked with electric heater where indicated on Drawings.
 - .8 Provide low (-20°C) ambient operation kit.
 - .9 Auto restart after power failure.
-

.10 Acceptable Manufacturers

.1 Mitsubishi

.2 Daikin

3 Execution

3.1 **GENERAL**

.1 Install unit and accessories as per manufacturer's instructions.

.2 Manufacturer to certify installation, and start-up and commission units.

.3 Install miscellaneous steel framing, supports, braces, etc. as required to hang or support equipment and ductwork as specified herein, and as shown on Drawings.

.4 Install and wire all accessories shipped loose with units for fully operating systems.

End of Section

1 General

1.1 **REFERENCES**

- .1 CSA, Canadian Standards Association.
- .2 ULC, Underwriters' Laboratories of Canada.

1.2 **SUBMITTALS**

- .1 Submit the following Product data and Shop Drawings in one package.
 - .1 Product Data:
 - .1 Submit copies of manufacturer's product data in accordance with Section 01 33 00 Submittal Procedures, indicating:
 - .1 Product characteristics.
 - .2 Performance criteria, minimum operating air flow.
 - .3 Mounting methods, unit support.
 - .4 Physical size.
 - .5 KW rating, voltage, phase.
 - .6 Cabinet material thicknesses.
 - .7 Limitations, clearance to combustibles.
 - .8 Colour and finish.
 - .2 Shop Drawings:
 - .1 Submit Shop Drawings in accordance with Section 01 33 00 Submittal Procedures, indicating:
 - .1 Equipment, capacity and piping connections.
 - .2 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, sizes and location of mounting bolt holes.
 - .3 Commissioning
 - .1 Submit Commissioning Plan, Commissioning Procedures, Certificate of Readiness, Deficiency Report and Commissioning Closeout Report, in accordance with Division 23.
 - .2 Submit design data and test reports.
 - .3 Submit inspection and test reports.

.4 Closeout Submittals

- .1 Submit the following for incorporation into Operation and Maintenance Manuals in accordance with Section 01 33 00 Submittal Procedures.
 - .1 Identification: Manufacturer name, type, year, serial number, number of units, and capacity.
 - .2 Functional description detailing operation and control.
 - .3 Performance criteria and maintenance data.
 - .4 Operating instructions and precautions.
 - .5 Component parts availability including names and addresses of spare part Suppliers.
 - .6 Lubrication schedule, maintenance and troubleshooting guidelines.
- .2 Manufacturer's installation instructions for the following items:
 - .1 Force flow heater.
- .3 Submit As-Built Drawings in accordance with Section 01 33 00 Submittal Procedures.

2 Products

2.1 **ELECTRIC FORCED AIR HEATER (FAH)**

- .1 Manufacturers:
 - .1 Ouellet
 - .2 Chromalox (Dimplex)
 - .3 Stelpro
 - .2 Construction: 0.8 mm thick steel (20 ga) removable and tamperproof panel, glass fibre insulation and integral air outlet and inlet.
 - .3 Finish: Polyester epoxy powder coat, white.
 - .4 Electric coils: durable tubular heating element with fins.
 - .5 Fans: statically and dynamically balanced, direct driven, sleeve bearings, resilient mounted,
 - .6 Motor: Totally enclosed type with permanently lubricated bearings, built-in thermal overload protection and resilient rubber isolation mounting.
 - .7 Capacity: As per Drawing.
 - .8 Built-in disconnect switch.
 - .9 Controls
-

- .1 On-off switch with integral overloads in cabinet.
- .2 Remote wall-mounted thermostat.
- .3 120 V control circuit with magnetic contactor and transformer.
- .4 High temperature limit switch.
- .10 Units must be UL and CSA approved.

2.2 **ELECTRIC UNIT HEATER**

- .1 Manufacturers:
 - .1 Ouellet Model OAS
 - .2 Chromalox (Dimplex)
 - .3 Stelpro
- .2 Construction: 18 gauge steel cabinet with threaded connections for hanger rods.
- .3 Finish: Epoxy powder coat, white.
- .4 Heating coil: Low surface temperature, seamless copper sheathed tubular elements, low-watt density.
- .5 Fan: Propeller type, dynamically and statically balanced, epoxy coated aluminum construction and fan guard.
- .6 Motor: Totally enclosed type with permanently lubricated bearings, built-in thermal overload protection and resilient rubber isolation mounting.
- .7 Air outlet: Two-way adjustable louvres.
- .8 Capacity: As per Drawing schedule.
- .9 Built-in disconnect switch.
- .10 Controls
 - .1 Remote wall-mounted thermostat.
 - .2 120 V control circuit with magnetic contactor and transformer.
 - .3 High temperature limit switch.
- .11 Units must be UL and CSA approved

3 Execution

3.1 **EXAMINATION**

- .1 Review proposed locations on-site and co-ordinate installation requirements with general trades, architectural finishes and power requirements.

3.2 **INSTALLATION**

- .1 Install in accordance with manufacturer's instructions.

- .2 Check final location with Consultant if different from that indicated prior to installation. Should deviations beyond allowable clearances arise, request and follow Consultant's direction.
- .3 Clean finned tubes and comb straight.
- .4 Provide supplementary suspension steel as required.
- .5 Install thermostats in locations indicated.
- .6 Before acceptance, set discharge patterns and fan speeds to suit requirements.

3.3 **COMMISSIONING**

- .1 Perform Commissioning in accordance with Section 23 08 23 Mechanical Commissioning.
- .2 Verify operational performance in general conformance with the following outline:
 - .1 Operational performance outline:
 - .1 Thermostat operation.
 - .2 Element response.
 - .3 Fan operation.
 - .4 Disconnect.
 - .5 Other unit control features/devices.
 - .2 Functional performance outline:
 - .3 Interlocks with associated equipment.
 - .4 Interface with adjacent building components.

3.4 **PROTECTION**

- .1 Protect from damage during construction. Do not operate during construction or until unit and area thoroughly cleaned and inspected.

End of Section

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- 1 General
 - 1.1 **SUMMARY**
 - .1 Section Includes
 - .1 Labour, Products, equipment and services necessary to complete the Work of this section including, but not limited to, the following:
 - .1 Radiant ceiling panels
 - 1.2 **SUBMITTALS**
 - .1 Shop Drawings
 - .1 Submit Shop Drawings in accordance with Section 01 33 00.
 - .2 Operation and Maintenance Data:
 - .1 Submit printed operation instructions and maintenance data in accordance with Section 01 33 00.
 - 2 Products
 - 2.1 **RADIANT CEILING PANELS**
 - .1 General
 - .1 Extruded aluminum radiant heating ceiling panels of the size and output shown on Drawings. Refer to architectural reflected ceiling plans, room finish schedules, and Mechanical Drawings to determine location, quantity, and finish of radiant panels.
 - .2 Panel to run continuously from wall to wall as shown on Drawings.
 - .3 Output based on a mean water temperature of 82°C (180°F) and room temperature of 21°C (70°F)
 - .2 Construction
 - .1 Tube saddles integral part of extruded panels.
 - .2 0.625 mm OD copper tubing mechanically fastened to panel. Apply non-hardening heat transfer paste between tubing and panel.
 - .3 Panels interlock with tongue and groove connection without visible joints and reinforced with aluminum cross channels. All panel section interlocking preformed at the factory with return bends installed and pressure tested. Field connections limited to connections to mains and connections to adjacent panel.
 - .4 Finish panels in white high emissivity paint suitable for repainting to colour specified later, or silkscreen finish to match adjacent acoustic tile ceiling.
 - .3 Accessories
 - .1 Provide built in linear diffuser over the entire length of the panel. Refer to HVAC floor plans for diffuser details. Diffuser and supply air boot by same manufacturer.
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- .4 Acceptable Manufacturers
 - .1 Airtex Radiant Systems (Engineered Air)
 - .2 Twa Panel Systems (R&D Energy Savers)
 - .3 Rosemex (Kilmer Environmental Inc.)
 - 3 Execution
 - 3.1 **PANELS**
 - .1 Install units as per manufacturer's instructions and as shown on Drawings.
 - .2 Install accessories shipped lose with units for fully operating systems.
 - 3.2 **RADIANT CEILING PANELS**
 - .1 Coordinate with Division 9 and Ceiling Contractor to assure proper division of Work. Support panels on moldings to match ceiling finish and supports.
 - .2 Install hanger supports for safety independent of the ceiling support system. Follow manufacturers' recommendations for size and quantity of hangers except provide a minimum of four wire supports per panel.
 - .3 Install miscellaneous steel framing, supports, braces, etc. as required to hang or support equipment as specified herein, and as shown on Drawings.
 - .4 Field trim panels to length where necessary to provide a continuous wall to wall appearance. Allow adequate expansion allowance.
 - .5 Connect panels with manufacturer supplied copper pigtail connections.
 - .6 Clean flush and pressure test system as specified elsewhere in Division 23 Specifications.
 - .7 Install minimum 25 mm thick fiberglass insulation on top of radiant panels, with aluminum foil facing faced down to radiant panel.
- End of Section
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- 1 General
 - 1.1 **SUMMARY**
 - .1 Section Includes
 - .1 Labour, Products, equipment and services necessary to complete the Work of this section.
 - 1.2 **SUBMITTALS**
 - .1 Shop Drawings
 - .1 Submit Shop Drawings in accordance with Section 01 33 00.
 - 2 Products
 - 2.1 **SELF GENERATING ELECTRIC TYPE STEAM HUMIDIFIERS**
 - .1 General
 - .1 Self-contained, electronically controlled, complete with all controls and distribution headers suitable for the specified application.
 - .1 ULC and CSA approved.
 - .2 Refer to schedule on Drawings for performance.
 - .2 Electric Pan Type
 - .1 Construction:
 - .1 Stainless steel vaporizing chamber with removable cover and gasket.
 - .2 Immersion type alloy sheathed heaters.
 - .3 Factory mounted and wired manual reset temperature switch.
 - .4 Factory mounted and wired door interlock safety switch.
 - .5 Electronic water level control with automatic refill, low water cut-off and bleed off functions.
 - .6 Clean out tray.
 - .7 Surface water skimmer system.
 - .8 Three levels of heater protection.
 - .9 Factory mounted control cabinet including microprocessor controller, contacts, control circuit, transformer and fuses.
 - .10 Electronic water level control complete with solenoid operated automatic refill, low water cut-off and skimmer bleed off functions.
 - .2 Controls:
 - .1 Fully modulating control 0 to 100% capacity.
 - .2 Duct mounted air proving switch.
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- .3 Duct high limit humidistat.
 - .4 Modulating duct mounted humidistat.
 - .3 Unit mounted microprocessor based control panel with the following features:
 - .1 Software self-diagnosis.
 - .2 Water level control.
 - .3 Timer operated drain/flush sequence.
 - .4 End of season drain down.
 - .5 Four position manual override.
 - .6 Multiple heater cycling.
 - .7 Connection terminals for remote fault indication.
 - .8 Field adaptable humidistat input signal.
 - .9 Fully modulating steam output control.
 - .4 Acceptable Manufacturers:
 - .1 DriSteam
 - .2 Armstrong
 - .3 Electrode Type
 - .1 Construction:
 - .1 Two independent compartments with front access doors.
 - .2 Disposable cylinder type.
 - .3 Independent control circuit and safety for each cylinder.
 - .4 Manual output adjustments (20 to 100%).
 - .5 Auto adaptive control.
 - .6 Full front access.
 - .7 Alphanumeric LCD display and keypad.
 - .8 Self diagnostics control.
 - .9 Solenoid control of supply and drain water.
 - .10 Automatic off season shut down.
 - .11 Steam distributor with condensate separator and return leg.
 - .12 Fill cup with internal 25 mm air gap.
 - .2 Controls:
 - .1 Fully modulating control 0 to 100% capacity.
-

- .2 Wall mounted electronic humidistat with locking cover, concealed adjustment and locking stops.
 - .3 Duct mounted air flow proving switch.
 - .4 Modulating duct mounted high limit control.
 - .3 Acceptable Manufacturers:
 - .1 Nortec
 - .2 Carnes
 - .4 Element Type
 - .1 Construction:
 - .1 Two independent compartments with hinged lockable doors.
 - .2 14 gauge aluminum casing with backed enamel finish.
 - .3 Easily removable stainless steel cleanable evaporation container.
 - .4 Electric heating immersion element.
 - .5 Level control.
 - .6 Internal electronic temperature sensor.
 - .7 External bimetallic temperature sensor.
 - .8 Water supply solenoid valve.
 - .9 Port motorized drain line ball valve with adjustable timer.
 - .10 Electronic level sensing assembly.
 - .11 Manual reset high temperature safety cut-out switch.
 - .12 Quick disconnect safety overflow connection and drain port.
 - .13 Electrical wiring quick connectors.
 - .14 Stainless steel steam distributor suitable for the application and complete with condensate separator and return leg.
 - .2 Micro-Processor Controller:
 - .1 Unit mounted microprocessor controller with alphanumeric display of the actual steam output, water level, and special diagnostics parameters such as abnormal operation, time delays, etc.
 - .2 Percent relative humidity.
 - .3 Set point.
 - .4 Frequency of drain cycles.
 - .5 Output span control.
-

- .6 Number of actual service hours.
- .3 Controls:
 - .1 Field adjustable fully modulating control to provide 0 to 100% capacity.
 - .2 Wall mounted electronic humidistat.
 - .3 High limit humidistat.
 - .4 Pressure differential switch.
 - .5 Field adjustable fully modulating control to provide 0 to 100% capacity.
 - .6 Wall mounted electronic humidistat.
 - .7 Duct mounted proportional high limit humidistat.
 - .8 Pressure differential switch.
- .4 Acceptable Manufacturers
 - .1 Neptronic
 - .2 DriSteam
 - .3 Pure Steam
 - .4 Armstrong

3 Execution

3.1 **INSTALLATION**

- .1 General
 - .1 Install humidifiers in accordance with manufacturer's instructions.
 - .2 Manufacturer to certify installation, supervise start-up and commission units.
 - .3 Install and wire all accessories shipped loose with units for fully operating systems.
- .2 Self Generating Electric Type
 - .1 Connect cold water make-up line to solenoid valve and provide drain piping as per manufacturer's instruction. Run drain piping to nearest drain.
 - .2 Install steam piping between generator and steam distributor using schedule 40 black steel with malleable iron screwed fittings.
 - .3 Install condensate piping from pan and generator using type L hard drawn copper with copper solder joint fittings.
- .3 Injection Type Humidifiers
 - .1 Install steam trap, strainer, control valve, piping and internal steam distributor support for each humidifier.

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the work of this section.
- .2 Section includes, but is not necessarily limited to, the following:
 - .1 Wire or pipe remote instrumentation required to operate package systems supplied by others. Modulating thermostats for these systems must match the system component characteristics.
 - .2 Supply, install and connect all control wiring for the systems described.
 - .3 Control wiring of components for systems listed herein requiring 120V or less. Included are such items as remotely mounted interlocks, sensors, 120V supply to refrigerated air dryers, seven day timers, etc.
- .3 Coordinate the work of this Division with other trades to obtain their electrical input for the electrical control schematics.
- .4 Advise and coordinate this Work with all associated trades and balancing technicians.

.2 Intent

- .1 It is the Owner's intent to expand the existing BAS network to accommodate the new HVAC equipment and other specified controlled or monitored points.
 - .2 The new Work associated with this Project shall seamlessly integrate to the existing BAS, maintaining all existing controls, system operations and control strategies. Update and upgrade the existing web servers (hardware and software) to include new system graphics and floor plans to conform to the new system and floor plan layouts.
 - .3 The new Work of this Project shall reside on the existing high-speed, peer-to-peer network of DDC controllers and a web-based operator interface. Operators shall be able to perform all normal operator functions through the web browser interface from any operator terminal.
 - .4 The system shall directly control HVAC equipment as specified in this Section as well as integrate to mechanical and electrical systems using the open BACnet communication protocol.
 - .5 Provide energy conservation features such as optimal start and stop, night setback, request-based logic, and demand level adjustment of setpoints as specified.
 - .6 Dynamic colour graphics shall be provided as specified in this Section, including indication of thermal comfort on floor plan summary graphics using dynamic colours to represent zone temperature relative in zone setpoint and zone (7 colour levels).
 - .7 To ensure interoperability with all systems building automation system shall be 100% native-BACnet (at all levels) as specifically detailed by this Section.
-

System shall use the BACnet protocol for communication to the operator workstation or web server and for communication between control modules. Schedules, setpoints, trends and alarms specified in this Section shall be BACnet objects.

1.2 **CODES, REGULATIONS AND STANDARDS**

- .1 Comply with municipal or provincial codes, rules and regulations and/or authorities having jurisdiction.
- .2 Comply with the National Building Code in areas where municipal or provincial regulations and/or codes are not mandatory.
- .3 All Work shall conform to the following Codes and Standards, as applicable:
 - .1 National Fire Protection Association (NFPA) Standards
 - .2 Ontario Electric Safety Code
 - .3 National Electrical Code
 - .4 Underwriters Laboratories Canada (ULC) listing and labels.
 - .5 UL 916 Energy Management
 - .6 NFPA 90A – Standard for the Installation of Air Conditioning and Ventilation Systems
 - .7 ASHRAE 90.1
 - .8 Occupational Health and Safety Act (OHSA)
 - .9 Federal Communications Commission (FCC) including Part 15, Radio Frequency Devices.
 - .10 ASHRAE 195 (BACnet)
- .4 In the case of conflicts or discrepancies, the more stringent regulation shall apply.
- .5 All work shall meet the approval of the Authorities Having Jurisdiction at the project site.

1.3 **MATERIAL APPROVALS**

- .1 Obtain special inspection and approvals by CSA and/or local authorities, for materials where specified.
- .2 Obtain such approval for the particular installation with the cooperation of the material supplier.

1.4 **PERMITS AND INSPECTIONS**

- .1 Obtain permits required for the installation of mechanical trades work including:
 - .1 Electrical inspection
 - .2 Arrange for inspections and tests and pay all fees and costs for the permits, inspections and tests. Obtain permits immediately after notification of award of Contract.
 - .1 Obtain copies of Drawings from the Consultant for submission with application for permits.
-

1.5 **RELATED WORK**

- .1 The following equipment will be supplied and installed under other sections or divisions.
 - .1 Manual balancing dampers, fire dampers, combination fire and smoke dampers, and gravity dampers: Division 23.
 - .2 Automatic control dampers supplied as an integral part of equipment. E.g. mixing box dampers and face and bypass dampers unless otherwise noted: Division 21, 22, 23 and 26.
 - .3 Direct expansion cooling valves: Division 23.
 - .4 Refrigerant solenoid valves: Division 23.
 - .5 Multizone dampers unless otherwise noted: Division 23.

1.6 **ITEMS TO BE SUPPLIED UNDER THIS SECTION AND INSTALLED UNDER OTHER SECTIONS**

- .1 Supply the following equipment to the appropriate mechanical trades for installation in accordance with instructions from, and under the supervision of, the Automatic Controls Subcontractor:
 - .1 Motorized dampers.
 - .2 Variable volume terminal unit operators. (These operators will be installed on the terminal units by the terminal unit Supplier)

1.7 **WORK UNDER OTHER CONTRACTS OR DIVISIONS**

- .1 The following equipment will be supplied and installed by other trades or Contractors:
 - .1 Door limit switches for automatic temperature controls.
 - .2 Electrical items of work as defined hereinafter
 - .3 All line/load side power wiring.
 - .4 Combination starters or contractors complete with integral pushbuttons, Hand-Off-Auto switches, etc. unless otherwise specified.
 - .5 All controls and wiring for:
 - .1 Fire alarm control system

1.8 **PRODUCT AVAILABILITY**

- .1 Product Development
 - .1 All Products to be new, currently under manufacture, and have been applied in similar installations for a minimum of two years.
 - .2 The installation shall not be used as a test site for new Products unless explicitly approved by the Owner's Representative in writing prior to bid date.
 - .2 Spare Parts
 - .1 Spare parts to be available for at least five years after completion of this Contract.
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1.9 **COORDINATION AND EXAMINATION**

.1 Examination

- .1 Carefully examine Work and Drawings of all related trades and thoroughly plan the Work so as to avoid interferences.
- .2 Report defects which would adversely affect the Work. Do not commence installation until such defects have been corrected.

.2 Coordination

- .1 Coordinate Work of this division such that items will properly interface with Work of other divisions. Prepare Installation Drawings of critical locations and submit to Consultant for review.
- .2 Architectural Drawings, or in their absence, Mechanical Drawings govern all locations.

1.10 **SUBMITTALS**

.1 Shop Drawings, Product Data and Samples

- .1 The BMS contractor shall submit a list of all Shop Drawings with submittal dates within 30 days of Contract award.
- .2 Submittals shall be in defined packages. Each package shall be complete and shall only reference itself and previously submitted packages. The packages shall be as approved by the Architect and Engineer for Contract compliance.
- .3 Allow 15 working days for the review of each package by the Architect and Engineer in the scheduling of the total BMS work.
- .4 Equipment and systems requiring approval of local authorities must comply with such regulations and be approved. Filing shall be at the expense of the BMS correspondence and permits to the Owner.
- .5 Prepare an index of all submittals and shop drawings for the installation. Index shall include a Shop Drawing identification number, Contract Documents reference and item description.
- .6 The BMS Contractor shall correct any errors or omissions noted in the first review.
- .7 At a minimum, submit the following:
 - .1 BMS network architecture diagrams including all nodes and interconnections;
 - .2 Systems schematics, sequences and flow diagrams;
 - .3 Points schedule for each point in the BMS, including: Point Type, Object Name, Expanded ID, Display Units, Controller type and Address;
 - .4 Samples of Graphic Display screen types and associated menus;
 - .5 Detailed Bill of Material list for each system or application, identifying quantities, part numbers, descriptions and optional features;

- .6 Control Damper Schedule including a separate line for each damper provided under this section and a column for each of the damper attributes, including: Code Number, Fail Position, Damper Type, Damper Operator, Duct Size, Damper Size, Mounting and Actuator Type;
 - .7 Room Schedule including a separate line for each VAV box and/or terminal unit indicating location and address;
 - .8 Control Valve Schedules including a separate line for each valve provided under this section and a column for each of the valve attributes: Code Number, Configuration, Fail Position, Pipe Size, Valve Size, Body Configuration, Close off Pressure, Capacity, Valve CV, Design Pressure and Actuator Type;
 - .9 Details of all BMS interfaces and connections to the work of other trades; and
 - .10 Product data sheets or marked catalog pages including part number, photo and description for all products including software.
- .2 Record Documentation
- .1 Operation and Maintenance Manuals
 - .1 Three (3) copies of the Operation and Maintenance Manuals shall be provided to the Owner's Representative upon completion of the project. The entire Operation and Maintenance Manual shall be furnished on Compact Disc media, and include the following for the BMS provided:
 - .1 Table of contents;
 - .2 As-built system record drawings. Computer Aided Drawings (CAD) record drawings shall represent the as-built condition of the system and incorporate all information supplied with the approved submittal;
 - .3 Manufacturer's product data sheets or catalog pages for all products including software;
 - .4 System Operator's manuals;
 - .5 Archive copy of all site-specific databases and sequences;
 - .6 BMS network diagrams; and
 - .7 Interfaces to all third-party products and work by other trades.
 - .2 The Operation and Maintenance Manual CD shall be self-contained and include all necessary software required to access the product data sheets. A logically organized table of contents shall provide dynamic links to view and print all product data sheets. Viewer software shall provide the ability to display, zoom and search all documents.
- 1.11 **TRADE QUALIFICATIONS**
- .1 Applicable to the following trades:
 - .1 Electricians.
-

.2 Requirements

- .1 Trade workers to have a certificate of qualification as journeyman or apprentice registration for the province where the Work is performed, or an interprovincial certificate.
- .2 Ratio of journeyman to apprentice: Note to exceed the defined ratio in the Apprenticeship Act of Ontario.
- .3 Certificates and registration must be provided to the Consultant on request.
- .4 Maintain on-site an up-to-date record listing journeyman and apprentices working on site.
- .5 Electricians to be part of IBEW. Electricians not part of IBEW need to submit reference letter with minimum 3 references at least 48 hours in advance of tender closing.

1.12 **PRODUCT DELIVERY, STORAGE AND HANDLING**

- .1 Seal instruments after manufacture and inspection and remain sealed until ready for installation.
- .2 Handle instruments and equipment carefully handled and protect from weather, dust and construction materials.

2 Products

2.1 **MATERIALS AND EQUIPMENT**

- .1 Use new materials and equipment, free from defects impairing strength and durability, as specified or specified equivalent.
- .2 Manufactured in Canada wherever possible.
- .3 Labelled or listed as required by code and/or inspection authorities.

2.2 **STANDARD SPECIFICATIONS**

- .1 Ensure that the chemical and physical properties, design, performance characteristics and methods of construction of all Products provided comply with the latest issue of applicable standard Specifications issued by authorities having jurisdiction.
- .2 Do not apply such standard Specifications to decrease the quality of workmanship, Products and services required by the Contract Documents.

2.3 **BMS GENERAL SYSTEM PERFORMANCE REQUIREMENTS**

.1 Suppliers/Installers

- .1 Supplied and installed by a Control Subcontractor specializing in such work. AS far as practical, all control equipment to be the products of a single manufacturer.
 - .2 Bids by Wholesalers, Contractors, Franchised Dealers or any firm whose principal business is not that of manufacturing and installing automatic temperature control systems shall not be acceptable.
 - .3 Single source responsibility of supplier shall be the complete installation and proper operation of the (BMS and) control system, including commissioning and proper calibration of each component in the entire system.
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- .4 An in-place support facility within 50 kilometers of the site with technical staff, spare parts inventory and all necessary test and diagnostic equipment.
 - .5 Standard of Acceptance:
 - .1 Johnson Controls
 - .2 Honeywell
 - .3 Automated Logic
 - .2 General Description
 - .1 The Building Management System (BMS) shall use an open architecture and fully support a multi-vendor environment. To accomplish this effectively, the BMS shall support open communication protocol standards and integrate a variety of third-party devices and applications. The system shall be designed for use on the Internet, or intranets using off the shelf, industry standard technology compatible with other owner provided networks.
 - .2 The Building Management System shall consist of the following:
 - .1 Standalone Network Automation Engine(s)
 - .2 Field Equipment Controller(s)
 - .3 Input/Output Module(s)
 - .4 Local Display Device(s)
 - .5 Portable Operator's Terminal(s)
 - .6 Distributed User Interface(s)
 - .7 Network processing, data storage and communications equipment
 - .8 Other components required for a complete and working BMS
 - .3 The system shall be modular in nature, and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, controllers and operator devices, while re-using existing controls equipment.
 - .4 System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution.
 - .1 The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.
 - .2 The System shall maintain all settings and overrides through a system reboot.
 - .5 System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution.
 - .3 BMS Architecture
 - .1 Automation Network
 - .1 The automation network shall be based on a PC industry standard of Ethernet TCP/IP. Where used, LAN controller cards shall be standard "off the shelf" products available through normal PC vendor channels.
-

- .2 The BMS shall network multiple user interface clients, automation engines, system controllers and application-specific controllers. Provide application and data server(s) as required for systems operation.
 - .3 All BMS devices on the automation network shall be capable of operating at a communication speed of 100 Mbps, with full peer-to-peer network communication.
 - .4 Network Automation Engines (NAE) shall reside on the automation network.
 - .5 The automation network will be compatible with other enterprise-wide networks. Where indicated, the automation network shall be connected to the enterprise network and share resources with it by way of standard networking devices and practices.
 - .2 Control Network
 - .1 Network Automation Engines (NAE) shall provide supervisory control over the control network and shall support at the minimum both of the following communication protocols:
 - .1 BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9
 - .1 The NAE shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
 - .2 The NAE shall be tested and certified as a BACnet Building Controller (B-BC).
 - .2 LonWorks enabled devices using the Free Topology Transceiver (FTT-10a).
 - .2 Control networks shall provide either "Peer-to-Peer," Master-Slave, or Supervised Token Passing communications, and shall operate at a minimum communication speed of 9600 baud.
 - .3 DDC Controllers shall reside on the control network.
 - .4 Control network communication protocol shall be BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135.
 - .5 A BACnet Protocol Implementation Conformance Statement (PICS) shall be provided for each controller device (master or slave) that will communicate on the BACnet MS/TP Bus.
 - .6 The PICS shall be submitted 10 days prior to bidding.
 - .3 Integration
 - .1 Hardwired
 - .1 Analog and digital signal values shall be passed from one system to another via hardwired connections.
 - .2 There shall be one separate physical point on each system for each point to be integrated between the systems.
-

- .2 Direct Protocol (Integrator Panel)
 - .1 The BMS system shall include appropriate hardware equipment and software to allow bi-directional data communications between the BMS system and 3rd party manufacturers' control panels. The BMS shall receive, react to, and return information from multiple building systems.
 - .2 All data required by the application shall be mapped into the Network Automation Engine's database, and shall be transparent to the operator.
 - .3 Point inputs and outputs from the third-party controllers shall have real-time interoperability with BMS software features such as: Control Software, Energy Management, Custom Process Programming, Alarm Management, Historical Data and Trend Analysis, Totalization, and Local Area Network Communications.
 - .3 BACnet Protocol Integration – BACnet
 - .1 The neutral protocol used between systems will be BACnet over Ethernet and comply with the ASHRAE BACnet standard 135.
 - .2 A complete Protocol Implementation Conformance Statement (PICS) shall be provided for all BACnet system devices.
 - .3 The ability to command, share point object data, change of state (COS) data and schedules between the host and BACnet systems shall be provided.
 - .4 User Interface
 - .1 Dedicated Web Based User Interface
 - .1 All real-time control functions, including scheduling, history collection and alarming, shall be resident in the BMS Network Automation Engines to facilitate greater fault tolerance and reliability.
 - .2 Dedicated User Interface Architecture: The architecture shall be implemented to conform to industry standards, so that it can accommodate applications provided by the BMS Contractor and by other third party applications suppliers, including but not limited to Microsoft Office Applications. Specifically it must be implemented to conform to the following interface standards.
 - .1 Microsoft Internet Explorer or other web browser for user interface functions
 - .2 Microsoft Office Professional or equal for creation, modification and maintenance of reports, sequences other necessary building management functions.
 - .3 Microsoft Outlook or other e-mail program for supplemental alarm functionality and communication of system events and reports.
-

- .4 Required network operating system for exchange of data and network functions such as printing of reports, trends and specific system summaries.
 - .3 Operating System Software
 - .1 Windows 10
 - .2 Where user interface is not provided via browser, provide complete operator workstation software package, including any hardware or software keys. Include the original installation disks and licenses for all included software, device drivers, and peripherals.
 - .3 Provide software registration cards to the Owner for all included software.
 - .2 Distributed Web Based User Interface
 - .1 All features and functions of the dedicated user interface previously defined in this document shall be available on any computer connected directly or via a wide area or virtual private network (WAN/VPN) to the automation network and conforming to the following specifications.
 - .2 The software shall run on the Microsoft Internet Explorer (6.0 or higher) or other web browser supporting the following functions:
 - .1 Configuration
 - .2 Commissioning
 - .3 Data Archiving
 - .4 Monitoring
 - .5 Commanding
 - .6 System Diagnostics
 - .3 Minimum hardware requirements:
 - .1 1GB RAM
 - .2 2.0 GHz Clock Speed Pentium 4 Microprocessor
 - .3 100 GB hard drive
 - .4 1 keyboard with 83 keys (minimum)
 - .5 SVGA 1024x768 resolution display with 64K colours and 16 bit colour depth
 - .6 Mouse or other pointing device
 - .3 Site Management User Interface Application Components
 - .1 Operator Interface
 - .1 An integrated browser based client application shall be used as the user operator interface program.
-

- .2 The System shall employ an event-driven rather than a device polling methodology to dynamically capture and present new data to the user.
 - .3 All Inputs, Outputs, Setpoints, and all other parameters as defined within this section, shown on the design drawings, or required as part of the system software, shall be displayed for operator viewing and modification from the operator interface software.
 - .4 The user interface software shall provide help menus and instructions for each operation and/or application.
 - .5 The system shall support customization of the UI configuration and a home page display for each operator.
 - .6 The system shall support user preferences in the following screen presentations:
 - .1 Alarm
 - .2 Trend
 - .3 Display
 - .4 Applications
 - .7 All controller software operating parameters shall be displayed for the operator to view/modify from the user interface. These include: setpoints, alarm limits, time delays, PID tuning constants, run-times, point statistics, schedules, and so forth.
 - .8 The Operator Interface shall incorporate comprehensive support for functions including, but not necessarily limited to, the following:
 - .1 User access for selective information retrieval and control command execution
 - .2 Monitoring and reporting
 - .3 Alarm, non-normal, and return to normal condition annunciation
 - .4 Selective operator override and other control actions
 - .5 Information archiving, manipulation, formatting, display and reporting
 - .6 BMS internal performance supervision and diagnostics
 - .7 On-line access to user HELP menus
 - .8 On-line access to current BMS as-built records and documentation
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- .9 Means for the controlled re-programming, re-configuration of BMS operation and for the manipulation of BMS database information in compliance with the prevailing codes, approvals and regulations for individual BMS applications
 - .9 The system shall support a list of application programs configured by the users that are called up by the following means:
 - .1 The Tools Menu
 - .2 Hyperlinks within the graphics displays
 - .3 Key sequences
 - .10 The operation of the control system shall be independent of the user interface, which shall be used for operator communications only. Systems that rely on an operator workstation to provide supervisory control over controller execution of the sequences of operations or system communications shall not be acceptable.
 - .2 Navigation Trees
 - .1 The system shall have the capability to display multiple navigation trees that will aid the operator in navigating throughout all systems and points connected. At minimum provide a tree that identifies all systems on the networks.
 - .2 Provide the ability for the operator to add custom trees. The operator will be able to define any logical grouping of systems or points and arrange them on the tree in any order. It shall be possible to nest groups within other groups. Provide at minimum 5 levels of nesting.
 - .3 The navigation trees shall be "dockable" to other displays in the user interface such as graphics. This means that the trees will appear as part of the display, but can be detached and then minimized to the Windows task bar. A simple keystroke will reattach the navigation to the primary display of the user interface.
 - .3 Alarms
 - .1 Alarms shall be routed directly from Network Automation Engines to PCs and servers. It shall be possible for specific alarms from specific points to be routed to specific PCs and servers. The alarm management portion of the user interface shall, at the minimum, provide the following functions:
 - .1 Log date and time of alarm occurrence.
-

- .2 Generate a "Pop-Up" window, with audible alarm, informing a user that an alarm has been received.
 - .3 Allow a user, with the appropriate security level, to acknowledge, temporarily silence, or discard an alarm.
 - .4 Provide the ability to direct alarms to an e-mail address, phone number or alphanumeric pager. This must be provided in addition to the pop up window described above. Systems that use e-mail and pagers as the exclusive means of annunciating alarms are not acceptable.
 - .5 Configuration of which NAE offline alarms are seen by each user
 - .6 Any attribute of any object in the system may be designated to report an alarm.
 - .2 The BMS shall annunciate diagnostic alarms indicating system failures and non-normal operating conditions.
 - .3 The BMS shall allow a minimum of 4 categories of alarm sounds customizable through user defined wav.files.
 - .4 The BMS shall annunciate application alarms at minimum, as required by Specifications and Drawings.
 - .4 Reports and Summaries
 - .1 Reports and Summaries shall be generated and directed to the user interface displays, with subsequent assignment to printers, or disk. As a minimum, the system shall provide the following reports:
 - .1 All points in the BMS
 - .2 All points in each BMS application
 - .3 All points in a specific controller
 - .4 All points in a user-defined group of points
 - .5 All points currently in alarm
 - .6 All points locked out
 - .7 All user defined and adjustable variables, schedules, interlocks and the like.
 - .2 Summaries and Reports shall be accessible via standard UI functions and not dependent upon custom programming or user defined HTML pages.
 - .3 Selection of a single menu item, tool bar item, or tool bar button shall print any displayed report or summary on
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the system printer for use as a building management and diagnostics tool.

- .4 Provide the capability to view, command and modify large quantities of similar data in tailored summaries created online without the use of a secondary application like a spreadsheet. Summary definition shall allow up to seven user defined columns describing attributes to be displayed including custom column labels. Up to 100 rows per summary shall be supported. Summary viewing shall be available over the network using a standard Web browser.
- .5 Reports shall be selectable by date, time, area and device. Each report shall include a color visual summary of essential energy information.

.5 Schedules

- .1 A graphical display for time-of-day scheduling and override scheduling of building operations shall be provided. At a minimum, the following functions shall be provided:
 - .1 Weekly schedules
 - .2 Exception Schedules
 - .3 Monthly calendars
- .2 Weekly schedules shall be provided for each group of equipment with a specific time use schedule.
- .3 It shall be possible to define one or more exception schedules for each schedule including references to calendars.
- .4 Monthly calendars shall be provided that allow for simplified scheduling of holidays and special days for a minimum of five years in advance. Holidays and special days shall be user-selected with the pointing device or keyboard, and shall automatically reschedule equipment operation as previously defined on the exception schedules.
- .5 Changes to schedules made from the User Interface shall directly modify the network automation engine schedule database.
- .6 Schedules and calendars shall comply with ASHRAE Standard 135 BACnet Standard.
- .7 The calendar object supports an option to add a reference to another calendar object that is designated to be the master for the facility. Any Supervisory and BAC calendars can be configured to reference a single master global calendar. Changes to the master global

calendar are automatically synced with all calendars that are referenced.

- .8 Selection of a single menu item or tool bar button shall print any displayed schedule on the system printer for use as a building management and diagnostics tool.
- .9 Software shall be provided to configure and implement optimal start and stop programming based on existing indoor and outdoor environmental conditions as well as equipment operating history.
- .10 The system solar clock shall support the scheduling and energy management functions. The solar clock will calculate the sunrise, sunset, and sun angle values for a specified latitude and longitude. A time offset can also be specified. An example would be to use the solar clock object as a master to an interlock to turn lights on 30 minutes after sunset and off 30 minutes before sunrise.

.6 Security/Passwords

- .1 Multiple-level passwords access protection shall be provided via roles and permissions. The feature will allow the system to base access on a user's job title or role and allow the user/manager access interface control, display, and database manipulation capabilities based on an assigned password.
 - .2 Roles may be copied and altered to meet specific roles and permissions based on the particular policies.
 - .3 Each user shall have the following: A user account name, a complex password or passphrase, other user account policies (such as session timeout), timesheet access based on day of the week and time of day, and specific user view.
 - .4 The system shall allow each user to change his or her password at will.
 - .5 When entering or editing passwords, the system shall not echo the actual characters for display on the monitor.
 - .6 A maximum of 150 categories may be used to determine or assign areas of responsibilities to each user account. A maximum of 13 (of the 150) named categories which are specifics such as "No Access, View, Advanced Review, Operate, Intervene, Diagnostic, Manage Item Events, Manage Every, and Configure Items".
 - .7 A minimum of 100 unique passwords shall be supported.
 - .8 Operators shall be able to perform only those commands available for their respective passwords. Display of menu selections shall be limited to only those items
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defined for the access level of the password used to log-on.

- .9 Operators shall be further limited to only access, command, and modify those buildings, systems, and subsystems for which they have responsibility. Provide a minimum of 100 categories of systems to which individual operators may be assigned.
- .10 The system shall automatically generate a report of log-on/log-off and system activity for each user. Any action that results in a change in the operation or configuration of the control system shall be recorded, including: modification of point values, schedules or history collection parameters, and all changes to the alarm management system, including the acknowledgment and deletion of alarms.
- .11 After successful login to the Site Management Portal (SMP) the last time and date that user name was previously logged in is shown on the screen.
- .12 Each login attempt is recorded in the system Audit Log with the option to record the IP address of the PC that made the login.

.7 Screen Manager

- .1 The system shall allow a customized image on the login screen (i.e. organization name, logo).
- .2 User View navigations can be displayed as either a set of tabs or a drop down list.
- .3 Allows user preference for assigning of a background color for when an object is Out of Service which will enable the operator to quickly distinguish points that have been commanded to this state.
- .4 The user interface shall be provided with screen management capabilities that allow the user to activate, close, and simultaneously manipulate a minimum of 4 active display windows plus a network or user defined navigation tree.

.8 Dynamic Color Graphics

- .1 The graphics application program shall be supplied as an integral part of the user interface. Browser or Workstation applications that rely only upon HTML pages shall not be acceptable.
- .2 The graphics applications shall include a create/edit function and a runtime function. The system architecture shall support an unlimited number of graphics documents (graphic definition files) to be generated and executed. The graphics shall be able to display and

provide animation based on real-time data that is acquired, derived, or entered.

- .3 Graphics runtime functions: A maximum of 16 graphic applications shall be able to execute at any one time on a user interface or workstation with 4 visible to the user. Each graphic application shall be capable of the following functions:
 - .1 All graphics shall be fully scalable
 - .2 The graphics shall support a maintained aspect ratio.
 - .3 Multiple fonts shall be supported.
 - .4 Unique background shall be assignable on a per graphic basis.
 - .5 The color of all animations and values on displays shall indicate the status of the object attribute.
 - .6 Graphics that represent buildings or systems shall allow natural links and transitions between related detailed tabular views of data that compliment the graphic.
 - .4 Operation from graphics: It shall be possible to change values (setpoints) and states in system controlled equipment directly from the graphic.
 - .5 Floor Plan graphics: The user interface shall provide graphic applications that summarize conditions on a floor. Floor plan graphics shall indicate thermal comfort using dynamic colors to represent zone temperature deviations from zone setpoint(s). Floor plan graphics shall display overall metrics for each zone in the floor.
 - .6 Aliasing – Many graphic displays representing part of a building and various building components are exact duplicates, with the exception that the various variables are bound to different field values. Consequently, it shall be possible to bind the value of a graphic display to aliases, as opposed to the physical field tags.
 - .7 Graphic editing tool – A graphic editing tool shall be provided that allows for the creation and editing of graphic files. The graphic editor shall be capable of performing/defining all animations, and defining all runtime binding.
 - .1 The graphic editing tool shall provide a library of standard HVAC equipment, floor plan, lighting, security and network symbols.
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- .2 The graphic editing tool shall provide for the creation and positioning of library symbols by dragging from tool bars or drop-downs and positioning where required.
 - .3 The graphics editing tool shall permit the importing of AutoCAD drawings for use in the system.
 - .4 The graphic editing tool shall be able to add additional content to any graphic by importing images in the SVG, PNG or JPG file formats.
 - .9 Historical trending and data collection
 - .1 Each Automation Engine shall store trend and point history data for all analog and digital inputs and outputs, as follows:
 - .1 Any point, physical or calculated, may be designated for trending. Two methods of collection shall be allowed:
 - 1. Defined time interval
 - 2. Upon a change of value
 - .2 Each Automation Engine shall have the capability to store multiple samples for each physical point and software variable based upon available memory, including an individual sample time/date stamp. Points may be assigned to multiple history trends with different collection parameters.
 - .2 Trend and change of value data shall be stored within the engine and uploaded to a dedicated trend database or exported in a selectable data format via a provided data export utility. Uploads to a dedicated database shall occur based upon one of the following: user-defined interval, manual command, or when the trend buffers are full. Exports shall be as requested by the user or on a time scheduled basis.
 - .3 The system shall provide a configurable data storage subsystem for the collection of historical data. Data can be stored in SQL database format.
 - .4 The system shall provide data to enable optimization capabilities including fault detection and diagnostics, advanced analytics and central plant optimization without the need of a gateway or additional hardware.
 - .10 Trend data viewing and analysis
 - .1 Provide a trend viewing utility that shall have access to all database points.
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- .2 It shall be possible to retrieve any historical database point for use in displays and reports by specifying the point name and associated trend name.
 - .3 The trend viewing utility shall have the capability to define trend study displays to include multiple trends.
 - .4 Displays shall be able to be single or stacked graphs with on-line selectable display characteristics, such as ranging, color, and plot style.
 - .5 Display magnitude and units shall both be selectable by the operator at any time without reconfiguring the processing or collection of data. This is a zoom capability.
 - .6 Display magnitude shall automatically be scaled to show full graphic resolution of the data being displayed.
 - .7 The Display shall support the user's ability to change colors, sample sizes, and types of markers.
- .11 Database Management
- .1 Where a separate SQL database is utilized for information storage the System shall provide a Database Manager that separates the database monitoring and managing functions by supporting two separate windows.
 - .2 Database secure access shall be accomplished using standard SQL authentication including the ability to access data for use outside of the Building Automation application.
 - .3 The database managing function shall include summarized information on trend, alarm, event, and audit for the following database management actions:
 - .1 Backup
 - .2 Purge
 - .3 Restore
 - .4 The Database Manager shall support four tabs:
 - .1 Statistics – shall display Database Server information and Trend, Alarm (Event), and Audit information on the Metasys Databases.
 - .2 Maintenance – shall provide an easy method of purging records from the Metasys Server trend, alarm (event), and audit databases by supporting separate screens for creating a backup prior to purging, selecting the database,
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- and allowing for the retention of a selected number of day's data.
 - .3 Backup – Shall provide the means to create a database backup file and select a storage location.
 - .4 Restore – shall provide a restricted means of restoring a database by requiring the user to log into an Expert Mode in order to view the Restore screen.
 - .5 The Status Bar shall appear at the bottom of all Database Manager Tabs and shall provide information on the current database activity. The following icons shall be provided:
 - .1 Ready
 - .2 Purging Record from a database
 - .3 Action Failed
 - .4 Refreshing Statistics
 - .5 Restoring database
 - .6 Shrinking a database
 - .7 Backing up a database
 - .8 Resetting internet information Services
 - .9 Starting the Device Manager
 - .10 Shutting down the Device Manager
 - .11 Action successful
 - .6 The Database Manager monitoring functions shall be accessed through the Monitoring Settings window and shall continuously read database information once the user has logged in.
 - .7 The System shall provide user notification via taskbar icons and e-mail messages when a database value has exceeded a warning or alarm limit.
 - .8 The Monitoring Settings window shall have the following sections:
 - .1 General – Shall allow the user to set and review scan intervals and start times.
 - .2 Email – Shall allow the user to create and review e-mail and phone text messages to be delivered when a Warning or Alarm is generated.
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- .3 Warning – shall allow the user to define the Warning limit parameters, set the Reminder Frequency, and link the e-mail message.
 - .4 Alarm – shall allow the user to define the Alarm limit parameters, set the Reminder Frequency, and link the e-mail message.
 - .5 Database login – Shall protect the system from unauthorized database manipulation by creating a Read Access and a Write Access for each of the Trend, Alarm (Event) and Audit databases as well as an Expert Mode required to restore a database.
 - .9 The Monitoring Settings Taskbar shall provide the following informational icons:
 - .1 Normal – Indicates by color and size that all databases are within their limits.
 - .2 Warning - Indicates by color and size that one or more databases have exceeded their Warning limit.
 - .3 Alarm - Indicates by color and size that one or more databases have exceeded their Alarm limit.
 - .10 The System shall provide user notification via Taskbar icons and e-mail messages when a database value has exceeded a warning or alarm limit.
 - .12 Demand Limiting and Load Rolling
 - .1 The System shall provide a Demand Limiting and Load Rolling program for the purpose of limiting peak energy usage and reducing overall energy consumption.
 - .2 The System shall support both Sliding Window and Fixed Window methods of predicting demand.
 - .3 The System shall support three levels of sensitivity in the Sliding Window demand calculations for fine tuning the system.
 - .1 Low Setting – Sheds loads later and over the shortest amount of time. Maximizes the time the equipment is on.
 - .2 Medium Setting – Sheds loads earlier over a longer amount of time than the Low Setting. Increases the time the equipment is on and decreases the probability of exceeding the Tariff Target over the Low Setting.
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- .3 High Setting – Sheds loads earlier over a longer amount of time than the Medium Setting. Minimizes the probability of exceeding the Tariff Target.
 - .4 The System shall have both a Shed Mode and a Monitor Only Mode of operation.
 - .1 When the Shed Mode is engaged, the System shall actively control the Demand.
 - .2 When the Monitor Mode is engaged, the System will simulate the shedding action but will not take any action.
 - .5 The Demand Limiting program shall monitor the energy consumption rate and compare it to a user defined Tariff Target. The system shall maintain consumption below the target by selectively shedding loads based upon a user defined strategy.
 - .6 The Demand Limiting program shall be capable of supporting a minimum of 10 separate Load Priorities. Each load shall be user assigned to a Load Priority.
 - .7 The Demand Limiting program shall be capable of supporting a minimum of 12 separate Tariff Targets defining the maximum allowed average power during the current interval.
 - .8 The System shall support a Maximum Shed Time for each load as determined by the user. The system shall restore the load before the Maximum Shed time has expired.
 - .9 The System shall support a Minimum Shed Time for each load as determined by the user. The system shall not restore the load sooner than the Minimum Shed Time has expired.
 - .10 The System shall support a Minimum Release Time for each load as determined by the user. The System shall not shed the load until it has been off for the Minimum Release time.
 - .11 The System shall support three user defined options if the meter goes unreliable.
 - .1 Shedding – The currently shed loads will be released as their Maximum shed Times expire.
 - .2 Maintain the Current Shed Rate – The System will use the Demand Limiting shed rate that was present when the meter went unreliable.
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- .3 Use Unreliable Meter Shed Rate – the system will control to a user defined Unreliable Shed Rate target.
 - .12 The Load Rolling program shall sum the loads currently shed and compare it to a user defined Load Rolling Target. The system shall maintain consumption below the target by selectively shedding loads based upon a user defined Load Priority.
 - .13 The Load Rolling program shall be capable of supporting a minimum of 10 separate Load Priorities. Each load shall be user assigned to a Load Priority.
 - .14 The Load Rolling program shall be capable of supporting a minimum of 12 separate Tariff Targets defining the amount of power by which the demand must be reduced.
 - .15 The System shall provide the user with a Load Tab that displays all of the Demand Limiting and Load Rolling parameters for any selected load.
 - .16 The System shall provide the user with a Load Summary that displays all of the loads associated with the Demand Limiting and Load Rolling programs. Status Icons for each load shall indicate:
 - .1 Load is Offline
 - .2 Load is Disabled
 - .3 Load is Shed
 - .4 Load is Locked
 - .5 Load is in Comfort Override
 - .17 The Load Summary shall include a Load Summary Runtime view listing the following load conditions:
 - .1 Load Priority
 - .2 Shed Strategy
 - .3 Load Rating
 - .4 Present Value
 - .5 Ineligibility Status
 - .6 Active Timer
 - .7 Time Remaining
 - .8 Last Shed Time
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.4 System User Interface

- .1 BMS Contractor shall provide and install all computer hardware and software required for the purpose of configuration and consolidation of information and programs required for the delivery of a Task Focused, Web Based Portal to the BMS. The system User Interface shall provide a natural, complementary extension to the site management user interface previously described.
- .2 The user interface architecture shall be implemented to conform to industry standards, so that it can accommodate the required applications provided by the BMS Contractor as well as communicate information to and from any size control system.
- .3 The exact same user interface shall be accessible from any type of personal computer or mobile device running any type of operating system (ex. iOS, Android, Windows).
- .4 The interface shall automatically adapt and optimize the information displayed to fit the screen size of the client device and shall also be touch friendly.
- .5 The user interface shall organize and display information using customer specific locations and spaces. At a minimum, the user interface shall provide:
 - .1 Organization of all space, equipment and point information in a familiar way, reducing the need for extensive training prior to use.
 - .2 A navigation mechanism for users to select the specific location or space to display information for – only spaces and locations in the navigation tree, nothing more.
 - .3 The ability to search for and/or bookmark any location or space by name for quick access to critical or troublesome areas.
 - .4 The same navigation mechanisms apply across any client device (ex. Smart phone, tablet, personal computer) for consistency and ease of use.
- .6 Plug-ins and special native app software (ex. Downloaded and installed from an app store) shall not be required to conduct daily operations of buildings and equipment.
- .7 The user interface shall clearly display equipment relationships without custom graphic generation.
- .8 The user interface shall provide a single display of all potential issues in a facility including items currently in alarm, warning, override, out-of-service and offline.
- .9 The user interface shall provide a single display of all activity related to a specific piece of equipment including user changes,

discarded user changes, pending alarms, discarded alarms and acknowledged alarms.

- .10 The user interface shall provide support for up to 100 concurrent users from an unlimited number of individuals with defined password access to the system.
- .11 Provide the capability to view, command and modify large quantities of similar data in tailored summaries without the use of a secondary application, like a spreadsheet. These summaries shall be automatically generated or user defined. User defined summaries shall allow up to seven user defined columns describing attributes to be displayed including custom column labels. Up to 100 rows per summary shall be supported.
- .12 Operator Interface
 - .1 Password access shall be as described previously for management portal UI
 - .2 Once logged in, the System shall display a pre-selected screen tailored to the task requirements of the individual user.
 - .3 The User Interface shall utilize an intuitive navigation and display method designed for operators who access the system for casual information and control or on an infrequent basis. It shall feature three basic components.
 - .1 Radio buttons for selection of the type of information to be displayed including Alerts, Summary, Schedules and Diagnostics
 - .2 Navigation tree for selection of the specific data to be displayed on screen for the selected type. The navigation tree may be hidden and expanded by the operator to optimize the display of information
 - .3 A display window that provides the selected information by type in a pre-configured tabular format
 - .4 The user interface software shall provide help menus and instructions for each operation and/or application.
 - .5 The system shall provide support for up to 100 concurrent users from an unlimited universe individuals with defined password access to the system
 - .6 The system shall utilize Secure Sockets Level (SSL) support as required to allow the ready access portal to communicate across a network in a way designed to prevent eavesdropping, tampering, and message forgery. It provides endpoint authentication and

- communications privacy over the network using cryptography
- .7** The system shall have the capability to display multiple navigation trees that correspond to the user views configured in the management portal UI.
- .8** The alert summary of the ready access portal shall, at the minimum, provide the following information
- .1 Alert (Alarm) type
 - .2 Date and time of alert occurrence
 - .3 Priority (color coded to level)
 - .4 Item name.
 - .5 Item value (if applicable)
 - .6 Message
 - .7 Any attribute of any object in the system may be designated to report an alarm
- .9** A standard summary on the ready access portal shall, at the minimum, provide the following information
- .1 Point type graphic icon
 - .2 Item name
 - .3 Item value
 - .4 Item status
 - .5 Access to the change value window (if applicable) for the purpose of setting, holding or releasing an item value
- .10** A custom summary on the ready access portal shall display user-specified summaries of key data sets that can be quickly filtered and sorted. Items within these custom summaries can be commanded.
- .11** A graphic view on the ready access portal shall display as described previously for management portal UI.
- .12** The schedule detail summary of the ready access portal shall, at the minimum, provide the following information
- .1 Scheduled occurrences including time and value
 - .2 Scheduled overrides including start time, end time and value
 - .3 A list of all scheduled items including name and attribute, value, status and priority
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- .4 Access to the Add Temporary Override window for the purpose of adding a temporary override to the schedule
 - .13 The diagnostic (trend) summary of the ready access portal as viewed on a personal computing device shall provide the following information.
 - .1 Item name
 - .2 Item status
 - .3 Trend name
 - .4 Trend status
 - .5 Full path name
 - .6 Access to trend detail summary including trended value, time and date arranged in a user selectable format of 1 hour, 12 hours, 24 hours, 48 hours or 72 hours
 - .4 Network Automation Engines (NAE)
 - .1 Network Automation Engine
 - .1 The Network Automation Engine (NAE) shall be a fully user-programmable, supervisory controller. The NAE shall monitor the network of distributed application-specific controllers, provide global strategy and direction, and communicate on a peer-to-peer basis with other Network Automation Engines.
 - .2 Automation network: The NAE shall reside on the automation network and shall support a subnet of system controllers.
 - .3 User interface: Each NAE shall have the ability to deliver a web based User Interface (UI) as previously described. All computers connected physically or virtually to the automation network shall have access to the web based UI.
 - .1 The web based UI software shall be imbedded in the NAE. Systems that require a local copy of the system database on the user's personal computer are not acceptable.
 - .2 The NAE shall support a minimum of two (2) concurrent users.
 - .3 The web based user shall have the capability to access all system data through one NAE.
 - .4 Remote users connected to the network through an Internet Service Provider (ISP) or telephone dial up shall also have total system access through one NAE.
 - .5 Systems that require the user to address more than one NAE to access all system information are not acceptable.
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- .6 The NAE shall have the capability of generating web based UI graphics. The graphics capability shall be imbedded in the NAE.
 - .7 Systems that support UI Graphics from a central database or require the graphics to reside on the user's personal computer are not acceptable.
 - .8 The web based UI shall support the following functions using a standard version of Microsoft Internet Explorer and/or other web browser:
 - .1 Configuration
 - .2 Commissioning
 - .3 Data Archiving
 - .4 Monitoring
 - .5 Commanding
 - .6 System Diagnostics
 - .9 Systems that require workstation software or modified web browsers are not acceptable.
 - .10 The NAE shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems.
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- .4 Processor – The NAE shall be microprocessor-based with a minimum word size of 32 bits. The NAE shall be a multi-tasking, multi-user, and real-time digital control processor. Standard operating systems shall be employed. NAE size and capability shall be sufficient to fully meet the requirements of this Specification.
 - .5 Memory – Each NAE shall have sufficient memory to support its own operating system, databases, and control programs, and to provide supervisory control for all control level devices.
 - .6 Hardware Real Time Clock – The NAE shall include an integrated, hardware-Based, real-time clock.
 - .7 The NAE shall include troubleshooting LED indicators to identify the following conditions:
 - .1 Power - On/Off
 - .2 Ethernet Traffic – Ethernet Traffic/No Ethernet Traffic
 - .3 Ethernet Connection Speed – 10 Mbps/100 Mbps
 - .4 Field Communication (FC) Bus – Normal Communications/No Field Communications
 - .5 Peer Communication – Data Traffic between NAE Devices
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- .6 Run – NAE Running/NAE in Startup/NAE Shutting Down/Software Not Running
 - .7 Bat Fault – Battery Defective, Data Protection Battery Not Installed
 - .8 Fault – General Fault
 - .8 Communications Ports – The NAE shall provide the following ports for operation of operator Input/Output (I/O) devices, such as industry-standard computers, modems, and portable operator's terminals.
 - .1 USB port
 - .2 RS-232 serial data communication port
 - .3 RS-485 port
 - .4 Ethernet port
 - .9 Diagnostics – The NAE shall continuously perform self-diagnostics, communication diagnosis, and diagnosis of all panel components. The Network Automation Engine shall provide both local and remote annunciation of any detected component failures, low battery conditions, or repeated failures to establish communication.
 - .10 Power Failure – In the event of the loss of normal power, The NAE shall continue to operate for a user adjustable period of up to 10 minutes after which there shall be an orderly shutdown of all programs to prevent the loss of database or operating system software.
 - .1 During a loss of normal power, the control sequences shall go to the normal system shutdown conditions. All critical configuration data shall be saved into Flash memory.
 - .2 Upon restoration of normal power and after a minimum off-time delay, the controller shall automatically resume full operation without manual intervention through a normal soft-start sequence.
 - .11 Certification – The NAE shall be listed by Underwriters Laboratories (UL).
 - .12 Controller network – The NAE shall support the following communication protocols as a minimum on the controller network:
 - .1 The NAE shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9 on the controller network.
 - .1 The NAE shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
 - .2 The NAE shall be tested and certified as a BACnet Building Controller (B-BC).
 - .3 A BACnet Protocol Implementation Conformance Statement shall be provided for the NAE.
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- .4 The Conformance Statements shall be submitted 10 days prior to bidding.
 - .5 The NAE shall support a minimum of 50 control devices.
 - .2 The NAE shall support LonWorks enabled devices using the Free Topology Transceiver FTT10.
 - .1 All LonWorks controls devices shall be LonMark certified.
 - .2 The NAE shall support a minimum of 64 LonWorks enabled control devices.
 - .5 Network Control Engine (Building Controller Unit (BCU))
 - .1 The Network Control Engine (NCE) shall be a fully user-programmable, supervisory controller. The NCE shall monitor the network of distributed application-specific controllers, provide global strategy and direction, and communicate on a peer-to-peer basis with other Network Control Engines.
 - .2 The Network Control Engine (NCE) shall be a fully user-programmable, digital controller that includes a minimum of 33 I/O points.
 - .3 Automation Network – The NCE shall reside on the automation network and shall support a subnet of 32 Field controllers.
 - .4 User Interface – Each NCE shall have the ability to deliver a web based User Interface (UI) as previously described. All computers connected physically or virtually to the automation network shall have access to the web based UI.
 - .1 The web based UI software shall be imbedded in the NCE. Systems that require a local copy of the system database on the user's personal computer are not acceptable.
 - .2 The NCE shall support a minimum of two (2) concurrent users.
 - .3 The NCE shall have the capability of generating web based UI graphics. The graphics capability shall be imbedded in the NCE.
 - .4 Systems that support UI Graphics from a central database or require the graphics to reside on the user's personal computer are not acceptable.
 - .5 The web based UI shall support the following functions using a standard version of Microsoft Internet Explorer and/or other web browser:
 - .1 Configuration
 - .2 Commissioning
 - .3 Data Archiving
 - .4 Monitoring
 - .5 Commanding
 - .6 System Diagnostics

- .6 Systems that require workstation software or modified web browsers are not acceptable.
- .7 The NCE shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems.
- .5 The NCE shall employ a finite state control engine to eliminate unnecessary conflicts between control functions at crossover points in their operational sequences. Suppliers using non-state based DDC shall provide separate control strategy diagrams for all controlled functions in their submittals.
- .6 The NCE shall be factory programmed with a continuous adaptive tuning algorithm that senses changes in the physical environment and continually adjusts loop tuning parameters appropriately. Controllers that require manual tuning of loops or perform automatic tuning on command only, shall not be acceptable.
- .7 The NCE shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB.
- .8 The NCE shall support the following minimum number and types of inputs and outputs:
 - .1 Ten Universal Inputs - shall be configured to monitor any of the following:
 - .1 Analog Input, Voltage Mode
 - .2 Analog Input, Current Mode
 - .3 Analog Input, Resistive Mode
 - .4 Binary Input, Dry Contact Maintained Mode
 - .5 Binary Input, Pulse Counter Mode
 - .2 Eight Binary Inputs - shall be configured to monitor either of the following:
 - .1 Dry Contact Maintained Mode
 - .2 Pulse Counter Mode
 - .3 Four Analog Outputs - shall be configured to output either of the following
 - .1 Analog Output, Voltage Mode
 - .2 Analog Output, Current Mode
 - .4 Seven Binary Outputs - shall output the following:
 - .1 24 VAC Triac
 - .5 Four Configurable Outputs - shall be configured to output either of the following:
 - .1 Analog Output, Voltage Mode
 - .2 Binary Output, 24 VAC Triac Mode

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- .9 The NCE shall have the ability to monitor and control a network of sensors and actuators over a Sensor-Actuator Bus (SA Bus).
 - .1 The SA Bus shall be a Master-Slave/Token-Passing (MS/TP) Bus supporting BACnet Standard protocol SSPC-135, Clause 9.
 - .2 The SA Bus shall support a minimum of 10 devices.
 - .3 The SA Bus shall operate at a maximum distance of 360 metres between the NCE and the furthest connected device.
 - .10 The NCE shall have the capability to execute complex control sequences involving direct wired I/O points as well as input and output devices communicating over the Field Trunk or the SA Bus.
 - .11 The NCE shall support, but not be limited to, the following applications:
 - .1 Central Equipment including chillers and boilers
 - .2 Lighting and electrical distribution
 - .3 Built-up air handling units for special applications
 - .4 Power generation and energy monitoring equipment
 - .5 Interfaces to security and fire detection systems
 - .12 The NCE shall be microprocessor-based with a minimum word size of 32 bits. The NCE shall be a multi-tasking, multi-user, and real-time digital control processor. Standard operating systems shall be employed. NCE size and capability shall be sufficient to fully meet the requirements of this Specification.
 - .13 The NCE shall employ an industrial single board computer.
 - .14 Each NCE shall have sufficient memory to support its own operating system, databases, and control programs, and to provide supervisory control for all control level devices.
 - .15 The NCE shall include an integrated, hardware-based, real-time clock.
 - .16 The NCE shall employ nonvolatile Flash memory to store all programs and data. The NCE shall employ a data protection battery to save data and power the real time clock when primary power is interrupted.
 - .17 The NCE shall provide removable, color coded, screw terminal blocks for 24 VAC power, communication bus and I/O point field wiring.
 - .18 The NCE shall include troubleshooting LED indicators to identify the following conditions:
 - .1 Power
 - .2 Fault
 - .3 SA Bus
 - .4 FC Bus
 - .5 Battery Fault
-

- .6 Ethernet
 - .7 10 LNK
 - .8 100 LNK
 - .9 Run
 - .10 Peer Com
 - .19 Communications Ports: The NCE shall provide the following ports for operation of operator Input/Output (I/O) devices, such as industry-standard computers, modems, and portable operator's terminals.
 - .1 USB port
 - .2 RS-232 serial data communication port
 - .3 RS-485 port
 - .4 RJ-45 Ethernet port
 - .5 RJ-12 jack
 - .20 Diagnostics: The NCE shall continuously perform self-diagnostics, communication diagnosis, and diagnosis of all panel components. The Network Control Engine shall provide both local and remote annunciation of any detected component failures, low battery conditions, or repeated failures to establish communication.
 - .21 Power Failure: In the event of the loss of normal power, The NCE shall continue to operate for a user adjustable period of up to 10 minutes after which there shall be an orderly shutdown of all programs to prevent the loss of database or operating system software.
 - .1 During a loss of normal power, the control sequences shall go to the normal system shutdown conditions. All critical configuration data shall be saved into Flash memory.
 - .2 Upon restoration of normal power and after a minimum off-time delay, the controller shall automatically resume full operation without manual intervention through a normal soft-start sequence.
 - .22 Certification: The NCE shall be listed by Underwriters Laboratories (UL). UL 916, Energy Management Equipment. FCC Compliant to CFR47, Part 15, Subpart B, Class A
 - .23 Field Controller Bus: The NCE shall support the following communication protocols on the Field Controller Bus:
 - .1 The NCE shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9 on the controller network.
 - .1 The NCE shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
 - .2 The NCE shall be tested and certified as a BACnet Building Controller (B-BC).
-

- .3 A BACnet Protocol Implementation Conformance Statement shall be provided for the NCE.
 - .4 The Conformance Statements shall be submitted 10 days prior to bidding.
 - .5 The NCE shall support a minimum of 32 control devices.
 - .2 The NCE shall support LonWorks enabled devices using the Free Topology Transceiver FTT10 on the Field Controller Bus (LonWorks Network).
 - .1 All LonWorks controls devices shall be LonMark certified.
 - .2 The NCE shall support a minimum of 32 LonWorks enabled control devices.
- .6 DDC System Controllers
 - .1 Advanced Application Field Equipment Controller (FAC) / Equipment Controller Unit (ECU)
 - .1 The Advanced Application Field Equipment Controller (FAC) shall be a fully user-programmable, digital controller that communicates via BACnet MS/TP protocol or optionally via N2Open.
 - .1 The FAC shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9 on the controller network.
 - .1 The FAC shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
 - .2 The FAC shall be tested and certified as a BACnet Application Specific Controller (B-ASC).
 - .3 A BACnet Protocol Implementation Conformance Statement shall be provided for the FAC.
 - .4 The Conformance Statement shall be submitted 10 days prior to bidding.
 - .2 The FAC shall employ a finite state control engine to eliminate unnecessary conflicts between control functions at crossover points in their operational sequences. Suppliers using non-state based DDC shall provide separate control strategy diagrams for all controlled functions in their submittals.
 - .3 Controllers shall be factory programmed with a continuous adaptive tuning algorithm that senses changes in the physical environment and continually adjusts loop tuning parameters appropriately. Controllers that require manual tuning of loops or perform automatic tuning on command only shall not be acceptable. The FAC shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB.

- .4 The FAC shall include an integral real-time clock and support time-based tasks which enables these field controllers to monitor and control:
 - .1 Schedules
 - .2 Calendars
 - .3 Alarms
 - .4 Trends
 - .5 The FAC can continue time-based monitoring when offline for extended periods of time from the system network.
 - .6 The FAC can operate as a stand-alone controller in applications that do not require a networked supervisory device or for network applications where it is preferred to have the scheduling, alarming, and/or trending performed locally in the field controllers.
 - .7 The FAC shall include troubleshooting LED indicators to identify the following conditions:
 - .1 Power On
 - .2 Power Off
 - .3 Download or Startup in progress, not ready for normal operation
 - .4 No Faults
 - .5 Device Fault
 - .6 Field Controller Bus - Normal Data Transmission
 - .7 Field Controller Bus - No Data Transmission
 - .8 Field Controller Bus - No Communication
 - .9 Sensor-Actuator Bus - Normal Data Transmission
 - .10 Sensor-Actuator Bus - No Data Transmission
 - .11 Sensor-Actuator Bus - No Communication
 - .8 The FAC shall accommodate the direct wiring of analog and binary I/O field points.
 - .9 The FAC shall support the following types of inputs and outputs:
 - .1 Universal Inputs - shall be configured to monitor any of the following:
 - .1 Analog Input, Voltage Mode
 - .2 Analog Input, Current Mode
 - .3 Analog Input, Resistive Mode
 - .4 Binary Input, Dry Contact Maintained Mode
 - .5 Binary Input, Pulse Counter Mode
-

- .2 Binary Inputs - shall be configured to monitor either of the following:
 - .1 Dry Contact Maintained Mode
 - .2 Pulse Counter Mode
 - .3 Analog Outputs - shall be configured to output either of the following
 - .1 Analog Output, Voltage Mode
 - .2 Analog Output, Current Mode
 - .4 Binary Outputs - shall output the following:
 - .1 Line-voltage relay outputs
 - .5 24 VAC Triac
 - .6 Configurable Outputs - shall be capable of the following:
 - .1 Analog Output, Voltage Mode
 - .2 Binary Output Mode
 - .10 The FAC shall have the ability to reside on a Field Controller Bus (FC Bus).
 - .1 The FC Bus shall be a Master-Slave/Token-Passing (MS/TP) Bus supporting BACnet Standard protocol SSPC-135, Clause 9.
 - .2 The FC Bus shall support communications between the FACs and the NAE.
 - .3 The FC Bus shall also support Input/Output Module (IOM) communications with the FAC and with the NAE.
 - .4 The FC Bus shall support a minimum of 100 IOMs and FACs in any combination.
 - .5 The FC Bus shall operate at a maximum distance of 4500 metres. between the FAC and the furthest connected device.
 - .11 The FAC shall have the ability to monitor and control a network of sensors and actuators over a Sensor-Actuator Bus (SA Bus).
 - .1 The SA Bus shall be a Master-Slave/Token-Passing (MS/TP) Bus supporting BACnet Standard Protocol SSPC-135, Clause 9.
 - .2 The SA Bus shall support a minimum of 10 devices per trunk.
 - .3 The SA Bus shall operate at a maximum distance of 360 metres. between the FAC and the furthest connected device.
 - .12 The FAC shall have the capability to execute complex control sequences involving direct wired I/O points as well as input and output devices communicating over the FC Bus or the SA Bus.
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- .13 The FAC shall support, but not be limited to, the following applications:
 - .1 Chiller plant applications
 - .2 Heating central plant applications
 - .3 Built-up air handling units for special applications
 - .4 Terminal & package units
 - .5 Special programs as required for systems control
 - .7 Field Equipment Controller (FEC) / Equipment Controller Unit (ECU)
 - .1 The Field Equipment Controller (FEC) shall be a fully user-programmable, digital controller that communicates via BACnet MS/TP protocol or optionally via N2Open.
 - .1 The FEC shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9 on the controller network.
 - .1 The FEC shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
 - .2 The FEC shall be tested and certified as a BACnet Application Specific Controller (B-ASC).
 - .3 A BACnet Protocol Implementation Conformance Statement shall be provided for the FEC.
 - .4 The Conformance Statement shall be submitted 10 days prior to bidding.
 - .2 The FEC shall employ a finite state control engine to eliminate unnecessary conflicts between control functions at crossover points in their operational sequences. Suppliers using non-state based DDC shall provide separate control strategy diagrams for all controlled functions in their submittals.
 - .3 Controllers shall be factory programmed with a continuous adaptive tuning algorithm that senses changes in the physical environment and continually adjusts loop tuning parameters appropriately. Controllers that require manual tuning of loops or perform automatic tuning on command only shall not be acceptable. The FEC shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB.
 - .4 The FEC shall include troubleshooting LED indicators to identify the following conditions:
 - .1 Power On
 - .2 Power Off
 - .3 Download or Startup in progress, not ready for normal operation
 - .4 No Faults
 - .5 Device Fault
 - .6 Field Controller Bus - Normal Data Transmission
-

- .7 Field Controller Bus - No Data Transmission
 - .8 Field Controller Bus - No Communication
 - .9 Sensor-Actuator Bus - Normal Data Transmission
 - .10 Sensor-Actuator Bus - No Data Transmission
 - .11 Sensor-Actuator Bus - No Communication
 - .5 The FEC shall accommodate the direct wiring of analog and binary I/O field points.
 - .6 The FEC shall support the following types of inputs and outputs:
 - .1 Universal Inputs - shall be configured to monitor any of the following:
 - .1 Analog Input, Voltage Mode
 - .2 Analog Input, Current Mode
 - .3 Analog Input, Resistive Mode
 - .4 Binary Input, Dry Contact Maintained Mode
 - .5 Binary Input, Pulse Counter Mode
 - .2 Binary Inputs - shall be configured to monitor either of the following:
 - .1 Dry Contact Maintained Mode
 - .2 Pulse Counter Mode
 - .3 Analog Outputs - shall be configured to output either of the following
 - .1 Analog Output, Voltage Mode
 - .2 Analog Output, current Mode
 - .4 Binary Outputs - shall output the following:
 - .1 24 VAC Triac
 - .5 Configurable Outputs - shall be capable of the following:
 - .1 Analog Output, Voltage Mode
 - .2 Binary Output Mode
 - .7 The FEC shall have the ability to reside on a Field Controller Bus (FC Bus).
 - .1 The FC Bus shall be a Master-Slave/Token-Passing (MS/TP) Bus supporting BACnet Standard protocol SSPC-135, Clause 9.
 - .2 The FC Bus shall support communications between the FECs and the NAE.
 - .3 The FC Bus shall also support Input/Output Module (IOM) communications with the FEC and with the NAE.
-

- .4 The FC Bus shall support a minimum of 100 IOMs and FECs in any combination.
 - .5 The FC Bus shall operate at a maximum distance of 4500 metres between the FEC and the furthest connected device.
 - .8 The FEC shall have the ability to monitor and control a network of sensors and actuators over a Sensor-Actuator Bus (SA Bus).
 - .1 The SA Bus shall be a Master-Slave/Token-Passing (MS/TP) Bus supporting BACnet Standard Protocol SSPC-135, Clause 9.
 - .2 The SA Bus shall support a minimum of 10 devices per trunk.
 - .3 The SA Bus shall operate at a maximum distance of 360 metres between the FEC and the furthest connected device.
 - .9 The FEC shall have the capability to execute complex control sequences involving direct wired I/O points as well as input and output devices communicating over the FC Bus or the SA Bus.
 - .1 The FEC shall support, but not be limited to, the following applications:
 - .1 Built-up air handling units
 - .2 Terminal & package units
 - .3 Special programs as required for systems control
- .8 Field Devices
- .1 Input/Output Module (IOM)
 - .1 The Input/Output Module (IOM) provides additional inputs and outputs for use in the FEC and FAC.
 - .2 The IOM shall communicate with the FEC/FAC over the FC Bus or the SA Bus.
 - .3 The IOM shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9 on the controller network.
 - .1 The IOM shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
 - .2 The IOM shall be tested and certified as a BACnet Application Specific Controller (B-ASC).
 - .3 A BACnet Protocol Implementation Conformance Statement shall be provided for the FEC.
 - .4 The Conformance Statement shall be submitted 10 days prior to bidding.
 - .4 The IOM shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB.
 - .5 The IOM shall have a minimum of 4 points to a maximum of 17 points.

- .6 The IOM shall support the following types of inputs and outputs:
 - .1 Universal inputs shall be configured to monitor any of the following:
 - .1 Analog Input, Voltage Mode
 - .2 Analog Input, Current Mode
 - .3 Analog Input, Resistive Mode
 - .4 Binary Input, Dry Contact Maintained Mode
 - .5 Binary Input, Pulse Counter Mode
 - .2 Binary inputs shall be configured to monitor either of the following:
 - .1 Dry Contact Maintained Mode
 - .2 Pulse Counter Mode
 - .3 Analog outputs shall be configured to output either of the following
 - .1 Analog Output, Voltage Mode
 - .2 Analog Output, current Mode
 - .4 Binary outputs shall output the following:
 - .1 24 VAC Triac
 - .5 Configurable outputs shall be capable of the following:
 - .1 Analog Output, Voltage Mode
 - .2 Binary Output Mode
 - .7 The IOM shall include troubleshooting LED indicators to identify the following conditions:
 - .1 Power On
 - .2 Power Off
 - .3 Download or Startup in progress, not ready for normal operation
 - .4 No Faults
 - .5 Device Fault
 - .6 Normal Data Transmission
 - .7 No Data Transmission
 - .8 No Communication
-

- .2 Networked Thermostat (Type 1)
 - .1 The networked thermostat shall be capable of controlling air handling unit
 - .2 Communicate over the Field Controller Bus using BACnet Standard MS/TP Bus Protocol
 - .3 BACnet Testing Labs (BTL) certified and carry the BTL Label.
 - .4 Support remote read/write and parameter adjustment from the web based User Interfaceable through a Network Automation Engine.
 - .5 Include an intuitive User Interface providing plain text messages.
 - .1 Two line, 8 character backlit display
 - .2 LED indicators for Fan, Heat, and Cool status
 - .3 Five (5) User Interface Keys
 - .1 Mode
 - .2 Fan
 - .3 Override
 - .4 Degrees C/F
 - .5 Up/Down
 - .4 The display shall continuously scroll through the following parameters:
 - .1 Room Temperature
 - .2 System Mode
 - .3 Schedule Status – Occupied/Unoccupied/Override
 - .4 Applicable Alarms
 - .6 The Networked Thermostat shall provide the flexibility to support any one of the following inputs:
 - .1 Integral Indoor Air Temperature Sensor
 - .2 Duct Mount Air Temperature Sensor
 - .3 Remote Indoor Air Temperature Sensor with Occupancy Override and LED Indicator
 - .4 Two configurable binary inputs
 - .7 The Networked Thermostat shall provide the flexibility to support any one of the following outputs:
 - .1 Fan Speed
 - .2 Two On/Off
-

- .3 Two Floating
 - .4 Two Proportional (0 to 10V)
 - .8 The Networked Thermostat shall provide a minimum of six levels of keypad lockout.
 - .9 The Networked Thermostat shall provide the flexibility to adjust the following parameters:
 - .1 Adjustable temporary occupancy from 0 to 24 hours
 - .2 Adjustable heating/cooling deadband from 0.5°C to 1.5°C (1°F to 3°F)
 - .3 Adjustable heating/cooling cycles per hour from 4 to 8
 - .10 The Networked Thermostat shall employ nonvolatile electrically erasable programmable read-only memory (EEPROM) for all adjustable parameters.
 - .3 Networked Thermostat (Type 2)
 - .1 The Networked Thermostat shall be capable of controlling a pressure dependent Variable Air Volume System or other similar zoning type systems employing reheat including local hydronic reheat valves.
 - .2 Communicate over the FC Bus using BACnet Standard protocol.
 - .3 The TEC shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
 - .4 Capable of remote read/write and parameter adjustment from the web based User Interface (UI) through an NAE.
 - .5 The Networked Thermostat shall include an intuitive UI providing plain text messages.
 - .1 Two line, eight character backlit display
 - .2 LED indicators for Heating, and cooling status
 - .3 Three User Interface Keys
 - .1 Override
 - .2 Up
 - .3 Down
 - .6 The display shall continuously scroll through the following parameters:
 - .1 Room Temperature
 - .2 System Mode
 - .3 Schedule Status – Occupied/Unoccupied/Override
 - .4 Applicable Alarms
-

- .7 The Networked Thermostat shall provide the flexibility to support any one of the following inputs:
 - .1 Integral Indoor Air Temperature Sensor
 - .2 Duct Mount Air Temperature Sensor
 - .3 Remote Indoor Air Temperature Sensor with Occupancy Override and LED Indicator
 - .8 Two configurable binary inputs
 - .9 The Networked Thermostat shall provide the flexibility to support either of the following outputs:
 - .1 Two On/Off or Floating
 - .2 Two Proportional (0 to 10V)
 - .10 The Networked Thermostat shall provide a minimum of six (6) levels of keypad lockout.
 - .11 The Networked Thermostat shall provide the flexibility to adjust the following parameters:
 - .1 Adjustable Temporary Occupancy from 0 to 24 hours
 - .2 Adjustable heating/cooling deadband from 1°C to 3°C (2°F to 5°F)
 - .3 Adjustable heating/cooling cycles per hour from 4 to 8
 - .12 The Networked Thermostat shall employ nonvolatile electrically erasable programmable read-only memory (EEPROM) for all adjustable parameters.
 - .4 VAV Modular Assembly (VMA)
 - .1 The VAV Modular Assembly shall provide both standalone and networked direct digital control of pressure-independent, variable air volume terminal units. It shall address both single and dual duct applications.
 - .2 The VMA shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
 - .3 The VAV Modular Assembly shall communicate over the FC Bus using BACnet Standard protocol.
 - .4 The VAV Modular Assembly shall have internal electrical isolation for AC power, DC inputs, and MS/TP communications. An externally mounted isolation transformer shall not be acceptable.
 - .5 The VAV Modular Assembly shall be a configurable digital controller with integral differential pressure transducer and damper actuator. All components shall be connected and mounted as a single assembly that can be removed as one piece.
-

- .6 The VAV Modular Assembly shall be assembled in a plenum-rated housing.
 - .7 The integral damper actuator shall be a fast response stepper motor capable of stroking 90 degrees in 60 seconds for quick damper positioning to speed commissioning and troubleshooting tasks.
 - .8 The controller shall determine airflow by a state-of-the-art digital non-flow pressure sensor to provide 14-bit resolution with bidirectional flow operation that supports automatic correction for polarity on high- and low-pressure DP tube connections; this pressure sensor eliminates high- and low-pressure connection mistakes.
 - .9 Each controller shall have the ability to automatically calibrate the flow sensor to eliminate pressure transducer offset error due to ambient temperature / humidity effects.
 - .10 The controller shall utilize a proportional plus integration (PI) algorithm for the space temperature control loops.
 - .11 Each controller shall continuously, adaptively tune the control algorithms to improve control and controller reliability through reduced actuator duty cycle.
 - .12 The controller shall provide the ability to download and upload VMA configuration files, both locally and via the communications network. Controllers shall be able to be loaded individually or as a group using a zone schedule generated spreadsheet of controller parameters.
 - .13 Control setpoint changes initiated over the network shall be written to VMA non-volatile memory to prevent loss of setpoint changes and to provide consistent operation in the event of communication failure.
 - .14 The controller firmware shall be flash-upgradeable remotely via the communications bus to minimize costs of feature enhancements.
 - .15 The controller shall provide fail-soft operation if the airflow signal becomes unreliable, by automatically reverting to a pressure-dependent control mode.
 - .16 The controller shall interface with balancer tools that allow automatic recalculation of box flow pickup gain ("K" factor), and the ability to directly command the airflow control loop to the box minimum and maximum airflow setpoints.
 - .17 Controller performance shall be self-documenting via on-board diagnostics. These diagnostics shall consist of control loop performance measurements executing at each control loop's sample interval, which may be used to continuously monitor and document system performance. The VMA shall calculate exponentially weighted moving averages (EWMA) for each of the following. These metrics shall be available to the end user for efficient management of the VAV terminals.
 - .1 Absolute temperature loop error
 - .2 Signed temperature loop error
-

- .3 Absolute airflow loop error
 - .4 Signed airflow loop error
 - .5 Average damper actuator duty cycle
 - .18 The controller shall detect system error conditions to assist in managing the VAV zones. The error conditions shall consist of:
 - .1 Unreliable space temperature sensor
 - .2 Unreliable differential pressure sensor
 - .3 Starved box
 - .4 Actuator stall
 - .5 Insufficient cooling
 - .6 Insufficient heating
 - .19 The controller shall provide a flow test function to view damper position vs. flow in a graphical format. The information would alert the user to check damper position. The VMA shall also provide a method to calculate actuator duty cycle as an indicator of damper actuator runtime.
 - .20 The controller shall provide a compliant interface for ASHRAE Standard 62.1 (indoor air quality), and shall be capable of resetting the box minimum airflow based on the percent of outdoor air in the primary air stream.
 - .21 The controller shall comply with ASHRAE Standard 90.1 (energy efficiency) by preventing simultaneous heating and cooling, and where the control strategy requires reset of airflow while in reheat, by modulating the box reheat device fully open prior to increasing the airflow in the heating sequence.
 - .22 Inputs:
 - .1 Analog inputs with user defined ranges shall monitor the following analog signals, without the addition of equipment outside the terminal controller cabinet:
 - .1 0-10 VDC Sensors
 - .2 1000ohm RTDs
 - .3 NTC Thermistors
 - .2 Binary inputs shall monitor dry contact closures. Input shall provide filtering to eliminate false signals resulting from input "bouncing."
 - .3 For noise immunity, the inputs shall be internally isolated from power, communications, and output circuits.
 - .4 Provide side loop application for humidity control.
-

- .23 Outputs
 - .1 Analog outputs shall provide the following control outputs:
 - .1 0-10 VDC
 - .2 Binary outputs shall provide a SPST Triac output rated for 500mA at 24 VAC.
 - .3 For noise immunity, the outputs shall be internally isolated from power, communications, and other output circuits.
 - .24 Application Configuration
 - .1 The VAV Modular Assembly shall be configured with a software tool that provides a simple Question/Answer format for developing applications and downloading.
 - .25 Sensor Support
 - .1 The VAV Modular Assembly shall communicate over the Sensor-Actuator Bus (SA Bus) with a Network Sensor.
 - .2 The VMA shall support an LCD display room sensor.
 - .3 The VMA shall also support standard room sensors as defined by analog input requirements.
 - .4 The VMA shall support humidity sensors defined by the AI side loop.
 - .5 Network Sensors (NS)
 - .1 The Network Sensors (NS) shall have the ability to monitor the following variables as required by the systems sequence of operations:
 - .1 Zone Temperature
 - .2 Zone Humidity
 - .3 Zone Setpoint
 - .4 Discharge Air Temperature
 - .5 Zone CO2
 - .2 The NS shall transmit the information back to the controller using BACnet Standard protocol.
 - .3 The NS shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
 - .4 The Network Zone Sensors shall include the following items:
 - .1 A backlit Liquid Crystal Display (LCD) to indicate the Temperature, Humidity and Setpoint (if indicated on drawings)
 - .2 An LED to indicate the status of the Override feature
-

- .3 A button to toggle the temperature display between Fahrenheit and Celsius
- .4 A button to program the display for temperature or humidity
- .5 A button to initiate a timed override command
- .6 Available in either surface mount, wall mount, or flush mount
- .7 Available with either screw terminals or phone jack
- .5 The Network Discharge Air Sensors shall include the following:
 - .1 4 inch or 8 inch duct insertion probe
 - .2 10 foot pigtail lead
 - .3 Dip Switches for programmable address selection
 - .4 Ability to provide an averaging temperature from multiple locations
 - .5 Ability to provide a selectable temperature from multiple locations
- .6 The Network CO2 Zone Sensors shall include the following:
 - .1 Available in either surface mount or wall mount
 - .2 Available with screw terminals or phone jack
 - .3 in NEMA 1 plastic housings.

2.4 **SENSORS AND TRANSMITTERS**

- .1 General Requirements
 - .1 Installation, testing, and calibration of all sensors, transmitters, and other input devices shall be provided to meet the system requirements.
 - .2 Acceptable manufacturers:
 - .1 Johnson Control Inc
 - .2 Honeywell
 - .3 Automated Logic
 - .2 Temperature Sensors
 - .1 General Requirements:
 - .1 Sensors and transmitters shall be provided, as outlined in the input/output summary and sequence of operations.
 - .2 The temperature sensor shall be of the resistance type, and shall be either two-wire 1000 ohm nickel RTD, or two-wire 1000 ohm platinum RTD.
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- .3 The following point types (and the accuracy of each) are required, and their associated accuracy values include errors associated with the sensor, lead wire, and A to D conversion:

Point Type	Accuracy
Room Temp	$\pm 0.3^{\circ}\text{C}$.
Duct Temperature	$\pm 0.3^{\circ}\text{C}$.
All Others	$\pm 0.5^{\circ}\text{C}$.

.2 Room Temperature Sensors

- .1 Room sensors shall be constructed for either surface or wall box mounting.

- .2 Room sensors shall have the following options when specified:

- .1 Setpoint warmer/cooler dial or reset slide switch providing a $\pm 1^{\circ}\text{C}$ (adjustable) range.
- .2 Individual heating/cooling setpoint switches.
- .3 A momentary override request push button for activation of after-hours operation.
- .4 Analog thermometer.

.3 Room Temperature Sensors with Integral Display

- .1 Room sensors shall be constructed for either surface or wall box mounting.

- .2 Room sensors shall have an integral LCD display and four button keypad with the following capabilities:

- .1 Display room air temperatures.
- .2 Display and adjust room comfort setpoint.
- .3 Display and adjust fan operation status.
- .4 Timed override request push button with LED status for activation of after-hours operation.
- .5 Display controller mode.
- .6 Password selectable adjustment of setpoint and override modes.

.4 Thermowells

- .1 Thermowell manufacturer shall have models available in stainless steel, brass body, and copper bulb.
 - .2 When thermowells are required, the sensor and well shall be supplied as a complete assembly, including wellhead and sensor.
 - .3 Thermowells shall be pressure rated and constructed in accordance with the system working pressure.
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- .4 Thermowells and sensors shall be mounted in a direct mount (no adapter) offering faster installation or 1/2" NPT saddle and allow easy access to the sensor for repair or replacement.
 - .5 Thermowells constructed of 316 stainless steel shall comply with Canadian Registration Number (CRN) pressure vessel rating.
 - .5 Outside Air Sensors
 - .1 Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall also be provided with a solar shield.
 - .2 Sensors exposed to wind velocity pressures shall be shielded by a perforated plate that surrounds the sensor element.
 - .3 Temperature transmitters shall be of NEMA 3R or NEMA 4 construction and rated for ambient temperatures.
 - .4 The outdoor sensor shall be easily mounted on a roof, pole or side of a building utilizing its already assembled mounting bracket.
 - .5 Outside Relative Humidity sensors 0-100% full range of accurate measurement. Operating temperature -20 to 60°C (-4 to 140°F).
 - .6 Outside temperature sensors operating temperature range is -40 to 60°C (-40 to 140°F), +/- 0.3°C (+/- 0.5°F).
 - .6 Duct Mount Sensors
 - .1 Duct mount sensors shall mount in an electrical box through a hole in the duct, and be positioned so as to be easily accessible for repair or replacement.
 - .2 Duct sensors shall be insertion type and constructed as a complete assembly, including lock nut and mounting plate.
 - .3 For outdoor air duct applications, a weatherproof mounting box with weatherproof cover and gasket shall be used.
 - .7 Averaging Sensors
 - .1 For ductwork greater in any dimension than 1200 mm and/or where air temperature stratification exists, an averaging sensor with multiple sensing points shall be used.
 - .2 For plenum applications, such as mixed air temperature measurements, a continuous averaging sensor or a string of sensors mounted across the plenum shall be used to account for stratification and/or air turbulence. The averaging string shall have a minimum of 4 sensing points per 3000 mm long segment.
 - .3 Capillary supports at the sides of the duct shall be provided to support the sensing string.
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.3 Humidity Sensors

- .1 The sensor shall be a solid-state type, relative humidity sensor of the Thin Film Capacitance or Bulk Polymer Design. The sensor element shall resist service contamination.
- .2 The humidity transmitter shall be equipped with non-interactive span and zero adjustments, a 2-wire isolated loop powered, 4-20 mA, 0-100% linear proportional output.
- .3 The humidity transmitter shall meet the following overall accuracy, including lead loss and Analog to Digital conversion. 3% between 20% and 80% RH @ 25°C unless specified elsewhere.
- .4 Outside air relative humidity sensors shall be installed with a rain proof, perforated cover. The transmitter shall be installed in a NEMA 3R or NEMA 4 enclosure with sealtite fittings.
- .5 A single point humidity calibrator shall be provided, if required, for field calibration. Transmitters shall be shipped factory pre-calibrated.
- .6 Duct type sensing probes shall be constructed of 304 stainless steel, and shall be equipped with a neoprene grommet, bushings, and a mounting bracket.

.4 Differential Pressure Transmitters

- .1 General Air and Water Pressure Transmitter Requirements:
 - .1 Pressure transmitters shall be constructed to withstand 100% pressure over-range without damage, and to hold calibrated accuracy when subject to a momentary 40% over-range input.
 - .2 Pressure transmitters shall transmit a 0 to 5 VDC, 0 to 10 VDC, or 4 to 20 mA output signal.
 - .3 Differential pressure transmitters used for flow measurement shall be sized to the flow sensing device, and shall be supplied with Tee fittings and shut-off valves in the high and low sensing pick-up lines to allow the balancing Contractor and Owner permanent, easy-to-use connection.
 - .4 A minimum of a NEMA 1 housing shall be provided for the transmitter. Transmitters shall be located in accessible local control panels wherever possible.
- .2 Building Differential Air Pressure Applications (-250 Pa to +250 Pa)
 - .1 The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points.
 - .2 The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
 - .1 -250 Pa to +250 Pa input differential pressure ranges.
 - .2 4-20 mA output.

- .3 Maintain accuracy up to 20 to 1 ratio turndown.
 - .4 Reference Accuracy: +0.2% of full span.
 - .3 Low Differential Air Pressure Applications (0 to 625 Pa)
 - .1 The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points.
 - .2 The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
 - .1 0 to 500 Pa input differential pressure ranges.
 - .2 4-20 mA, 0-5 VDC, 0-10 VDC, output.
 - .3 Maintain accuracy up to 20 to 1 ratio turndown.
 - .4 Reference Accuracy: +0.25%, or 0.5% of full span.
 - .5 Power Monitoring Devices
 - .1 Current Measurement (Amps)
 - .1 Current measurement shall be by a combination current transformer and a current transducer. The current transformer shall be sized to reduce the full amperage of the monitored circuit to a maximum 5 Amp signal, which will be converted to a 4-20 mA DDC compatible signal for use by the Facility Management System.
 - .2 Current Transformer: A split core current transformer shall be provided to monitor motor amps.
 - .1 Operating frequency – 50 - 400 Hz.
 - .2 Insulation – 0.6 Kv class 10Kv BIL.
 - .3 UL recognized.
 - .4 Five amp secondary.
 - .5 Select current ration as appropriate for application.
 - .6 Acceptable manufacturers: Setra
 - .3 Current Transducer: A current to voltage or current to mA transducer shall be provided. The current transducer shall include:
 - .1 6X input over amp rating for AC inrushes of up to 120 amps.
 - .2 Manufactured to UL 1244.
 - .3 Accuracy: +.5%, Ripple +1%.
 - .4 Minimum load resistance 30kOhm.
 - .5 Input 0-20 Amps.
-

- .6 Output 4-20 mA.
- .7 Transducer shall be powered by a 24VDC regulated power supply (24 VDC +5%).
- .8 Acceptable manufacturers: Setra

.6 Smoke Detectors

- .1 Ionization type air duct detectors shall be furnished as specified elsewhere in Division 26 for installation under Division 23. All wiring for air duct detectors shall be provided under Division 28, Fire Alarm System.

.7 Status and Safety Switches

.1 General Requirements

- .1 Switches shall be provided to monitor equipment status, safety conditions, and generate alarms at the BMS when a failure or abnormal condition occurs. Safety switches shall be provided with two sets of contacts and shall be interlock wired to shut down respective equipment.
- .2 Acceptable manufacturers:
 - .1 Johnson Control Inc
 - .2 Honeywell
 - .3 Automated Logic

.2 Current Sensing Switches

- .1 The current sensing switch shall be self-powered with solid-state circuitry and a dry contact output. It shall consist of a current transformer, a solid state current sensing circuit, adjustable trip point, solid state switch, SPDT relay, and an LED indicating the on or off status. A conductor of the load shall be passed through the window of the device. It shall accept over-current up to twice its trip point range.
- .2 Current sensing switches shall be used for run status for fans, pumps, and other miscellaneous motor loads.
- .3 Current sensing switches shall be calibrated to show a positive run status only when the motor is operating under load. A motor running with a broken belt or coupling shall indicate a negative run status.

.3 Air Filter Status Switches

- .1 Differential pressure switches used to monitor air filter status shall be of the automatic reset type with SPDT contacts rated for 2 amps at 120VAC.
 - .2 A complete installation kit shall be provided, including: static pressure taps, tubing, fittings, and air filters.
 - .3 Provide appropriate scale range and differential adjustment for intended service.
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- .4 Air Flow Switches
 - .1 Differential pressure flow switches shall be bellows actuated mercury switches or snap acting micro-switches with appropriate scale range and differential adjustment for intended service.
 - .5 Air Pressure Safety Switches
 - .1 Air pressure safety switches shall be of the manual reset type with SPDT contacts rated for 2 amps at 120VAC.
 - .2 Pressure range shall be adjustable with appropriate scale range and differential adjustment for intended service.
 - .6 Low and High Temperature Limit Switches
 - .1 The low temperature limit switch shall be of the manual reset type with Double Pole/Single Throw snap acting contacts rated for 16 amps at 120VAC.
 - .2 The sensing element shall be a minimum of 4.5 metres in length and shall react to the coldest or hottest section. Element shall be mounted horizontally across duct in accordance with manufacturers recommended installation procedures.
 - .3 For large duct areas where the sensing element does not provide full coverage of the air stream, additional switches shall be provided as required to provide full protection of the air stream.
 - .4 Acceptable manufacturers:
 - .1 Johnson Controls Ltd.
 - .2 Honeywell
 - .3 Automated Logic
 - .8 Control Relays
 - .1 Control Pilot Relays
 - .1 Control pilot relays shall be of a modular plug-in design with retaining springs or clips.
 - .2 Mounting Bases shall be snap-mount.
 - .3 DPDT, 3PDT, or 4PDT relays shall be provided, as appropriate for application.
 - .4 Contacts shall be rated for 10 amps at 120VAC.
 - .5 Relays shall have an integral indicator light and check button.
 - .9 Electronic Signal Isolation Transducers
 - .1 A signal isolation transducer shall be provided whenever an analog output signal from the BMS is to be connected to an external control system as an input (such as a chiller control panel), or is to receive as an input signal from a remote system.
-

- .2 The signal isolation transducer shall provide ground plane isolation between systems.
- .3 Signals shall provide optical isolation between systems.
- .4 Acceptable manufacturers: Advanced Control Technologies

.10 Thermostats

- .1 Electric room thermostats of the heavy-duty type shall be provided for electric heaters. All these items shall be provided with concealed adjustment. Finish of covers for all room-type instruments shall match and, unless otherwise indicated or specified, covers shall be manufacturer's standard finish.

2.5 CONTROL AIR DAMPERS

.1 Type

- .1 Modulating control dampers
 - .1 Opposed blades
- .2 Two position control dampers
 - .1 Parallel blades

.2 Construction

- .1 Bearings
 - .1 Thermal plastic resin copolymer, nylon or impregnated bronze
 - .2 At blade axles, linkage devices, etc.
 - .2 Damper blades and frames
 - .1 Extruded aluminum
 - .2 Maximum blade length: 1.2 m without internal frame support
 - .3 Blade edge seals: EPDM gaskets
 - .4 Frame side seals: extruded TPE
 - .5 Frame style: flanged to duct
 - .6 Jack shaft: extendable, combination of aluminum and zinc/nickel coated steel
 - .7 Damper leakage: 50 L/s per m² damper face area at 1 kPa differential static pressure
 - .3 Damper blades for outside air applications
 - .1 As above
 - .2 Operating temperature: -40°C to 100°C
 - .3 Thermally broken and insulated blades; expanded polyurethane foam insulation
-

.4 Damper leakage: 21 L/s per m² damper face area at 1 kPa differential static pressure

.4 Acceptable manufacturer:

.1 Tamco – Series 1000

.2 Tamco – Series 9000 (outside air applications)

.3 Nailor

.4 Ruskin

.5 Alumavent

2.6 **VALVE AND DAMPER OPERATORS**

.1 General

.1 Provide valves and dampers with metal body operators sized to assure smooth, positive operation over the entire operating range, without chatter or slamming, and to give tight shutoff at end positions against the system pressures to be encountered.

.2 Failure position:

.1 Spring return, normally open or normally closed sequence as required so that systems will "Fail-safe" in case of control air pressure or power failure.

.2 On 2-way butterfly valves, Provide double acting or reversible actuators.

.3 Sequencing by spring range will not be approved for valves or dampers.

.4 Furnish valves and dampers with operators and spring ranges designed to match as linearly as possible the full scale operating range of the control valve.

.5 Adequately size operators and in sufficient quantity to ensure smooth damper operation.

.2 Selection

.1 Indoor

.1 Electric

.2 Outdoor

.1 Electric

.3 Ancillary devices

.1 End switches as detailed

.2 Pilot positioner relays

.3 Interconnection piping

.3 Electronic Actuators

.1 General

- .1 Low torque, fully modulating or two position as indicated.
- .2 Time for full open to full close: two minutes nominal
- .3 Current limiting, digital motor rotation sensing circuits, or adjustable end of travel switches to provide motor protection.
- .4 Tandem mounting of actuators for higher torque requirements are acceptable.
- .5 Spring return with manual override unless otherwise indicated or specified.
- .6 On loss of control signal, valve will fail to the designated normally open or closed position.

.2 Terminal equipment

- .1 Non-spring return type

.3 Power and communications

- .1 Positive positioning at 2-10 VDC or 4-20 mA signal
- .2 Visual position indicator
- .3 Built-in rotation reversing switch
- .4 Actuator generated 2-10 VDC electronic feedback signal
- .5 Capacity to add auxiliary switches when required
- .6 Power: 24 VAC or VDC for proportional control, 24 or 120 VAC for 2 position, maximum 15 VA.

2.7 **GAS DETECTION SYSTEM**

.1 Gas Detection Control panel

- .1 CSA approved
 - .2 Microprocessor based central gas detection system control to provide gas detection and control functionality as described herein, in the controls sequences, and as shown on the drawings.
 - .3 Capable of communication with gas detection sensors through -485 communications bus.
 - .4 Capable of activating up to 32 separate relay modules.
 - .5 Capable of communication with a separate annunciator panel.
 - .6 Control panel shall include a backlit, alphanumeric, LCD to indicate the detected levels for each sensor.
-

- .7 The control panel shall include separate LED indication as follows:
 - .1 Green LED: Normal operation
 - .2 Red LED: Alarm (level 1 and 2)
 - .3 Amber/Yellow LED: Sensor or control failure.
 - .8 Integrated 65 dBA alarm.
 - .9 Manufacturers
 - .1 Vulcain / Honeywell
 - .2 MSA
 - .3 Critical Environment Technologies Canada
 - .2 Gas Detection Sensors - general
 - .1 Standalone gas detection transmitter with 120/24 built-in step down transformer, remote gas sensor.
 - .2 NEMA 4X or approved equivalent enclosure.
 - .3 Capable of activating up to 32 separate relay modules.
 - .4 Capable of communication with a separate annunciator panel.
 - .5 Control panel shall include a backlit, alphanumeric, LCD to indicate the detected levels for each sensor.
 - .6 Transmitter
 - .1 Remote electrochemical cell for monitoring listed gas as per Drawings.
 - .2 Complete with local LED indication for high and low alarm as well as a green LED power "ON" light
 - .3 Power: 24 VDC
 - .4 Replaceable gas cartridge with smart sensor capable of self-testing.
 - .5 Accuracy: $\pm 3\%$
 - .6 Capable of operating within 5-95% RH and -20°C to 40°C
 - .7 Factory calibrated and certified without the requirement for Site calibration.
 - .8 On-board audible alarm with 85 dBA at 3 metres.
 - .9 LCD display to provide local gas concentration reading.
 - .10 Sufficient relays to activate exhaust fans.
 - .11 Minimum three (3) relays.
 - .7 Location: The Drawings indicate approximate quantity and layout of sensors. The detector manufacturer shall review the application and locations and revise
-

- as necessary. The Contractor shall allow for a minimum of five more detectors than shown on Drawings.
- .8 System supplier to provide site inspection, operating and maintenance instructions and a trained technician to perform system start-up and calibration checks.
 - .9 Manufacturer
 - .1 Vulcain (Honeywell)
 - .2 MSA
 - .3 Critical Environment Technologies Canada
 - .10 Sequence of Operation
 - .1 Refer to Drawings.
 - .2 At low level alarm, low alarm LED lights on. Low level alarm remains until gas concentration level below first alarm set point.
 - .3 At high level alarm, high alarm LED lights on and audible alarm horn activates.
 - .4 Alarm setting: refer to drawings
 - .3 CO Detectors
 - .1 Carbon monoxide (CO) sensors
 - .2 Powered from separate 120V power supply
 - .3 Capable of communicating with a central gas detection system control panel from the same manufacturer as the sensors.
 - .4 Location: The drawings indicate approximate quantity and layout of sensors. The detector manufacturer shall review the application and layout and revise as necessary to suit the detector supplied. The Contractor shall allow for a minimum of five more detectors than shown on the drawings.
 - .5 Measuring range: 0 - 250 PPM.
 - .6 Alarm setting range: 0 - 250 PPM.
 - .7 System performance: Repeatability: +/-1.0% full scale. Accuracy: +/- 5% full scale
 - .8 Outputs: 4 - 20mA, linear
 - .9 Power input: 24 VAC, 60 Hz, 200 VA Max.
 - .10 Sensor enclosure: Heavy duty aluminum.
 - .11 Sensor life: Sensors shall be warranted to have a minimum useful life of one year.
 - .12 Sensor distance: Maximum distance from sensor to controller shall be 610 m.
-

- .13 Sensors in wash areas shall be complete with splash guards. Sensors in truss space complete with remote sensing and remote calibration.
 - .14 Manufacturer:
 - .1 Vulcain (Honeywell)
 - .2 MSA Instrument Div.
 - .3 Critical Environment Technologies Canada
 - .4 CO₂ Detectors
 - .1 Carbon dioxide (CO₂) sensors.
 - .2 Simultaneously monitor the temperature (either in Celsius or Fahrenheit) and the relative humidity in addition to carbon dioxide
 - .3 Powered from separate 24 V power supply. Provide 120/24 low voltage control transformer mounted adjacent to sensor.
 - .4 Capable of communicating with a central gas detection system control panel from the same manufacturer as the sensors.
 - .5 The detection unit, digital version, shall be able to communicate with a BAS using a BACnet MS/TP.
 - .6 Location: The drawings indicate approximate quantity and layout of sensors. The detector manufacturer shall review the application and layout and revise as necessary to suit the detector supplied. The contractor shall allow for a minimum of five more detectors than shown on the drawings.
 - .7 Measuring range: 0 – 2000 ppm. Response time of less than 60 seconds (adjustable).
 - .8 Alarm setting range: 1200 ppm alarm.
 - .9 System performance: Repeatability: +/-1.0% full scale. Accuracy: +/- 5% full scale
 - .10 Outputs: 4 - 20mA, linear
 - .11 Power input: 24 VAC, 60 Hz, 200 VA Max.
 - .12 Graphic LCD 122 x 32 displays and programmable by three buttons in the front panel
 - .13 Sensor enclosure: Heavy duty aluminum.
 - .14 Sensor life: Sensors shall be warranted to have a minimum useful life of one year.
 - .15 Sensor distance: Maximum distance from sensor to controller shall be 600 m.
 - .16 Wall mounted where shown on the drawings
 - .17 Manufacturer:
 - .1 Vulcain (Honeywell)
-

- .2 MSA Instrument Div.
 - .3 Critical Environment Technologies Canada.
 - .5 NO₂ Detectors
 - .1 Nitrogen oxide (NO₂) sensors
 - .2 Powered from separate 120V power supply
 - .3 Capable of communicating with a central gas detection system control panel from the same manufacturer as the sensors.
 - .4 Location: The drawings indicate approximate quantity and layout of sensors. The detector manufacturer shall review the application and layout and revise as necessary to suit the detector supplied. The Contractor shall allow for a minimum of five more detectors than shown on the drawings.
 - .5 Measuring range: 0 - 10 PPM.
 - .6 Alarm setting range: 0 - 10 PPM.
 - .7 System performance: Repeatability: +/-1.0% full scale. Accuracy: +/- 5% full scale.
 - .8 Outputs: 4 - 20mA, linear.
 - .9 Power input: 24 VAC, 60 Hz., 200 VA Max.
 - .10 Sensor enclosure: Heavy duty aluminum.
 - .11 Sensor life: Sensors shall be warranted to have a minimum useful life of one year.
 - .12 Sensor distance: Maximum distance from sensor to controller shall be 610 m.
 - .13 Sensors in wash areas shall be complete with splash guards. Sensors in truss space complete with remote sensing and remote calibration.
 - .14 Manufacturer:
 - .1 Vulcain (Honeywell)
 - .2 MSA Instrument Div.
 - .3 Critical Environment Technologies Canada
 - .6 VOC Detectors
 - .1 Volatile Organic Compound (VOC) sensors
 - .2 Powered from separate 24 V power supply
 - .3 Capable of communicating with a central gas detection system control panel from the same manufacturer as the sensors.
-

- .4 Location: The drawings indicate approximate quantity and layout of sensors. The detector manufacturer shall review the application and layout and revise as necessary to suit the detector supplied. The Contractor shall allow for a minimum of five more detectors than shown on the drawings.
- .5 Measuring range: 0 – 100% LEL.
- .6 Alarm setting range: 25% LEL first alarm, second alarm 50% LEL.
- .7 System performance: Repeatability: +/-1.0% full scale. Accuracy: +/- 5% full scale
- .8 Outputs: 4 - 20mA, linear
- .9 Power input: 24 VAC, 60 Hz, 200 VA Max.
- .10 Sensor enclosure: Heavy duty aluminum.
- .11 Sensor life: Sensors shall be warranted to have a minimum useful life of one year.
- .12 Sensor distance: Maximum distance from sensor to controller shall be 610 m.
- .13 Manufacturer:
 - .1 Vulcain (Honeywell)
 - .2 MSA Instrument Div.
 - .3 Critical Environment Technologies Canada.

2.8 **EQUIPMENT SUPPORTS**

- .1 Support Frames: galvanized modular framing system: Unistrut.
- .2 Backboards: 20 mm fire rated plywood.

3 **Execution**

3.1 **EXAMINATION**

- .1 Thoroughly examine the design documentation for control devices and equipment. Notify the Consultant of any discrepancies, conflicts or omissions prior to commencement of rough-in work.

3.2 **INSTALLATION**

- .1 Execute work in accordance with requirements specified in the various sections of Division 25, and where referenced to other divisions.
 - .2 Lay out the work so that it does not interfere with Work under other divisions of Specifications.
 - .3 Make good any damage to Owner's property or other trade's work caused by improperly locating or carrying out of work.
 - .4 Location of pipes, ductwork, raceways and equipment may be altered without extra cost provided alteration is made before installation.
-

3.3 PROTECTION

- .1 Protect work and materials before, during and after erection from weather and other hazards and keep in a clean and orderly manner.
- .2 Protect pipe ends, valves and parts of equipment left unconnected to prevent damage or intrusion of foreign matter. Provide pipe caps for threaded male connections and plugs for threaded female connections.

3.4 PAINTING

- .1 With the exception of prime painting of miscellaneous steel or any other specific requirements as specified under the respective sections of this Work, or equipment otherwise factory painted, all painting will be provided under Division 09.
- .2 Field Prime Painting
 - .1 Mechanical rooms, boiler rooms, fan rooms, crawl spaces, pipe tunnels and penthouses; paint exposed galvanized metal surfaces with one coat of zinc dust galvanized primer and one coat of 100% alkyd base enamel.
 - .2 Clean rust and oil from exposed iron and steel work provided under this division whether or not it has been factory prime painted. Paint this equipment with one coat of chrome oxide phenolic base primer and one coat of 100% alkyd base enamel in an approved colour.

3.5 CONSTRUCTION REVIEW

- .1 The construction review will include milestone and periodic reviews.
 - .2 Milestone Reviews
 - .1 Specific milestone reviews will be performed by the Consultant for compliance with the Ontario Building Code, including any or all of the following:
 - .1 Equipment Demonstration and Training
 - .2 Substantial Performance and Deficiency Review
 - .3 Total Performance
 - .2 Some or all of these reviews are of portions of the Work which may be concealed. If Work is enclosed before the Consultant can review the installation, the Consultant may direct the Contractor to expose the Work for it to be examined, at no additional cost to the project including rework affecting other Trades.
 - .3 If deficiencies are noted during any review where work will be enclosed, correct noted deficiencies and have them reviewed by the Consultant prior to the Work being enclosed.
 - .4 Provide a minimum of seven (7) calendar days' written notice to the Consultant when requesting each review date.
 - .5 The Consultant will provide a checklist to the Contractor of required milestone reviews which must be completed. Maintain this list on site along with identified test reports, and make available for Consultant's review when requested. When
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completed, include this checklist form with the Test Reports forms specified in this Division.

.3 Periodic Reviews

- .1 The Consultant will conduct periodic reviews, as required for the project. These reviews are for the benefit of the Owner to describe the progress and workmanship of the Work, and are not intended as any form of quality assurance for the Contractor.
- .2 Deficiencies will generally not be reported as part of this review, as the work has not been reported by the Contractor as being complete. However, deficiencies may be reported where it may not be possible to correct the work at a later date, or at a great expense.
- .3 The Contractor shall not rely on these Periodic Reviews to identify deficiencies during the progress of the Work.

.4 Deficiency Review

- .1 The Consultant will conduct a deficiency review only after the Contractor submits an application for Substantial Performance. As part of this application, the Contractor shall submit its own comprehensive deficiency list of incomplete or incorrect work. Failure by the Contractor to list any deficiency does not relieve the Contractor from correcting or completing the Work.
- .2 The Consultant shall review the work and any deficiencies noted will be classified as Major or Minor.
 - .1 Major deficiencies are required to be corrected as part of obtaining Substantial Performance.
 - .2 Minor deficiencies may be corrected before or after Substantial Performance.

.5 Final Review

- .1 The Consultant will conduct a final review only after the Contractor submits a declaration that all of the following has been completed:
 - .1 Noted deficiencies have been corrected.
 - .2 Final as-built drawings have been submitted to the Owner.
 - .3 Final Operating and Maintenance manuals have been submitted to the Owner.
 - .4 Final Test reports, including Alternate season tests have been submitted to the Owner.

- .6 The Consultant will only review the deficiency list to confirm these deficiencies have been corrected.

.7 Tubing and Conduit

- .1 Tubing and conduit: Follow horizontal and perpendicular building lines to fit into the layout of the area. Properly support and install in a neat and workmanlike manner throughout.

- .2 Install panels in readily accessible locations. Unless otherwise shown, mount control panels at a height of 1800 mm from the floor to the top of the cabinet for units without operator input devices (LCD screens, keypads, etc). For units with operator input devices, mount unit so that the horizontal centerline of the LCD display is location 1650 mm above the floor.

- .3 Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.

3.6 **LOCAL CONTROL PANELS**

- .1 Install BCU and ECU controllers in separate EEMAC 4 or 12 panels, to suit location. Install operator LCD screen, where specified, on the front panel door to allow operator access without opening door.
- .2 Support local control panels from fixed masonry or concrete walls. Do not support from drywall partition walls. Provide free standing support frames in other locations.

3.7 **WIRING COORDINATION**

- .1 Provide wiring and conduit under this Section of the work as follows:
 - .1 Between ceiling mounted junction boxes and terminal unit controllers.
 - .2 Between MCC mounted receptacle panels in mechanical rooms and controllers and control devices within the same area.
 - .3 Provide circuit breakers in "RP" and "ERP" panels; provide breaker locks to prevent unauthorized use of the breaker.
- .2 Power wiring provided under Division 26 as follows:
 - .1 120 VAC power and conduit to a junction box located in the ceiling adjacent to each terminal unit.
 - .2 120 VAC normal power panels labeled "RP" with spaces available for use.
 - .3 120 VAC emergency power panels labeled "ERP" with spaces available for use.
- .3 Termination at Packaged Equipment and Systems:
 - .1 Terminate wiring at packaged equipment and system controllers provided under Division 23.
 - .2 For equipment or systems panels provided under other Divisions of the Work, pull wire into control panel as per OEM manufacturer's instructions. Final termination at equipment or panel will be by the trade Contractor providing/installing the equipment.

3.8 **WIRING**

- .1 Maximum Control Voltage: 120 V.
 - .2 Supply, install and connect power transformers as required for each system.
 - .3 Sizing of conduit and selection of size and type of wire is by the Contractor under this Section of the Work.
 - .4 Flexible Metal and Liquid Tight Conduit
-

- .1 Maximum 1000 mm length
- .2 Minimum size: 20 mm.
- .3 Supported at each end.
- .5 Control and Status Relays
 - .1 Provide relays in designated enclosures only. Relays may be installed within packaged equipment control panels.
 - .2 Do not install relays within motor starter enclosures. Install relays in spare MCC sections, or provide a NEMA 1 (4) (12) enclosure mounted adjacent to the MCC or starter.
- .6 Control and interlock wiring: comply with Electrical Safety Code and Division 26, and as specified herein.
- .7 Wire
 - .1 All cables ULC listed for application
 - .2 Exposed cable in ceiling plenums: FT6 plenum rated.
- .8 Conduit
 - .1 Wiring in ceiling plenum spaces to be in conduit or be FT6 plenum rated cable.
 - .2 Wiring in all other areas to be in conduit.
 - .3 Wiring for rated smoke venting/control system to be FT6 plenum rated cable AND be installed conduit.
- .9 Sleeves
 - .1 Provide wall sleeves for plenum rated cable passing through walls.
 - .2 Maintain fire rating at all penetrations.

3.9 **FIBRE OPTIC CABLE SYSTEM**

- .1 Install cable to maintain the minimum cable and unjacked fiber bend radii as specified by the manufacturer.
- .2 Do not exceed maximum pulling tensions as specified by the manufacturer. Do not exceed manufacturer's ratings for post installation residual cable tension.
- .3 Install fiber optic cabinets, hardware and cable entering the cabinet as per manufacturer's instructions.

3.10 **ARCHITECTURE**

- .1 Refer to drawings for system architecture schematic. The system architecture shown provides a general summary of the design intent and does not show all control devices.
 - .1 Obtain a CAD design file from the Consultant and complete the development of the system architecture drawing. In the absence of a design architecture, provide an architecture drawing as required.

- .2 Include on the architecture drawing the following:
 - .1 Operator work stations
 - .2 Building LAN network
 - .3 Field LAN network
 - .4 NAE, NCE and BCU, with identification label, and room location.
 - .5 FAC, FEC and ECU, with identification label, and room location.
 - .6 LAN system repeaters.

.2 Controllers

- .1 Provide a separate FEC for each piece of major equipment.
- .2 Provide a separate FAC for each major system, including hydronic system water pumps.
- .3 A universal programmable style FAC or FEC may be used to terminate miscellaneous I/O including system instrumentation, freestanding fans and pumps, etc. which may not form part of a more complex system.
- .4 Select ECU's to provide a minimum of 15% spare capacity for each point type at each controller, but in no case less than 1 spare point.

3.11

PROGRAMMING

.1 General

- .1 Point Naming: modular description without written point index.
 - .1 Use manufacturer's standard naming convention.
- .2 Provide programming for the system as specified and control sequence requirements. Include for additional programming necessary for the operation of the system but not specifically identified herein.
- .3 Imbed sufficient comments in programming logic to clearly describe each section of the program. Comment statements to reflect language used in the sequences of operation.
- .4 Enter all computer programs and data files into the related computers including English descriptors, control programs, approved parameters and settings.

.2 Graphics

- .1 Provide graphics for each major piece of equipment/system and for each floor plan in the building. Design CAD files will be provided to the controls Contractor for this purpose. Equipment to include:
 - .1 Air handling units with associated condensing unit
 - .2 Terminal box units
 - .3 Sump pumps

- .4 Any integrated system including fire alarm, lighting control, security, etc.
 - .3 Reporting information
 - .1 Implement samples of the following features:
 - .1 Bar chart (four different bars on one chart)
 - .2 Curve plot (five curves on one plot)
 - .3 Trend log
 - .4 Alarm message (action taking message)
 - .5 Run time maintenance message
 - .6 Trouble action message
 - 3.12 **NAMEPLATES**
 - .1 Provide Nameplates
 - .1 Lamacoid type:
 - .1 On each BMS control device, indicating device number.
 - .2 On the panel front to identify each system being controlled and to identify each front mounted component.
 - .2 Laminated data card
 - .1 Field devices
 - .2 Damper actuators
 - .3 DDC terminal unit box controllers
 - .4 Automatic control valve actuators.
 - .2 Warning Labels
 - .1 Provide plastic adhesive-backed labels, black lettering on yellow background, on each starter and equipment automatically controlled through the BMS system, as follows:

CAUTION

This equipment is operating under automatic control and may start at any time without warning.
 - .2 Securely fasten Lamacoid nameplates to the equipment or adjacent to the equipment, with round-head cadmium plated steel self-tapping screws.
 - 3.13 **OPERATING INSTRUCTIONS**
 - .1 Provide the services of a competent technician qualified to instruct the operating personnel in maintenance and operating procedures, after commissioning, for a period of not less than one day. Training to include:
 - .1 Overall operational program.
-

- .2 Equipment functions.
- .3 Commands.
- .4 Graphics generation.
- .5 Appropriate operator intervention following system's operation.
- .2 Provide Operating instructions for the control system in accordance with this Section and include a description of the sequence of operation and reproducible drawings of the "as-built" system schematics.
- .3 Maintain CD-R copies of all data file and application software for reload use in the event of a system crash or memory failure. Delivery one copy to the Owner during training sessions, and archive one copy in the control manufacturer's local software vault.
- .4 "As-built" system schematics:
 - .1 Changes made during construction.
 - .2 Component final set points.
 - .3 Controller sensitivity and authority settings.
 - .4 Include maintenance instructions for control components supplied under this Section.

3.14 **ADJUSTMENT AND DEMONSTRATION OF SYSTEMS**

- .1 After completion of the installation, regulate and adjust all sensors, motors and other equipment provided under this contract and place them in complete operating condition. Coordinate this work with the Mechanical Contractor and system balancing technicians.
- .2 During the balancing and adjustment of the heating and ventilation systems, assist the Mechanical Contractor and system balancing technicians in the complete balancing of the systems.
- .3 After this work is completed, advise the Consultant in writing that the installation is complete and ready for inspection.

3.15 **TESTING AND REPORTING**

- .1 Conduct complete performance tests to demonstrate to the Consultant the correct operation of each individual control system and each item of control equipment. Repeat performance tests as necessary until all systems are proven satisfactory.
- .2 Report Format
 - .1 Prepare test forms in MS Excel, Word, Access or other Database format.
 - .2 Include the following header information for each test report:
 - .1 Owner Name
 - .2 Project Name
 - .3 Contractor Name
 - .4 Consultant Name

- .5 Name of Test Report
 - .3 Include the following on the front sheet of the consolidated report:
 - .1 Contractor Company Name
 - .2 Name and signature of the person submitting the report.
 - .3 Date of report
 - .4 The following statement: *"The undersigned certifies that the test results recorded in this report are correct, and that results have been witnessed by the trade responsible for the test"*.
 - .4 Submit the above tests in a hardcopy form, separately bound from the Operations and Maintenance manuals, and in Adobe Acrobat PDF format, in accordance with Section 01 33 00.
 - .3 Controls Report
 - .1 Provide a test report in spreadsheet format which summarizes the following data for each piece of controls operation.
 - .1 Equipment ID and name.
 - .2 Device Location.
 - .3 ECU reference.
 - .4 BCU reference.
 - .5 I/O reference.
 - .2 Record the following tests for each device as applicable:
 - .1 Communications Loop Integrity Test.
 - .2 Sensor Range Test
 - .3 Actuator Stroke Test
 - .4 Controls logic function test – single loop.
 - .5 Controls logic function test – equipment or system test.
 - .3 Communications Loop Integrity Test
 - .1 Check communications between DDC controller and remote I/O device.
 - .4 Sensor Range Calibration Test
 - .1 Provide data for minimum and maximum sensor values, setpoint value and current value at time of test.
 - .5 Actuator Stroke Test
 - .1 Provide data on actuator stroke from 0-100% full stroke.
 - .2 Indicate output value vs. actuator position (i.e. 20 mA = 100% open).
-

- .6 Controls Logic Function Test – Single Loop
 - .1 Two position actuators: use manual control function from operator's workstation to change current state of controller output
 - .2 Modulating valves: Vary Setpoint of control variable to modulate valve from 0-100% opening, at nominal 25% increments.
- .7 Controls Logic Function Test – Equipment or System Test
 - .1 Create a point form checklist of the Sequence of Operation for each system.
 - .2 Operate system through each control sequence element specified.
 - .3 Operate each system through an actual power outage, and restart on power resumption.
 - .4 Operate each applicable system for automatic restart on emergency power.
 - .5 Operate each system through scheduled operation.

3.16 **COMMISSIONING ASSISTANCE**

- .1 Provide fifteen days of eight hours each (net of travel time) after Substantial Performance for on-site programming in conjunction with the Owner's commissioning agent.
- .2 Perform commissioning of the controls system in accordance with Section 25 05 00.

3.17 **SERVICE AND GUARANTEE**

- .1 The controls systems herein specified shall be free from defects in workmanship and material under normal use and service after commissioning and acceptance of the complete control system.
- .2 After acceptance of the systems by the Consultant, provide any service required for the proper performance of the control systems for a period of one year or one complete heating and cooling cycle.
- .3 This service shall include readjustment of the controls for proper balance of the systems under the direction of the testing and balancing firm six months after the initial adjustment. The controls shall be adjusted and set for optimum performance under the changed operating conditions during this system rebalancing.
- .4 Include replacement parts for defective components and any labour to remove and replace such parts at no cost to the Owner.

3.18 **SENSOR AND SWITCHES**

- .1 Duct installation
 - .1 Do not mount in dead air space
 - .2 Thermally isolate elements from brackets and supports so as to respond to air temperature only.
 - .3 Support sensor element independently from coils and filter racks.
-

- .2 Averaging Duct Type Sensor Switch
 - .1 Sensor length: not less than 1000 mm for each square meter of duct cross-sectional area.
 - .2 Wire multiple sensors in parallel for freeze protection applications.
 - .3 Wire multiple sensors separately for temperature measurement.
- .3 High Limit Controls
 - .1 Coverage
 - .1 Provide a temperature sensitive head for approximately every 1.5 sw. m of duct cross sectional area.
 - .2 Install heads in a staggered arrangement to give complete coverage of the duct.
- .4 Low Limit Controls
 - .1 Coverage:
 - .1 String horizontally across the full width of duct or coil with runs at a maximum of 300 mm centres.
 - .2 Where one control is insufficient to provide the specified coverage, provide two or more controls to be wired in series.
 - .3 Coordinate with other trades so that the capillary does not obstruct access from access openings or doors to other duct mounted equipment.
 - .4 Coordinate with other trades so that the capillary does not obstruct access from access openings or doors to other duct mounted equipment.
- .5 Airflow Stations
 - .1 Locate airflow stations in accordance with manufacturer's guidelines so as to approach ideal laboratory conditions.
 - .2 Cap off manifold until cleaning of ducts is complete.
- .6 Pressure and Differential Switches
 - .1 Install isolation valve and snubber between sensor and pressure source.
 - .2 Protect sensing elements on steam and high temperature greater than 98°C with pigtail syphon between valve and sensor.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **CODES, PERMITS AND INSPECTIONS**

.1 Applicable Codes

- .1 Ontario Electrical Safety Code
.2 Ontario Building Code
.3 Ontario Fire Code

- .2 Comply with Ontario Electrical Safety Code, all local, provincial and federal laws, where applicable and with authorities having jurisdiction. Make any changes or alterations required by authorized inspector of authority having jurisdiction.

- .3 Equipment and material must be acceptable to Electrical Safety Authority.

- .4 Where materials are specified which require special inspection and approval, obtain such approval for the particular installation with the cooperation of the material Supplier.

- .5 Obtain and pay for permits and inspections required for work performed.

- .6 Supply and install warning signs, nameplates and glass covered single line diagrams as required by Electrical Safety Authority.

- .7 Submit required documents and Shop Drawings to authorities having jurisdiction in order to obtain approval for the Work. Copies of Contract Drawings and Specifications may be used for this purpose.

1.3 **REFERENCE STANDARDS**

- .1 These Specifications supplement the referenced standards.

- .2 Where standards differ between authorities, the most rigid apply.

- .3 Where requirements of the Specifications exceed referenced standards, the Specifications apply.

1.4 **COORDINATION**

- .1 Refer to and comply with Section 01 10 00.

- .2 Carefully examine Work and Drawings of all related trades and thoroughly plan the Work so as to avoid interferences. Report defects which would adversely affect the Work. Do not commence installation until such defects have been corrected.

- .3 Coordinate Work of this division such that items will properly interface with Work of other divisions.

- .4 Architectural Drawings, or in the absence of Architectural Drawings, Mechanical Drawings govern all locations.
-

- .5 Coordinate work of this division with Division 21 to ensure that damage does not occur to the fireproofing work of Division 21.

1.5 **SUBSTITUTIONS**

- .1 When only one manufacturer's catalogued trade name is specified, provide only that catalogued trade name, material or Product.
- .2 When more than one manufacturer's trade name is specified for a material or Product, the choice is the bidders.
- .3 No substitution is allowed upon award of Contract.

1.6 **DIMENSIONS AND QUANTITIES**

- .1 Dimensions shown on Drawings are approximate. Verify dimensions by reference to Shop Drawings and field measurement.
- .2 Quantities or lengths indicated in Contract Documents are approximate only and shall not be held to gauge or limit the Work.
- .3 Make necessary changes or additions to routing of conduit, cables, cable trays, and the like to accommodate structural, mechanical and architectural conditions. Where raceways are shown diagrammatically run them parallel to building column lines.

1.7 **EQUIPMENT LOCATIONS**

- .1 Devices, fixtures and outlets may be relocated, prior to installation, from the location shown on the Contract Drawings, to a maximum distance of 3 m, without adjustment to Contract Price.
- .2 Switch, control device and outlet locations are shown diagrammatically.

1.8 **INSTALLATION DRAWINGS**

- .1 Prepare Installation Drawings for equipment, based upon approved Vendor Drawings, to check required code clearances, raceway, busway and cable entries, sizing of housekeeping pads and structure openings. Submit Installation Drawings to Consultant for review.

1.9 **"AS BUILT" RECORD DRAWINGS**

- .1 (Refer to and comply with Section 01 33 00.) Maintain a set of Contract Drawings on site and record all deviations from the Contract Documents. **As a mandatory requirement, recording must be done on the same day deviation is made. Be responsible for full compliance with this requirement.**
 - .2 Mark locations of feeder conduits, junction and terminal boxes and ducts or conduits run underground either below the building or outside the building.
 - .3 Where conduit and wiring are underground or underfloor, furnish field dimension with respect to building column lines and inverts with respect to finished floor levels or grades.
 - .4 Record deviations from branch circuit numbers shown on Drawings.
 - .5 Prepare diagrams of interconnecting wiring between items of equipment including equipment supplied by Owner and under other Specification sections.
-

1.10 **SINGLE LINE DIAGRAM**

- .1 Reproduce this diagram in drawing form under glazed frame and mount in main switchgear room. Provide a copy of this diagram to the Consultant and include in the Maintenance Manuals.

1.11 **TEST REPORTS**

- .1 For each check and test performed prepare and submit a test report, signed by the Test Engineer, and where witnessed, by the Consultant.
- .2 Include record of all tests performed, methods of calculation, date and time of test, ambient conditions, names of testing company, Test Engineer, witnesses; also calibration record of all test instruments used together with manufacturers name, serial number and model number.
- .3 Include calibration record, percentage error and applicable correction factors.
- .4 Submit a certified test report from each manufacturer, signed by the certifying inspector, confirming correct installation and operation of each Product and part of Work. Include name of certifying inspector, date and times of inspection, ambient conditions.

1.12 **SHOP (VENDOR) DRAWINGS AND PARTS LISTS**

- .1 Refer to and comply with Section 01 33 00.
- .2 Submit for review, manufacturer's or vendor's drawings for all Products being furnished except cable (up to 1000V), wire and conduit. Include rating, performance, specification sheets, descriptive literature, schematic and wiring diagrams, dimensional layouts and weights of components as well as complete assembly.
- .3 Drawings for equipment assemblies, such as switchgear and unit substations, must include the entire assembly on a single drawing having a minimum size of 420 mm x 594 mm.

1.13 **FACTORY WITNESS TESTS**

- .1 Prior to Consultant attendance at factory for witness testing, perform the following:
 - .1 Successfully conduct test to be witnessed.
 - .2 Following successful testing, inform the Consultant, in writing, that tests to be witnessed have been successfully performed.

1.14 **OPERATING AND MAINTENANCE MANUALS**

- .1 Refer to and comply with Section 01 33 00 and related sections.

1.15 **AREA CLASSIFICATION**

- .1 _____

2 Products

2.1 **APPROVALS AND QUALITY**

- .1 Provide new materials bearing certification marks or labels acceptable under Ontario Electrical Safety Code.

- .2 Equipment must bear, on manufacturer's label, certification mark or label acceptable under Electrical Safety Authority.
- .3 Provide units of same manufacture where two or more units of same class or type of equipment are required.
- .4 Manufacturer's names are stated in this Specification to establish a definite basis for tender submission and to clearly describe the quality of Product that is desired for the Work.

2.2 **STANDARD SPECIFICATIONS**

- .1 Ensure that the chemical and physical properties, design, performance characteristics and methods of construction of all Products provided comply with latest issue of applicable standard Specifications issued by authorities having jurisdiction, but such standard Specifications shall not be applied to decrease the quality of workmanship, Products and services required by the Contract Documents.

2.3 **SPRINKLER PROOF EQUIPMENT**

- .1 Ensure that electrical equipment installed in electrical rooms and other areas containing sprinklers is constructed such that exposure to water from the sprinkler heads does not impair the effectiveness of the enclosed equipment.
- .2 Provide a separate cover or roof on all 2285 mm high equipment. Provide an overhang at the front, rear and sides to effectively prevent the entrance of water either at the top or through projecting faceplates, meters, etc.
- .3 Where penetrations are made in drip shields, flash and seal using manufacturer's approved caulking to maintain drip shield integrity.
- .4 Ensure that enclosure louvres are of outdoor design such that falling water or water running down the sides will not enter the enclosure.
- .5 Where enclosure openings in the top or sides are required for outgoing conduits, provide waterproof conduit fittings.
- .6 Provide panels and transformers with hoods.
- .7 Provide sprinkler proof busways.
- .8 In electrical rooms containing sprinklers provide wall mounted equipment such as pull boxes, junction boxes, splitter troughs, wireways, auxiliary gutters, cable troughs and disconnect switches located below the level of the sprinkler heads with the following accessories:
 - .1 Gaskets on doors and drip shields on equipment, panelboards, panels and enclosures.
 - .2 Louvres facing outward and downward where openings are required for heat dissipation. Expanded metal screening is not acceptable.

2.4 **HOUSEKEEPING PADS**

- .1 Provide 100 mm high concrete pads under floor mounted electrical equipment. Extend pads 50 mm outside the equipment perimeter.

2.5 FIRE BARRIERS

- .1 Where electrical material or devices pass through fire rated separations, make penetrations and provide fire barrier seals with a fire resistance rating equivalent to the rating of the separation.
- .2 Prior to installation, submit for review, proposed fire barrier seal materials, method of installation and ULC system number.
- .3 Acceptable Manufacturers:
 - .1 A/D Fire Protection Systems
 - .2 Dow Corning
 - .3 Fire Stop Systems
 - .4 IPC Flamesafe Firestop
 - .5 Nelson Electric
 - .6 3M
 - .7 Tremco

2.6 MISCELLANEOUS METAL FABRICATIONS

- .1 Provide miscellaneous structural supports, platforms, braces, brackets and preformed channel struts necessary for suspension, attachment or support of electrical equipment in accordance with Section 05 50 00.

2.7 SILICONE

- .1 Products and materials containing silicone are not permitted.
- .2 Refer to and comply with Section 01 61 05.

2.8 EQUIPMENT COLOUR CODING

- .1 Exterior finish paint colour for switchgear, control panels, panelboards and devices on emergency and UPS systems:
 - .1 Emergency systems: Red
 - .2 UPS systems: Blue

2.9 PRODUCTS FURNISHED BY OWNER

- .1 Refer to Sections 00 21 00, 00 41 13, and 01 10 00.
- .2 Carefully examine the Vendor or Manufacturers' Drawings and provide any incidental and miscellaneous materials, mounting hardware and supports required for complete systems.

3 Execution

3.1 MANUFACTURER'S ATTENDANCE

- .1 Provide manufacturer's representatives to initially start-up each part of the Work, as specified, to check, adjust, calibrate and balance as applicable all components including controls and field wiring. Provide these services for such period and for as many visits as necessary to achieve complete working order in the subject Work.

3.2 **FIELD INSPECTION**

- .1 Provide Field Engineer for inspection and certification of equipment during installation, testing and commissioning as required.

3.3 **PAINTING**

- .1 Touch up finishes on electrical equipment found to be marred on completion of the Work using same colour and type of finish as originally used.
- .2 Prime paint field fabricated metalwork.
- .3 Other painting will be provided under Section 09 91 00.

3.4 **CORE DRILLING**

- .1 Core Drilling Procedure
 - .1 Examine locations to be core drilled where:
 - .1 Diameter is greater than 25 mm
 - .2 Multiple drillings required and where the distance between centres is less than ten times the diameter of the hole
 - .2 Examine by most suitable method including:
 - .1 X-ray
 - .2 Ferro scan
 - .3 Cable detection
 - .3 Examine from both sides of the structure to be drilled.
 - .4 Examine proposed core drilling locations to determine:
 - .1 Possible interference with
 - .1 Services
 - .2 Structural components
 - .2 Possible presence of asbestos tile or other asbestos based material. Report any occurrence or suspected occurrence to the Consultant immediately.
 - .5 Select locations as suitable for core drilling and label them:
 - .1 Uniquely number each drilling location and core so that markings will be legible after drilling
 - .2 Mark each core with a north pointing arrow where drilling a slab or upward pointing arrow where drilling a wall

- .6 Without interfering with or damaging any services or structural elements, drill pilot holes sufficient to verify location of potential obstructions or for alignment purposes.
- .7 Use impact drill when drilling holes of 25 mm diameter or less. For holes of greater diameter use core drill.
- .8 Prepare report showing intended core drill locations including printouts and X-ray images. Prior to drilling submit the report to Consultant for approval.
- .9 Proceed with core drilling only after approval has been received from Consultant.
- .10 Confine drilling operation to time-of-day as stipulated by Consultant.
- .11 Position suitable warning notices of a type acceptable to Consultant and exercise caution to ensure safety and protection of personnel and property during drilling especially from effects of water, dust damage, or falling objects below the slab or behind the wall being drilled.
- .12 Stop drilling immediately, and report to Consultant, if contact is made with foreign objects such as reinforcing steel (rebar), electrical conduit, water pipes, drainage pipes.
- .13 Cover open holes with secured covers to guard against fall through of objects.
- .14 Provide necessary firestopping, temporary or otherwise, sufficient to firestop holes that would be otherwise open during hours that the location is unattended. Coordinate placement of firestopping with Consultant.
- .15 Store all cores or core fragments on site and make them available for inspection by Consultant. Dispose of the cores or core fragments after permission is received from Consultant.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Conform to latest issues, amendments and supplements of following standards:

- | | | |
|-----|------------------------|--|
| .1 | CISC/CPMA 2.75 | - Canadian Institute of Steel Construction/
Canadian Paint Manufacturers Association, A
Quick Drying Primer For Use on Structural
Steel |
| .2 | CAN/CGSB-1.40-M | - Primer, Structural Steel, Oil Alkyd Type |
| .3 | CAN3-C21.1-M | - Control Cable - 600V |
| .4 | CAN3-C21.2-M | - Control Cable for Low Energy Circuits 150V
and 300V |
| .5 | CAN/CSA C22.2 No. 18 | - Outlet Boxes, Conduit Boxes, and Fittings |
| .6 | CAN/C22.2 No. 26 | - Wireways, Auxiliary Gutters and Associated
Fittings |
| .7 | CSA C22.2 No. 30-M | - Explosion-Proof Enclosures for Use in Class I
Hazardous Locations |
| .8 | CSA C22.2 No. 38-M | - Thermoset Insulated Wires and Cables |
| .9 | CSA C22.2 No. 40-M | - Cutout, Junction and Pull Boxes |
| .10 | CSA C22.2 No. 42-M | - General Use Receptacles, Attachment Plugs
and Similar Wiring Devices |
| .11 | CSA C22.2 No. 45-M | - Rigid Metal Conduit |
| .12 | CSA C22.2 No. 49 | - Flexible Cords and Cables |
| .13 | CAN/CSA C22.2 No. 51-M | - Armoured Cables |
| .14 | CSA C22.2 No. 52-M | - Service-Entrance Cables |
| .15 | CSA C22.2 No. 56 | - Flexible Metal Conduit and Liquid-Tight
Flexible Metal Conduit |
| .16 | CSA C22.2 No. 62 | - Surface Raceway Systems |
| .17 | CSA C22.2 No. 65 | - Wire Connectors |
| .18 | CSA C22.2 No. 75-M | - Thermoplastic Insulated Wires and Cables |
| .19 | CSA C22.2 No. 76-M | - Splitters |

.20	CSA C22.2 No. 79	- Cellular Metal and Cellular Concrete Floor Raceways and Fittings
.21	CSA C22.2 No. 80	- Underfloor Raceways and Fittings
.22	CSA C22.2 No. 83-M	- Electrical Metallic Tubing
.23	CAN/CSA-C22.2 No. 85-M	- Rigid PVC Boxes and Fittings
.24	CAN/CSA C22.2 No. 94-M	- Special Purpose Enclosures
.25	CSA C22.2 No. 123-M	- Aluminum Sheathed Cables
.26	CSA C22.2 No. 124-M	- Mineral-Insulated Cables
.27	CSA C22.2 No. 126-M	- Cable Tray Systems
.28	CSA C22.2 No. 127	- Equipment Wires
.29	CAN/CSA-C22.2 No. 131-M	- Type Teck 90 Cable
.30	CSA C22.2 No. 138-M	- Heat Tracing Cable and Cable Sets for Use in Hazardous Locations
.31	CSA C22.2 No. 159-M	- Attachment Plugs, Receptacles and Similar Wiring Devices for Use in Hazardous Locations: Class I, Groups A, B, C, and D; Class II, Group G, in Coal or Coke Dust, and in Gaseous Mines
.32	CSA C22.2 No. 174-M	- Cable and Cable Glands for Use in Hazardous Locations
.33	CSA C22.2 No. 182.1	- Industrial Type, Special Use Attachment Plugs, Receptacles, and Connectors
.34	CSA C22.2 No. 182.2-M	- Industrial Locking Type, Special Use Attachment Plugs, Receptacles, and Connectors
.35	CSA C22.2 No. 182.3-M	- Special Use Attachment Plugs, Receptacles, and Connectors
.36	CSA C22.2 No. 208-M	- Fire Alarm and Signal Cable
.37	CSA C22.2 No. 211.2-M	- Rigid PVC (Unplasticized) Conduit
.38	CSA C22.2 No. 211.3	- Rigid Fiberglass Reinforced Epoxy (RE) Conduit and Associated Fittings
.39	CSA C22.2 No. 214-M	- Communications Cables
.40	CSA C22.2 No. 222-M	- Type FCC Under-Carpet Wiring System
.41	CSA C22.2 No. 227.1	- Electrical Nonmetallic Tubing
.42	CSA C22.2 No. 227.2	- Flexible Liquid-Tight Nonmetallic Conduit
.43	CSA C22.2 No. 227.3-M	- Flexible Nonmetallic Tubing

- .44 CSA C22.2 No. 230-M - Tray Cables
- .45 CSA C22.2 No. 232-M - Optical Fiber Cables
- .46 SSPC - Steel Structures Painting Council, "Steel Structures Painting Manual, Vol. 2"

1.3 **SUBMITTALS**

- .1 Consultant reserves the right to require Contractor to submit samples of any materials to be used in this Project.

2 Products

2.1 **WIRE - LOW VOLTAGE UP TO 1000V SERVICE**

.1 Conductors

- .1 ASTM Class B, soft drawn, electrolytic copper
- .2 Stranded

.2 Insulation

- .1 CSA type RW90 XLPE (-40°C)
 - .1 Heat and moisture resistant
 - .2 Low temperature, chemically cross-linked thermosetting polyethylene material
 - .3 600 V rated
 - .4 For maximum 90°C (194°F) conductor temperature
 - .5 For installation at minimum -40°C (-40°F) temperature
 - .6 To CSA C22.2 No. 38
- .2 CSA type RWU90 XLPE (-40°C):
 - .1 Heat and moisture resistant
 - .2 Low temperature, chemically cross-linked thermosetting polyethylene material
 - .3 1000 V rated
 - .4 For maximum 90°C (194°F) conductor temperature
 - .5 For installation at minimum -40°C (-40°F)
 - .6 To CSA C22.2 No. 38
- .3 CSA type T90 NYLON (-10°C):
 - .1 Heat resistant
 - .2 Flame retardant

- .3 Thermoplastic PVC material with extruded nylon cover
 - .4 600 V rated
 - .5 For maximum 90°C (194°F) conductor temperature dry and 75°C in wet locations
 - .6 For installation at minimum -10°C (14°F)
 - .7 To CSA C22.2 No. 75-M
 - .4 CSA type TEW:
 - .1 Heat resistant
 - .2 600 V rated
 - .3 For maximum 105°C (221°F) conductor temperature
 - .4 To CSA C22.2 No. 127
 - .5 CSA type SEW-2
 - .1 Heat resistant
 - .2 600 V rated
 - .3 For maximum 200°C (392°F) conductor temperature
 - .4 To CSA C22.2 No. 127
 - .3 Acceptable Manufacturers
 - .1 Alcan Cable
 - .2 Alcatel Canada Wire
 - .3 Pirelli Cables
 - 2.2 **CABLE - LOW VOLTAGE UP TO 1000V SERVICE**
 - .1 CSA Type AC90 XLPE (-40°C)
 - .1 Conductors
 - .1 ASTM Class B, soft drawn, electrolytic copper
 - .2 Solid for sizes #10 AWG and smaller
 - .3 Stranded for sizes #8 AWG and larger
 - .2 Insulation
 - .1 Heat and moisture resistant
 - .2 Low temperature, chemically cross-linked thermosetting polyethylene material
 - .3 600 V rated for sizes #10 AWG and smaller
-

- .4 1000 V rated for sizes #8 AWG and larger
 - .5 For maximum 90°C (194°F) conductor temperature
 - .6 For installation at minimum -40°C (-40°F) temperature
 - .7 To CSA C22.2 No. 38
 - .3 Construction
 - .1 Two, three or four insulated conductors
 - .2 Bare ground conductor
 - .3 Overall interlocking aluminum armour
 - .4 To CSA C22.2 No. 51
 - .4 Acceptable Manufacturers
 - .1 Alcan Cable
 - .2 Alcatel Canada Wire
 - .3 Pirelli Cables
 - .2 CSA Type TECK90 (-40°C)
 - .1 Conductors
 - .1 ASTM Class B, soft drawn, electrolytic copper
 - .2 Stranded
 - .2 Insulation
 - .1 Heat and moisture resistant
 - .2 Low temperature, chemically cross-linked thermosetting polyethylene material
 - .3 600 V or 1000 V rated
 - .4 For maximum 90°C (194°F) conductor temperature
 - .5 For installation at minimum -40°C (-40°F) temperature
 - .6 CSA type RW90 XLPE
 - .7 To CSA C22.2 No. 38
 - .3 Construction
 - .1 One or more insulated conductors
 - .2 Bare, stranded, copper ground conductor for multi-conductor cables
 - .3 Bare, solid, served copper ground conductors for single conductor cables
-

- .4 Fillers with binder tape to produce a circular cross-section for multi-conductor cables
 - .5 Power cables
 - .1 One, two, three or four conductors
 - .2 Conductors 1000 V rated
 - .6 Control cables
 - .1 Two or more conductors
 - .2 Conductors 600 V rated
 - .7 Composite cables
 - .1 Three power conductors
 - .2 Three #14 AWG control conductors
 - .3 Conductors 600V rated
 - .8 Extruded PVC inner jacket over conductor assembly
 - .9 Interlocking aluminum armour over inner jacket
 - .10 Extruded PVC overall jacket over armour
 - .1 FT4 flame test rated
 - .2 Colour black unless otherwise indicated
 - .11 Cable assembly for installation at minimum -40°C (-40°F) temperature
 - .12 To CSA C22.2 No. 131 and CSA C22.2 No. 174
 - .4 Acceptable Manufacturers
 - .1 Alcan Cable
 - .2 Alcatel Canada Wire
 - .3 BICC Phillips
 - .4 Pirelli Cables
 - .3 CSA Type RA90 XLPE (-40°C)
 - .1 Conductors
 - .1 ASTM Class B, soft drawn, electrolytic copper
OR
 - .2 CSA type ACM aluminum alloy
 - .3 Stranded
-

- .2 Insulation
 - .1 Heat and moisture resistant
 - .2 Low temperature, chemically cross-linked thermosetting polyethylene material
 - .3 600 V rated
 - .4 For maximum 90°C (194°F) conductor temperature
 - .5 For installation at minimum -40°C (-40°F) temperature
 - .6 CSA type RW90 XLPE
 - .7 To CSA C22.2 No. 38
 - .3 Construction
 - .1 Single conductor
 - .2 Continuous, corrugated aluminum sheath of minimum cross-sectional area to comply with electrical code table 16
 - .3 Extruded PVC overall jacket over armour
 - .1 FT4 flame test rated
 - .2 Colour black unless otherwise indicated
 - .4 Cable assembly for installation at minimum -40°C (-40°F) temperature
 - .5 To CSA C22.2 No. 123 and CSA C22.2 No. 174
 - .4 Acceptable Manufacturers
 - .1 Alcan Cable
 - .2 Alcatel Canada Wire
 - .3 BICC Phillips
 - .4 CSA Type TC, Tray Cable (-40°C)
 - .1 Conductors
 - .1 ASTM Class B, soft drawn, electrolytic copper
 - .2 Stranded
 - .2 Insulation
 - .1 Heat and moisture resistant
 - .2 Low temperature, chemically cross-linked thermosetting polyethylene material
 - .3 600 V rated
 - .4 For maximum 90°C (194°F) conductor temperature
-

- .5 For installation at minimum -40°C (-40°F) temperature
 - .6 CSA type RW90 XLPE to CSA C22.2 No. 38
 - .3 Construction
 - .1 Two or more insulated conductors
 - .2 Bare, stranded, copper ground conductor
 - .3 Fillers with binder tape to produce a circular cross-section
 - .4 Jacket
 - .1 PVC
 - .2 FT4 flame test rated
 - .3 Low acid gas rated to CSA C22.2 No. 0.3
 - .4 Black colour
 - .5 To CSA C22.2 No. 230
 - .4 Acceptable Manufacturers
 - .1 Alcatel Canada Wire
 - .2 BICC Phillips
 - .3 Pirelli Cables
 - .5 CSA Type MI
 - .1 Conductors
 - .1 ASTM Class B, soft drawn, electrolytic copper
 - .2 Solid
 - .2 Insulation
 - .1 Powdered magnesium oxide
 - .2 600 V rated
 - .3 Construction
 - .1 Solid conductor
 - .2 Insulation around the conductor compressed to form a solid, homogeneous mass between the conductor and the metal sheath throughout the entire length of cable
 - .3 Soft annealed seamless copper sheath over insulation
 - .4 Extruded PVC overall jacket over sheath
 - .1 FT4 flame test rated
-

- .2 Colour black unless otherwise indicated
 - .5 To CSA C22.1 No. 124-M
 - .4 Acceptable Manufacturer
 - .1 Pyrotenax
 - .6 EMF-Free Power Cable
 - .1 Conductors
 - .1 ASTM Class B, soft drawn, electrolytic copper
 - .2 Stranded central conductor
 - .3 Solid, served concentric return conductors, equivalent to central conductor
 - .4 Conductor size and number of runs to suit feeder ratings as shown on drawings
 - .2 Insulation
 - .1 Heat and moisture resistant
 - .2 Ethylene propylene rubber (EPR)
 - .3 Minimum 600 V rated
 - .4 For maximum 90°C (194°F) conductor temperature
 - .5 For installation at minimum -40°C (-40°F) temperature
 - .6 To CSA C22.2 No. 38
 - .3 Construction
 - .1 Single conductor with served wire return conductor (coaxial)
 - .2 PVC inner-jacket over return conductor
 - .3 Interlocking aluminum over inner jacket
 - .4 Overall PVC jacket
 - .4 Power filters
 - .1 Filter parameters to suit the feeder characteristics (rating, length, etc.)
 - .2 EEMAC type 1 enclosure
 - .5 Engineered system
 - .1 Provide EMF-free power cables and power filters as a complete engineered system from the manufacturer
 - .6 Acceptable Manufacturer
 - .1 United Wire & Cable (ZeroFlux® Power Cable)

2.3 **MODULAR WIRING (LIGHTING SYSTEMS)**

- .1 Distribution Boxes
 - .1 Steel, EEMAC 1 enclosure, minimum size 300 mm x 300 mm x 100 mm
 - .2 Modular connectors, five-wire, female
 - .3 Terminal block for incoming wiring
 - .4 Stranded copper wiring between terminal block and modular connectors
- .2 Extension/Tap Cables
 - .1 Armoured type cable, #10 or #12 AWG, copper conductors rated 600 V, 90°C (194°F) insulation
 - .2 Modular connectors, five-wire, one male at one end and twin female at other end or splitters to maintain circuit continuity on removal of luminaire drop cable
- .3 Luminaire Drop Cables
 - .1 Service cord, type SEO or armoured cable, three-wire, stranded copper conductors rated 600V, 105°C (221°F) insulation, colour phase identification on jacket (phase A, red; phase B, black; phase C, blue)
 - .2 Modular connector, male
 - .3 Prewired to luminaires
- .4 Modular Connectors
 - .1 Rated 347 V, 20 A
 - .2 Rated to connect or disconnect an individual luminaire under load
- .5 Acceptable Manufacturers
 - .1 Flex Systems (Flex) 3+
 - .2 Lithonia Reloc
 - .3 Holophane Holoflex
 - .4 Cooper MWS

2.4 **CABLE CONNECTORS**

- .1 Connectors for Type AC90 Cable
 - .1 Steel or malleable iron
 - .2 Insulated throat
 - .3 Acceptable manufacturers
 - .1 Efcor 1000B series
 - .2 Elliott 65200 series

- .3 Thomas & Betts 3110 series
 - .2 Connectors for Type TECK90 Cable
 - .1 Copper free aluminum body
 - .2 Steel or copper free aluminum fittings and locknut
 - .3 Certified for use in hazardous locations Classes I, II, and III
 - .4 Class I hazardous location sealing fitting
 - .5 Acceptable manufacturers
 - .1 Thomas & Betts "STE" series
 - .2 Crouse-Hinds type TMC
 - .3 Commander/Iberville type TEK
 - .3 Connectors for Type RA90 Cable
 - .1 Copper free aluminum body
 - .2 Steel or copper free aluminum fittings
 - .3 Acceptable manufacturers
 - .1 Alcatel Canada Wire
 - .2 Crouse-Hinds, type TMC
 - .4 Connectors for Type TC, Tray Cable
 - .1 Copper free aluminum body
 - .2 Steel or copper free aluminum fittings and locknut
 - .3 Acceptable manufacturers
 - .1 Thomas & Betts, Tray-Star, HLT series
 - .2 Crouse-Hinds, type TMC
 - 2.5 **WIRE AND CABLE CONNECTORS**
 - .1 Copper compression type wire and cable terminations for #8 AWG and larger conductors, colour keyed, sized to suit. Long barrel NEMA 2 hole lugs for sizes #1/0 AWG and larger.
 - .1 Acceptable Manufacturers
 - .1 Thomas & Betts series 54000
 - .2 Ideal Powr-Connect
 - .3 Burndy Hylug
 - .2 Twist type splicing connectors, copper, sized to suit, with nylon or plastic shroud for tee connections in #10 AWG and smaller conductors.
-

- .1 Acceptable Manufacturers
 - .1 Thomas & Betts spring type
 - .2 Ideal Twister
 - .3 Marr Marrette
 - .3 Conductor compression splice for #10 AWG or smaller.
 - .1 Acceptable Manufacturers
 - .1 Thomas & Betts STA-Kon series
 - .2 Ideal Splices
 - .3 Burndy
 - 2.6 **HEAT SHRINKABLE TUBING INSULATION, HEAVY WALL**
 - .1 Acceptable Manufacturers
 - .1 Thomas & Betts, Shrink-Kon series
 - .2 Ideal Thermo-Shrink, TS-46
 - .3 Raychem tubing WCSM
 - .4 3M cable sleeve ITCSN
 - 2.7 **MOTOR LEAD CONNECTION KITS, 600 VOLT**
 - .1 Connection kits for low voltage motors.
 - .2 Acceptable Manufacturers
 - .1 3M, motor lead splice kit, pigtail, 5300 series
 - .2 Raychem, motor connection kit, MCK, type V
 - 2.8 **MOTOR LEAD CONNECTION KITS, 5000 VOLT**
 - .1 Connection kits for 4000 V motors.
 - .2 Acceptable Manufacturers
 - .1 3M, motor lead splice kit, pigtail, 5320 series
 - .2 Raychem, motor connection kit, MCK-5, type V
 - 2.9 **CONDUIT AND FITTINGS**
 - .1 Rigid Steel Conduit
 - .1 To CSA C22.2 No. 45-M
 - .2 Rigid thickwall galvanized steel threaded conduit
 - .2 Coated Steel Conduit
 - .1 Corrosive resistant coated rigid thickwall steel threaded conduit, CSA approved.
-

- .2 Acceptable Manufacturers
 - .1 Rob Roy Plastibond PVC coated
 - .2 Columbex Green Guard II epoxy polyester coated
- .3 Rigid PVC Conduit
 - .1 To CSA C22.2 No. 211.2-M
 - .2 Rigid PVC conduit
- .4 Flexible Steel Conduit
 - .1 To CSA 22.2 No. 56
 - .2 Liquid-tight flexible steel conduit with PVC cover
- .5 Non-Metallic Flexible Conduit
 - .1 Non-metallic extra flexible PVC conduit
 - .2 Acceptable Manufacturers
 - .1 Carlon, Carflex X-Flex
 - .2 Hubbell, Polytuff Black
- .6 Rigid Steel Conduit Fittings
 - .1 To CAN/CSA C22.2 No. 18
 - .2 Galvanized or polymer coated cast steel fittings
 - .3 Expansion fittings, watertight with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions
 - .4 Sealing condulets for hazardous areas
 - .5 Corrosive resistant coated cast steel fittings for corrosive resistant conduit
- .7 Rigid PVC Conduit Fittings
 - .1 To CSA C22.2 No. 85-M
 - .2 Rigid PVC fittings of same manufacture as rigid PVC conduit
- .8 Liquid Tight Flexible Steel Conduit Fittings
 - .1 Watertight connectors with nylon insulated throat
 - .1 Acceptable Manufacturers:
 - .1 T & B Series 5331 with Sealing O-ring Series 5262
 - .2 Commander/Iberville Series 6300-IT with nitrile O-ring

2.10 **EMT AND FITTINGS**

- .1 EMT
-

- .1 To CSA C22.2 No. 83-M
- .2 EMT galvanized cold rolled steel tubing
- .2 EMT Fittings
 - .1 Compression type, steel
 - .1 Gland compression connectors with insulated throats
 - .2 Compression couplings
 - .3 Acceptable manufacturers:
 - .1 T & B Series 5123 & 5120
 - .2 O-Z/Gedney type ZTC series
 - .3 Commander/Iberville Series 5600-IT and 5700
 - .2 Set screw type, steel, concrete-tight
 - .1 Connectors with insulated throats
 - .2 Couplings
 - .3 Acceptable manufacturers
 - .1 Commander/Iberville Series 5400 and 5500

2.11 **CABLE TRAY**

- .1 Cable Trays and Fittings
 - .1 To EEMAC F5-1
 - .2 To CAN/CSA C22.2 No. 126-M
 - .2 Ladder Type
 - .1 Class C1
 - .2 Aluminum (Steel, hot dip galvanized after fabrication)
 - .3 Side height, 100 mm(150 mm)
 - .4 Rung spacing, 300 mm
 - .3 Ventilated Type
 - .1 Class C1
 - .2 Aluminum (Steel, hot dip galvanized after fabrication)
 - .3 Side height, 100 mm(150 mm)
 - .4 Solid Type
 - .1 Class C1
 - .2 Aluminum (Steel, hot dip galvanized after fabrication)
-

- .3 Side height, 100 mm(150 mm)
 - .5 Centre Rail Type
 - .1 Class C1
 - .2 Aluminum
 - .3 Rung spacing 150 mm, 225 mm, 300 mm
 - .4 Loading depth 75 mm, 100 mm, 150 mm
 - .5 Rung width 25 mm minimum
 - .6 Acceptable manufacturers for ladder, ventilated and solid types:
 - .1 B-Line
 - .2 Canadian Electrical Raceways
 - .3 Canstrut
 - .4 Electrotray
 - .5 Pilgrim
 - .6 Pursley
 - .7 Unistrut
 - .7 Acceptable manufacturers for centre rail type:
 - .1 Wiremold, Spec Mate CA series
 - .2 B-Line, Cent-R-Rail
 - 2.12 **WIREWAY**
 - .1 To CSA C22.1 No. 94-M.
 - .2 Steel with hinged cover to give uninterrupted access.
 - .3 Elbows, tees, couplings and hanger fittings manufactured as accessories for wireway supplied.
 - .4 Acceptable Manufacturers:
 - .1 Amalgamated Electric
 - .2 Canadian Electrical Raceways
 - .3 Schneider Square D
 - .4 Pilgrim
 - .5 Pursley
-

2.13 **SURFACE RACEWAY**

- .1 Surface metal raceway, snap-in divider to form two compartments for power and voice/data, with removable cover.
- .2 Elbows, couplings, end caps, device brackets and faceplates for power, data and voice, and fittings manufactured as accessories for wireway supplied. 120 V power receptacles and mounting only for voice/data.
- .3 Acceptable manufacturer:
 - .1 Wiremold with following components:
 - .1 4000 series, ivory colour
 - .2 Device mounting plate, V4049-G and faceplate 5507-G colour grey
 - .3 Duplex receptacles, 120V, 15A, Leviton Decora plus, colour grey 16262-GY
 - .4 Duplex receptacle, 120V, 20A, P & S Sierraplex, colour grey, 26342-GRY

2.14 **CELLULAR FLOOR SYSTEM**

- .1 Standards
 - .1 Raceways and fittings to CSA C22.2 No. 79.
 - .2 Activation kits and components CSA approved.
- .2 Trench duct: Steel construction, intermittent bottom, adjustable compartment dividers, removable covers, external levelling screws, void closures, coupling mechanisms, end closures, elbows and coverplate lifting device.
- .3 Preset inserts: Steel construction, triple service access with grommetted openings for access to low tension and power cells.
- .4 Activation kits: Pedestal fitting, multiplex service, two duplex power convenience receptacles, two data receptacles, two telephone jack outlets, and fittings to connect to preset inserts.
- .5 Acceptable Manufacturer
 - .1 Walker: Trenchduct type VA, preset inserts NRG-Bloc series and activation kits M6 series

2.15 **FASTENINGS, SUPPORTS AND SLEEVES**

- .1 Fastenings
 - .1 Galvanized steel straps, beam clamps and threaded rods
 - .2 Sleeves
 - .1 Schedule 40 steel pipe, minimum I.D. 13 mm larger than outside diameter of conduit or cable passing through.
-

- .3 Strut
 - .1 Continuous slotted channel
 - .2 Twelve gauge pre-galvanized steel
 - .3 41.2 mm x 41.2 mm minimum
 - .4 Acceptable manufacturers:
 - .1 B-Line
 - .2 Pilgrim
 - .3 Pursley
 - .4 Unistrut

2.16 **SPLITTER BOXES**

- .1 Code gauge (galvanized) sheet steel enclosure EEMAC Type (1) (4) (12) welded corners and formed hinged cover suitable for locking in closed position.
- .2 Cast steel enclosure EEMAC 7 (9) with gasketed bolt on cover for hazardous locations.
- .3 Copper (aluminum) main and branch lugs to match required size and number of incoming and outgoing conductors.
- .4 At least three spare terminals on each set of lugs in splitters less than 400 A.

2.17 **JUNCTION BOXES**

- .1 Galvanized steel EEMAC Type 1 (4) (12) size as required by code for number and size of conduits, conductors and devices, complete with covers, corrosion resistant screws, terminal blocks and mounting rails.
- .2 Screw-on sheet steel covers to match enclosure for surface mounting boxes.
- .3 Covers with 25 mm minimum extension around for flush-mounted junction boxes.
- .4 Galvanized steel barriers as required.

2.18 **TERMINAL BLOCKS - SURGE PROTECTION**

- .1 Terminal blocks, rail mounted, with surge voltage protection, rated for circuit voltage.
- .2 Acceptable Manufacturers
 - .1 Phoenix Contact Termitrab SLKK5 (Termitrab SLKK5-F) (TT-SLKK5-S).

2.19 **PULL BOXES**

- .1 Galvanized sheet steel welded construction, EEMAC Type 1, (4) (12).
 - .2 Screw-on galvanized sheet steel covers for surface mounting boxes.
 - .3 Covers with 25 mm minimum extension around, for flush mounted pull boxes.
 - .4 Galvanized steel barriers as required.
-

2.20 **CONDUIT BOXES - GENERAL**

- .1 Boxes for EMT
 - .1 Galvanized pressed steel
- .2 Boxes for Rigid Steel Conduit
 - .1 Galvanized cast iron alloy FS boxes with mounting feet for surface mounted switches and receptacles
 - .2 Gasketed cover plate for exterior location
 - .3 For corrosive resistant coated conduit: Cast boxes with same finish as conduit
- .3 Boxes for Rigid PVC Conduit
 - .1 PVC boxes

2.21 **OUTLET BOXES - SHEET STEEL**

- .1 Pressed steel single and multi-gang flush device boxes, minimum size 100 mm x 50 mm x 38 mm. 100 mm square outlet boxes where more than one conduit enters one side, with extension rings as required.
- .2 100 mm square or octagonal outlet boxes.
- .3 119 mm square outlet boxes with extension and plaster rings as necessary for flush mounting devices in gypsum board, plaster or panelled walls.

2.22 **MASONRY BOXES**

- .1 Pressed steel masonry single and multi-gang boxes for devices flush mounted in exposed masonry walls with extension and plaster rings as required.

2.23 **CONCRETE BOXES**

- .1 Pressed steel concrete type boxes for flush mount in concrete with extension and plaster rings as required.

2.24 **OUTLET BOXES - FITTINGS**

- .1 Bushings and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of foreign materials.
- .3 Double locknuts and insulated bushings for sheet steel metal boxes.

2.25 **WIRING DEVICES - SWITCHES**

- .1 Specification grade, general purpose AC switches, manual toggle operated, (white), (ivory) and (brown) colour, 15 A, 20 A, 120-277 V, 347 V, single pole, double pole, three-way, four-way switches as required.
- .2 Acceptable Manufacturers:
 - .1 Hubbell - HBL1201 Series: HBL1221 Series: HBL18201 Series: HBL 18221 Series

- .2 P & S - 15AC Series: 20AC Series: 370000 Series
- .3 Arrow Hart - 1891 Series: 1991 Series: 18201 Series: 18221 Series
- .3 Specification grade, general purpose AC switches, manual rocker operated, (white), (ivory) colour, 15 A, 20 A, 120-277 V, 347 V, single pole, double pole, three-way, four-way switches as required.
- .4 Acceptable Manufacturers
 - .1 Bryant, 120-277V, Fashion Series 9000
 - .2 Hubbell, 120-277V, Style Line 2100 Series
 - .3 Leviton, 120-277V and 347V, Decora Plus 5600 Series
 - .4 Pass & Seymour, 120-277V and 347V, Sierraplex Decorator, 2600 and 2600000 Series

2.26 **WIRING DEVICES - DIMMER SWITCHES**

- .1 Dimmer switches: solid state, full range with slider type handle on-off switch, (white), (ivory) rated to suit circuit load, 1000 watts minimum, 120 volts.
- .2 Acceptable Manufacturers:
 - .1 P & S
 - .2 Lutron

2.27 **WIRING DEVICES - OCCUPANCY SENSORS**

- .1 W1 Automatic wall switch, passive infrared, (120V) (277V) (347V), adjustable time delay thirty seconds to thirty minutes, 180 degrees coverage, minimum 300 sq.ft. hand motion at desktop, adjustable light sensor (21-2150 lux), white.
 - .1 Wattstopper WS-250 Series
- .2 W2 Automatic wall switch, passive infrared, (120V) (277V) (347V), adjustable time delay five minutes to thirty minutes, manual or auto on, 180 degrees coverage, minimum 300 sq.ft. hand motion at desktop, white.
 - .1 Wattstopper PW-100 Series
- .3 W2B Automatic wall switch, passive infrared, (120V) (277V) (347V), adjustable time delay five minutes to thirty minutes, manual or auto on, dimmer, 180 degrees coverage, minimum 300 sq.ft. hand motion at desktop, white.
 - .1 Wattstopper PW-100D-I-U
- .4 W3 Automatic wall switch, dual technology, (120V) (277V) (347V), adjustable time delay five minutes to thirty minutes, manual or auto on, 180 degrees coverage, minimum 300 sq.ft. hand motion at desktop, white.
 - .1 Wattstopper DW-100
- .5 W4 Outdoor PIR Occupancy sensor lighting control to mount internal to task lighting fixtures. 360 degree High Bay lens (20'-40'), 7.5' wire lead length, 24VDC; IP65.

- .1 Leviton OSF20-ILW
- .6 DT1 Ceiling mounted dual technology, 2000 sq.ft. coverage at 180 degrees, corner mounting bracket, adjustable time delay, adjustable sensitivity, built-in light level sensor (20 to 2150 lux), (120V/20A) (277V/20A) (347V/15A) power packs/slave packs as required, white.
- .1 Wattstopper DT-200
- .7 DT2 Ceiling mounted dual technology, 1000 sq.ft. coverage at 360 degrees, adjustable time delay, adjustable sensitivity, built-in light level sensor (100 to 3200 lux), (120V/20A) (277V/20A) (347V/15A) power packs/slave packs as required, white.
- .1 Wattstopper DT-300
- .8 C1 Ceiling mounted ultrasonic, 2000 sq.ft. coverage at 360 degrees, temperature and humidity resistant receivers, logic key/on bypass, adjustable time delay fifteen seconds to fifteen minutes, (120V/20A) (277V/20A) (347V/15A) power packs/slave packs as required, white.
- .1 Wattstopper W-2000A
- .9 C2 Ceiling mounted ultrasonic, 1000 sq.ft. coverage at 360 degrees, temperature and humidity resistant receivers, logic key/on bypass, adjustable time delay fifteen seconds to fifteen minutes, (120V/20A) (277V/20A) (347V/15A) power packs/slave packs as required, white.
- .1 Wattstopper W-1000A
- .10 C3 Ceiling mounted ultrasonic, 500 sq.ft. coverage at 360 degrees, temperature and humidity resistant receivers, logic key/on bypass, adjustable time delay fifteen seconds to fifteen minutes, (120V/20A) (277V/20A) (347V/15A) power packs/slave packs as required, white.
- .1 Wattstopper W-500A
- .11 C4 Ceiling mounted passive infrared, 300 sq.ft coverage, corner mounted, optional ON override through logic key/ON bypass, adjustable time delay thirty seconds to thirty minutes, (120V/20A) (277V/20A) (347V/15A) power packs/slave packs as required, white.
- .1 Wattstopper WPIR
- .12 CH Ceiling mounted ultrasonic, 90 lin.ft. hallway coverage, temperature and humidity resistant receivers, logic key/on bypass, adjustable time delay fifteen seconds to fifteen minutes, (120V/20A) (277V/20A) (347V/15A) power packs/slave packs as required, white.
- .1 Wattstopper W-2000H

2.28 **WIRING DEVICES – TIME SWITCHES**

- .1 T1 (120V) (277V) digital time switch, zero crossing, pushbutton programming, adjustable time-out setting five minutes to twelve hours, flash and beep warnings, time scroll for temporary override of pre-set time-out, reset feature to return to pre-set timeout setting, electroluminescent, white.

- .1 Wattstopper TS-400
 - .2 T2 24 V low voltage digital time switch, local power packs as required to suit load, zero crossing, pushbutton programming, adjustable time-out setting five minutes to twelve hours, flash and beep warnings, time scroll for temporary override of pre-set time-out, reset feature to return to pre-set timeout setting, electroluminescent, white
 - .1 Wattstopper TS-400-24.
- 2.29 **WIRING DEVICES - RECEPTACLES FOR GENERAL SERVICE**
- .1 Receptacles: Specification grade suitable for back and side wiring, complete with grounding terminal. Colour as required for type of area for straight blade devices and black colour for twistlock devices.
 - .2 Receptacles of one manufacturer.
 - .3 Acceptable Manufacturers:
 - .1 15A, 125V, (5-15R) Single Straight Blade
 - Arrow Hart 5261
 - Leviton 5261
 - Hubbell 5261
 - Pass & Seymour 5261
 - .2 15A, 125V, (5-15R) Duplex Straight Blade
 - Arrow Hart 5262
 - Leviton 5262
 - Hubbell 5262
 - Pass & Seymour 5262
 - .3 20A, 125V, (5-20R) Single Straight Blade
 - Arrow Hart 5361
 - Leviton 5361
 - Hubbell 6331
 - Pass & Seymour 5361
 - .4 20A, 125V, (5-20R) Duplex Straight Blade
 - Arrow Hart 5392
 - Leviton 5362
 - Hubbell 5392
 - Pass & Seymour 5362
 - .5 15A, 125V, (5-15R) Duplex GFCI, Straight Blade
 - Arrow Hart GF5242AH
 - Leviton 6599-W
 - Hubbell GF-5252
 - Pass & Seymour 1591
 - .6 15A, 125V, (5-15R) Duplex Isolated Ground, Straight Blade
 - Arrow Hart IG5262AH
 - Leviton 5262-IG
 - Hubbell IG-5262
 - Pass & Seymour IG6200
 - .7 20A, 125V, (L5-20R) Single locking, 2 pole, 3 wire, grounding
 - Arrow Hart 6200
 - Leviton 2310
 - Hubbell 2310ACN
 - Pass & Seymour L520-RCN
 - .8 20A, 250V, (L6-20R) Single locking, 2 pole, 3 wire,
 - Arrow Hart 6210
 - Leviton 2320
-

	grounding	-	Hubbell 2320ACN
		-	Pass & Seymour L620-RCN
.9	30A, 250V, (L6-30R) Single locking, 2 pole, 3 wire, grounding	-	Arrow Hart 6340
		-	Leviton 70630-FR
		-	Hubbell 2620CAN
		-	Pass & Seymour L630RCN
.10	30A, 250V, (L15-30R) Single locking, 3 pole, 4 wire, 3 phase, grounding	-	Arrow Hart 6520
		-	Leviton 2720
		-	Hubbell 2720ACN
		-	Pass & Seymour L1530-RCN
.11	20A, 277V, (L7-20R) Single locking, 2 pole, 3 wire, grounding	-	Arrow Hart 6220
		-	Leviton 2331
		-	Hubbell 2330ACN
		-	Pass & Seymour L720R
.12	20A, 347V (L24-20R) Single locking, 2 pole, 3 wire, grounding	-	Leviton 3721
		-	Pass & Seymour L3720-RCN
.13	15A, 125V (5-15R) Quad straight blade, 2 pole, 3 wire grounding	-	Bryant 1254
		-	Hubbell 415 series
		-	Pass & Seymour 1254
.14	15A, 347V, (24-15R) Quad straight blade, 2 pole, 3 wire grounding	-	Bryant 3474W
		-	Hubbell 415347WC
		-	Pass & Seymour 3474W
.15	15A, 125V, (5-15R) Duplex straight blade	-	Arrow Hart 26262
		-	Leviton Decora Plus
		-	Hubbell 2152 series
		-	Pass & Seymour 885
.16	15A, 125V (5-15R) Duplex straight blade, 2 pole, 3 wire grounding, surge suppression, indicator light, blue (ivory) colour	-	Arrow Hart 5250
		-	Hubbell 5260
.17	15A, 125V (5-15R) Duplex straight blade, 2 pole, 3 wire grounding, isolated ground, surge suppression, indicator light, blue (ivory) colour	-	Arrow Hart IG5250
		-	Hubbell IG5262

2.30 **WIRING DEVICES - COVER PLATES**

- .1 Stainless steel Type 302 alloy, vertically brushed, 0.8 mm thick cover plates.
- .2 Nylon, smooth, high impact strength.
- .3 Pressed steel, galvanized.
- .4 Cast covers for cast boxes with gaskets.
- .5 Cover plates of same manufacture as devices.

2.31 **WELDING RECEPTACLES**

.1 Circuit Breaking Receptacle

.1 Receptacle and back box assembly, 600 volt, 60 amp, three-wire, four-pole, weatherproof, aluminum housing.

.2 Acceptable Manufacturers

.1 Appleton Powertite, AJA mounting box and spring door

.2 Crouse-Hinds, Arktite AREA 6000 series, AJ back box, angle adaptor and spring door

.3 Russellstoll, type JRFA, twenty degree angle adaptor and spring door

.2 Interlocked Receptacle and Switch

.1 Receptacle interlocked with unfused disconnect switch, 600 volt, 60 amp, three-wire, four-pole. Receptacle with aluminum housing and spring door. Disconnect switch with NEMA 12 sheet steel enclosure.

.2 Acceptable Manufacturers

.1 Appleton WSRD interlocked receptacle

.2 Crouse-Hinds Arktite receptacle with WSRD disconnect switch

.3 Schneider Square D with Crouse-Hinds Arktite receptacle and class 3110 disconnect switch

.3 Compact Interlocked Receptacle and Switch

.1 Compact unit, receptacle interlocked with unfused disconnect switch, 600 volt, 60 amp, three-wire, four-pole, watertight, NEMA 4X non-metallic enclosure.

.2 Acceptable Manufacturers

.1 Bryant, 460SM series

.2 Crouse-Hinds, Arktite CSR Series

.3 Hubbell, Circuit-Lock

2.32 **SNOW MELTING SYSTEM (SELF-REGULATING CABLE)**

.1 Copper heating cables with semi-conductive core fluoropolymer jacket, copper shield and polyolefin outer jacket. Cold leads of adequate length for each cable set so entire heated length is in concrete section to be heated. Raychem Electromelt EM2-XR.

.2 Automatic snow detector, controller, and contactors to switch cable sets, also air temperature thermostat, and "test/off/auto" switch to control each system. Complete with kits of same manufacture for splices, seals and power connections.

.3 Cast junction boxes for connection of heating cables to power supply from panel. Heat shrink sleeves for watertight connections.

- .4 Thermostat: Rated 20 A, 120 V, suitable for outdoor ambient monitoring. Enclosure die-cast aluminum EEMAC 4, watertight and dusttight with threaded conduit hub. Set point +3°C with a minimum adjustment of 6°C above and 3°C below setpoint.
- .5 Snow sensor, 20 A, 120 V with EEMAC 4 enclosure for electrical wiring and relay, arranged for mounting on vertical conduit.
- .6 Acceptable Manufacturer:
 - .1 Raychem, Electromelt System

2.33 **SNOW MELTING SYSTEM (MI CABLE)**

- .1 Heating cables type MI with polyethylene jacket. Cold leads, jacketed, of adequate length for each cable set so entire heated length is in concrete section to be heated.
- .2 Control panel: 120 V AC supply, two-pole contactor, hold-on timer, bypass switch for manual control and status indicators.
- .3 Heat shrink sleeves for watertight connections.
- .4 Slab sensing thermostat.
- .5 Snow sensor arranged for mounting on vertical conduit with integral ambient thermostat.
- .6 Acceptable Manufacturer
 - .1 Pyrotenax: Slab sensing thermostat model 4688-WP, control panel model APS-3 and slab sensing thermostat model 4688-WP.

2.34 **ICE MELTING CABLE SYSTEM**

- .1 System comprises ice melting cable, junction boxes, downspout hangers, heat shrinkable tubes, end seals and thermostat.
- .2 Ice melting cable: Self regulating cable rated ten watts per foot when it contacts ice and five watts per foot in air, 120 volt power supply.
- .3 Junction boxes: Steel, EEMAC type 4 or cast steel fittings.
- .4 Thermostat: 4.5°F (40°F) setpoint, rated 120V, 22A, EEMAC 4x enclosure, three foot capillary tube.
- .5 Acceptable Manufacturers
 - .1 Ice melting cable: Raychem type GM-1X
 - .2 Downspout hangers: Raychem type GMK-DH
 - .3 Thermostat: Raychem type AMC-F5

2.35 **HEAT TRACING CABLE**

- .1 120 volt copper heat tracing cables for installation (inside) (and) (on exterior of) pipes complete with line voltage thermostat with remote sensor and capillary.
- .2 Acceptable Manufacturers:
 - .1 Thermon

.2 Raychem

.3 Pyrotenax

2.36 **PLYWOOD BACKBOARDS**

.1 Plywood backboards, good one side, 1220 mm x 2440 mm x 19 mm unless indicated otherwise. Treat with primer and two coats of fire retardant paint.

.2 Mount plywood on vertical strapping, on 40 mm centres to provide 10 mm clearance between wall and rear of plywood. Treat strapping similar to plywood.

2.37 **FINISH**

.1 Equipment enclosure finish: Baked grey enamel, ANSI 49 or ANSI 61.

3 **Execution**

3.1 **WIRE AND CABLE**

.1 Install wiring in raceways unless noted otherwise.

.2 Minimum wire sizes:

.1 Power and lighting - No. 12 AWG

.2 Control - No. 14 AWG

.3 Fire alarm - No. 18 AWG

.3 Wire and cable application and type:

Application	Type
.1 Lighting branch circuit where connection to luminaire is AC90 cable	T90 nylon
.2 Receptacle branch circuit	T90 nylon
.3 Ceiling boxes to luminaires in suspended ceiling	T90 nylon or AC90 cable
.4 Wiring under raised floor used as plenum	AC90 cable or wire in flexible metal conduit
.5 Wiring inside high temperature equipment	TEW or SEW-2
.6 Branch circuits other than those covered above	RW90
.7 Equipment feeders, circuits	RW90
.8 Underground and under slab raceways, duct banks, direct burial	RWU90

.4 Type AC90 cable length limitations:

.1 Ceiling box to luminaire: 1.2 m maximum in non-accessible ceilings;
1.8 m in accessible ceilings

.2 Junction box to outlet: 3.6 m maximum

- .5 Load current limitations:
 - .1 Conductors rated for more than 90°C: 90°C (194°F) code ampacity rating
 - .2 Motor connection: 75°C (167°F) code ampacity rating
- .6 EMF-Free Power Cables
 - .1 Install the EMF-free power cable system in complete accordance with the manufacturer's written instructions.
 - .2 Provide a manufacturer's representative on site during installation of the system.
 - .3 At completion of the work, provide a letter from the manufacturer indicating that the system was installed to the manufacturer's satisfaction and that it is ready for use.
 - .4 Provide manufacturer's commissioning report to include the manufacturer's standard readings and specifically the following readings taken at three locations, determined by the Consultant; 1 m from the feeder and distance from the feeder where the EMF is 0.5 micro Teslas.
 - .1 Background AC and steady state (DC) EMF readings (feeder de-energized)
 - .2 EMF readings at full load, balanced $\pm 5\%$
 - .3 EMF readings near full load with 20% $\pm 5\%$ unbalance
 - .5 Acceptance Criterion
 - .1 The installation will be deemed not acceptable if the ac EMF is in excess of 0.5 micro Teslas above the background EMF at any point along the feeder not within 2 m of either end for all load conditions

3.2 **MODULAR WIRING**

- .1 Install and connect modular wiring.

3.3 **CONNECTORS**

- .1 Install compression terminations and splices in accordance with manufacturer's written instructions.
- .2 Make splices in junction boxes.
- .3 Make connections in lighting circuits with twist type splicing connectors.
- .4 Terminate and splice conductors No. 8 and larger at terminal blocks in junction boxes.
- .5 Seal terminations and splices exposed to moisture, corrosive conditions or mechanical abrasions with heavy wall heat shrinkable insulation.
- .6 Install fixture type connectors and tighten. Replace insulating cap.

3.4 **MOTOR LEAD CONNECTION KITS, 600 VOLT**

- .1 Install motor lead connection kits for low voltage motors.
-

3.5 **MOTOR LEAD CONNECTION KITS, 5000 VOLT**

- .1 Install motor lead connection kits for 4000 V motors.

3.6 **CONDUIT AND EMT - GENERAL**

- .1 Run parallel or perpendicular to building lines.
- .2 Group raceways wherever possible. Support on channels.
- .3 Install expansion joints as required.
- .4 Run raceways in web portion of structural steel columns and beams.
- .5 Do not drill structural members to pass through.
- .6 Locate raceways behind infrared or unit heaters with 1.5 m clearance.
- .7 Locate raceways not less than 125 mm clear where parallel to steam or hot water lines with a minimum of 75 mm at crossovers.
- .8 Do not install horizontal runs in masonry walls.
- .9 Use metallic raceway where temperatures exceed 75°C (167°F) or where enclosed in thermal insulation.
- .10 EMT and non-metallic conduits to contain insulated green ground wire.
- .11 Install 6 mm diameter nylon pull cord in empty raceways.

3.7 **CONDUIT AND FITTINGS**

- .1 Minimum conduit sizes:

.1	Surface installation	21 trade size conduit
.2	Embedded in concrete	27 trade size conduit
.3	Directly buried	53 trade size conduit

- .2 Conduit application and type:

Application		Type
.1	Corrosive areas	rigid steel corrosion resistant coated
.2	Hazardous areas	rigid steel
.3	Outdoor areas	rigid steel
.4	Embedded in concrete, other than grade slab	rigid steel (PVC)
.5	In or below grade slab	PVC
.6	Exposed in unfinished areas up to 3 m above finished floor. Use EMT above 3 m	rigid steel

-
- | | | |
|----|--|-------------------------------------|
| .7 | Connection to motors and equipment
subject to vibration | liquid tight flexible steel conduit |
| .8 | Final connection to dry type transformer | flexible steel conduit |
| .9 | Whip connection to modular furniture | non-metallic extra flexible PVC |
- .3 Use field threads on rigid conduit of sufficient length to draw conduits up tight.
- .4 Do not bend coated steel conduit. Use elbows for deflections.
- .5 Do not install conduit in or under slab.
- .6 Use factory "ells" where ninety degree bends are required for 27 trade size and larger conduits.
- .7 Bend conduit offsets cold. Do not install crushed or deformed conduits and avoid trapped runs in damp or wet locations. Prevent the entrance of water and lodging of concrete, plaster, dirt, or trash in conduit, boxes, fittings, and equipment during course of construction.
- .8 Where conduit joints occur in damp or wet locations, make joints watertight by applying an approved compound on the entire thread area before assembling. Draw up all conduit joints as tightly as possible.
- .9 Cap exposed empty conduits which do not terminate in outlets, panels, cabinets, etc., with standard galvanized plumber's pipe caps.
- .10 Plug empty conduits which terminate flush with floors or walls with flush coupling and brass plug.
- .11 Install conduit sleeves for all exposed conduits and cables passing through walls, ceilings, or floors, and fill void between sleeve and conduit with caulking. If fire-rated caulking is required by code, use same class as walls, ceilings or floors.
- .12 Terminate conduit stubbed up through concrete floor for connection to free standing equipment with a coupling flush with finish floor, and extend rigid conduit to equipment, except where required, use flexible conduit from a point 150 mm above floor.
- .13 Install double locknuts and bushings on all rigid conduit terminations into threadless openings. Increase length of conduit threads at terminations sufficiently to permit bushing to be fully seated against end of conduit.
- .14 Mechanically bend steel conduit.
- .15 Install sealing condulets in conduits at hazardous area boundaries.
- .16 Conduits in Poured Concrete
- | | |
|----|--|
| .1 | Locate to suit reinforcing steel. Secure firmly to prevent movement during pour. |
| .2 | Clear each conduit with mandrel and brush before concrete sets. |
| .3 | Protect conduits from damage where they stub out of concrete. |
| .4 | Install sleeves where conduits pass through slab or wall. |
| .5 | Provide oversized sleeve before membrane is installed where conduits pass through waterproof membrane. Use cold mastic between sleeve and conduit. |
-

- .6 Encase conduits completely in concrete; provide 50 mm minimum concrete cover.
- .7 Replace with exposed conduit, any conduit run found to be obstructed after concrete sets.

3.8 **EMT AND FITTINGS**

- .1 Minimum EMT size: 21 trade size conduit.
- .2 EMT Application
 - .1 Exposed in unfinished areas, above truss level and for drops in column web to 3 m above finished floor. Use rigid steel conduit below 3 m.
 - .2 In block walls and stud partitions.

3.9 **CABLE TRAY**

- .1 Install cable tray systems.
- .2 Provide barriers where required by code.
- .3 Support cable trays from structural members. Support cable tray on both sides or on cantilever brackets to provide continuous open access to one side of the tray as required. Coordinate support locations and weight per support with building structure. Provide any additional support fastenings required.
- .4 Provide the following minimum clearances:
 - .1 300 mm vertical between top of tray and equipment or structure above.
 - .2 300 mm vertical between trays.
 - .3 600 mm horizontal on access side of tray.
- .5 Ensure that sharp burrs or projections are removed to prevent damage to cables and injury to personnel.
- .6 Install cables individually.
- .7 Lay cables into cable tray. Use rollers where necessary, to pull cables.
- .8 For maintained spacing, secure cables in cable tray at 3 m centers for horizontal runs with black coloured tie wraps and at 1.5 m centres for vertical runs with aluminum clamps supplied by tray manufacturer.
- .9 Maintain power cables greater than one diameter minimum spacing unless shown otherwise.
- .10 Firestop Fire Barriers (Refer to Section 26 05 01).
 - .1 Frame openings in walls, and floors for width and depth required for cable tray to run through with 50 mm clear all around.

3.10 **WIREWAYS**

- .1 Install per manufacturer's recommendations.
-

- .2 Keep number of elbows, offsets and connections to a minimum.
- .3 Install barriers where required by code.
- .4 Install gutters to full length of equipment.

3.11 **SURFACE RACEWAYS**

- .1 Install per manufacturer's recommendations.

3.12 **CELLULAR FLOOR SYSTEM**

- .1 Install trench duct, preset inserts and activation kits including activation power and data receptacles and telephone jack outlets.
- .2 Tack weld trench duct to non-cellular decking, and tack weld trench duct void closures.
- .3 Seal voids at preset inserts, cellular raceway butt joints and void closures with sealing compound.

3.13 **FASTENINGS AND SUPPORTS**

- .1 Provide supports and fastenings for the Work of this division. Do not use supports or equipment provided by other trades.
 - .2 Equipment fastenings and supports shall conform to manufacturers recommendations.
 - .3 Do not attach to, or suspend any electrical Product or service from the roof deck, mechanical ductwork or piping.
 - .4 Do not use wire lashing or perforated strap to support or secure raceways or cable.
 - .5 Support rods for any suspended item must not be attached to or extended through steel pan type roofs or through concrete slab roofs.
 - .6 For surface mounting of two or more raceways or cables use channels.
 - .7 Where there is no wall support for raceways and cables dropped vertically to equipment, provide channel properly secured to floor and structure.
 - .8 Hang supports from structural members. Where location does not permit direct support from structure provide necessary brackets, frames, channels secured to structural members.
 - .9 Fasten exposed conduit and cables to building construction or support systems using straps. Use beam clamps on exposed steelwork.
 - .10 Masonry, tile and plaster surfaces: Use lead anchors.
 - .11 Poured concrete: Use expandable inserts. Low velocity powder activated fastenings may be used only in poured concrete.
 - .12 Steel structures: Use clips, spring loaded bolts, cable clamps, designed as accessories to basic channel members.
 - .13 Do not use powder activated fasteners in, tile, precast concrete or steel structure.
 - .14 Do not install conduits or cables on the bottom chord of joists or trusses.
-

- .15 Use beam clamps of the two-bolt design and of such type that the rod load is transmitted only concentrically to the beam web centreline. The use of "C" and "I" beam side clamps will not be allowed.
- .16 Where the roof or floor framing consists of open web or long span steel joists and/or trusses, ensure that hangers are located at or within 150 mm of the joist or truss top or bottom chord panel points, otherwise provide additional structural steel as required where hanger spacing does not coincide with joist or truss spacing. Design suspension assembly such that the hanger load is transmitted only concentrically to the supporting joist or truss. The use of "C" and "I" beam clamps, brackets, etc., will not be allowed.
- .17 Locate secondary structural steel members between joists or trusses at or within 150 mm of top or bottom chord panel points. Where the secondary structural steel member cannot be located at or near a joist or truss panel point, provide additional diagonal structural steel web member/members designed for the applicable load to the nearest panel point in the opposite chord member. Diagonal hangers which will induce lateral stresses in the chord members of the joist will not be permitted. Submit Shop Drawings of the suspension assembly indicating the location of suspension or support points, the maximum load at each suspension point, location and size of hangers, brackets and intermediate framing members when required, and also details of connection to building structure.

3.14 **SPLITTER BOXES**

- .1 Install splitters as indicated and mount plumb, true and square to the building lines.
- .2 Extend splitters full length of equipment arrangement.

3.15 **JUNCTION BOXES**

- .1 Install junction boxes in inconspicuous but accessible locations. Secure to structure.
- .2 Install terminal blocks on mounting rails, for termination of each wire and cable regardless of size.
- .3 Only one voltage source is permitted in a junction box.
- .4 Install barriers to separate different auxiliary systems.

3.16 **TERMINAL BLOCKS - SURGE SUPPRESSION**

- .1 Install surge suppression terminal blocks.

3.17 **PULL BOXES**

- .1 Install pull boxes in inconspicuous but accessible locations. Secure to structure.
- .2 Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.
- .3 Only one voltage source is permitted in a pull box.
- .4 Install barriers to separate different auxiliary systems.

3.18 **OUTLET AND CONDUIT BOXES**

- .1 Install conduit outlet boxes for conduit up to 32 mm and pull boxes for larger conduits.
 - .2 Support boxes independently of connecting conduits.
-

- .3 Seal boxes during construction to prevent entry of debris, dust and dirt.
- .4 For flush installations mount plaster rings to box, flush with wall surface to permit wall finish to come within 6 mm of opening.
- .5 Provide correct size of openings in boxes for conduit, armoured cable connections. Reducing washers will not be acceptable.
- .6 Install switches and other controls close to door lock or latch jambs and other openings, maintaining a minimum of 100 mm from trims of doors (except where installed in door frames of metal partitions) check door swings.
- .7 Install 100 mm square or octagonal outlet boxes for lighting fixture outlets.

3.19 **MASONRY BOXES**

- .1 In block walls use deep boxes to provide clear space around knockout for AC90 cable entry.

3.20 **WIRING DEVICES - SWITCHES**

- .1 Install single throw switches with handle in up position when switch is closed.
- .2 Install switches in gang type outlet box when more than one switch is required in a location.
- .3 Mount toggle switches at height indicated.
- .4 Install switch colours as follows:

	Area	Colour
.1	Gypsum board, plaster or panelled	(white) (ivory) (brown)
.2	Office	(white) (ivory) (brown)
.3	Factory, service	brown (ivory)

3.21 **WIRING DEVICES - DIMMER SWITCHES**

- .1 Install each dimmer switch in outlet box at locations indicated.
- .2 Mount dimmer switches at height indicated.

3.22 **WIRING DEVICES - RECEPTACLES**

- .1 Install receptacles vertically, use gang type outlet box where more than one receptacle is required in a location.
 - .2 Where split receptacle has a portion switched, mount vertically and switch upper portion.
 - .3 Coordinate with architectural and interior design drawings for final positioning and mounting heights of power and voice/data receptacles. Where there is disagreement between electrical and architectural drawings, take the architectural drawings as correct.
 - .4 Maintain clearances between receptacle outlet boxes and millwork as stipulated on the drawings.
 - .5 Align and evenly space outlet boxes that are mounted as a group.
-

- .6 Install receptacle colours as follows:

Area	Colour
.1 Gypsum board, plaster or panelled	(white) (ivory) (brown)
.2 Office	(white) (ivory) (brown)
.3 Factory, service, exterior	brown

3.23 **WIRING DEVICES - COVER PLATES**

- .1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
- .2 Install suitable common cover plates where wiring devices are grouped.
- .3 Do not use cover plates designed for flush outlet boxes on surface-mounted boxes.
- .4 Provide plaster ring where necessary.
- .5 Install cover plates as follows:

Area	Cover Plate Type
.1 Gypsum board, plaster or panelled	stainless steel (nylon) (white) (ivory)
.2 Factory, service	galvanized steel
.3 Exterior	cast cover

3.24 **WELDING RECEPTACLES**

- .1 Install welding receptacles.
- .2 Ensure that phase rotation is similar for all receptacles.

3.25 **CONTROL DEVICES**

- .1 Install as indicated.

3.26 **SNOW MELTING SYSTEM (SELF-REGULATING CABLE OR MI CABLE)**

- .1 Install cables.
- .2 Where not embedded in concrete, waterproof in-line splices may be used for connections to cold leads. Use heat shrink sleeves or other appropriate method to waterproof splices. Where cables are embedded in concrete, extend heating cables from slab to junction box. Splice to cold leads in junction boxes.
- .3 Secure cables in place with cable straps supplied by cable manufacturer. Maintain indicated spacing.
- .4 Install thermostat sensor, clear of cable, to sense slab temperature.
- .5 Install snow sensor in exposed location on roof well clear of any projection which could obstruct deposit of snow in collector. Mount sensor 600 mm above roof deck.
-

3.27 ICE MELTING CABLE SYSTEM

- .1 Install junction boxes, in suitable protected location, adjacent to start of each ice melting cable installation. Install ice melting cables along complete length of roof drains and downspouts. Install cable end seals at cable terminations at bottom of downspouts. Install downspout hangers where cable enters downspouts and roof drains.
- .2 Install thermostat in electrical room. Extend capillary through exterior wall, provide clamp on outside wall surface to hold coiled capillary with probe clear of wall. Seal wall penetration.

3.28 HEAT TRACING CABLES

- .1 Install heat tracing cables where indicated. Measure pipes at site for exact length and verify sizes.
- .2 Secure cable and remote sensor to pipe in accordance with cable manufacturer's recommendation keeping bulb clear of heating cable.
- .3 Install heating cable as per manufacturer's recommendations.
- .4 Wire to thermostat and heater cable in conduit. Provide watertight coupling at heater cable.
- .5 Coordinate with mechanical and sprinkler pipe trades. For exterior applied cable do not energize until insulation has been applied over cable.
- .6 Where installed inside pipes provide watertight gland for installation by pipe fitters.
- .7 Megger test insulation resistance before installation, before addition of thermal insulation and after addition of thermal insulation in accordance with manufacturer's recommendations.
- .8 Install and commission heat tracing system under supervision of manufacturer's representative.

3.29 PLYWOOD BACKBOARDS

- .1 Install plywood backboards.

3.30 FIELD FABRICATED METAL WORK

- .1 Clean and prime paint field fabricated metal work.
- .2 After fabrication deburr, scrape, grind smooth, wire brush with power brush and degrease metal work.
- .3 Prime paint steel with one coat of CISC/CPMA 2.75 oil alkyd primer.
- .4 Prime paint aluminum as follows: Wash with detergent solution and wipe down with SSPC-SP1 solvent. Apply Glidden #Y-5229 primer to 1.5 mils DFT.
- .5 For brass and bronze alloy materials, prepare as for aluminum but apply one coat of CAN/CGSB-1.40-M zinc chromate primer.

End of Section

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- 1 General
 - 1.1 **SUMMARY**
 - .1 Section Includes
 - .1 Labour, Products, equipment and services necessary to complete the Work of this section.
 - 1.2 **GENERAL**
 - .1 Modifications, demolition and installation of services within this building require utmost care due to vital operation of systems involved. Removal and installation of systems require constant communication with Consultant.
 - 1.3 **CO-ORDINATION BETWEEN NEW AND EXISTING INSTALLATIONS**
 - .1 Provide interfacing components between new and existing systems as necessary for proper performance and operation.
 - 1.4 **EXISTING SERVICES**
 - .1 Ensure existing services remain undisturbed and energized except where indicated to be disconnected.
 - .2 Disconnect and remove abandoned wiring materials and devices.
 - .3 Cut raceways flush where embedded in structure.
 - .4 Retain abandoned embedded outlet boxes and close with pressed steel cover plates.
 - .5 Make safe all circuit wiring left for future use.
 - 1.5 **INTERRUPTION OF SERVICES**
 - .1 Obtain Consultant's written approval before interrupting any service. Long outages are not acceptable.
 - .2 Provide temporary services to maintain continuity in the event that services must be interrupted.
 - 1.6 **PREMIUM TIME**
 - .1 Include cost of premium time in Tender Price for work during nights, weekends or other time outside normal working hours necessary to do the Work and maintain electrical services in operation.
 - 2 Products
 - 2.1 **USE OF EXISTING MATERIAL AND EQUIPMENT**
 - .1 Unless noted otherwise, existing panels, boxes and wiring materials may be reused if acceptable to inspection authority.
 - .2 Unless noted otherwise, provide additional equipment of same type and manufacture to supplement existing equipment.
 - .3 Reused luminaires: Furnish new lamps.
-

3 Execution

3.1 **EXISTING MATERIAL AND EQUIPMENT**

- .1 Equipment to be reused or relocated: Test for proper operation, and repair as necessary.
- .2 Repair or replace existing equipment which is damaged in process of relocation.
- .3 Reused luminaires: Install lamps, clean fixtures and touch up damaged finish.
- .4 Relocate existing junction, pull or terminal boxes which become inaccessible due to new mechanical ductwork or equipment.

3.2 **DEMOLITION**

- .1 Demolish existing work, where indicated, and remove from site.
- .2 Execute all demolition work so as to create minimum vibration or dust within and outside the building. Obtain Consultant's approval of methods before proceeding.

3.3 **WORK IN EXISTING TENANT FACILITIES**

- .1 Coordinate Work in tenant facilities with tenant. Ensure that no interruptions and/or interferences occur with tenant's normal operation.
- .2 Be responsible for any damage created in existing tenant facilities when installing equipment and materials.

3.4 **PENETRATIONS IN EXISTING STRUCTURE**

- .1 Perform cutting, patching and repairing. Before proceeding obtain Consultant's approval.
- .2 Where necessary to penetrate existing floors, walls, ceiling, roof or structural members provide sleeve and follow Consultant's instructions.
- .3 Restore surfaces to same finish and condition as existed prior to penetration.
- .4 Core Drilling Procedure
 - .1 Examine locations to be core drilled where:
 - .1 Diameter is greater than 25 mm
 - .2 Multiple drillings required and where the distance between centres is less than ten times the diameter of the hole
 - .2 Examine by most suitable method including:
 - .1 X-ray
 - .2 Ferro scan
 - .3 Cable detection
 - .3 Examine from both sides of the structure to be drilled.
 - .4 Examine proposed core drilling locations to determine:
 - .1 Possible interference with

- .1 Services
- .2 Structural components
- .2 Possible presence of asbestos tile or other asbestos based material. Report any occurrence or suspected occurrence to the Consultant immediately.
- .5 Select locations as suitable for core drilling and label them:
 - .1 Uniquely number each drilling location and core so that markings will be legible after drilling
 - .2 Mark each core with a north pointing arrow where drilling a slab or upward pointing arrow where drilling a wall
- .6 Without interfering with or damaging any services or structural elements, drill pilot holes sufficient to verify location of potential obstructions or for alignment purposes.
- .7 Use impact drill when drilling holes of 25 mm diameter or less. For holes of greater diameter use core drill.
- .8 Prepare report showing intended core drill locations including printouts, X-ray images. Submit the report for approval, to Consultant, prior to drilling.
- .9 Proceed with core drilling only after approval has been received from Consultant.
- .10 Confine drilling operation to time-of-day as stipulated by Consultant.
- .11 Position suitable warning notices of a type acceptable to Consultant and exercise caution to ensure safety and protection of personnel and property during drilling especially from effects of water, dust damage, or falling objects below the slab or behind the wall being drilled.
- .12 Stop drilling immediately, and report to Consultant, if contact is made with foreign objects such as reinforcing steel (rebar), electrical conduit, water pipes, drainage pipes.
- .13 Cover open holes with secured covers to guard against fall through of objects.
- .14 Provide necessary firestopping, temporary or otherwise, sufficient to firestop holes that would be otherwise open during hours that the location is unattended. Coordinate placement of firestopping with Consultant.
- .15 Store all cores or core fragments on site and make them available for inspection by Consultant. Dispose of the cores or core fragments after permission is received from Consultant.

3.5 **SALVAGE MATERIALS**

- .1 Remove from site materials in renovated areas that are not to remain or be reused, unless noted as remaining property of Owner.

End Of Section

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- 1 General
- 1.1 **SUMMARY**
- .1 Section Includes
- .1 Labour, Products, equipment and services necessary to complete the Work of this section.
- 1.2 **APPROVALS**
- .1 Identification subject to prior approval of Consultant.
- 2 Products
- 2.1 **WIRE AND CABLE MARKERS**
- .1 Wire and Cable Diameter Less Than 13 mm
- .1 Acceptable manufacturer
- .1 Wieland Z type
- .2 Cable Diameter 13 mm and Larger
- .1 Acceptable manufacturer
- .1 Wieland K type
- .3 Non-Circular Wire
- .1 Acceptable manufacturer
- .1 Raychem Shrinkmark sleeves
- 2.2 **CONDUIT AND ELECTRICAL METALLIC TUBING MARKERS**
- .1 Stick-On Marker
- | | Raceway Size | Minimum Character Height |
|----|--------------|--------------------------|
| .1 | ¾" - 1¼" | 15 mm |
| .2 | 1½" - 2" | 19 mm |
| .3 | Over 2" | 32 mm |
- .2 Acceptable Manufacturers
- .1 Brady, vinyl cloth, black on orange, type B-500
- .2 Panduit, vinyl cloth, black on yellow, type PCL
- .3 Wieland, mylar, black on yellow, type NL
- 2.3 **CABLE TRAY MARKERS**
- .1 Stick-On Marker
- .1 Acceptable Manufacturers
-

- .1 Brady, vinyl cloth, black on orange, 48 mm character height, type B-500
- .2 Safety Supply Canada, conduit and voltage markers, style A, 48 mm character height
- .3 Panduit, vinyl indoor/outdoor, black on yellow, 50 mm character height, type PVL
- .4 Wieland, black on yellow, 50 mm character height, Electrocode NL

2.4 **BUSWAY MARKERS**

- .1 Stick-On Marker
 - .1 Acceptable Manufacturers
 - .1 Brady, vinyl cloth, black on orange, 48 mm character height, type B-500
 - .2 Safety Supply Canada, conduit and voltage markers, style A, 48 mm character height
 - .3 Panduit, vinyl indoor/outdoor, black on yellow, 50 mm character height, type PVL
 - .4 Wieland, black on yellow, 50 mm character height, Electrocode NL
 - .2 Laminated plastic, black letters on white background, 75 mm character height.
 - .3 Suspended sign, rigid vinyl, black on yellow, 75 mm character height.
 - .1 Acceptable Manufacturers
 - .1 Panduit
 - .2 Safety Supply Canada
 - .4 Typical identification: "12-1-1, 600A, 3P, 4W".

2.5 **PANELBOARD IDENTIFICATION**

- .1 Engraved laminated plastic, black lettering on white background, 6 mm character height.
- .2 Typical two-line identification for lighting panel:
 - "Lighting Panel C, 120/208V, 3 ph, 4W"
 - "Supplied from panel BB"
- .3 Directories: Typewritten identification of breaker number, ampere rating and connected equipment.

2.6 **SWITCHBOARD IDENTIFICATION**

- .1 Engraved laminated plastic, black lettering on white background, 15 mm minimum character height.
 - .2 Typical identification: "Switchboard AAA, 347/600V, 3 ph, 4 w"; for branch feeders "Power Panel B.
-

2.7 **MOTOR STARTER, CONTACTOR AND DISCONNECT SWITCH IDENTIFICATION**

- .1 Engraved laminated plastic, black lettering on white background, 6 mm character height.
- .2 Typical identification: "Pump S4, 208V, 3 ph".

2.8 **MAGLOCK/FIRE ALARM PULL STATIONS IDENTIFICATION**

- .1 Engraved laminated plastic, red lettering on white background, 25 mm character height.
- .2 Identification: "EMERGENCY EXIT UNLOCKED BY FIRE ALARM OR BY SECURITY SYSTEM".

2.9 **WARNING SIGNS**

- .1 Outdoor: Metal, porcelain enamel finish. Indoor: Rigid vinyl.
- .2 Typical identification: "Danger - High Voltage".
- .3 Acceptable Manufacturers
 - .1 Outdoor: Safety Supply Canada
 - .2 Indoor: Safety Supply Canada, Panduit

2.10 **MARKER TAPE, SERVICE AND PHASE IDENTIFICATION**

- .1 Acceptable Manufacturer
 - .1 3M, Scotch Code Tape, type STD with SDR colour refills or 3M Scotch 35 colour tape.

3 Execution

3.1 **SYSTEMS IDENTIFICATION**

- .1 Identify outlet boxes for various systems with distinctive paint colour. Apply a small area of paint to inside of outlet, junction and pull boxes and panels. In suspended ceiling areas, apply paint to inside and outside of junction boxes. System colours:

System	Normal	Emergency	UPS
120/208 volt	black	black/red	black/blue
347/600 volt	orange	orange/red	orange/blue
Fire alarm	red		
Intercom	brown		
Low voltage control	black		
PA and sound	light green		

3.2 **POWER COMPANY SERVICE IDENTIFICATION**

- .1 Identify service conductors with coloured marker tape as follows:
 - .1 Phase A - red
 - .2 Phase B - black
 - .3 Phase C - blue
 - .4 Neutral - white

- .5 Ground - green

3.3 **WIRE AND CABLE IDENTIFICATION**

- .1 Identify power, control, lighting and receptacle wires with continuous colouring as follows:
 - .1 Phase A - red
 - .2 Phase B - black
 - .3 Phase C - blue
 - .4 Neutral - white
 - .5 Ground - green
 - .6 Isolating ground - green and yellow
 - .7 Control - red
 - .8 Interlock - yellow
 - .9 D.C. - blue
- .2 For larger wire sizes available only in black, install coloured wire marker tape in accordance with above coding.

3.4 **WIRE AND CABLE IDENTIFICATION**

- .1 Cables Bearing Identification Numbers on the Drawings
 - .1 Install identification markers at each end of cable run.
- .2 Control/Indication Conductors
 - .1 Install conductor identification markers at switchgear, motor control centres and motor starter terminal blocks and at remote devices.
 - .2 Identification in accordance with the Drawings and reviewed Shop Drawings.
- .3 Lighting and Receptacle Branch Circuits
 - .1 Install conductor identification markers at panel, outlet box connections to lighting fixtures and device outlet boxes.
 - .2 Typical identification if fixture or device is connected to panel A, circuit 5: A-5.
- .4 Low Voltage Lighting Control
 - .1 Install conductor identification marker at relay phase conductors. Typical identification if connected to panel A, circuit 5: A-5.
 - .2 Install conductor identification marker on conductors between control locations and relay panels. Identify in accordance with reviewed Shop Drawings.
- .5 Data, Voice and Fibre Optic Cables
 - .1 Label horizontally distributed cabling at the following locations:
 - .1 Both ends of cable run

- .2 Entrance and exit of cable pathway (i.e. cable trays, zone conduits, etc.)
- .2 Label riser/backbone distribution cables at the following locations:
 - .1 Both ends of cable run
 - .2 Entrance and exit of cable pathway (i.e. cable trays, zone conduits, etc.)
 - .3 1.5 m above finished floor in communication closets and equipment rooms
 - .4 At entrance and exit of a sleeve or slot in communication closets and equipment rooms

- .3 Use the following colour codes for labels:

Function	Colour
Auxiliary and miscellaneous circuits	Yellow
Common equipment	Purple
Customer side of network interface	Green
First level backbone	White
Horizontal cabling to workstations	Blue
Interbuilding backbone	Brown
Key telephone systems	Red
Network side of network interface	Orange
Second level backbone	Gray

Note: Common equipment refers to PBX equipment, host computer, LANs and multiplexer. Miscellaneous refers to maintenance alarms, security, paging systems, and other system and circuits not an integral part of common equipment. Colour codes to ANSI/TIA/EIA-606.

- .6 Fire Alarm and Miscellaneous Systems
 - .1 Install identification on conductors at panels, remote devices and system connections. Identify in accordance with reviewed Shop Drawings.
 - .2 Install maglock/fire alarm pull station identification adjacent to each door equipped with a maglock.

3.5 **CONDUIT AND ELECTRICAL METALLIC TUBING (EMT) IDENTIFICATION**

- .1 Where Drawings indicate conduit and EMT identification numbers/letters, install identification markers at each end of run and at pull box locations.

3.6 **CABLE TRAY IDENTIFICATION**

- .1 Install markers indicating system, voltage, or voltages for trays with barriers, and identification number at intervals of 20 m maximum, at branches and termination locations.

3.7 **BUSWAY IDENTIFICATION**

- .1 Install stick-on markers indicating busway identification number and rating at cable tap boxes and thereafter at intervals of 30 m maximum.
- .2 Install suspended identification signs at start of run and at intervals of 30 m maximum.

3.8 **PANELBOARD IDENTIFICATION**

- .1 Install identification plates, using adhesive, on outside of panel.
- .2 Install directory.
- .3 Identify main bus as follows:
 - .1 Phase A - red
 - .2 Phase B - black
 - .3 Phase C - blue
 - .4 Neutral - white
 - .5 Ground - green

3.9 **SWITCHBOARD IDENTIFICATION**

- .1 Install identification plates for panel and branch feeders.

3.10 **MOTOR STARTER, CONTACTOR AND DISCONNECT SWITCH IDENTIFICATION**

- .1 Install identification plates using self-tapping screws.

3.11 **IDENTIFICATION AFTER FINISH PAINTING**

- .1 Behind access doors at shaft plenums: identify busways, feeder cables and feeder conduits.

3.12 **EQUIPMENT WARNING SIGNS**

- .1 Install "Danger - High Voltage" signs.
- .2 When equipment is supplied from more than one source install red warning signs to this effect.

3.13 **PATCH PANEL AND FACEPLATE IDENTIFICATION**

- .1 Identify each jack at each wall or furniture outlet with a label supplied by the faceplate manufacturer. Each jack identification designation to match the respective cable identification designation.
- .2 Identify each jack at each patch panel jack with labels, front and back, supplied by the patch panel manufacturer. Each jack identification designation to match the respective cable identification designation.
- .3 In addition to an alphanumeric label use manufacturer's matching colour coded icons, which conform to ANSI/TIA/EIA-606, to identify individual jacks on faceplate and patch panels.

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

- .1 Canadian Standards Association: CSA
.2 C22.3 No. 1
.3 C22.2 No. 0.3-M
.4 C22.3 No. 2
.5 C22.2 No. 04-M
.6 C22.2. No. 41
.7 American Society for Testing and Materials: ASTM
.8 National Electric Testing Association Inc.: NETA

1.3 **SUBMITTALS**

- .1 Submit certified test reports in accordance with Section 26 05 01.

2 Products

2.1 **MATERIALS**

- .1 Furnish all materials, instrumentation, etc. required to execute testing and commissioning as specified, including manufacturers testing and commissioning.
.2 Calibrate test instruments and for each instrument record identifying numbers, date of calibration and percentage of error (if any) on appropriate test reports.
.3 Furnish megger test instruments as follows:
Megger Voltage System Voltage
500 V up to 250 V (low voltage)
1000 V 277 V to 1000 V (low voltage)

3 Execution

3.1 **CO-ORDINATION OF ELECTRICAL PROTECTIVE DEVICES**

- .1 Following receipt of Shop Drawings, obtain from manufacturers time-current curves of all protective devices.
.2 Coordinate setting of relays, rating of fuses and trip elements of circuit breakers, so that the protective device immediately ahead of any fault operates before any upstream protection and establish selective coordination throughout the system.
-

- .3 Prepare a complete set of curves showing time current characteristics for all breakers and fuses from main switchboard main circuit down to 208/120 V panels.

3.2 **PRE-TEST INSPECTION AND CLEANING**

- .1 Check that all dust, debris, surplus materials and tools, have been removed from equipment.
- .2 Inspect all parts of the power distribution systems at each voltage level for completeness, check and set circuit protective devices, fuses, breaker relays, trips, and all ancillary devices in accordance with the reviewed coordination studies, approved drawings and manufacturer's instructions.
- .3 Check phase sequence throughout the systems and application of colour codes to equipment and cables.
- .4 Verify all cable sizes, equipment ratings, trip settings conform to Specifications and coordination study.

3.3 **TESTING GENERAL**

- .1 Test the electrical installation including all safety devices as the Work progresses and on completion.
- .2 Without adjustment to the Contract Price:
 - .1 Repair, rework or replace any equipment, material or workmanship which fails specified tests.
 - .2 Perform such additional tests and re-tests as may be directed by the Consultant and/or Owner's Representative.
- .3 Energize each voltage level of the system immediately after testing is complete.
- .4 In case this is not feasible verify all fuse sizes and trip settings and repeat megger tests of each feeder and equipment with circuit breakers and switches open, immediately before energization.
- .5 Distribution Panels and Panelboards
 - .1 Check bolted connections bus to bus, and bus to cable lug with torque wrench, to manufacturer's values. Mark with adhesive tape or label when satisfactory.
 - .2 Measure contact resistance on low voltage fusible and non fusible switches, circuit breakers, contactors and auxiliary equipment. Acceptable values:

	Microhms
Low voltage - up to 250 V	500
Low voltage - 277V to 1000V	500
 - .3 Megger test insulation resistance phase to phase and phase to ground of fusible switches, circuit breakers, contactors, buswork, auxiliary equipment. Acceptable values:

	Megohms
Low voltage, up to 250V	1
Low voltage, 277V to 1000 V	50

Duration of each test: one (1) minute

- .4 Check ground bus and ground path for continuity, and connection to all non-current carrying metalwork. Maximum acceptable reading 0.1 ohms.
- .5 Check for physical faults: Damaged or dirty insulators, alignment of contacts, switchblades, operating mechanism, clearances, barriers, mounting.
- .6 Operate circuit breakers, switches, contactors, three times.
- .7 Operate equipment through design functions, including remote control operation, actuation of alarm and indication devices, mechanical and electrical operation and operation from protective relays.
- .8 Check 600V circuit breakers for trip and target operation. Test long time, short time, instantaneous and ground fault trips. Trip settings shall conform to values selected in the coordination study. Verify pickup and time values. Compare actual trip time with manufacturer's specifications and present in tabular form.
- .9 Balance loads on all panelboards. Use Shop Drawing information for all equipment loads.

3.4 LOW VOLTAGE SWITCHBOARDS UP TO 1000 VOLT SERVICE

- .1 Visually inspect components and complete assembly, check wiring and interconnections.

3.5 LOW VOLTAGE STARTERS, CONTACTORS UP TO 1000 VOLT SERVICE

- .1 Visually inspect components and the complete assembly.
- .2 Check each contactor and starter for switch or breaker operation, fuse or breaker rating, contactor size and operation, auxiliary contact operation.
- .3 Check starter overloads with motor nameplate ratings.
- .4 Check controls and starters and contactors operation on load.
- .5 Check motor rotation.

3.6 DISTRIBUTION TRANSFORMERS UP TO 1000 VOLT SERVICE

- .1 Set taps for nominal voltage output from secondary with initial loads applied.
- .2 Check for clear airflow through enclosure.
- .3 Check that connections are not stressed.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Conform to latest issues, amendments and supplements of following standards:

- | | | | |
|-----|--------------------------------------|---|--|
| .1 | CAN3-C155-M | - | Shunt Capacitors for AC Power Systems |
| .2 | CSA C9-M | - | Dry-Type Transformers |
| .3 | CSA C22.2 No. 4-M | - | Enclosed Switches |
| .4 | CSA C22.2 No. 5.1M | - | Moulded Case Circuit Breakers |
| .5 | CSA C22.2 No. 27 | - | Busways |
| .6 | CSA C22.2 No. 31-M | - | Switchgear Assemblies |
| .7 | CSA C22.2 No. 39 | - | Fuseholder Assemblies |
| .8 | CSA C22.2 No. 47 | - | Air-Cooled Transformers (Dry Type) |
| .9 | CSA C22.2 No. 106-M | - | HRC Fuses |
| .10 | NEMA BU1.1 | - | General Instructions for Proper Handling, Installation, Operation, and Maintenance of Busway Rated 600 Volts or Less |
| .11 | ANSI/UL 1449 4 th edition | - | Surge Protective Devices |
| .12 | ANSI/UL 1283 5 th edition | - | Electromagnetic Interference Filters |
| .13 | ANSI/IEEE C62.41 | - | Surge Voltages in LowVoltage AC Power Circuits |

2 Products

2.1 **DISTRIBUTION PANELS**

.1 Description

- .1 Distribution panel comprising two basic units: Main circuit breaker and distribution circuit breakers.

.2 Construction

- .1 Steel, indoor, sprinkler proof enclosure, type as specified in Section 26 05 02, dead front, free standing. Suitable for mounting against a wall. Facilities for lifting into position and bolting to floor.
- .2 Provisions for addition of future sections at both ends.

.3 Bus

- .1 All bus, copper.
 - .2 Neutral bus, full capacity where indicated.
 - .3 Bus short circuit rating: 65 kA, 3 phase, rms, symmetrical, unless indicated on Drawings.
 - .4 Ground bus, 6 mm x 25 mm extending full length of switchboard, solderless connector at each end suitable for No. 2/0 AWG copper grounding cable.
 - .4 Main Circuit Breaker
 - .1 Circuit breaker, electronic trip, molded case, full function 100% rated where indicated, three-pole, quick make, quick break, trip free, provision for padlocking in off position.
 - .5 Distribution Unit
 - .1 Circuit breakers, molded case, standard function 80% rated, three-pole, quick make, quick break, trip free, thermal magnetic or solid state trip elements. Provision for padlocking in "off" position.
 - .2 Spaces to be fully bussed for addition of future breakers.
 - .6 Cable Entry
 - .1 Top cable entry through removable aluminum plates.
 - .7 Surge protective Device (SPD)
 - .1 SPD with connection to switchboard bus via circuit breaker with features as follows:
 - .1 Hybrid filter consisting of thermally protected metal oxide varistors and a parallel filter circuit.
 - .2 High energy transient voltage suppression, surge current diversion and high frequency attenuation of wave shapes in Category C environment as defined in ANSI/IEEE C62.41.
 - .3 Surge current rating, based on 8 x 20µs wave shape, as follows:
 - .1 Per mode: 125 kA minimum
 - .2 Per phase: 250 kA minimum
 - .4 Filter noise attenuation: 50 dB minimum, normal mode, from 10 kHz to 100 MHz.
 - .5 Normal protection modes: line to line (and line to neutral for four-wire systems). Common protection modes: line to ground (and neutral to ground for four-wire systems).
 - .6 Fusing for each protection mode.
 - .7 Status LED indication of each phase.
 - .8 Trouble light.
-

- .9 Auxiliary contact for remote annunciation of system integrity.
- .10 Transient surge counter.
- .11 UL1449 4th edition and UL1283 5th edition listed, CSA or CUL approved.
- .12 Acceptable manufacturers for SPD
 - .1 Eaton
 - .2 Schneider
 - .3 Siemens
- .13 Electrical parameter monitoring system:
 - .1 Refer to Section 26 09 13.
- .8 Sub-metering system
 - .1 Refer to Section 26 09 13.
- .9 Nameplate
 - .1 Nameplate, engraved laminated plastic, black lettering on white background as follows:
 - .1 Switchboard identification, 15 mm minimum character height
- .10 Finish
 - .1 ANSI 49 light grey enamel finish.
- .11 Acceptable Manufacturers
 - .1 Schneider
 - .2 Siemens
 - .3 Eaton

2.2 **PANELBOARDS - CIRCUIT BREAKER TYPE**

- .1 Panelboards to be product of one manufacturer.
 - .2 Enclosures: Steel, type as specified in Section 26 05 01.
 - .3 Bus: Copper, half capacity ground bar and full or double capacity neutral bar as indicated, braced for interrupting capacity as indicated.
 - .4 Circuit breakers: Bolt-on, quick-make, quick-break, thermal and magnetic trips, trip indicating, trip free handle. Common operating handle on multipole breaker.
 - .5 Integral surge protective device, where indicated, with features as follows:
 - .1 Connection to panelboard bus via circuit breaker.
 - .2 Hybrid filter consisting of thermally protected metal oxide varistors and a parallel filter circuit.
-

- .3 High energy transient voltage suppression, surge current diversion and high frequency attenuation of wave shapes in Category B environment as defined in ANSI/IEEE C62.41.
- .4 Surge current rating, based on 8 x 20µs wave shape, as follows:
 - .1 Per mode: 80 kA minimum
 - .2 Per phase: 160 kA minimum
- .5 Filter noise attenuation: 50 dB minimum, normal mode, from 10 kHz to 100 MHz.
- .6 Normal protection modes: Line to line (and line to neutral for four-wire system). Common protection modes: Line to ground (and neutral to ground for four-wire system)
- .7 Fusing for each protection mode.
- .8 Status LED indication of each phase.
- .9 UL1449 4th edition and UL1283 5th edition listed, CSA or CUL approved.
- .6 Door: Hinged lockable door.
- .7 Keys: Two keys per panelboard; key panelboards alike.
- .8 In addition to CSA requirements, manufacturer's nameplate to indicate panel withstand fault current.
- .9 Lock-on devices: For circuits supplying continuously operating equipment. Minimum quantity 10% of 15A, 20A and 30A rated breakers.
- .10 Spaces: Fully bussed for future breakers with removable filler plates.
- .11 Breaker arrangement: Locate breakers at specific circuit number locations shown on panelboard schedule sheet.
- .12 Acceptable Manufacturers
 - .1 Schneider
 - .2 Eaton
 - .3 Siemens

2.3 **DRY TYPE TRANSFORMERS - UP TO 600V**

- .1 Dry-type transformers: Type ANN, copper windings, insulation Class H, 150°C rise.
 - .2 Enclosure: Steel, sprinkler proof enclosure type as specified in Section 26 05 01.
 - .3 Taps: Full capacity four – 2½%, two above and two below normal.
 - .4 Impedance: Minimum 3% and maximum 6%.
 - .5 Vibration isolators: Internal noise and vibration isolating pads.
 - .6 Mounting brackets: Floor and wall standard.
 - .7 Acceptable Manufacturers:
-

- .1 Eaton
- .2 Hammond
- .3 Schneider

2.4 **MANUAL MOTOR STARTERS**

- .1 Enclosure: Steel, sprinkler proof enclosure type as specified in Section 26 05 01.
- .2 Overload relay and heater element in each phase, manual reset.
- .3 Heavy duty type single phase toggle switch, and three phase pushbutton type, quick-make quick-break switching mechanism.
- .4 Pilot light: Heavy duty, transformer, push to test, red.
- .5 Provision for padlocking in OFF position.
- .6 Acceptable Manufacturers:
 - .1 Allen-Bradley
 - .2 Eaton
 - .3 Schneider
 - .4 Siemens

2.5 **MAGNETIC MOTOR STARTERS**

- .1 Enclosure: Steel, sprinkler proof enclosure type as specified in Section 26 05 01.
- .2 NEMA type combination magnetic motor starters, fusible disconnect type with overload relay and heater element in each phase.
- .3 Rating: Minimum size-1.
- .4 Door mounted accessories:
 - .1 Pushbuttons or three-position HOA selector switches, heavy duty oil tight type.
 - .2 Pilot lights: Heavy duty, transformer, press to test, red.
 - .3 Lens colour: Running – red; stopped – green; alarm/malfunction – amber.
- .5 Control transformer: 120V secondary, fused, sized to suit control circuit load plus 50VA.
- .6 Auxiliary contacts: Minimum one spare N/C, one spare N/O interchangeable, in addition to seal-in contact.
- .7 For control voltage from an external source:
 - .1 Provide terminals, covered with hard insulating guard.
 - .2 Apply a lamaroid warning plate on the outside of the starter cover describing the source of outside control power.
- .8 Acceptable Manufacturers

- .1 Allen-Bradley
- .2 Eaton
- .3 Schneider
- .4 Siemens

2.6 **CONTACTORS**

- .1 Enclosure: Steel, sprinkler proof enclosure type as specified in Section 26 05 01.
- .2 NEMA type, heavy duty, designed for the application, e.g. lighting contactors for lighting circuits.
- .3 Auxiliary contacts, minimum two N/O and two N/C.
- .4 Control transformer, fused primary and secondary, 120 volt output.
- .5 Hand/Off/Auto (HOA) control selector switch and red pilot light, "press to test" type.
- .6 Acceptable Manufacturers:
 - .1 Allen-Bradley
 - .2 Eaton
 - .3 Schneider
 - .4 Siemens

2.7 **CONTROL STATIONS**

- .1 Pushbutton and selector switches: heavy duty, oiltight.

2.8 **FUSIBLE AND NON FUSIBLE DISCONNECT SWITCHES**

- .1 Enclosure: Steel, sprinkler proof enclosure type as specified in Section 26 05 01.
- .2 Switches: Quick-make, quick-break, heavy duty, short circuit rating 100,000A rms sym. Provision for locking in off position with up to three padlocks.
- .3 Viewing window: For viewing blades.
- .4 Electrical interlock: Mechanically operated from switch mechanism, rated 120 VAC, 15A, one N/O and one N/C contact at non-fusible switches local to motors
- .5 Except as noted otherwise, furnish and install non-fusible safety switches on all electrically powered equipment to isolate equipment from power supply.
- .6 Acceptable Manufacturers:
 - .1 Schneider
 - .2 Eaton
 - .3 Siemens

2.9 **FUSES**

- .1 HRC fuses to CSA C22.2 No. 106-M.
- .2 Time delay fuses as follows:
 - .1 Fuses up to 600V, up to 600A HRCI-J, Form I: Class J Bussman JHC, Gould Shawmut AJT.
 - .2 Fuses above 600A HRC-L, Form I: Class L Bussman KLU, Gould Shawmut A4BT.
- .3 Provide spare fuses of each type and size in use as follows:
 - .1 600A and below: Six.
 - .2 Above 600A: Three.
- .4 Submit a list of spare fuses to Consultant for approval.

2.10 **METERING CABINET**

- .1 Steel enclosure NEMA 1, sprinkler proof, sized 900 mm x 900 mm x 300 mm deep. Code gauge steel complete with hinged door, lock and latch and removable back plate to meet utility requirements.
- .2 Acceptable Manufacturers:
 - .1 Hammond

2.11 **RELAYS**

- .1 Totally enclosed plug-in type relay with four form-C contacts, operating coil to suit required voltage. Complete with mounting socket.
- .2 Acceptable Manufacturers
 - .1 Allen-Bradley
 - .2 Schneider
 - .3 Eaton

2.12 **AC INVERTER SYSTEM**

- .1 Description: Inverter, batteries, battery charger, contactors and controls for supply of emergency AC power to a normally energized load of circuit breaker controls.
- .2 References
 - .1 Comply with:
 - .1 CSA C22.2 No. 107.1-M – Commercial and Industrial Power Supplies
 - .2 ANSI/UL924 – Emergency Lighting and Power Equipment
- .3 Enclosure
 - .1 Steel enclosure type to comply with Section 26 05 01, floor mounting, front lockable doors. Common enclosure for inverter, battery, charger and controls.
 - .2 Finish ASA 61 grey.

- .4 Rating
 - .1 Input: 120 V, single phase, 60 Hz
 - .2 Normal output: 120 V, single phase, 60 Hz
 - .3 Load: facility for normally on loads, size to suit circuit breaker control transformer in main switchboard.
 - .4 Operating time: Thirty minutes with full nameplate capacity rating at end of thirty minutes continuous operation up to end of ten year battery design life expectancy.
 - .5 Features
 - .1 Input failure sensing
 - .2 Auto test
 - .3 Contactors to transfer from normal to inverter power
 - .4 Automatic battery disconnection at low battery voltage
 - .5 AC output circuit breaker
 - .6 Output voltmeter
 - .7 Inverter on/off control switch
 - .8 Inverter trip LED
 - .9 Manual bypass pushbutton
 - .6 Inverter
 - .1 Frequency regulation: $\pm 1\%$
 - .2 Voltage regulation: $\pm 10\%$ for 10-100% load
 - .3 Output: sinusoidal wave form with total harmonic distortion of less than 10%.
 - .7 Battery: Sealed, lead calcium gas recombination type, ten year design life expectancy
 - .8 Battery charger:
 - .1 Capable of full battery recharge within twenty-four hours of full discharge.
 - .2 Automatic equalize cycle, constant trickle charge
 - .3 Regulation: $\pm 0.5\%$ output for $\pm 10\%$ input variation
 - .4 DC voltmeter and charge rate ammeter.
 - .5 LED indicators for "ON" float and high charge modes.
 - .6 LED indicators common alarm with cut-off switch for AC failure, high battery voltage, low battery voltage and charger failure.
-

- .9 System Diagnostics
 - .1 Diagnostics to provide report to satisfy Ontario Building Code test requirements.
 - .2 Communication port RS485 and interface to provide monthly diagnostic report to Owner's computer.
- .10 Acceptable Manufacturers
 - .1 Lumacell
 - .2 Or accepted equal

3 Execution

3.1 **GENERAL**

- .1 Protect equipment from dust, debris, moisture, and physical damage, with sealed envelope of plastic or other impervious material until building is enclosed and cleaned and equipment is energized.
- .2 Protect from condensation by maintaining at suitable temperature above 0°C.
- .3 Finish equipment enclosures to ANSI 49 or ANSI 61, baked grey enamel.

3.2 **PANELBOARDS**

- .1 Locate panelboards, secure, plumb true and square to structure.
- .2 Mounting Methods
 - .1 Exterior walls and interior combustible walls: mount on continuous slotted channel strut with 41 mm clear between back of panel and wall. Where practical, group panelboards on common frame.
 - .2 Interior non-combustible walls: mount against wall.
- .3 Where panelboards are flush mounted, provide three 25 mm empty conduits from each panelboard into ceiling space above.
- .4 Identify load circuits on panel directory complete with name and location.
- .5 Where panelboards are equipped with fused switches, install fuses immediately prior to energization. Record fuse rating on breaker or switch cover.

3.3 **DISTRIBUTION TRANSFORMERS**

- .1 Support from building structure on trapezes or L brackets. Locate to provide free flow of cooling air.
- .2 Loosen isolation pads until no compression is visible.
- .3 Make final connection with flexible metal conduit.
- .4 Leave slack in cables and flexible conduit, to avoid stress on connections.

3.4 **MOTOR CONTROL EQUIPMENT**

- .1 Secure equipment plumb true and square to structure.
- .2 Check nameplate rating of motor to select overload relay heater elements; install heater elements.
- .3 Check operation of starters and correct motor rotation. Coordinate with Mechanical Division.
- .4 Provide plastic covers to exclude dirt and dust until starters are energized.

3.5 **DISCONNECT SWITCHES**

- .1 Install local to equipment on adjacent wall, column, or other suitable mounting surface. Where necessary provide free standing rigid continuous slotted channel strut frame.
- .2 Where mounted on masonry walls, allow minimum of 6 mm clear space between enclosure and masonry wall.

3.6 **FUSES**

- .1 Store fuses in a moisture free location until ready to energize.
- .2 Install fuses immediately prior to energization.
- .3 Prior to acceptance of the Work, clearly mark manufacturer's labels on inside cover of each fusible unit, with ampere rating and catalogue symbol of replacement fuses to be used.

3.7 **METERING CABINET**

- .1 Install cabinet in accordance with utility requirements.

3.8 **AC INVERTER SYSTEM**

- .1 Install AC inverter system
- .2 Commission inverter system under supervision of inverter system and battery system manufacturer's representatives.

End Of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

.1 Labour, Products, equipment and services necessary to complete the Work of this section including, but not limited to, the following:

.1 Lighting equipment as per the luminaire schedule and as specified herein.

.2 Refer to architectural reflected ceiling plans for exact location of luminaires.

.3 Check latest ceiling finish schedule in areas where recessed luminaires are specified to ensure that luminaires have suitable ceiling trim for particular ceiling finish.

1.2 **SUBMITTALS**

.1 Submit Shop Drawings in accordance with Section 01 33 00.

.2 Submit certified copies of photometric test data, for each luminaire type, prepared by independent testing laboratory. Photometric data to include total input watts, candlepower summary, candlepower distribution, zonal lumen summary, luminaire efficiency, coefficient of utilization table, lamp type, ballast type and manufacturer, and lumen rating in accordance with IESNA testing procedures.

.3 Submit samples as directed by Consultant for the following luminaire types:

1.3 **REFERENCES**

.1 Refer to the latest issue of the following standards:

.1 CSA C22.2 No. 9-M - General Requirements for Luminaires

.2 CSA C22.2 No. 34-M - Electrode Receptacles, Fittings, and Connectors for Gas Tubes

.3 CSA C22.2 No. 43-M - Lampholders

.4 CSA C22.2 No. 66 - Specialty Transformers

.5 CSA C22.2 No. 74 - Equipment for Use with Electric Discharge Lamps

.6 CSA C22.2 No. 141-M - Unit Equipment for Emergency Lighting

.7 ANSI/IEEE C62.41 - IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits

.8 CSA C860 - Performance of Internally Lighted Exit Signs

1.4 **CODES AND STANDARDS**

.1 All wiring to be in accordance with the Ontario Electrical Safety Code.

.2 Provide only equipment bearing a label acceptable to the Electrical Safety Authority (ESA) to indicate that the equipment has been tested to applicable CSA standards.

2 Products

2.1 **LUMINAIRES**

.1 General

- .1 Furnish luminaires in accordance with CSA C22.2 No. 9.
- .2 Furnish medium screw base lampholders of nickel or brass in accordance with CSA C22.2 No. 43.
- .3 Furnish mogul screw base lampholders of porcelain and nickel in accordance with CSA C22.2 No. 43.
- .4 Furnish lamp bases for gas tube lamps in accordance with CSA C22.2 No. 34.
- .5 Luminaire finishes shall resist chipping, crazing, discolouration.
- .6 Luminaires to contain no asbestos.
- .7 Furnish luminaires with flanges and gaskets to eliminate light leaks.

.2 Incandescent Luminaires

- .1 Furnish luminaires with all mounting and installation hardware.
- .2 Furnish accessories (guards, shields, reflectors, etc.) of the same manufacture as the luminaire.

.3 Fluorescent Luminaires

- .1 Fabricate steel luminaires from minimum 22 gauge mild sheet steel with joints securely fastened.
- .2 Do not use pre-painted steel.
- .3 Remove sharp edges.
- .4 Phosphate dip, prime and paint luminaire body, hardware and accessories with two coats of baked enamel, or other finish where indicated, after fabrication.
- .5 Interior baked enamel finish to have a minimum 88% reflectance and a minimum thickness of 1.2 mils.
- .6 Where two-level switching is indicated, furnish two ballasts, separately switched, with one ballast connected to the outer lamps and the other ballast connected to the inner lamp(s).
- .7 Acrylic lens, 100% virgin acrylic, 0.125" nominal thickness, extruded aluminum hinged frame.

.4 HID Luminaires

- .1 Rated for operation over a -30°C to +40°C (-22°F to +104°F) ambient temperature range unless otherwise noted in luminaire schedule.

.5 Exit Light Luminaires

- .1 Aluminum housing, stencil face, knock-out chevrons, unless otherwise noted in luminaire schedule.
- .2 150 mm high red letters.
- .3 Universal ceiling, end-to-wall, surface back-to-wall mounting or recessed mounting if indicated.
- .4 Connection for emergency 12 V source where indicated.
- .5 LED type with diffusing lens.

2.2

BALLASTS

.1 Fluorescent

- .1 To CSA C22.2 No. 74.
- .2 Electronic, to operate one or two lamps, integrally mounted in luminaire unless otherwise indicated.
- .3 Rapid start type for normal output lamps unless otherwise indicated.
- .4 Instant start type for high output lamps.
- .5 Totally enclosed containing no polychlorinated biphenyls.
- .6 Rated 60 Hz, voltage as indicated.
- .7 Rated for operation over an ambient temperature range of 10°C to 40°C (50°F to 104°F).
- .8 Maximum case temperature not greater than 25°C (77°F) above ambient temperature.
- .9 Operate at in a frequency range of 25 kHz to 40 kHz.
- .10 Produce no visible flicker.
- .11 Minimum sound rating of Class A.
- .12 Minimum ballast factor of 0.9 unless otherwise noted in luminaire schedule.
- .13 Minimum power factor of 0.95.
- .14 Maximum crest factor of 1.5.
- .15 Maximum input current total harmonic distortion of 15% measured at rated output.
- .16 To withstand line transients as defined by ANSI/IEEE C62.41, Category A.
- .17 Acceptable manufacturers (unless otherwise specified in luminaire schedule):
 - .1 Advance
 - .2 Osram Sylvania

- .3 Universal
 - .2 Metal Halide
 - .1 To CSA C22.2 No. 66 and CSA C22.2 No. 74.
 - .2 Integrally mounted in luminaire unless otherwise indicated.
 - .3 Rated 60 Hz, voltage as indicated.
 - .4 Two-winding constant wattage isolated winding (CWI) or three-winding magnetic regulator (Mag Reg) type ballast unless otherwise specified in luminaire schedule.
 - .5 Lamp wattage regulation to be $\pm 10\%$ maximum for a line voltage variation of $\pm 10\%$ from rated voltage.
 - .6 Totally enclosed containing no polychlorinated biphenyls.
 - .7 Class 180 insulation.
 - .8 Minimum ballast factor of 0.95.
 - .9 Minimum power factor of 0.95.
 - .10 Maximum crest factor of 1.65 for metal halide and 1.80 for mercury.
 - .11 Maximum input current total harmonic distortion of 20% measured at rated output.
 - .12 Ballast UL bench top rise temperature code to be suitable for the luminaire in which it is installed.
 - .13 Minimum -30°C (-22°F) starting temperature.
 - .14 Acceptable manufacturers:
 - .1 General Electric
 - .2 Holophane
 - .3 Universal
 - .4 Advance
 - .3 High Pressure Sodium
 - .1 To CSA C22.2 No. 66 and CSA C22.2 No. 74.
 - .2 Integrally mounted in luminaire unless otherwise indicated.
 - .3 Rated 60 Hz, voltage as indicated.
 - .4 Two-winding constant wattage isolated winding (CWI) or three-winding magnetic regulator (Mag Reg) type ballast unless otherwise specified in luminaire schedule.
 - .5 Lamp wattage regulation to be $\pm 10\%$ maximum for a line voltage variation of $\pm 10\%$ from rated voltage.
-

- .6 Totally enclosed containing no polychlorinated biphenyls.
- .7 Class 180 insulation.
- .8 Minimum ballast factor of 0.95.
- .9 Minimum power factor of 0.95.
- .10 Maximum crest factor of 1.65.
- .11 Maximum input current total harmonic distortion of 20% measured at rated output.
- .12 Ballast UL bench top rise temperature code to be suitable for the luminaire in which it is installed.
- .13 Minimum -40°C (-40°F) starting temperature.
- .14 Igniter with an automatic shutdown circuit to de-energize the high voltage pulses when an inoperative or missing lamp is detected.
- .15 Acceptable manufacturers:
 - .1 General Electric
 - .2 Holophane
 - .3 Universal
 - .4 Advance

2.3 LAMPS

.1 Compact Fluorescent

watts	type	base	colour temp (K)	hrs life @ 3hrs per start	initial lumens	CRI
9	twin	single end 2-pin	2700/3500/4100	10,000	580	82
13	twin	single end 2-pin	2700/3500/4100	10,000	800	82
13	twin	single end 2-pin	5000	10,000	785	80
9	dbt twin	single end 2-pin	2700/4100	10,000	525	82
13	dbt twin	single end 2-pin	2700/3000/3500/4100	10,000	810	82
13	dbt twin	single end 4-pin	2700/3000/3500/4100	12,000	900	82
18	dbt twin	single end 2-pin	2700/3000/3500/4100	10,000	1150	82
18	dbt twin	single end 4-pin	2700/3000/3500/4100	12,000	1150	82
26	dbt twin	single end 2-pin	2700/3000/3500/4100	10,000	1710	82
26	dbt twin	single end 4-pin	2700/3000/3500/4100	12,000	1710	82
13	triple	single end 4-pin	2700/3000/3500/4100	12,000	900	82
18	triple	single end 4-pin	2700/3000/3500/4100	12,000	1200	82
26	triple	single end 4-pin	2700/3000/3500/4100	12,000	1710	82
32	triple	single end 4-pin	2700/3000/3500/4100	12,000	2200	82
42	triple	single end 4-pin	2700/3000/3500/4100	12,000	3200	82
57	triple	single end 4-pin	2700/3000/3500/4100/5000	12,000	4300	82
70	triple	single end 4-pin	2700/3000/3500/4100	12,000	5200	82

.2 Fluorescent

watts	type	base	colour temp (K)	hrs life @ 3hrs per start	initial lumens	CRI	length (ins.)	length (mm)
14	T5	Miniature bi-pin	3000/3500/4100/6500	20,000	1350	85	21.6	548
21	T5	Miniature bi-pin	3000/3500/4100/6500	20,000	2100	85	33.4	848
28	T5	Miniature bi-pin	3000/3500/4100/6500	20,000	2900	85	45.2	1148
35	T5	Miniature bi-pin	3000/3500/4100/6500	20,000	3650	85	57.1	1450
24	T5HO	Miniature bi-pin	3000/3500/4100/6500	20,000	2000	85	21.6	548
39	T5HO	Miniature bi-pin	3000/3500/4100/6500	20,000	3500	85	33.4	848
54	T5HO	Miniature bi-pin	3000/3500/4100/6500	25,000	5000	85	45.2	1148
80	T5HO	Miniature bi-pin	3000/3500/4100/6500	20,000	7000	85	57.1	1450
17	T8	medium bi-pin	3000/3500/4100	20,000	1300	75	24	610
17	T8	medium bi-pin	3000/3500/4100	24,000	1350	85	24	610
25	T8	medium bi-pin	3000/3500/4100	20,000	1950	75	36	915
25	T8	medium bi-pin	3000/3500/4100	20,000	2150	85	36	915
28	T8/ES	medium bi-pin	3000/3500	24,000	2725	85	48	1219
28	T8/ES	medium bi-pin	4100/5000	24,000	2750	82	48	1219
32	T8	medium bi-pin	3000/3500/4100	20,000	2800	78	48	1219
32	T8	medium bi-pin	3000/3500/4100	20,000	2950	85	48	1219
32	T8	medium bi-pin	5000	20,000	2650	78	48	1219
32	T8	medium bi-pin	5000	20,000	2800	85	48	1219
32	T8	medium bi-pin	6500	20,000	2700	78	48	1219

.3 Incandescent

watts	type	base	Volts	hrs life	initial lumens
250	T4	Mini-can	130	2,000	5000

.4 Metal Halide Pulse Start

watts	type*	base/burn pos.	clear/coated colour temp.	hrs life @ 10hrs per start	initial lumen s	CRI	protected*
32	ED17-P.S.	Medium base down	coated-3200K	10,000	2400	70	yes
32	ED17-P.S.	Medium base up	coated-3200K	10,000	2400	70	yes
50	BD17-P.S.	Medium universal	clear-3200K	5,000	3900	70	no
50	BD17-P.S.	Medium universal	coated-3200K	5,000	3500	70	no
50	BD17-P.S.	Medium universal	clear-4000K	5,000	3100	75	no
50	BD17-P.S.	Medium universal	coated-4000K	5,000	2900	75	no
50	ED17-P.S.	Medium universal	clear-3500K	10,000	3400	70	yes
50	ED17-P.S.	Medium universal	coated-3500K	10,000	3200	70	yes
70	BD17-P.S.	Medium universal	clear-3200K	12,000	5500	70	no

70	BD17-P.S.	Medium universal	coated-3200K	12,000	5300	70	no
70	BD17-P.S.	Medium universal	clear-4000K	12,000	4700	75	no
70	BD17-P.S.	Medium universal	coated-4000K	12,000	4500	75	no
70	ED17-P.S.	Medium universal	clear-3200K	12,000	5500	70	yes
70	ED17-P.S.	Medium universal	coated-3200K	12,000	5300	70	yes
100	BD17-P.S.	Medium universal	clear-3200K	15,000	9000	70	no
100	BD17-P.S.	Medium universal	coated-3200K	15,000	8500	70	no
100	BD17-P.S.	Medium universal	clear-4000K	15,000	8100	75	no
100	BD17-P.S.	Medium universal	coated-4000K	15,000	7600	75	no
100	ED17-P.S.	Medium universal	clear-3200K	15,000	9000	70	yes
100	ED17-P.S.	Medium universal	coated-3200K	15,000	8500	70	yes
150	BD17-P.S.	Medium universal	clear-3200K	15,000	12500	70	no
150	BD17-P.S.	Medium universal	coated-3200K	15,000	12000	70	no
150	BD17-P.S.	Medium universal	clear-4000K	15,000	11700	75	no
150	BD17-P.S.	Medium universal	coated-4000K	15,000	11200	75	no
150	ED17-P.S.	Medium universal	clear-3500K	15,000	12500	70	yes
150	ED17-P.S.	Medium universal	coated-3500K	15,000	12000	70	yes
175	BD17-P.S.	Medium base up	clear-4000K	15,000	17500	75	no
175	BD17-P.S.	Medium base up	coated-4000K	15,000	16500	75	no
175	BT28-P.S.	EX39 (keyed) base up	clear-4000K	10,000	14400	65	yes
175	ED23.5-P.S.	Mogul base up	clear-3200K	15,000	17000	65	no
175	ED23.5-P.S.	Mogul base up	coated-3200K	15,000	16,000	65	no
175	ED23.5-P.S.	Mogul base up	clear-4000K	15,000	17500	75	no
175	ED23.5-P.S.	Mogul base up	coated-4000K	15,000	16500	75	no
250	BT28-P.S.	EX39 (keyed) base up	clear-4000K	10,000	23000	65	yes
250	ED28-P.S.	Mogul base up	clear-4200K	15,000	23000	65	no
250	ED28-P.S.	Mogul base up	coated-3900K	15,000	21500	65	no
320	ED28-P.S.	Mogul base up	clear-4000K	20,000	31000	65	no
320	ED28-P.S.	Mogul base up	coated-3700K	20,000	30000	70	no
320	ED28-P.S.	Mogul base up	clear-4000K	20,000	34000	65	no
320	ED28-P.S.	Mogul base up	coated-3700K	20,000	33000	70	no
320	ED28-P.S.	EX39 (keyed)	coated-3700K	20,000	30600	70	yes

		base up					
320	ED37-P.S.	EX39 (keyed) base up	clear-4000K	20,000	32000	65	yes
320	ED37-P.S.	EX39 (keyed) base up	coated-3700K	20,000	30500	70	yes
400	ED28-P.S.	Mogul base up	clear-4200K	20,000	44000	65	no
400	ED28-P.S.	Mogul base up	coated-3700K	20,000	42000	70	no
400	ED37-P.S.	Mogul base up	clear-4000K	20,000	41000	65	no
400	ED37-P.S.	Mogul base up	coated-3700K	20,000	40000	70	no
400	ED37-P.S.	Mogul base up	clear-4000K	20,000	44000	65	no
400	ED37-P.S.	Mogul base up	coated-3700K	20,000	42000	70	no
400	ED37-P.S.	Mogul base down	clear-4000K	20,000	44000	65	no
400	ED37-P.S.	EX39 (keyed) base up	clear-4000K	20,000	42000	65	yes
400	ED37-P.S.	EX39 (keyed) base up	coated-3700K	20,000	40000	70	yes
750	BT37-P.S.	Mogul base up	clear-4000K	16,000	82000	65	no
750	BT37-P.S.	Mogul base up	coated-3700K	16,000	72000	70	no
1000	BT37-P.S.	Mogul universal- vert.	clear-3900K	12,000	115000	65	no
1000	BT37-P.S.	Mogul universal- horiz.	clear-3900K	9,000	105000	65	no

.5 Metal Halide MR16 Ceramic Lamps

watts	type	base/burn pos.	clear/coated colour temp.	hrs life	initial lumens	CRI	protected
20	MR16	GX10	3000K	12,000	1000	83	yes
35	MR16	GX10	3000K/4000K	10,000/12,000	2200	83/93	yes

.6 Metal Halide "T" Shape Ceramic Lamps

watts	type	base/burn pos.	clear/coated colour temp.	hrs life	initial lumens	CRI	protected
39	T4.5	Bi-Pin G12	3000K	10,000	3400	82	no
70	T6	Bi-Pin G12	3000K	15,000	6200	83	no
70	T6	Bi-Pin G12	4200K	15,000	6400	93	no
150	T6	Bi-Pin G12	3000K	12,000	14000	82	no
150	T6	Bi-Pin G12	4200K	12,000	13000	94	no

.7 High Pressure Sodium Lamps

watts	type	base/burn pos.	clear/coated colour temp.	hrs life	initial lumens	CRI
35	B17	Medium universal	clear-1900K	16,000	2250	22
35	B17	Medium universal	diffuse-1900K	16,000	2150	22
50	B17	Medium universal	clear-1900K	24,000	4000	22
50	B17	Medium universal	diffuse-1900K	24,000	3800	22
50	ED23.5	Mogul universal	clear-1900K	24,000	4000	22
50	ED23.5	Mogul universal	diffuse-1900K	24,000	3800	22
70	B17	Medium universal	clear-1900K	24,000	6400	22
70	B17	Medium universal	diffuse-1900K	24,000	5950	22

70	ED23.5	Mogul universal	clear-1900K	24,000	6400	22
70	ED23.5	Mogul universal	diffuse-1900K	24,000	5950	22
100	B17	Medium universal	clear-2000K	24,000	9500	22
100	B17	Medium universal	diffuse-2000K	24,000	8800	22
100	ED23.5	Mogul universal	clear-2000K	24,000	9500	22
100	ED23.5	Mogul universal	diffuse-2000K	24,000	8800	22

.8 Acceptable lamp manufacturers unless otherwise specified in luminaire schedule:

- .1 General Electric
- .2 Osram Sylvania
- .3 Philips

2.4 **LIGHTING POLES**

- .1 Design poles and arms to withstand wind loading of 160 km/h and gusts of 1.3, without deformation, with designated luminaires installed.
- .2 Furnish poles (square) (round) (octagonal), (tapered) (straight), (steel) (aluminum), finish and colour as shown, designed for mounting on concrete base, height as indicated, complete with base bolt covers, grounding lug, handhole and flush weatherproof cover at base housing fuses and terminal strip.
- .3 Fuseholder, in-line, waterproof, breakaway type with 10 A fuse.
 - .1 Acceptable fuseholder manufacturers:
 - .1 Bussman, Tron fuseholder, HEB series with insulation boot
 - .2 Buchanan/Elastimold, Style 65
 - .3 Gould Shawmut, GEB series with insulating boots

2.5 **EMERGENCY BATTERY UNITS**

- .1 Supply voltage 120 (277) (347) V ac.
- .2 Output voltage 12 V dc.
- .3 Batteries: Sealed lead acid calcium alloy grid type sized to operate the lamp load to 91% of initial voltage for thirty minutes unless otherwise specified in luminaire schedule.
- .4 Battery charger: Solid state, multi-rate, voltage/current regulated, sized to restore battery to full charge in twelve hours.
- .5 Low voltage disconnect: Solid state, modular, operates at 80% battery voltage.
- .6 EEMAC 1 code gauge steel housing unless otherwise specified in luminaire schedule.
- .7 Auxiliary equipment:
 - .1 "AC power ON"
 - .2 "Fast charge" pilot light
 - .3 Voltmeter

- .4 Test switch
- .5 Five minute time delay relay
- .6 Cord and plug (120 V only)
- .8 Lamp heads: Mounted as indicated, 360 degree horizontal and 180 degree vertical adjustment, type and wattage as specified in luminaire schedule.
- .9 Acceptable manufacturers: As specified in luminaire schedule.

3 Execution

3.1 **INSTALLATION - GENERAL**

- .1 Provide supports for luminaires. Support single units from luminaire studs in outlet boxes. For continuous row fluorescent type, provide support for each end plus at least one for each channel section, or additional as required. Swivel mount stems. Provide concrete inserts at points of luminaire support in unfinished areas where a concrete slab serves as ceiling. Provide support from concrete floor and roof steel above ceiling as applicable.
- .2 Align luminaires in rows, maintain required heights, and install luminaires clear of other work.
- .3 Clean and relamp existing luminaires being removed and installed in new locations.
- .4 Keep luminaires covered and protected from construction dust and debris until building is broom clean and free of suspended dust clouds.
- .5 Do not lamp luminaires until ready for testing and use. Obtain Owner's approval before lamping. Install lamps in lampholders.
- .6 When installation is complete, demonstrate operation to satisfaction of Owner.
- .7 Standard octagonal boxes may be supplied where conduits feeding luminaires in finished areas are exposed on ceiling if hanger canopies entirely cover outlet boxes and are neatly notched for conduit. Otherwise, provide cast conduit outlet boxes with a diameter larger than canopies.
- .8 Attach boxes or hickey directly to poured concrete with 6 mm minimum diameter bolts and lead expansion anchors where luminaires are suspended directly from concrete slabs. Use 8 mm minimum bolts through precast slabs, welded to 100 mm x 100 mm minimum, 3.5 mm plate above slabs.
- .9 Do not mount luminaires above pipes, ducts or equipment. In event of unavoidable tight locations, provide hangers to clear obstructions. Check layouts of other trades on job and plan cooperatively. Luminaires in any room shall hang at one height. Obtain approval before any changes are made to layouts shown.
- .10 Provide continuous 12 mm x 38 mm channel above ceiling, where luminaires are suspended or mounted on furred ceilings. Fasten luminaires to channel with two 6 mm minimum diameter studs with minimum 1220 mm on centre.
- .11 Where two 1220 mm surface or suspended fluorescent luminaires occur in tandem, a 2440 mm body may be used. Where two single lamp luminaires occur in tandem, a common lamp ballast may be used.

- .12 Verify catalogue number of luminaires with description prior to ordering, and check for final ceiling finish in areas where recessed luminaires are called for in order to provide ceiling trim, flanges and mounting brackets to suit particular construction used where luminaires are installed.
- .13 Support luminaires in an approved manner to comply with the Ontario Electrical Safety Code and the Ontario Building Code.
- .14 Provide steel luminaire studs, brackets and hangers. Where luminaires are hung on chain hangers, provide chain of closed link type capable of supporting ten times luminaire weight. Use U-bolts for chain ends; S-hooks are not acceptable.

3.2 **INSTALLATION - INDUSTRIAL**

- .1 For industrial luminaires suspended from ceiling outlet boxes, provide 13 mm rigid combination conduit stems, luminaire stud, and self-aligning hangers. In other locations, except as otherwise detailed or required, provide ceiling or wall outlet boxes with 9.5 mm, no-bolt luminaire studs. Provide special hangers for support of any luminaire which weighs more than 23 kg.
- .2 In high vibration areas, mount luminaires with cushion hangers.
- .3 Where specified, provide safety restraint device (safety chain or safety cord) of minimum length as recommended by the manufacturer.
- .4 The manufacturer to certify that the safety restraint device has been drop tested for the actual luminaire and restraint length.

3.3 **INSTALLATION - EMERGENCY AND EXIT LIGHTS**

- .1 Exit sign installation shall meet all requirements of the authorities having jurisdiction.
- .2 Install emergency battery units where shown. Support on brackets supplied by manufacturer.
- .3 Aim heads to properly illuminate exit path.

3.4 **INSTALLATION - CEILINGS**

- .1 Suspend luminaires mounted from or in a suspended T-bar ceiling directly from building structure, independent of the T-bar system, to ULC, Local Fire Marshal's Office, Ontario Building Code, Electrical Safety Authority (ESA) and Consultant's approval.
- .2 In non-accessible ceilings wire with not more than 1200 mm of AC90 or RW90 XLPE wire in flexible conduit to adjacent outlet boxes placed above finished ceiling within reach of the luminaire openings.
- .3 In accessible ceilings wire with not more than 1.8 m of AC90 or RW90 XLPE wire in flexible conduit to adjacent outlet boxes, locations as shown on the Drawings.
- .4 Provide suitable trim for all luminaires installed in drywall ceilings or within lay-in or snap-in tiles.

3.5 **INSTALLATION - POLES**

- .1 Wire down inside of lighting poles with No. 10 AWG RW90 plus No. 10 AWG insulated ground wire and secure to clips. Provide strain relief at the top of the pole so that the

weight of the wiring down to the bottom of the pole does not place a strain on the wiring terminations. Install fuse holders and fuses.

- .2 Assemble arms and luminaires securely to pole. Provide lamps in lampholders.
- .3 Erect pole plumb and true on base. Along roadways, orient pole handhole on the side opposite the roadway unless otherwise indicated.
- .4 Connect underground ground wire and pole ground wire at ground lug in pole.
- .5 Leave slack in wires to allow connector and ground wire to be pulled out of handhole 150 mm clear of pole without disconnecting.

3.6 **FLOODLIGHTS**

- .1 Aim floodlights at night to satisfaction of Consultant.
- .2 Provide support from the building structure where floodlights are supported from buildings. Make support and wiring penetrations of the building envelope waterproof.

End of Section

265000_LUMINAIRE SCHEDULE				
TYPE	VOLTS	LAMP (QTY)	DESCRIPTION	MFR.TYPE/SERIES
L01	120	LED 3500K, MINIMUM 80 CRI	2' x 4' LED Recessed Ceiling Panel, 4000lm	Peer Lux PNLV Lithonia EPanel Metalux 22FP
L01B	120	LED 3500K, MINIMUM 80 CRI	2' x 4' LED Recessed Ceiling Panel, 4800lm	Peer Lux PNLV Lithonia EPanel Metalux 22FP
L01C	120	LED 3500K, MINIMUM 80 CRI	2' x 4' LED Recessed Ceiling Panel, 6000lm	Peer Lux PNLV Lithonia EPanel Metalux 22FP
L02	120	LED 3500K, MINIMUM 80 CRI	4' LED Wall mount strip light, 160w/lm, 4000lm	Metalux SNLED or equivalent
L03	120	LED 3500K, MINIMUM 80 CRI	1' x 4' LED Recessed Ceiling Panel, 3000lm	Peer Lux PNLV Lithonia EPanel Metalux 22FP
L04	120	LED 3500K, MINIMUM 80 CRI	4 inch LED Recessed Round Downlight, 2000lm, 40 deg	EcoNU4RD-SW-20-35K-80-HE40-120-NC-WH- WH or equivalent
L04B	120	LED 3500K, MINIMUM 80 CRI	4 inch LED Recessed Round Downlight, 1200lm, 40 deg	EcoNU4RD-SW-20-35K-80-HE40-120-NC-WH- WH or equivalent
L05	120	LED 3500K, MINIMUM 80 CRI	4' LED Surface Mount strip light, 4000lm, round,clear lens	Metalux SNLED or equivalent
L06	120	LED 3500K, MINIMUM 80 CRI	4' Surface Mount strip light, 2200lm, round, semi frost lens, narrow	Metalux SNLED or equivalent
L07	120	LED 3500K, MINIMUM 80 CRI	2' x 2' LED Recessed Ceiling Panel, 4000lm	Metalux SNLED or equivalent
L08	120	LED 3500K, MINIMUM 80 CRI	LED Round Wall Mount Cylinder, IP66 rated	Gothan EVO4WC Cylinder or equivalent

265000_LUMINAIRE SCHEDULE				
TYPE	VOLTS	LAMP (QTY)	DESCRIPTION	MFR.TYPE/SERIES
L09	120	LED 4000k, MINIMUM 75 CRI	Wet Location LED, Pendant mounted, Enclosed and gasketed fibreglass reinforced polyester housing with steel eclosed wireway, Corrosion resistant latches, High impact frosted acrylic diffuser, Medium distribution, IP66, 0-10V Dimmable Driver, Total 40 Watts, 4000 Lumens	Lithonia DMW2 4000L MD AFL 40K 80 CRI or equivalent
L09B	120	LED 4000k, MINIMUM 75 CRI	Wet Location LED, Surface mounted, Enclosed and gasketed industrial, Corrosion resistant latches	Lithonia DMW 120V or equivalent
L10	120	LED 3500K, MINIMUM 80 CRI	Undercabinet striplight, length to suit cabinet geometry. Clip mounting to underside of cabinet. See Architectural typical kitchen millwork detail for mounting geometry. Provide 4 output driver mounted under cabinet near wall	Vode ZipOne 707 or equivalent
L11	120	LED 4000K	Outdoor wall mount fixture, IP66, -40 - 40C 6000LM,type 4 wide distribution, Black finish	Kim Lighting Wall Director 2.0 WDS-D-24L-60-4K7-4W or equivalent
L12	120	LED 3000K	2' x 4', Wet location, vandal-reistant lensed troffer. 6400lm.	GRW Wet Location and GRV Vandal LED Troffer or equivalent
LH01	120	LED	20" Black Outdoor Wall Lantern, Suitable for Damp Locations, C-US Wet Rated, 700lm	Hinkley 2364MB-LL or equivalent
X01	120	LED	Exit Sign, Aluminum Housing, LED, Single Or Double Face, Back-to-Wall, End-to-Wall, pendant or Ceiling Mounted As Shown on Drawings, Green Running Man Pictogram, White Housing	Lumacell LA Series Beghelli Micra RM Series Aimlite RPALW Series
X02	120	LED	Exit Sign, Aluminum Housing, LED, Single Or Double Face, Back-to-Wall, End-to-Wall, pendant or Ceiling Mounted As Shown on Drawings, Green Running Man Pictogram, White Housing, C/W battery pack and remote heads	Lumacell LA Series Beghelli Micra RM Series Aimlite RPALW Series
B01	120	6W LED MR16	Emergency Battery Unit, 120 Volt Input, 12 Volt Output, Minimum 100 Watt Capacity For 30 minute for connected load, Enclosed In EEMAC 1 Code Gauge Steel Housing, 10 Year Life, Time Delay Relay, Voltmeter, Two Integral 6 Watt LED MR16 Heads	Lumacell Signature Series LD10 Heads, Lumacell RG12S Series or approved equal

1 General

1.1 **SUMMARY**

.1 Labour, Products, equipment and services necessary to complete the Work of this section including, but not limited to, the following:

.1 Control Devices

.1 Distributed dimming control systems

.2 Central dimming control system

.2 Input Devices

.1 Occupancy, vacancy sensors

.2 Sensor power packs

.3 Daylight sensors

.4 Multi Sensors

.5 Touchscreens

.6 Wallstations

.3 End Devices

.1 Relays

.2 Digital to Analog converters

.3 0-10V to Reverse phase converters

.4 LED drivers

.4 Software and Integration

.1 BMS integration

.2 LAN/VLAN integration

.3 Partition controls

.4 DMX integration

.5 ASCII integration

.6 Programming software

.7 Emergency lighting control (if applicable)

1.2 **REFERENCES**

.1 American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE)

.1 C62.41-1991 – Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.

- .2 ASTM International (ASTM)
 - .1 D4674 -02a Standard Test Method for Accelerated Testing for Color Stability of Plastics Exposed to Indoor Fluorescent Lighting and Window-Filtered Daylight.
- .3 Canadian Standards Association (CSA).
 - .1 CSA C22.2 # 14 Industrial Control Equipment
 - .2 CSA C22.2 # 184 Solid-State Lighting Controls
 - .3 CSA C22.2 # 156 Solid-State Speed Controls
- .4 International Electrotechnical Commission.
 - .1 (IEC) 801-2 Electrostatic Discharge Testing Standard.
 - .2 IEC/EN 60669-2-1 Switches for household and similar fixed electrical installations - electronic switches.
- .5 International Organization for Standardization (ISO)
 - .1 9001:2000 – Quality Management Systems.
- .6 National Electrical Manufacturers Association (NEMA)
 - .1 WD1 (R2005) - General Color Requirements for Wiring Devices.
- .7 Underwriters Laboratories, Inc. (UL):
 - .1 489 (2002) - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
 - .2 508 (1999) - Standard for Industrial Control Equipment.
 - .3 1472 (1996) - Solid-State Dimming Controls.
 - .4 924 (2003) - Emergency Lighting and Power Equipment.
- .8 National Fire Protection Association (NFPA)
 - .1 701 (2004) Standard Methods of Fire Tests for Flame Propagation

1.3 **COORDINATION REQUIREMENTS**

- .1 Coordination
 - .1 Coordinate the placement of lighting control panels
 - .2 Coordinate the placement of sensors, wallstations and other user input devices
 - .3 Coordinate the placement of daylight sensors to achieve optimal daylight dimming
 - .2 Prewire meeting: Conducted on-site with lighting control system manufacturers or designated representative prior to commencing work as part of the manufacturer's standard practice and startup services. Manufacturer to review with the installer:
 - .1 Installation of lighting control panels and locations
-

- .2 Lighting control network wiring
- .3 Network IT requirements
- .4 Low voltage wiring requirements
- .5 Lighting control integration requirements
- .6 Lighting control system integration network wiring and connectivity
- .7 Installer responsibilities
- .8 Startup and training schedule and actions

1.4 **SUBMITTALS**

- .1 Submit under provisions of Section 013300.
- .2 Specification Conformance Document: Indicate whether the submitted equipment:
 - .1 Meets specification exactly as stated.
 - .2 Meets specification via an alternate means and indicate the specific methodology used.
- .3 Shop Drawings; include:
 - .1 Load schedule indicating actual connected load, load type, and voltage per circuit, circuits and their respective control zones, circuits that are on emergency, and capacity, phase, and corresponding circuit numbers.
 - .2 Schematic of system.
- .4 Product Data: Catalog specification sheets with performance specifications demonstrating compliance with specified requirements.
- .5 Project Record Documents: Installer to record actual installation location and settings of lighting control panels and components.

1.5 **QUALITY ASSURANCE**

- .1 Manufacturer: Minimum 10 years experience in manufacture of architectural lighting controls.
- .2 Manufacturer's Quality System: Registered to ISO 9001:2000 Quality Standard, including in-house engineering for product design activities.
- .3 Central dimming control system:
 - .1 Meets UL, cUL, and/or CSA Standards specifically for the required loads. Provide evidence of compliance upon request.

1.6 **PROJECT CONDITIONS**

- .1 Do not install equipment until following conditions can be maintained in spaces to receive equipment:
 - .1 Ambient temperature: 0° to 40° C (32° to 104° F).

- .2 Relative humidity: Maximum 90 percent, non-condensing.
- .3 Lighting control system must be protected from dust and sprays during installation.

1.7 **WARRANTY**

- .1 Provide manufacturer's warranty covering 5 year 100 percent parts to repair and replace defective equipment.
 - .1 Systems that do not provide 100 percent parts at no extra charge for the first 5 years of installation shall not be acceptable.
- .2 Provide manufacturer's additional warranty options to customer where required.
 - .1 Provide warranty options beyond initial 5 year period as an additional purchased service.

1.8 **COMMISSIONING**

- .1 Provide factory-certified field service engineer to a site visit to ensure proper system installation and operation under following parameters:
 - .1 Qualifications for factory-certified field service engineer:
 - .1 Certified by the equipment manufacturer on the system installed.
 - .2 Make a visit upon completion of installation of central dimming control system:
 - .1 Verify connection of power feeds and load circuits.
 - .2 Verify connection Wallstation controls.
 - .3 Verify proper connection iCAN link.
 - .4 Download system panel data to dimming panels.
 - .5 Check dimming panel load types and currents and remove by-pass jumpers.
 - .6 Verify system operation control by control, circuit by circuit.
 - .7 Obtain sign-off on system functions.
 - .8 User to be trained on system operation

1.9 **MAINTENANCE**

- .1 Make ordering spare parts available to end user.
 - .2 Make new replacement parts available for minimum of ten years from date of manufacture.
 - .3 Provide factory direct technical support hotline.
 - .4 Provide on-site service support where required.
 - .5 Offer renewable service contract on yearly basis, to include parts, factory labor, and annual training visits to customer if desired.
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1.10 DELIVERY, STORAGE AND FIELD CONDITIONS

- .1 Ensure products are delivered as shipped, including pallet assembly and packaging has not been damaged in shipment.
- .2 Store products in a clean, dry location in manufacturers original packaging.
- .3 Store products in an environment that meets products ambient and storage temperature per products specification sheets.
- .4 Store products in an environment that meets products relative humidity of less than 90 percent, non-condensing as outlined on the product specification sheets.

1.11 SYSTEM DESCRIPTION AND OPERATION

- .1 The Lighting Control and Automation system as defined under this section covers the following equipment:
 - .1 Distributed dimming control system – Simplified factory assembled dimming and switching solutions that meet typical applications and simplify low voltage wiring to help a space meet the latest IECC, ASHRAE and Title 24 energy codes.
 - .2 Centralized dimming control system – Factory assembled dimming and switching solutions that allow for applications to scale from small to enterprise while providing simplified low voltage wiring to allow for system completion faster. This system includes third party integration and features to simplify complex application designs.
 - .3 Occupancy Sensors – PIR, DT and ULT Auto adjusting, NEMA WD7 compliant occupancy or vacancy sensors.
 - .4 Wallstations – Smart device that are fully programmable, pre-engraved digital pushbutton wallstations and dimmers.
 - .5 Scene Wallstation – Smart device that are fully programmable, pre-engraved digital pushbutton scene wallstations, dimmers and programmable scene buttons.
 - .6 Daylight Photosensor – Smart device that is a multi-zone open loop daylight sensor with two-way active infrared (IR) communications, which can provide dimming control for daylight harvesting.
 - .7 Touchscreens – Full color touchscreen that can be programmed to control any area on the lighting control network. Shall include multiple screens with templates for simplified programming as well as password protected screen locking features.
 - .8 3rd Party Integration – Interface shall be provided to allows for 3rd party integration via serial or Ethernet into the iLumin Plus lighting system using standard ASCII commands
 - .9 BAS Integration – BACnet interface shall be available to allow BAS systems to detect and control area status.
 - .10 Demand Response – OpenADR or other demand response input shall be connected to one or more iLumin Plus panels. The DR signal will trigger a
-

- response to the lighting and is fully programmable based on a single area or the entire network.
 - .11 iLumin Plus communication network – iCANnet CANbus wiring using Belden 1502 or 1502P network wire to create the iLumin Plus system lighting control network.
 - .12 2 wire topology free polarity free low voltage network – 18AWG or 14AWG twisted pair wire (purple and purple) is preferred for connecting user interface devices to the iLumin Plus lighting control panels. This simplifies the design, installation and controls allowing the installer and designer to get off the job faster.
 - .2 Minimum lighting control performance required, unless local energy code is more stringent.
 - .1 Occupancy/vacancy requirements – Provide occupancy/vacancy sensors as indicated on drawings and sequence of operation.
 - .2 Daylight Zones – Primary sidelit or toplit areas within an enclosed space shall be controlled separately and automatically by a multi-level photocontrol device.
 - .3 Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to dim electric light to the lowest light level.
 - .4 Provide the ability to adjust the high end and low end trim of the dimmers to ensure the lighting automatically provides energy saving even when daylighting calls for full illumination.
 - .5 Provide the ability for the dimmers and the relays to function separately. Systems where the 0-10V dimmers and relays are tied together reduce design capabilities and shall not be acceptable.
 - .6 Provide the ability to provide occupancy status to a Building Automation System.
 - .7 Shall be capable of automatically responding to a Demand Response Signal and adjusting the lighting level. (Required for California Title 24 2013)
 - 2 Products
 - 2.1 **MANUFACTURERS**
 - .1 Acceptable Manufacturers:
 - .1 Cooper Lighting Solutions
 - .2 Douglas Controls
 - .2 Basis of design product: Cooper iLumin Plus system or subject to compliance and prior approval with specified requirements of this section, one of the following:
 - .1 Cooper iLumin Plus system
 - .2 Douglas Controls
 - .3 Substitutions:
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- .1 No substitution will be accepted prior to award of Contract.
- .2 All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by the design professional
- .3 Proposed substitutes must be accompanied by a review of the specification noting compliance on a line-by-line basis.
- .4 Provide complete engineered shop drawings (including power wiring) with deviations for the original design highlighted in an alternate color to the engineer for review and approval prior to rough-in.

2.2 **GENERAL**

- .1 Provide system hardware that is designed, tested, manufactured, and warranted by a single manufacturer.
- .2 Architectural Lighting Controls: Ten-year operational life while operating continually at any temperature in an ambient temperature range of 0° C (32°F) to 40° C (104°F) and 90 percent non-condensing relative humidity.
- .3 Designed and tested to withstand electrostatic discharges up to 12,000 V without impairment per IEC 801-2.

2.3 **ILUMIN PLUS PANELS**

- .1 Mechanical:
 - .1 Meets UL, cUL, and/or CSA Standards specifically for the required loads. Provide evidence of compliance upon request.
 - .2 Delivered and installed as a factory assembled panel listed to UL508.
 - .3 Field wiring accessible from front of panel without need to remove dimmer or relay assemblies or other components.
 - .4 Panels passively cooled via free-convection, unaided by fans or other means.
 - .2 Electrical:
 - .1 Electrolytic capacitors to operate under the component manufacturer's maximum temperature rating when device is under fully-loaded conditions in 40° C (104° F) ambient temperature.
 - .2 Design and test dimmers/relays to withstand line-side surges without impairment to performance.
 - .1 Panels: Withstand surges without impairment of performance when subjected to surges of 6,000 volts, 3,000 amps per ANSI/IEEE C62.41 and per IEC 61000-4-5 surge requirements.
 - .2 Other power handling devices: Withstand surges without impairment of performance when subjected to surges of 6,000 volts, 200 amps per ANSI/IEEE C62.41.
 - .3 Utilize air gap off, activated when user selects "off" at any control to disconnect the load from line supply.
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- .4 Power failure memory and dimmer/relay recovery:
 - .5 When power is interrupted and subsequently returned, lights will automatically return to same levels (dimmed setting, full on, or off) prior to power interruption.
 - .6 In 3 phase panels loss of power to any phase should not effect operation or control dimmers on any other phase.
 - .3 Performance:
 - .1 Shall be UL listed to relevant standards (UL508A, UL916, cULus)
 - .2 Shall be capable of mixed voltages 120/277VAC 50/60Hz
 - .3 Shall be capable of mixed sources including normal and emergency power
 - .4 Shall include a panel SCCR rating of 25kA
 - .5 Shall be capable of providing a mixed module solution panel including relays, dimmers and DALI controls.
 - .6 Shall be capable of meeting the latest IECC, ASHRAE and Title 24 energy codes
 - .7 Shall support three enclosure sizes
 - .1 Small Enclosure
 - .1 Shall support up to two modules
 - .2 Medium Enclosure
 - .1 Shall support up to four modules and PC connection module
 - .2 Shall include configurations with Ethernet connection to building LAN or VLAN
 - .3 Large Enclosure
 - .1 Shall support up to eight modules and PC connection module
 - .2 Shall include configurations with Ethernet connection to building LAN or VLAN
 - .4 Relay Module: (SCMR1220)
 - .1 Up to 48 relays in large enclosure
 - .2 Each relay module shall support up to twelve 20A fully rated relays
 - .1 Shall include heavy duty 20A @40C relays
 - .3 Rated life of relay: Minimum 1,000,000 cycles.
 - .4 Load switched in manner so that there is no arcing at mechanical contacts when power is applied to and removed from load circuits.
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- .5 Fully rated output continuous duty for inductive, capacitive, and resistive loads.
 - .6 Relay controller shall include the capability for DMX input control with base address
 - .7 Relay controller shall include the capability for DALI input control
 - .8 Relay controller shall include alert dry contact input for hardware override of all relays
 - .5 Dimmer Module: (SCMH1200)
 - .1 Up to 48 Low Voltage Dimming (0-10V) channels in large enclosure
 - .2 Each dimmer module shall support up to twelve 0-10V channels; Meet following requirements:
 - .3 Capable of controlling any 0-10V source.
 - .4 0-10V dimmers shall include a fail to full output safety feature by default
 - .5 Provide isolated 0-10V output signal conforming to IEC 60929.
 - .1 50mA sink current per channel via IEC 60929.
 - .2 50mA source current per channel
 - .6 0-10V controller shall include the capability for DALI input control
 - .6 DALI: (SCMD4)
 - .1 Up to 16 DALI buses in medium enclosure
 - .2 Each DALI module shall support up to four DALI buses
 - .3 Shall include dedicated test/override buttons for each DALI bus
 - .4 Shall include a separate power supply for each DALI bus
 - .1 Shall provide 16V nominal, 250mA max current per bus
 - .2 Shall support 64 standard DALI devices per bus
 - .5 DALI controller shall include the capability for DMX input control with base address
 - .6 DALI controller shall include the capability for DALI input control
 - .7 DALI controller shall include alert dry contact input for hardware override of all relays
 - .7 Ethernet: (EG2)
 - .1 Shall provide a single ethernet port for connection to the building LAN or VLAN
-

- .2 Shall be capable of facilitating a LAN or Wi-Fi connection to the iLumin Plus system
- .3 Shall include an integral web server
- .4 Shall provide the capability for mobile devices to override the lighting system via scene or channel slider commands
- .5 Shall provide the capability for 3rd party integration via ASCII control strings
- .6 Shall provide the capability for bridging the iLumin Plus network across LAN or VLAN connections

2.4

INPUT DEVICES

.1 WALLSTATIONS & TOUCHSCREENS

.1 Product: DALI Wallstation

.1 Electronics:

- .1 Use 18AWG – 14AWG wiring for low voltage communication to SCMD4 module

.2 Functionality:

- .1 Upon button press, LEDs to immediately illuminate.
- .2 Each button shall be programmable to control any area, scene, channel

.3 Color: White

- .4 Provide color matching faceplates with concealed mounting hardware where specified.

- .5 Engrave wall stations with appropriate button, zone, and scene descriptions as specified.

.2 Product: Ineo Wallstation

.1 Electronics:

- .1 Use iCANnet wiring for low voltage communication to ensure reliable data communication in high electrical noise environments.

.2 Functionality:

- .1 Upon button press, LEDs to immediately illuminate.
- .2 Each button shall be programmable to control any area, scene, channel

.3 Color: White

- .4 Provide color matching faceplates with concealed mounting hardware where specified.
-

- .5 Engrave wall stations with appropriate button, zone, and scene descriptions as specified.
 - .3 Product: [TSC-30]
 - .1 Communication: iCANnet protocol.
 - .2 Power: From the 9V external power supply (included)
 - .3 Connections: Five (5) wires Belden 1502 or 1502P
 - .4 Mounting: Wallbox (included)
 - .5 VGA 320x240 pixel resolution, 65,000 colors available
 - .6 3.5" diagonal backlit LCD touchscreen
 - .7 Shall allow up to 250 pages to be stored in memory
 - .8 Groups: The set of fixtures controlled by a given touchscreen shall be completely configurable through software and can span entire iLumin Plus network.
 - .9 Shall support individual zone level adjustment and save scene controls
 - .2 ADDRESSABLE MULTI-SENSOR
 - .1 Product: [MST-6], [MTS-12],
 - .1 Communication: DALI protocol.
 - .2 Power: From the DALI bus.
 - .3 Maximum Current Draw: 3.75 mA.
 - .4 Connections: Two (2) wires (16/18AWG, FT6, non-twisted, non-shielded, non-polarized and plenum rated) connected to the DALI communication bus.
 - .5 Sensing Technologies: Occupancy, daylight and temperature.
 - .6 Daylight Sensing Range: 0-400 lux.
 - .7 Daylight Sensing Coverage: Light input within 60° cone.
 - .8 Occupancy Detection Technology: Passive infrared.
 - .9 Occupancy Detection Coverage Area: 600 sq. ft. or 1,200 sq. ft.
 - .10 Occupancy Detection Angle: 360°.
 - .11 Mounting: Junction box or ceiling tile.
 - .12 Groups: The set of fixtures controlled by a given multi-sensor shall be completely configurable through software and can span iLumin Plus network..
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- .13 Timers: All times shall be configurable through the web software and shall not require any manual configuration of settings prior to installation. Timer values can range from 1 second to 24 hours
 - .14 Shall be capable of occupancy forwarding to send occupancy status to other areas within the system
 - .2 Product: [NC3-C]
 - .1 Communication: iCANnet protocol.
 - .2 Power: From the iCANnet bus.
 - .3 Connections: Five (5) wires Belden 1502 or 1502P
 - .4 Sensing Technologies: Occupancy, daylight
 - .5 Daylight Sensing Range: 0-400 lux.
 - .6 Daylight Sensing Coverage: Light input within 60° cone.
 - .7 Occupancy Detection Technology: Passive infrared.
 - .8 Occupancy Detection Coverage Area: 250 sq. ft.
 - .9 Occupancy Detection Angle: 360°.
 - .10 Mounting: ceiling tile.
 - .11 Groups: The set of fixtures controlled by a given multi-sensor shall be completely configurable through software and can span entire iLumin Plus network.
 - .12 Timers: All times shall be configurable through the web software and shall not require any manual configuration of settings prior to installation. Timer values can range from 1 second to 24 hours
 - .13 Shall be capable of occupancy forwarding to send occupancy status to other areas within the system
 - .14 Capable of sending a command to turn HVAC on and off
 - .3 ADDRESSABLE SENSOR POWERPACK
 - .1 Product: [FLT-SP-MV-DC2], [FLT-SP-MV-DC1], [FLT-SP-347-DC2], [FLT-SP-347-DC1], [FLT-SP-240-DC2], [FLT-SP-24-DC1]
 - .1 Communication: DALI protocol.
 - .2 Power: 347VAC.
 - .3 Maximum Current Draw: 2 mA.
 - .4 Maximum number of sensors: Up to five (5) PIR or DT sensors are connected and report to the system as a single addresss.
 - .5 Connections: Two (2) wires (16/18AWG, FT6, non-twisted, non-shielded, non-polarized and plenum rated) connected to the DALI communication bus.
-

- .6 Sensor connections: Five (5) wires (16/18AWG, FT6, non-twisted, non-shielded, non-polarized and plenum rated) connected to sensor for controls and addressing

.4 CEILING MOUNTED SENSORS

- .1 Product: [OAC-DT-2000-R], [OAC-DT-1000-R], [OAC-P-1500-R], [OAC-U-2000-R]

- .1 Provide all necessary mounting hardware and instructions.
 - .2 Sensors shall be Class 2 devices.
 - .3 Connect up to five (5) sensor to the DALI Powerpack for power and signal back to the iLumin Plus system
 - .4 Device calibration and features:
 - .1 Sensitivity – 0-100% in 10% increments.
 - .2 Time delay – 1-30, self-adjusts to 10 min based on room occupancy.
 - .3 Test mode – Fifteen second time delay.
 - .4 Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
 - .5 Walk-through mode.
 - .6 Ultrasonic and Dual Technology Sensors utilize two independent sensor detection circuits simultaneously to ensure optimum performance, regardless of location or proximity to walls and structures.
 - .7 Ultrasonic and Dual Technology Sensors utilize Variable Drive Circuitry (VDC) in cases of over saturation from misapplication, which automatically adjusts the volumetric output without reducing detection capability. Systems that reduce detection coverage area shall not be acceptable.
 - .8 Automatically and continually self-adjust ultrasonic frequency to ignore specific frequency, continuous noise from airflow to prevent detuning which can lead to inadvertent lights out. Sensors that require detuning shall not be acceptable.
 - .5 Device Status LEDs including:
 - .1 PIR Detection
 - .2 Ultrasonic detection
 - .6 Manual override of controlled loads.
-

- .7 Where specified, sensor packaging shall be 100% recycled [made entirely from post-consumer waste (100% post-consumer fiber content) as well as, 100% recyclable].

- .8 Sensors shall be RoHS compliant.

.5 WALL/CORNER MOUNTED SENSORS

- .1 Product: [OAWC-P-120W-R], [OAWC-P-009L-H-R], [OAWC-DT-120W-R],

- .1 Provide all necessary mounting hardware and instructions.

- .2 Sensors shall be Class 2 devices.

- .3 Connect up to five (5) sensor to the DALI Powerpack for power and signal back to the iLumin Plus system

- .4 Device calibration and features:

- .1 Sensitivity – 0-100% in 10% increments.

- .2 Time delay – 1-30, self-adjusts to 10 min. based on room occupancy.

- .3 Test Mode – Fifteen second time delay.

- .4 Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.

- .5 Walk-Through Mode.

- .6 Automatically and continually self-adjust ultrasonic frequency to ignore specific frequency continuous noise from airflow to prevent detuning which can lead to inadvertent lights out. Sensors that require detuning shall not be acceptable.

- .5 Device Status LEDs including:

- .1 PIR Detection

- .2 Ultrasonic detection

- .6 Manual override of controlled loads.

- .7 Where specified, sensor packaging shall be 100% recycled [made entirely from post-consumer waste (100% post-consumer fiber content) as well as, 100% recyclable].

- .8 Sensors shall be RoHS compliant.

2.5 END DEVICES

.1 ADDRESSABLE RELAYS AND DRIVERS

- .1 Product: [FLT-DAC-DALI-DC1], [FLT-DAC-DALI-DC2]

- .1 0-10V Addressable Dimming Modules
-

- .2 Communication: DALI protocol.
- .3 Power: From the DALI bus.
- .4 Maximum Current Draw: 3.75 mA.
- .5 Communication Connections: Two wires (16/18AWG, FT6, non-twisted, non-shielded, non-polarized and plenum rated) connected to the DALI communication bus.
- .6 Power Ratings: Up to 4A Ballast 120/277/347 VAC.
- .7 Dimming Control: 0-10V, 50 mA max current sink.
- .8 Mounting: Fixture or conduit (90° elbow and mounting clips included).
- .9 UL 924 Listed component.
- .2 Product: [FLT-HPRS-DALI]
 - .1 Communication: DALI protocol.
 - .2 Power: From the DALI bus.
 - .3 Maximum Current Draw: 3.75 mA.
 - .4 Enclosure: Standard outlet box or NEMA 250, Type 1, unless otherwise indicated.
 - .5 Communication Connections: Two (2) wires (16/18AWG, FT6, non-twisted,
 - .6 non-shielded, non-polarized and plenum rated) connected to the DALI communication bus.
 - .7 Power Ratings: Up to 20 A at 347 VAC.
 - .8 Field relays shall be capable of controlling plug loads.
 - .9 Mounting: Junction box.

2.6 **INTEGRATION AND ACCESSORIES**

.1 **BAS INTEGRATION**

- .1 Product: [FPA-W34-1130] BMSPRO 2 - BACnet Interface
 - .1 The iLumin Plus network shall permit data protocol translation through a building automation interface Gateway. The BACnet Gateway shall permit BACnet communication protocol to operate individual areas, scenes or channels and read the status. The iLumin Plus network shall respond efficiently to the requested information from the BACnet network.
 - .2 The BMSPRO2 provides up to 10,000 points of control and can communicate to multiple panel types.
 - .3 The BMSPRO 2 requires a dedicated EG2 interface for connectivity either installed in an iLumin Plus panel or as a separate accessory.
-

- .4 Provide PIC list definition and object model to other system manufacturers.

.2 LAN/VLAN INTEGRATION

.1 Product: [EG2-NA] Ethernet Gateway

- .1 Shall provide a single ethernet port for connection to the building LAN or VLAN
- .2 Shall be capable of facilitating a LAN or Wi-Fi connection to the iLumin Plus system
- .3 Shall include an integral web server
- .4 Shall provide the capability for mobile devices to override the lighting system via scene or channel slider commands
- .5 Shall provide the capability for 3rd party integration via ASCII control strings
- .6 Shall provide the capability for bridging the iLumin Plus network across LAN or VLAN connections
- .7 Provide ability for bi-direction communication by means of Ethernet communication to system by means of user-supplied PC, digital audiovisual, or BAS equipment. Control to be located on the same Local Area Network.
- .8 Allow for custom communication command strings to be entered in to software to allow lighting control system to control other devices

.3 SERIAL INTEGRATION

.1 Product: [SI-2-NA] RS232 Interface

- .1 Communication: iCANnet protocol.
- .2 Power: From the iCANnet bus.
- .3 Connections: Five (5) wires Belden 1502 or 1502P
- .4 Mounting: Junction box
- .5 Provide ability for bi-direction communication by means of RS232 serial communication to system by means of user-supplied PC, digital audiovisual, or BMS equipment. Control to be located within 50 feet (15 meters) of RS232 source.
- .6 Allow for custom RS-232 command strings to be entered in to software to allow lighting control system to control any other device

.4 PARTITION CONTROL;

.1 Product: [UIG-NA], [UIM-NA]

- .1 Communication: iCANnet protocol.
 - .2 Power: From the iCANnet bus.
-

- .3 Connections: Five (5) wires Belden 1502 or 1502P
 - .4 Inputs: Four (4) digitally optically isolated inputs
 - .5 Mounting: Junction box
 - .6 Partitioning: Shall provide partitioning and room join capabilities using either a button press, input, or IR wall partition sensors
 - .7 Low Voltage Input: Shall provide the capability for contact closures to integrate between lighting controls and other systems.
 - .1 The contact closure input device will accept both momentary and maintained contact closures.
 - .2 Product: [IRTR]
 - .1 Infrared Transmitter & Receiver
 - .2 Provide the ability to sense the presence or absence of partitions.
 - .3 Requires the connection to a UIG-2-NA or UIM-NA
 - .5 NETWORK ACCESSORIES
 - .1 Product: [LCNJ]
 - .1 Communication: iCANnet protocol.
 - .2 Power: From the iCANnet bus.
 - .3 Connections: Five (5) wires Belden 1502 or 1502P
 - .4 Mounting: Junction box
 - .5 Shall allow direct access to the iLumin lighting control network while in the space being modified.
 - .2 Product: [BN-2-NA]
 - .1 Network Bridge
 - .2 Communication: iCANnet protocol.
 - .3 Power: From the iCANnet bus.
 - .4 Connections: Five (5) wires Belden 1502 or 1502P
 - .5 Mounting: Junction box
 - .6 Shall allow the network to extend more than 1000m/3200 feet.
 - .7 Shall permit the connection of multiple networks allowing up to 65,000 devices on one system.
 - 2.7 SOFTWARE
 - .1 ICANsoft Suite
 - .1 Product: [SW-2]
-

- .1 Software shall support multiple functions to setup entire enterprise iLumin Plus system
 - .1 DALI addressing tool
 - .2 Device editor for system programming and scheduling
 - .3 iCANsoft editor for system programming and scheduling
 - .4 Smartphone configuration tool for mobile applications
 - .5 Touchscreen configuration tool
 - .6 Panel editor for floor plan control
- .2 Software shall support multiple diagnostic tools for troubleshooting the iLumin Plus system
 - .1 Network monitor
 - .2 Flash tool for updating system device firmware
 - .3 Device simulator
- .3 Shall include with user-friendly software suitable for operation on computer workstations which serve as central control stations for the selection and operation of lighting scenes
- .4 Clients shall interface with the software via Eaton Lighting Systems iCANsoft application

3 Execution

3.1 **INSTALLATION**

- .1 Install equipment in accordance with manufacturer's installation instructions.
 - .2 Provide complete installation of system in accordance with Contract Documents.
 - .3 Define each dimmer's/relay's load type, assign each load to a zone, and set control functions.
 - .4 Provide equipment at locations and in quantities indicated on Drawings. Provide any additional equipment required to provide control intent.
 - .5 100 digital devices (Source Controllers, User Interfaces, etc) may reside on a single network segment with a network length not to exceed 3000 feet. Additional network segments shall be accomplished by the employment of a network bridge up to 65000 devices. Network segments shall be terminated at the end of each segment.
 - .6 Devices to be connected via Daisy Chain topology.
 - .7 Network wire recommended is Belden#1502R or 1502P (plenum) or similar. Wire shall meet color code requirements to insure proper installation of the network polarity.
 - .8 All panels are "masters" and may be added to the network in any location and any amount as long as network installation guidelines are met.
 - .9 Panels are designed to function independently from external control devices.
-

End of Section

IDEN. No	AREA	CONTROLS	SEQUENCE
1	Corridors	Local low voltage switches Occupancy sensors Low voltage relays Time of day schedule	ON: 50% by time of day schedule; remaining 50% by occupancy sensor when space is occupied ADJUST: Reduced to 50% when space is not occupied, increased to 100% when occupied OFF: by time of day schedule OVERRIDE: local manual switches to override ON when scheduled OFF
2	Washrooms; Janitor Room	Local low voltage switches Low voltage relays Vacancy sensors	ON: manual by local switches OFF: vacancy sensors
3	Private Offices	Local dimming type wall switch sensor or vacancy sensor & dimming switch as indicated on drawings Photocells where Primary and/or Secondary sidelighting is available Low voltage relay	ON: 100% manual by local wall dimmers/dimming sensor ADJUST: Local dimmer; photocell where daylighting is available OFF: vacancy sensor
4	Open Offices; Copy/Print Rooms	Local dimming switches preset for 50% ON, 100% ON, OFF (no additional manual adjustment) Photocells where Primary and/or Secondary sidelighting is available Vacancy sensor Low voltage relays	ON: manual by local dimming switches ADJUST: Local dimmer (2 levels only); photocell where daylighting is available OFF: by switch or vacancy sensor
5	Meeting Rooms, Conference Rooms, Multipurpose rooms	Local dimming switches Photocells where Primary and/or Secondary sidelighting is available Vacancy sensor Low voltage relays	ON: manual by local dimmer switches ADJUST: Local dimmers; photocell where daylighting is available OFF: vacancy sensor, and manual override by local dimmer switches
6	Mechanical, Electrical, Comms. Rooms	Local low voltage switch Low voltage relay	ON: Manual by local control OFF: Manual by local control or schedule
7	Lobby, Vestibule	Local low voltage switch Occupancy sensor Photocell where daylighting is available Low voltage relays Time of day schedule	ON: 50% Auto on by schedule; remaining 50% by occupancy sensor when space is occupied ADJUST: Dimmed to 50% by occupancy sensor when not occupied; dimmed by photocell in response to daylighting OFF: time of day schedule OVERRIDE: local manual switch to override ON when scheduled OFF
8	Storage up to 1000 sq ft	Local wall switch or sensor switch Vacancy sensors Low voltage relays	ON: Manual on using local switch; OFF: Auto off using vacancy sensors when space is not occupied
9	Exterior	photocell Low voltage relays time-of-day schedule	ON/OFF: by time of day schedule and photocell REDUCE: dimmed by time of day schedule

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **ALTERNATE PRODUCTS**

.1 Submit a Tender Bid based on the use of Products indicated as base system Products.

- .2 Voluntarily submit an alternative Bid based on the use of Products indicated as alternative Products. Indicate in the Bid Form, the change in Bid Price by the use of alternative Products. By submitting a Bid based on alternative Products the Bidder accepts responsibility for coordination and interferences that may arise from their use.

1.3 **SYSTEM DESCRIPTION**

.1 Pathways – Hangers and Supports

- .1 Supports for structured cabling to segregate cabling from electrical and mechanical sources of interference or sources of potential damage.

.2 Open Hook Hangers

- .1 Open hook hangers (J hooks) permitted only where expressly indicated.
.2 Open hook hangers (J hooks) only of the type expressly indicated.

.3 Cable Retention Wraps

- .1 Cable retention wraps permitted only of the type and where expressly indicated.
.2 Cable retention wraps permitted only of the type indicated.
.3 Hard nylon cable retention wraps (Tiewrap™) or like Products not permitted as communications cable retainers nor permitted to be in direct contact with cable jacket.

.4 Pathways – Conduits

- .1 Comply with Section 26 05 00.
.2 Metallic and non-metallic conduit and cable tray to TIA 569.
.3 Flexible conduits at building expansion joints, connections from overhead pull-boxes to furniture access poles, and between wall pass-through boxes and modular systems furniture assemblies.
.4 Flexible liquid-tight metallic conduit for isolation and protection of communications cables between outlet boxes and enclosed raceways installed below access floors in areas not designated as a computer room.

.5 Pathways – Conduit Device Boxes

- .1 Comply with Section 26 05 00.
.2 Metallic and non-metallic device boxes to TIA 569.
.3 Device boxes of sufficient depth and width to prevent cable curvature in breach of manufacturer's specification for bending radius.
.4 Device boxes of sufficient capacity to permit storage of cable working allowance without interference to outlets and terminations.
-

- .6 Pathways – Cable Tray and Cable Runway
 - .1 Overhead cable tray in telecommunications rooms and computer rooms where indicated.
 - .2 Overhead cable runway in finished and unfinished areas where indicated.
 - .3 Under floor cable tray in finished areas with access floor where indicated.
 - .7 Pathways – Ducts
 - .1 Comply with Section 26 05 53.
 - .2 Underground and buried duct conduit and services to TIA 569.
 - .3 Ducts installed complete with flexible inner-duct sleeving and marked mule tape.
 - .8 Grounding and Bonding
 - .1 Comply with CSA C22.1.
 - .2 Grounding and bonding to TIA 607.
 - .3 Comply with Telcordia GR-295-CORE
 - .4 Provide technical single point ground as telecommunications systems ground reference.
 - .1 Grounding and bonding system for telecommunications to achieve an independent electrical grounding and bonding scheme separate and isolated from other grounds including building ground, lightning ground, process and controls ground or grounds, with exception that technical ground and electrical safety ground bonded at single point only, being closest to the source of incoming electrical power or as indicated.
 - .2 Technical grounding bus bars in telecommunications rooms, computer equipment rooms, telecommunications carrier building entrance and service rooms.
 - .3 Main technical grounding bus bar(s).
 - .4 Bonding conductors between technical grounding bus bars and main technical grounding bus bar as indicated using conductor of size whichever is greater of #6 AWG or as required by electrical safety code or as indicated on the Contract Drawings.
 - .5 Bonding between main technical grounding bus bar and electrical safety ground.
 - .6 Computer and communications equipment cabinets bonded to technical ground.
 - .5 Common Electrical Ground
 - .1 Overvoltage protection building entrance devices bonded to electrical power safety ground.
 - .2 Communications metallic conduits, cable trays, cable runways, electrical enclosures, raceways bonded to electrical power safety ground.
 - .3 Electrical enclosures with the exception of computer and communications equipment cabinets bonded to electrical safety ground
 - .4 Grounding conductors in buried telecommunications ducts bonded to electrical safety ground.
-

.6 Pathways

- .1 Communications cable tray, cable runway, bonded to electrical safety ground through continuous minimum 10 AWG copper conductor. Bonding at intervals of 2440 mm or less.

.9 Submittals

- .1 Comply with Section 01 33 00.
- .2 Affix Engineer's seal or RCDD stamp of qualified persons identified herein to all submissions tendered under this division of the work to indicate work submitted has been reviewed by the qualified person. The indicated engineer seal or RCDD stamp in addition to seal or stamp required under provincial law.
- .3 Submit the following:
 - .1 Prepare and submit detailed and dimensioned drawings to describe and illustrate coordination of overhead communications systems, including but not limited to:
 - .1 Overhead support grid and suspension.
 - .2 Overhead cable tray.
 - .3 Overhead cable runway.
 - .4 Insulators.
 - .5 Top of equipment cabinets, frames and racks.
 - .6 Exhaust air containment ducts, flexible and rigid.
 - .7 Ceiling mounted AC units.
 - .8 Lighting fixtures.
 - .9 Overhead power distribution cables.
 - .10 Overhead power distribution busway.
 - .11 Overhead power tap boxes.
 - .12 Overhead optical fibre cable troughs and down drops.
 - .13 Overhead patch panels.
 - .14 Cable entry cable chimney to equipment cabinets.
 - .2 Shop Drawings
 - .1 Submit Shop Drawings for all component types prior to their use on site.
 - .2 Drawing illustrating front elevation of rack layouts prior to assembling said equipment.
 - .3 Drawing illustrating equipment room layouts where different from Contract Drawings. Identify dimensions of clearances to front, rear and sides of floor mounted components.
 - .4 Drawings illustrating cabling identification scheme prior to use on site.
- .4 Working, progress and constructed drawings
 - .1 Site maintained working progress drawings for Consultant's review when requested. Site maintained copy of site instructions, Change Orders,

Change Directives, minutes of site and trades coordination meetings for Consultant's review when requested.

.2 "As-Constructed" Record Drawings.

- .1 Prepare and submit drawings in hard copy format and in electronic machine readable Computer Aided Drafting (CAD) format describing the work as completed. Submit drawings in AUTOCAD format of release level no older than two versions prior to current release. Request copy of standards and conventions for use when creating and maintaining CAD files. Comply with layer conventions as indicated in CAD standards and practices documentation, or use existing layering conventions in existing files when machine readable files are available.
- .2 Where wires or communications raceways are underground or under floor or below finished grade, furnish field dimension with respect to building column lines and inverts with respect to finished floor levels or grades. Indicate inverts at point of penetration of conduits into below-grade hand wells, or below-grade maintenance chambers.
- .3 Record deviations from cable numbers shown on the Contract Drawings.
- .4 Prepare records of interconnecting and cross-connecting wiring between items of equipment including equipment supplied by Owner and under other Specification sections. Provide the records loaded into a data base. Select the data base by mutual agreement with the Consultant.
- .5 Approved data base Products
 - .1 Microsoft Access
 - .2 Microsoft Excel
 - .3 Flat ASCII text file in CSV format
- .6 Prepare drawings clearly identifying routes taken by cable where the cable is not supported along its length by an approved electrical raceway.
- .7 Submit Record Drawings no later than ten days following submitting a claim for Substantial Performance.

.5 Test reports

- .1 Submit test reports within three days of testing.

.6 Manuals

- .1 Submit Operating and Maintenance Manuals.

1.4 **TENDER SUBMISSIONS**

.1 Tender submissions from pre-qualified bidders

- .1 Submit a Tender to undertake work described under this division only if pre-qualified by the Owner.
- .2 Tenders to undertake this work will be accepted from other bidders only if accompanied by written approval from the Owner to have Tender Bid considered.

- .2 Tender submissions from bidders at large
 - .1 Submit a Tender to undertake work described under this division only if:
 - .1 Fully qualified and certified to undertake the work by the manufacturer(s) of the Product(s) proposed in the Tender;
 - .2 Compliant with bidder qualifications required and outlined herein below.

1.5 **PRE-AWARD SUBMISSIONS**

- .1 On request of the Owner submit the items listed herein before award of Contract as a condition of award. Failure to comply will be justifiable grounds for cancelling the Contract or disqualification of the bid at the sole discretion of the Owner.
- .2 Submit the following items prior to, or no later than ten working days following, the award of Contract.
 - .1 Personnel
 - .1 Submit a list of personnel who will be directly involved in overseeing the technical interpretation of the work described in the Contract Documents.
 - .2 Submit a list of personnel who will be directly involved in assessing the quality of the work during execution and in ensuring quality standards are upheld.
 - .3 Submit a statement indicating that the Bidder maintains the minimum number of trained installation technicians to comply with the structured cabling system manufacturer's business partner or certified partner program. Provide information on the manufacturer's requirements.
 - .4 Submit a list of trained personnel who will or may be assigned to the Project. Indicate the degree of training each technician has received and whether training was factory training or in-field. Submit for each person named, a record of factory training credentials issued by the named manufacturer(s) stating training curriculum and date of training applicable to the Products identified.
 - .5 Submit for each person named, professional and/or industry recognized credentials endorsing the ability and competency to undertake quality assurance, overseeing and technical guidance of the work.
 - .2 Corporate
 - .1 Submit a list to identify five or more like-sized systems undertaken by the Bidder. Identify the completion date of each. Provide on demand a reference who can and is willing to attest to the quality of the work results for each named project.
 - .3 Manufacturer
 - .1 Submit a statement from the manufacturer of the cabling Products proposed for use in this Contract indicating the Bidder's good standing with the manufacturer and the manufacturer's willingness and agreement to underwrite the performance warranty on the final installation.
 - .2 Failure to comply within ten working day following award may result in the disqualification of the bid at the sole discretion of the Owner.

1.6 **CONTRACTOR QUALIFICATIONS**

- .1 At any time before date of award or within ten business days following the date of award of Contract, submit the name of one or more persons who are qualified to undertake the

- work to implement and oversee the work of this division and described in the Contract Documents.
- .2 Identify one or more persons to fulfil two identified roles. Acceptable for both roles to be fulfilled by one person.
 - .1 Technical design supervisor
 - .2 Site work supervisor
 - .3 Acceptable qualifications are:
 - .1 Active member of BICSI and currently registered under BICSI RCDD program. Acceptable form of statement is RCDD certificate expiring no sooner than the date of substantial completion or one full year following the date of award whichever is the later.
 - .2 Active individual member or corporate member of BICSI and licensed within Canada as Professional Engineer with ten years demonstrated practice in the field of design and installation of communications infrastructure. Acceptable form of statement is an image of the signed Professional Engineer seal as cover to a history of work undertaken similar in nature and scope to the work described in the Contract Documents.
 - .4 Provide commitment to maintain same personnel or direct and immediate replacements through period of Contract. Acceptable replacements include personnel possessing like credentials for term including construction period.
 - .5 Provide commitment that qualified personnel will execute a tenure of commitment expiring no less than one year from the date of award, or a period conterminal with the final completion of the work whichever is the sooner.
 - .6 Quality assurance.
 - .7 Pre-Installation Meetings
 - .1 Arrange for and attend pre-installation design and construction meetings. Attendees at meetings to include site work supervisor and technical design supervisor.
 - .1 Minimum of one meeting to review the Contract scope of work.
 - .2 Minimum of one meeting to review the proposed execution of the work.
 - .8 Site Meetings
 - .1 Arrange for and attend construction progress meetings. Attendees at meetings to include site work supervisor and technical design supervisor.
 - .1 Minimum of two site meetings per month commencing on day of mobilization and running until four weeks after site work completion.
 - .2 These Specifications supplement the Electrical and Electronic Manufacturers Association of Canada, Canadian Standards Association Standards, Electronic Industries Association, Telecommunications Industries Association standards and recommendations. Conditions of the EEMAC, CSA, EIA, TIA and ISO/IEC standards and recommendations apply unless superseded or modified by this Specification.
 - .3 Where requirements of the Specifications exceed referenced standards, the Specifications apply. Where standards differ between authorities, the most stringent applies.
-

- .4 Requirements of the Specifications that are substandard to referenced standards should be brought to the attention of Consultant during bidding period in sufficient time to allow suitable action to be taken and addenda issued as necessary.
- .5 Equipment must be acceptable to electrical inspection authorities.
- .6 Where any part of the Work fails tests, on approval of the manufacturer repair the fault in a manner to prevent recurrence and re-test.
- .7 Where any part of the Work fails tests and that Work is to be built without physical discontinuity, remove the offending material and install new without increase in cost to the Contract.
- .9 Area Classification
 - .1 No area in the Work is classified as hazardous.
- .10 Warranty
 - .1 Comply with the terms of the warranty described in the Contract Documents.
 - .2 All components comprising the structured cabling channel as defined by TIA 568 by one manufacturer only and under the protection of a single installation and performance warranty.
 - .3 Provide Products protected under a single warranty where providing such is of benefit to the Owner. Provide evidence of this benefit.
 - .4 Assemble the cabling system using Products protected by a single warranty of minimum twenty-five years.
 - .5 Warranty to include protection against defective manufacture of Products and guarantee of fit for purpose for present and future uses for cable of stated performance level. Warranty to protect the Owner from defects in Product made evident by long term exposure to operating environment for which the Product is specified.
 - .6 Do not propose the use of Products or to provide contracting services if the manufacturer of the Products proposed will not warrant the Work to the best warranty most beneficial to the Owner.

2 Products

2.1 **MANUFACTURERS**

- .1 Use Products manufactured by stipulated manufacturer where identified.
- .2 Use Products manufactured by the identified preferred manufacturer as the basis of the Base Bid.
- .3 Use Products manufactured by identified alternative manufacturers as the basis of voluntary alternative bids. Provide justification for the use of alternative Products.
- .4 Avoid substitution of Products that are not beneficial to the Contract. Demonstrate benefit to the Contract and obtain approval prior to use of Products not identified in the Contract Drawings.

2.2 **ACCEPTABLE MANUFACTURERS**

- .1 Submit a Tender that includes only those Products identified in this and related sections in this division of the Specification.
 - .2 All components comprising the structured cabling channel as defined by TIA 568 by one or more manufacturers and under protection of a single installation and performance warranty.
-

2.3 **PRODUCT VENDORS**

- .1 Provide Products by a sole stipulated manufacturer where indicated.
- .2 Provide Products by listed alternative manufacturers where indicated for voluntarily proposed alternates. Acceptable alternative Products are listed within this and other sections comprising this division of the Work.
- .3 Use of Products not identified in this division as substitutes for stipulated or preferred Products is at the risk of the Contractor. At the discretion of the Owner, the Contractor may be called to replace the substituted Products at no cost to the Owner. A claim by the Contractor for a time delay caused by the need to replace substituted Products will be rejected.
- .4 For each alternative Product submit justification for use as alternates indicating benefits to the Owner. Identify if benefits are based on price, delivery, or performance.

2.4 **COMMUNICATIONS GROUNDING AND BONDING**

- .1 Pre-drilled Copper Bus Bar
 - .1 Telecommunications Grounding Busbar (TGB)
 - .1 Type T-250
 - .1 250 mm TGB telecommunications grounding bus bar, 6.5 x 50 x 250 mm, tin plated; four sets holes 6 mm diameter, spaced 16 mm; three sets of 10 mm holes spaced 25 mm, standoff insulators and mounting brackets.
 - .2 Type T-300
 - .1 300 mm TGB telecommunications grounding bus bar, 6.5 x 50 x 305 mm, tin plated; six sets holes 6 mm diameter, spaced 16 mm; three sets of 10 mm holes spaced 25 mm, standoff insulators and mounting brackets.
 - .3 Type T-500
 - .1 500 mm TGB telecommunications grounding bus bar, 6.5 x 50 x 508 mm, tin plated; twelve sets holes 6 mm diameter, spaced 16 mm; three sets of 10 mm holes spaced 25 mm, standoff insulators and mounting brackets.

Table 1 - Telecommunications ground bus bar - by manufacturer

Type	Panduit		
T-250	GB2B0304TPI-1		
T-300	GB2B0306TPI-1		
T-500	GB2B0312TPI-1		

- .2 Telecommunications Main Grounding Bus Bar (TMGB)
 - .1 Type TM-300
 - .1 300 mm TMGB telecommunications main grounding bus bar, 6.5 x 100 x 305 mm, tin plated; twelve sets holes 6 mm25 diameter, spaced 16 mm; six sets of 10 mm holes spaced 25 mm, standoff insulators and mounting brackets.
 - .2 Type TM-500
 - .1 500 mm TMGB telecommunications main grounding bus bar, 6.5 x 100 x 508 mm, tin plated; twenty-four sets holes 6 mm diameter,

spaced 16 mm; six sets of 10 mm holes spaced 25 mm, standoff insulators and mounting brackets.

Table 2 - Communications main ground bus bar - by manufacturer

Type	Panduit		
TM-300	GB4B0612TPI-1		
TM-500	GB4B0624TPI-1		

.3 Two-hole long barrel lug

.1 Comply with BICSI/J-STD-607A.

.2 Tin plated long barrel with inspection window to confirm cable insertion; two holes according to NEMA size and spacing.

2.5

PATHWAYS FOR COMMUNICATIONS SYSTEMS

.1 General

.1 Comply with Section 27 11 00 for overhead cable runway.

.2 Comply with Section 26 05 00 for rigid overhead cable tray.

.3 Supplement approved electrical raceways with items described herein.

.2 Cable Hangers and Supports

.1 Use only where expressly indicated as permitted.

.2 Cable supports of open hook construction (J hooks) with 54 mm wide cable bearing surface curved with radius greater than minimum required by supported cable.

.3 Listed manufacturers and Products:

.1 Panduit: JMJH2-X

.2 Ideal

.4 Cable retention wraps, soft, reusable hook-and-loop tie, coloured to match colour code indicated. Plenum rated.

.1 Panduit: HLTP and HLSP series

.5 Nylon cable retention wraps (Tiewraps™) not permitted.

.3 Conduit Guard

.1 Plastic protection press-on bushings to suit EMT and rigid galvanized steel conduit; size to suit conduit to maximum 103 diameter. Suitable for use in air supply or return plenum spaces.

.4 Flexible Corrugated Non-metallic Conduit

.1 Nominal inside diameters 25 mm, 32 mm.

.2 Fire ratings FT4, FT6.

.3 Manufacturer:

.1 Arlington

.5 Flexible Fabric Thin Wall Inner Duct Sleeve

.1 White with colour identification stripe including pull tape in one-, two-, three-cell on micro-cell format.

.2 Fire ratings of normal, riser and plenum with optional copper 18 gauge tracing strips.

- .3 Listed manufacturer and Products:
 - .1 Max cell
 - .1 Three-cell: 103 mm MXC4003XX series
 - .2 Three-cell: 78 mm MXC3456XX series
 - .3 Two-cell: 53 mm MXC2002XX series
 - .4 Micro two-cell: 27 mm MXCM3302XX series
 - .6 Flexible Liquid-tight Metallic Conduit
 - .1 Corrugated heavy gauge electro galvanized flexible steel strip helically wound conduit with integral copper bonding wire and PVC jacket, colour blue or grey in nominal inside diameter sizes 21 mm, 25 mm, 32 mm, with fire ratings FT4, FT6, to CSA C22.2 No. 0.3.
 - .2 Manufacturers:
 - .1 Delikon, Type YF-604
 - .7 Flexible Metallic Conduit
 - .1 Corrugated heavy gauge electro galvanized flexible steel strip helically wound conduit with integral copper bonding wire in nominal inside diameter sizes 21 mm, 25 mm, 32 mm.
 - .2 Manufacturers:
 - .1 Delikon, Type YF-504
 - .8 Cable Trays for Communications Systems
 - .1 Rigid ladder tray
 - .1 Comply with Section 26 05 00 and Section 26 05 33.
 - .2 Rigid solid bottom cable tray
 - .1 Comply with Section 26 05 00 and Section 26 05 53.
 - .3 Open wire mesh cable tray
 - .1 Form
 - .1 Tray formed of circular or ovaloid steel wire welded to form grid pattern of nominal 50 mm x 100 mm
 - .2 Folded sides to provide longitudinal structural support
 - .3 Widths ranging from nominal 200 mm to nominal 600 mm
 - .4 Fixed or snap-on cable retention side wall depths ranging from 50 mm to 150 mm
 - .5 Standard lengths of nominal 3 m
 - .2 Finishes:
 - .1 Painted black, white
 - .2 Zinc electroplated
 - .3 Certifications
 - .1 ULc or UL Canada or Certification acceptable to the AHJ
 - .2 CSA 22.2 No 126.1 Metal Cable Tray Systems
-

- .3 NEMA VE 1
- .4 Accessories
 - .1 Accessories as required
 - .1 Splicing kit
 - .2 Edge hanger
 - .3 Cantilever brackets
 - .4 Underfloor C bracket
 - .5 Split bolt grounding lug and clamp
 - .6 Divider
 - .7 Radius drop
 - .8 Side bracket
 - .9 Radius control side wall brackets
 - .10 Vertical radius bracket
 - .11 Conduit bracket
 - .12 Solid liner insert
 - .13 Side supported cable hanger brackets
 - .5 Manufacturer
 - .1 CPI Chatsworth
 - .2 T&B Thomas and Betts
 - .3 Legrand
 - .4 Panduit

2.6 **UNDERGROUND DUCTS AND RACEWAYS FOR COMMUNICATIONS**

- .1 Comply with Section 26 05 00 and Section 26 05 53.
- .2 Rigid PVC Conduit
 - .1 Rigid PVC conduit manufactured to CSA C22.2 No. 211.2
 - .2 Rigid PVC fittings, long sweep bend
- .3 Rigid Ferrous Metal Conduit with PVC Coating
 - .1 Rigid ferrous metal conduit to CSA C22.2 No. 45-M with PVC coating to nominal thickness of 1.02 mm conforming to NEMA publication RN1-1998
 - .2 Matching rigid ferrous metal PVC coated fittings and couplings; matching long sweep bends
- .4 Underground Enclosure
 - .1 Precast polymer concrete underground enclosure
 - .2 Precast polymer concrete enclosure reinforced with glass fibre, to 9072 kg loading application, open base, tamperproof cover locks
 - .3 Width: 305 mm square; depth: 457 mm, 609 mm, 913 mm

.4 Manufacturers:

.1 Synertech

3 Execution

3.1 **DIMENSIONS AND QUANTITIES**

- .1 Dimensions shown on Drawings are approximate. Verify dimensions by reference to Shop Drawings and field measurement.
- .2 Quantities or lengths indicated in any of the Contract Documents are approximate only.
- .3 Make necessary changes to routing of cables and the like to accommodate structural, mechanical, electrical and architectural conditions. Coordinate with other trades and make allowance for conditions that will arise from work in progress under separate contract.
- .4 Plan cable pathway routing to ensure compliance with cable performance specifications, reference standards, and to avoid electromagnetic interference effects.
- .5 Report to the Engineer immediately upon identification of any condition that may result in the performance criteria of the cabling being compromised.
- .6 Install measuring tape for full length of communications pathways in those pathways approaching cable performance distance limits. Measure length and confirm that distance limits are not exceeded.
- .7 Mark up areas on communications rooms backboards to indicate locations for installation and mounting of communications terminal blocks, security related devices and electronic equipment, public address and paging related equipment and terminal blocks and areas allocated for public carrier for overvoltage protection devices, demarcation terminal blocks and CATV distribution and amplification devices. Use removable tape to prepare proposed layout for Consultant's review. Overlay with black permanent marker after review by Engineer.

3.2 **COMMUNICATIONS GROUNDING AND BONDING**

.1 General

- .1 Install grounding and bonding to comply with Ontario Electrical Safety Code and all applicable codes.
- .2 Install inside grounding cables and conductors in electrical raceways, cable trays, cable runways, or in rigid PVC conduits as indicated. Install outside grounding cables and conductors in PVC rigid conduit or direct buried as indicated.
- .3 Install inside grounding to comply with BICSI/JSTD-607-A, TIA-607 and BICSI published Telecommunications Design Methods Manual.
- .4 Install outside grounding to comply with BICSI published Customer Owned Outside Plant Manual (latest edition).

.2 Bus Bars

- .1 Mount bus bars insulated from building ground and in locations and at elevations indicated.
 - .2 Mount horizontally with fasteners able to resist axial pull of 50 kgf.
 - .3 Ensure clearance of 50 mm from other metallic objects including components of dissimilar grounding systems.
-

.3 Enclosures

- .1 Bond communications enclosures only to telecommunications ground bus bar. Do not bond directly to electrical safety ground.
- .2 For arrays of four or fewer communications cabinets, connect individual #6 grounding cables between technical grounding bus bar and individual communications cabinets.
- .3 For arrays of five or more communications cabinets, connect individual #6 grounding cables between individual cabinets and a common #2 AWG insulated aisle ground cable using crimp taps. Connect aisle ground cable to technical ground bus bar using two-hole long barrel lug with window.

.4 Communications Shields

- .1 Bond communication shields to technical ground at both terminations when sharing a common single point ground system. Bond communications shield to technical ground at termination distant from work area outlets when terminations do not share a common ground system.
- .2 Make grounding connections to telecommunications cable conductive shields as indicated, using components designed for purpose and following manufacturer's instructions.
- .3 Protect finished communications grounding against making unwanted connections to dissimilar grounding systems.

.5 Flexible Conduits

- .1 Bond armour and bonding wire to ground through manufactured conduit accessories.

3.3 **ELECTRICAL SAFETY GROUND**

- .1 Bond electrical conduit for telecommunications, cable trays for telecommunications, cable runways directly to electrical safety ground. Do not bond directly to technical ground.
- .2 Bond main technical ground bus bar to electrical safety ground.

3.4 **PATHWAYS FOR COMMUNICATIONS SYSTEMS**

.1 General

- .1 Pathways laid out and installed to comply with latest release of ANSI/TIA 569.
- .2 Pathways run lengths to comply with latest release of ANSI/TIA 568. Notify Engineer in event of any inside path length exceeding 90 m.
- .3 Inside pathways installed parallel or perpendicular to building lines.
- .4 Submit drawings of proposed installation, and indicating deviation from cable routing shown on drawings to the Engineer for review prior to commencing installation.
- .5 Maintain minimum clearances measured from any point of the communications system to any point on the outer container of electrical and heat sources.

- .1 Unit substations10 mPower transformers enclosure (greater than 30 kVA)
10 mTransformers enclosures (up to 30 kVA)
1.2 mMotors casings (greater than 1 HP)
10 mMotors casings (up to 1 HP)
1.2 mSwitch gear enclosures (greater than 600V)
10 mFeeder cable / conduit (600V and above)

- | | | | | | | |
|-----|---------------|---------|------------|----------|------------|-----------|
| 1 | mDistribution | cable | / | conduit | (less than | 600V) |
| 750 | mmEMT | conduit | (enclosing | 30A | branch | circuits) |
| 300 | mmENT | conduit | (enclosing | 30A | branch | circuits) |
| 450 | mmAC90 | cable | (enclosing | 30A | branch | circuits) |
| 450 | mmEMT | conduit | (enclosing | 20A | branch | circuits) |
| 75 | mmENT | conduit | (enclosing | 20A | branch | circuits) |
| 150 | mmAC90 | cable | (enclosing | 20A | branch | circuits) |
| 150 | mmEMT | conduit | (enclosing | 15A | branch | circuits) |
| 65 | mmENT | conduit | (enclosing | 15A | branch | circuits) |
| 100 | mmAC90 | cable | (enclosing | 15A | branch | circuits) |
| 100 | mmControl | cabling | (in | separate | conduit) | zero |
- .19 Control cabling (exposed) 100 mm Class 2 wiring (in separate conduit) zero
- .21 Class 2 wiring (exposed) 100 mm Conduit (all others)
- | | | |
|-----|---------------|--------------------------|
| 75 | mmFluorescent | luminaires |
| 600 | mmPipes | (gas, oil, water, etc.) |
| 300 | mmHVAC | (equipment, ducts, etc.) |
- 150 mm Cable Protection
- .1 Provide protective cable sleeving to prevent damage to cables at transition from cable tray, conduit, pull box, junction box, maintenance hole, pull point. Provide sleeve to reduce friction, bending and crushing forces. Install split sleeve where impracticable to install solid.
- .3 Cable Hangers and Supports
- .1 Where expressly indicated, support cables by use of cable hangers. Space hangers at maximum 1 m separation.
- .2 Limit cables to twenty-four per hanger.
- .3 Apply cable retention wraps without causing tension, pressure or other deformation of cable and cable bundles. Complete wrap with 100 mm overlap. Spacing between wraps not more than 1.2 m except for cables in horizontal cable tray. Avoid wrapping cables in bundles in horizontal sections of cable tray. Secure cables in bundles in vertical portion of cables tray with supports at spacing of not more than 600 mm. Place and secure cables in tray to prevent edges pressing against cable jacket.
- .4 Do not use nylon cable retention wraps (Tiewraps™) for cable retention.
- .4 Conduit
- .1 Extend distribution and backbone conduit to cable tray.
- .2 Form field-formed raceway to comply with TIA 569 specifications.
- .3 Fit conduit guard bushings on each exposed entrance to conduit raceway.
- .4 Field form "gooseneck" bends in conduit where surface run conduit changes direction to penetrate a wall or partition at ninety degrees. Assume the gooseneck bend includes one hundred eighty degrees of bending.
- .5 Innerduct Sleeving
- .1 Provide and install flexible corrugated non-metallic conduit for protection against abrasion and bending, and as protection of optical fibre cables in open cable tray. Colour: Orange except black or grey where indicated; inside diameter: 25 mm except 32 mm where indicated; fire ratings: FT6 except FT4 where indicated.

- .2 Provide and install flexible fabric low friction pre-lubricated inner duct sleeve in all backbone conduits and in conduits intended to carry backbone cabling, and in all conduits below grade and also where indicated. Colour coded, with pre-installed pulling tape; electrically traceable where indicated.
 - .1 Three-cell construction for installation in 103 conduits
 - .2 Three-cell construction for installation in 78 conduits
 - .3 Two-cell construction for installation in 54 conduits
 - .4 Micro two-cell construction for installation in 27 conduits
- .6 Flexible Metallic Conduit
 - .1 Flexible non-combustible metallic liquid-tight conduit permitted below access flooring as pathway between communications raceways and individual outlet device boxes.
 - .2 Install conduit of trade size as indicated on the drawings or described in the Specification or 21 mm diameter whichever is the greatest.
- .7 Flexible Non-metallic Tubing
 - .1 Flexible non-metallic tubing not permitted in damp or wet locations.
 - .2 Flexible non-metallic cable not permitted between locations separated by greater than 150 m.
 - .3 Flexible non-metallic electrical tubing not permitted where aggregated bending exceeds one hundred eighty degrees.
 - .4 Acceptable use of flexible non-metallic tubing as replacement for rigid non-metallic conduit when minimum of one trade size larger than required size of indicated rigid conduit.
 - .5 Flexible non-metallic tubing permitted if maximum permitted pull tension of installed cable is not exceeded. Provide pull tension reports to the Engineer on request.
 - .6 Flexible non-metallic tubing installed complete with colour identified and measured mule tape.
 - .7 Mule tape incorporating copper tracing conductor for use in non-metallic tubing.

3.5

UNDERGROUND DUCTS AND RACEWAYS

- .1 General
 - .1 Clean out each section of duct by pulling a steel wire brush and mandrel of the correct size through the duct before pulling cables.
 - .2 Notify the Engineer if immovable obstructions are encountered when cleaning existing ducts.
 - .3 Protect cable at entry and exit from ducts by flexible corrugated non-metallic conduit.
 - .4 Install pull string with length markers ("Mule tape") in each duct and in each inner-duct where applicable.
 - .5 Conduit ducts below concrete slab on grade at minimum 300 mm below finished concrete floor or 100 mm below lowest elevation of concrete, whichever dimension is the greater.

.2 Cable Placement in Underground Ducts

- .1 Pull cables in underground ducts in continuous length, without splicing.
- .2 Install cables in lower ducts first, leaving upper ducts for future; install cables in inner-ducts where provided.
- .3 Apply only manufacturer recommended or approved lubricant to cables to reduce friction between the cable and the duct.
- .4 Apply cable grips with ball bearing swivel to the cable sheath or strength members to avoid applying tensile force directly to conductors or fibres when pulling cables.
- .5 Station personnel at each access point to observe and lubricate the cables during pull.
- .6 Provide cable slack at manholes for expansion and contraction; mount with clips to prevent sagging.
- .7 Submit tension pulling calculation prior to installation of cables to Consultant for review.
- .8 Monitor cable pull tension during installation. Do not exceed maximum tensile rating of cables.
- .9 Avoid bending cables to a radius less than manufacturer's recommendation, or ten times the cable outside diameter, whichever is the greater.
- .10 Where cable is pulled through a distance of greater than 30 m or through a pathway containing more than one ninety degree bend, use a dynamometer to record installation tension and a tension limiting device to prevent exceeding the maximum pulling tension specification during installation. Set the tension limit at or below the manufacturer's maximum limit. Take up the cable at intermediate pulling points with an intermediate cable take-up device reviewed by the Consultant.
- .11 Make cable pulls continuous and steady between pull points. Avoid interruptions to the pull unless necessitated by excessive tension on the cable.
- .12 Seal duct entrance into buildings with duct sealing compound to prevent the ingress of moisture, foreign materials and rodents.
- .13 Deem exposed any cable portion which is in a buried raceway and extends 1 m or more beyond the building curtain perimeter and provide over-voltage protection at each terminal.

3.6 **MANUFACTURER'S ATTENDANCE AND REPORT**

- .1 Provide manufacturer's representatives to verify installation practices for each part of the Work relevant to components including wiring and terminations.
- .2 Provide a construction review report prepared and signed by a representative of the manufacturer of wiring and terminations describing summary assessment for acceptability to meet warranty terms and conditions of work in progress for work described in this section and related sections affecting the Work. Submit a construction review report to accompany the first progress claim to include 50% of the Work by installed value. Submit second report on Substantial Completion of Work.
- .3 Manufacturer's report is an essential component of the Work and must be submitted to the Engineer before Consultant's Project deficiency review.

3.7 **FIELD INSPECTION**

- .1 Provide field technician for inspection and certification of cables, connectors, and associated equipment and accessories during installation, testing and commissioning as

required. Provide a field technician possessing industry recognized credentials. Submit the technician's credentials as a Shop Drawing within five days of receiving a request from the Engineer or within five days of award of Contract, whichever is the sooner.

- .2 Acceptable credentials include certificates of qualifications issued or assessed by a registered telecommunications industry association, a registered college or university, a registered training institution, a registered labour union, or a certificate of installer training issued by the manufacturer of the Products in use for the Work.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **SYSTEM DESCRIPTION**

.1 General

- .1 Comply with TIA 606.
- .2 Use identification schema parameters identified on Contract Drawings.
- .3 Identification of cables, cabinets, electrical raceways, grounding conductors, communications outlets, faceplates, firestops, by use of printed alphanumeric labels and colour coding markers as further described on the Contract Drawings and herein.

.2 Standard Colours

- .1 Coloured marking using standardized colours consisting of the following Pantone reference colours or the indicated commercial equivalent:

- .1 Red: Pantone 186C or 184C

- .1 Benjamin Moore: 133-20

- .2 Armourcoat: Fire Red 98-4748-6

- .2 Blue: Pantone 300C or 291C

- .1 Benjamin Moore: 133-33

- .2 Armourcoat: Commodore Blue 98-4745-2

- .3 White: Pantone White C

- .1 Benjamin Moore: 133-01

- .2 Armourcoat: Gloss White

- .4 Orange: Pantone 166C or 150C

- .1 Benjamin Moore: 007

- .2 Armourcoat: Zesty orange

- .5 Yellow: Pantone Yellow C or 101C

- .1 Benjamin Moore: 133-12

- .2 Armourcoat: Holland Yellow

- .6 Green: Pantone 336 or 353C
 - .1 Benjamin Moore: 133-40
 - .2 Armourcoat: Shutter Green
- .7 Brown: Pantone 478C or 465C
 - .1 Benjamin Moore: 133-60
 - .2 Armourcoat: Havana Brown
- .8 Black: Pantone Black C
 - .1 Benjamin Moore: 133-80
 - .2 Armourcoat: Gloss Black
- .9 Purple: Pantone 257C or 264C
 - .1 Benjamin Moore: 1396
 - .2 Armourcoat: N/A
- .10 Grey: Pantone 422C
 - .1 Benjamin Moore: Not specified
 - .2 Armourcoat: Not specified

1.3 **SUBMITTALS**

- .1 Prepare a sample printed copy of the identification labels and submit to the Consultant for review.

2 Products

2.1 **MANUFACTURERS**

- .1 Furnish or install Products manufactured by stipulated manufactures where so indicated on the Contract Documents.
- .2 Avoid use of Products by manufacturers not stipulated on the Contract Documents.
- .3 Occurrence of Products in these Specifications other than those stipulated for use is not to be interpreted as authorization to use such Products.

2.2 **WRAP-AROUND COLOUR IDENTIFICATION MARKERS**

- .1 Coloured Metallic Cable Ties
 - .1 Coloured aluminum cables ties
 - .1 Width: 8 mm
 - .2 Lengths: 140 mm, 201 mm, 362 mm to suit cable or conduit diameters of 25 mm, 51 mm, 102 mm
 - .3 Colours: Blue, green, red, yellow, black, clear aluminum

- .2 Listed manufacturers and representative Products:
 - .1 Panduit: MLT1H-LPAL, MLT2H-LPAL, MLT4H-LPAL etc
 - .2 Coloured Hook and Loop Non-Metallic Cable Ties
 - .1 Coloured non-metallic cables ties, adjustable and reusable, hook-and-loop material, -18°C to +104°C
 - .1 Widths: 8.4 mm, 13 mm, 19 mm
 - .2 Lengths: 150 mm, 300 mm, 457 mm
 - .3 Colours: Black, red, orange, yellow, green, blue, grey, white
 - .2 Listed manufacturers and representative Products:
 - .1 Panduit: HLT2I-X0 etc
 - .3 Electrical Colour Coding Tape
 - .1 PVC backing, 0.178 mm thick indoor outdoor suitable, pressure sensitive rubber adhesive, coloured, fade resistant, abrasion and weather resistant, to CSA C22.2 No 197-M1983
 - .1 Widths: 13 mm, 19 mm
 - .2 Colours: Black, brown, red, orange, yellow, green, blue, grey, white, violet
 - .2 Listed manufacturers and representative Products:
 - .1 Scotch 35 vinyl electrical colour coding tape
- 2.3 **LABELS**
- .1 General
 - .1 Comply with TIA-606A and CSA-T528.
 - .2 Prepare labels by use of machine printing.
 - .3 Avoid use of handwritten labels.
- Manufacturer: Same as original equipment Supplier, otherwise Panduit.
- .2 Cable Labels
 - .1 Self-adhesive, self-laminating material, white engrave area.
 - .2 Minimum two times full wrap-around cable.
 - .3 Faceplate Labels
 - .1 Labels to suit selected faceplate.
 - .4 Grounding Bus Bars
 - .1 Self-adhesive, white engraved areas, minimum size 25 x 50 mm, characters minimum height 12 mm.
-

- .5 Patch Panels
 - .1 Self-adhesive, white engraved areas to suit selected patch panel or termination strip.
 - .6 Rack and Cabinets
 - .1 Self-adhesive, white engraved areas, minimum size 50 x 75 mm, characters minimum height 12 mm.
 - 2.4 **PAINT**
 - .1 Comply with Section 09 91 00; otherwise treat as shop primed ferrous metal - alkyd finish.
 - .1 One coat alkyd, paint code 48, gloss enamel.
 - .2 Paint code: 48 - interior alkyd gloss enamel: Conforming to CAN/CGSB-1.60-M; Benjamin Moore 133, ICI Devoe 4308 Series, Para 400, PPG 6-282, Sherwin Williams B35-200 Series or Sico 888-111.
 - 3 Execution
 - 3.1 **COLOURS**
 - .1 Use components in the colour as indicated.
 - 3.2 **LABELLING**
 - .1 General
 - .1 Identify conduits, electrical raceways, pullboxes, junction boxes, for communications according to the colour scheme indicated on the Contract Drawings and herein.
 - .2 Identify cables, outputs, faceplates, jacks, grounding components and cabinets for communications according to the labelling and identification scheme indicated in the Contract Drawings and herein.
 - .3 Use cables, jacks, cords, icons, manufactured in the colours identified in the Contract Drawings and herein.
 - .4 Use the identification scheme as indicated.
 - .5 Apply labels so that the printed information may be read without the need to disturb the cables.
 - .6 Apply labels on cables as close to the end of the cable jacket as practicable, and no closer than 10 mm and not concealed by obstructions.
 - .7 Apply labels on jacks, faceplates and patch panels in the manner prescribed by the original equipment manufacturer.
 - .8 Apply more than one label where immediate obstructions may prevent ease of reading the prescribed label.
 - .9 Apply a label on the inside of the electrical device outlet box corresponding to each cable terminated on the faceplate mounted on the device box.
-

- .10 Use only approved cable marking materials.
 - .11 Clearly identify all outlets, patch-panels, patch-cords, cables, racks enclosures, spaces, closets, conduit, and raceways according to the administration system shown on the Contract Drawings.
 - .12 Use only machine printed labeling for outlets.
 - .13 Use only engraved plastic plates for the labeling of enclosures and racks.
 - .2 Horizontal Distribution Cabling
 - .1 Use the identification scheme as stipulated in the Contract Documents or herein.
 - .3 Backbone Cabling
 - .1 Use the identification scheme as stipulated in the Contract Documents or herein.
- 3.3 **LABELLING AND IDENTIFICATION SCHEMA**
- .1 Schema H: Industrial
 - .1 General
 - .1 Schema applicable to large scale multiple level industrial premises.
 - .2 Horizontal distribution cables defined by alpha-numeric full definition of cabling termination hub, followed by cable family, followed by cable medium, followed by cable ordinal.
 - .3 Backbone cables defined by alpha-numeric full definition of cabling termination hub of source termination point, followed by destination termination point, followed by cable family, followed by cable medium, followed by cable ordinal.
 - .4 Prefix terms omitted where all cables share common term.
 - .5 Outlet defined.
 - .2 Scheme
 - .1 Comply with proxy values indicated on the Contract Drawings.
 - .2 Scheme consisting of the following terms
 - .1 Region identifier
 - .1 Example: Country
 - .2 Alpha: Two characters
 - .3 Proxy: RR
 - .2 Facility identifier
 - .1 Example: City
 - .2 Alpha: Two characters
 - .3 Proxy: CC
-

- .3 Premises / area / building identifier
 - .1 Example: Production plant
 - .2 Alpha-numeric: Two characters
 - .3 Proxy: AA
 - .4 Floor / level identifier
 - .1 Indicates floor of cabling hub
 - .2 Example: Mezzanine
 - .3 Alpha-numeric: Two characters
 - .4 Proxy: FF
 - .5 Cabling hub identifier
 - .1 Example: Telecom enclosure
 - .2 Alpha-numeric: One to six characters
 - .3 Proxy: hhhhhH
 - .6 Cable family
 - .1 Example: Production network
 - .2 Alpha: One character
 - .3 Proxy: G
 - .7 Medium type
 - .1 Example: Optical fibre
 - .2 Alpha: One character
 - .3 Proxy: M
 - .8 Cable ordinal
 - .1 Example: Numeric value
 - .2 Numeric: Four character, zero filled, right justified
 - .3 Proxy: NNNN
 - .3 Horizontal distribution format
 - .1 Fully defined form
 - .1 RR-CC-AA-FF-hhhhhH-G-M-NNNN
 - .2 Abbreviated form for cables within a sole region
 - .1 CC-AA-FF-hhhhhH-G-M-NNNN
-

- .3 Abbreviated form for cables within a sole facility
 - .1 AA-FF-hhhhhH-G-M-NNNN
 - .4 Abbreviated form for cables within a sole premises
 - .1 FF-hhhhhH-G-M-NNNN
 - .5 Abbreviated form for cables within a sole premises and within a sole family
 - .1 FF-hhhhhH-M-NNNN
 - .6 Abbreviated form for cables within a sole premises and within a sole family and of a single medium
 - .1 FF-hhhhhH-NNNN
 - .4 Horizontal distribution format examples:
 - .1 Administration network copper Category 6 distribution cables on grade level terminating at communications enclosure at grid reference WA/11
 - .1 01-WA/11-A-C-0001.....01-WA/11-A-C-9999
 - .2 Production network copper Category 6 distribution cables on grade level terminating at communications enclosure at grid reference WA/11
 - .1 01-WA/11-P-C-0001....01-WA/11-P-C-9999
 - .3 Production network multimode optical fibre distribution cables on grade level terminating at communications enclosure at grid reference WA/11
 - .1 01-WA/11-P-M-0001....01-WA/11-P-M-9999
 - .4 Administration network copper Category 6 distribution cables on 2nd floor terminating at communications enclosure in telecom room 201.
 - .1 02-201-A-C-0001.....02-201-A-C-9999
 - .5 Back bone format
 - .1 Fully defined form
 - .1 RR-CC-AA-FF-hhhhhH-AA-FF-hhhhhH-G-M-NNNN
 - .2 Abbreviated form for cables within a sole region
 - .1 CC-AA-FF-hhhhhH-AA-FF-hhhhhH-G-M-NNNN
 - .3 Abbreviated form for cables within a sole facility
 - .1 AA-FF-hhhhhH-AA-FF-hhhhhH-G-M-NNNN
 - .4 Abbreviated form for cables within a sole premises
-

- .1 FF-hhhhhhH-FF-hhhhhhH-G-M-NNNN
 - .6 Backbone cabling format examples
 - .1 Administrative network copper multi-pair Category 6 backbone cables originating at second floor main telecom room #201, terminating at equipment enclosure WA/11 on grade level
 - .1 02-201-01-WA/11-A-C-0001
 - .2 Production network single mode optical fibre multi strand originating at second floor main telecom room #201, terminating at equipment enclosure WA/11 on grade level
 - .1 02-201-01-WA/11-P-S-0001
 - .3 Production network single mode optical fibre multi strand originating at grade level equipment enclosure WP/15, terminating at equipment enclosure WA/11 on grade level
 - .1 01-WP/15-01-WA/11-P-S-0001
 - .7 Outlet numbering format
 - .1 Fully defined form
 - .1 RR-CC-AA-FF-hhhhhhH-G-M-NNNN
 - .2 Typical usage
 - .1 hhhhhhH-G-M-NNNN
 - .8 Outlet numbering format examples
 - .1 Administration network copper Category 6 distribution cables on grade level terminating at communications enclosure at grid reference WA/11
 - .1 WA/11-A-C-0001
 - .2 Administration network copper Category 6 distribution cables on 2nd floor terminating at communications enclosure in telecom room 201.
 - .1 201-A-C-0001
 - .2 Scheme A: Consecutive Numbering – Single Data Outlet
 - .1 General
 - .1 Use this scheme where an outlet is indicated on the Contract Drawings as data.
 - .2 Identifier Scheme
 - .1 Scheme template: DxxxTyyy where
 - .1 D (fixed, literal) indicates DATA cable
 - .2 XXX (variable, ordinal) indicates building floor of outlet
-

- .3 T (variable) indicates the telecommunication room in which the cable is terminated
 - .4 YYY (variable, ordinal) indicates cable count ordinal
 - .5 Use full scheme for labels affixed to cables and jacks. Do not abbreviate.
- .3 Floor Ordinal
- .1 Use the numeric value of the floor on which the work area outlet is situated, padded left to three characters using zero as the pad character. Use numbers for floors above grade, prefix floors below grade with B or character to suit local conditions, use M to indicate mezzanine levels. In North America avoid the value "000".
 - .2 Example:
 - .1 Floor 12: 012
 - .2 Basement 3: 0B3
 - .3 Concourse 2: 0C2
 - .4 Mezzanine 2: 0M2
 - .5 Ground floor: 001
- .4 Termination Identifier
- .1 Use a sequential alphabetic identification character to indicate in which telecommunications room the cable is terminated: Match to existing convention such as N (North), S (South) otherwise use A, B, C etc.
- .5 Telecommunications Room Horizontal Cable Patch Panel Termination
- .1 Select the lowest numeric value as the starting value in an ordinal series to avoid duplication of identification with existing cabling, padded left to three characters using zero and the pad character.
 - .2 Label the data termination field beginning at the upper most and left most jack position, starting with the lowest ordinal, advancing horizontally left to right, and progressing vertically as each row of jacks is completed. Example 001, 002, etc.
 - .3 Label the cable at the patch panel with the same identification as the jack to which the cable is connected.
- .6 Cable Count Ordinals
- .1 Select the lowest numeric value as the starting value in an ordinal series to avoid duplication of identification with existing cabling, padded left to three characters using zero and the pad character.
 - .2 Example: Cable 32: 032.
-

.7 Work Area Outlet

- .1 Label the jacks at the work area outlet faceplate with the same identification as the cable connecting to the jack.
- .2 Install voice and data jacks with the same numeric ordinal on a common faceplate where local conditions permit.

.3 Scheme B: Basic Numbering

.1 General

- .1 Where an outlet is indicated on the Contract Drawings designate each jack as a communications jack suitable for data or voice or other services, with the following exceptions.
 - .1 Where an outlet is tagged on the Contract Drawings as "T", designate the jack for convenience telephone service.
 - .2 Where an outlet is tagged on the Contract Drawings as "P" designate the cable for payphone service.
 - .3 Where an outlet is tagged on the Contract Drawings as "M", designate the cable for monitored line service.
 - .4 Where an outlet is tagged on the Contract Drawing as "I", designate the cables for intercom service.
 - .5 Where an outlet is tagged on the Contract Drawing as "C", designate the cables for special communications service.

.2 Facility Prefix

- .1 Prefix all identifies with a building identifier. Default this field to blank if there is only one building.
- .2 Prefix all identifiers with a numeric value indicating the floor within the premises or facility for the telecommunications room where the cable is terminated.
 - .1 Example: Floor 2: 02; basement: B1; ground floor: 01
- .3 Follow the prefix with a hyphen separator and an alpha character and a hyphen separator to identify the specific telecommunications room where there is more than one to any floor.
- .4 Reserve the special value of "Z" to indicate a building entrance service room.
 - .1 Example: First and only telecom room: -A-; second telecom room on common floor: -B-; building entrance room: -Z-

.3 Numeric Ordinals

- .1 Select the lowest numeric value as the starting value in an ordinal series to avoid duplication of identification with new or existing cabling.

.4 Communications Cables

.1 Identify cables as nnn where nnn is a unique numeric ordinal beginning at 001 to 999.

.1 Example: Cable #1: 001; cable #50: 050

.5 Telephone Cables

.1 Identify telephone cables as Tnnn where nnn is a unique numeric ordinal beginning at 001 to 999 and T is a literal value.

.1 Example: Telephone cable #1: T001; telephone cable #50: T050

.6 Pay Phone Cables

.1 Identify payphone cables as Pnnn where nnn is a unique numeric ordinal beginning at 001 to 999 and P is a literal value.

.1 Example: Pay phone cable #1: P001; pay phone cable #2: P002

.7 Monitored Line Cables

.1 Identify monitored line cables as Mnnn where nnn is a unique numeric ordinal beginning at 001 to 999 and M is a literal value.

.1 Example: Monitored line cable #1: M001; monitored line cable #2: M002

.8 Intercom Cables

.1 Identify intercom line cables as Innn where nnn is a unique numeric ordinal beginning at 001 to 999 and I is a literal value.

.1 Example: Intercom line cable #1: I001; intercom line cable #2: I002

.9 Work Area Outlet

.1 Label the jacks at the work area outlet faceplate with the same identification as the cable connecting to the jack.

.10 Telecommunications Room Horizontal Cable Patch Panel Termination

.1 Label the jacks at the patch panel with the same identification as the cable connecting to the jack.

.2 Label the communications cable termination field beginning at the upper most and left most jack position, starting with the lowest ordinal, advancing horizontally, left to right, and progressing vertically as each row of jacks is completed. Example: 001, 002, 003, etc.

.1 For each non-generic cable, label the termination field beginning at the upper most and left most jack position, starting with the lowest ordinal, beginning a new row for each non-generic type.

.2 Example
P001, P002, P003, P004
T001, T002, T003, T004,

M001, M002, M003, M004,
C001, C002, C003, C004,

.11 Cable Identification Examples

- .1 A-01-A-001: Building A, floor 01, room A, cable 001
- .2 A-B1-Z-P001: Building A, basement B1, room Z (entrance room), pay phone 001

.4 Scheme M: Modular Numbering

.1 General

- .1 Where an outlet is tagged on the Contract Drawings as "V/2D", designate one jack as voice, the other two jacks as data.
- .2 Where an outlet is tagged on the Contract Drawings as "V/D", designate one jack as voice, the other jack as data.
- .3 Where an outlet is tagged on the Contract Drawings as "T" or "T1", designate the jack for convenience telephone service.
- .4 Where an outlet is tagged on the Contract Drawings as "P" or "P1", designate the cable for payphone service.
- .5 Where an outlet is tagged on the Contract Drawings as "M", designate the cable for monitored line service.
- .6 Where an outlet is tagged on the Contract Drawing as "I" or "I1", designate the cables for intercom service.

.2 Facility Prefix

- .1 Prefix all identifiers with a numeric value indicating the floor within the premises or facility for the telecommunications room in which the cable is terminated.
- .2 Follow the prefix with an alpha character to identify the specific telecommunications room where there is more than one to any floor.
- .3 Separate the prefix from the alphanumeric identifier with a hyphen separator.

.3 Numeric Ordinals

- .1 Select the lowest numeric value as the starting value in an ordinal series to avoid duplication of identification with existing cabling.

.4 Voice Cables

- .1 Identify voice cables as V-rr-pp-jj where
 - .1 "rr" is a unique two character numeric ordinal identifying the rack on which the cable is terminated beginning at 01.
 - .2 "pp" is a consecutive two character numeric ordinal, unique in any rack or cabinet, identifying the patch-panel on which the

cable is terminated, commencing at 01 at the uppermost patch panel in the rack.

.3 "jj" is a consecutive two character numeric ordinal, unique in any one patch panel, identifying the jack on which the cable is terminated, commencing at 01 at the uppermost, left most jack position in the panel.

.4 "V" is a literal value.

.5 Data Cables

.1 Identify data cables as D-rr-pp-jj where

.1 "rr" is a unique two character numeric ordinal identifying the rack on which the cable is terminated beginning at 01.

.2 "pp" is a consecutive two character numeric ordinal, unique in any rack or cabinet, identifying the patch-panel on which the cable is terminated, commencing at 01 at the uppermost patch panel in the rack.

.3 "jj" is a consecutive two character numeric ordinal, unique in any one patch panel, identifying the jack on which the cable is terminated, commencing at 01 at the uppermost, left most jack position in the panel.

.4 D is a literal value.

.6 Telephone Cables

.1 Identify telephone cables as T-rr-pp-jj where

.1 "rr" is a unique two character numeric ordinal identifying the rack on which the cable is terminated beginning at 01.

.2 "pp" is a consecutive two character numeric ordinal, unique in any rack or cabinet, identifying the patch-panel on which the cable is terminated, commencing at 01 at the uppermost patch panel in the rack.

.3 "jj" is a consecutive two character numeric ordinal, unique in any one patch panel, identifying the jack on which the cable is terminated, commencing at 01 at the uppermost, left most jack position in the panel.

.4 T is a literal value.

.7 Pay Phone Cables

.1 Identify payphone cables as Pnnn where nnn is a unique numeric ordinal not occurring in the existing Pay phone cabling beginning at 001 to 999 and P is a literal value.

.8 Monitored Line Cables

.1 Identify monitored line cables as Mnnn where nnn is a unique numeric ordinal not occurring in the existing monitored line cabling beginning at 001 to 999 and M is a literal value.

- .9 Intercom Cables
 - .1 Identify intercom line cables as Innn where nnn is a unique numeric ordinal not occurring in the existing intercom cabling beginning at 001 to 999 and I is a literal value.
 - .10 Work Area Outlet
 - .1 Label the jacks at the work area outlet faceplate with the same identification as the cable connecting to the jack.
 - .11 Telecommunications Room Horizontal Cable Patch Panel Termination
 - .1 Label the jacks at the patch panel with the same identification as the cable connecting to the jack.
 - .2 Label the voice termination field beginning at the upper most and left most jack position, starting with the lowest ordinal, advancing horizontally, left to right, and progressing vertically as each row of jacks is completed. Example: V001, V002, V003, etc.
 - .3 Label the data termination field beginning at the upper most and left most jack position, starting with the lowest ordinal, advancing horizontally in A and B pairs, left to right, and progressing vertically as each row of jacks is completed. Example D001A, D001B, D002A, D002B, etc.
 - .5 Scheme C: Consecutive Numbering
 - .1 General
 - .1 Where an outlet is tagged on the Contract Drawings as "V/2D", designate one jack as voice, the other two jacks as data A and data B respectively.
 - .2 Where an outlet is tagged on the Contract Drawings as "V/D", designate one jack as voice, the other jacks as data A.
 - .3 Where an outlet is tagged on the Contract Drawings as "T" or "T1", designate the jack for convenience telephone service.
 - .4 Where an outlet is tagged on the Contract Drawings as "P" or "P1", designate the cable for payphone service.
 - .5 Where an outlet is tagged on the Contract Drawings as "M", designate the cable for monitored line service.
 - .6 Where an outlet is tagged on the Contract Drawing as "I" or "I1", designate the cables for intercom service.
 - .2 Facility Prefix
 - .1 Prefix all identifiers with a numeric value indicating the floor within the premises or facility for the telecommunications room where the cable is terminated.
 - .2 Follow the prefix with an alpha character to identify the specific telecommunications room where there is more than one to any floor.
 - .3 Separate the prefix from the alphanumeric identifier with a hyphen separator.
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- .3 Numeric Ordinals
 - .1 Select the lowest numeric value as the starting value in an ordinal series to avoid duplication of identification with existing cabling.
 - .4 Voice Cables
 - .1 Identify voice cables as Vnnn where nnn is a unique numeric ordinal beginning at 001 to 999 and V is a literal value.
 - .5 Data Cables
 - .1 Identify one data cable to an outlet as DnnnA where nnn is a unique numeric ordinal beginning at 001 to 999 and D and A are literal values.
 - .2 Identify the second data cable to an outlet as DnnnB where nnn is a unique numeric ordinal beginning at 001 to 999 and D and B are literal values.
 - .6 Telephone Cables
 - .1 Identify telephone cables as Tnnn where nnn is a unique numeric ordinal beginning at 001 to 999 and T is a literal value.
 - .7 Pay Phone Cables
 - .1 Identify payphone cables as Pnnn where nnn is a unique numeric ordinal beginning at 001 to 999 and P is a literal value.
 - .8 Monitored Line Cables
 - .1 Identify monitored line cables as Mnnn where nnn is a unique numeric ordinal beginning at 001 to 999 and M is a literal value.
 - .9 Intercom Cables
 - .1 Identify intercom line cables as Innn where nnn is a unique numeric ordinal beginning at 001 to 999 and I is a literal value.
 - .10 Work Area Outlet
 - .1 Label the jacks at the work area outlet faceplate with the same identification as the cable connecting to the jack.
 - .2 Install voice and data jacks with the same numeric ordinal on a common faceplate.
 - .11 Telecommunications Room Horizontal Cable Patch Panel Termination
 - .1 Label the jacks at the patch panel with the same identification as the cable connecting to the jack.
 - .2 Label the voice termination field beginning at the upper most and left most jack position, starting with the lowest ordinal, advancing horizontally, left to right, and progressing vertically as each row of jacks is completed. Example: V001, V002, V003, etc.
 - .3 Label the data termination field beginning at the upper most and left most jack position, starting with the lowest ordinal, advancing horizontally in A
-

and B pairs, left to right, and progressing vertically as each row of jacks is completed. Example D001A, D001B, D002A, D002B, etc.

.6 Scheme D: Ottawa City

.1 General

- .1 Where an outlet is tagged on the Contract Drawings as "VV/DD", the outlet is served by two cables; cable A dedicated to a data jack, designated as DATA 1; cable B split between three jacks, designated as VOICE 1, VOICE 2, DATA 2.
- .2 Where an outlet is tagged on the Contract Drawings as "T", the outlet is served by one cable and is for convenience telephone service.
- .3 Where an outlet is tagged on the Contract Drawings as "P", the outlet is served by one cable and is for payphone service.
- .4 Where an outlet is tagged on the Contract Drawings as "M", the outlet is served by one cable and is for monitored line service.
- .5 Where an outlet is tagged on the Contract Drawing as "I", the outlet is served by one cable and is for intercom service.

.2 Jack Colours

- .1 Jack colours and position in faceplate:
 - .1 Data 1 colour: Grey: Position - lower left
 - .2 Voice 1 colour: Blue: Position - upper left
 - .3 Voice 2 colour: Beige: Position - upper right
 - .4 Data 2 colour: Orange: Position - lower right

.3 Facility Prefix

- .1 Maintain records in an electronic data file. Prefix all alpha-numeric identifiers with an alpha-numeric character string indicating the site reference.
- .2 For city of Ottawa sites, use the following site identifiers:
 - .1 Dispatch building: D
 - .2 Garage: G
 - .3 Bylaw building: B

.4 Termination Room Identifiers

- .1 Use a room identifier to identify the telecommunications rooms as follows:
 - .1 "1": Telecom room, dispatch building, 2nd floor
 - .2 "2": Telecom and equipment room, garage
 - .3 "3": Telecom enclosure, office mezzanine

- .4 "4": Telecom room, garage, tire bay
 - .5 "5": Telecom room, garage entrance
 - .6 "6": Telecom enclosure, garage mezzanine
 - .7 "9": Telecom room, bylaw building
- .5 Distribution Cable Identifications
- .1 Label each end of every distribution cable. Label each cable with a unique identifier. Use the same identifier at each end of each respective cable.
 - .2 Use a cable identifier to identify the various distribution cable purposes as follows:
 - .1 Data jack (D1): Cable type A
 - .2 Hybrid (V1 V2 D2): Cable type B
 - .3 Voice only (V): Cable type V
 - .4 Wireless access: Cable type W
 - .5 Express POTS: Cable type P
 - .6 Building ECMS: Cable type E
 - .3 Identify the cables comprising the pair of cables to a MIXED USE outlet as follows, where "b" is facility prefix: "n" is terminating room identifier, "xxx" is the cable ordinal, and "A" or "B" to identify the respective cables. Use the same cable ordinal for the two cables terminating at a common outlet.
 - .1 Cable to data 1: b-n-A-xxx
 - .2 Cable to voice 1, voice 2, data 2: b-n-B-xxx
 - .4 Identify the cable to a single use outlet as follows, where "b" is facility prefix: "n" is terminating room identifier, "xxx" is the cable ordinal, and "C" or "D" or "E" or "F" to identify the respective cables.
 - .1 Cable to voice: b-n-V-xxx
 - .2 Cable Wireless Access Point (WAP): b-n-W-xxx
 - .3 Cable to POTS outlet: b-n-P-xxx
 - .4 Cable to building EMCS: b-n-E-xxx
- .6 Numeric Ordinals
- .1 Select the lowest numeric value as the starting value in an ordinal series to avoid duplication of identification with existing cabling.
 - .2 Two cables terminating at a common faceplate to carry the same ordinal.
 - .3 Cable ordinals for all cables types to begin at 001, restarting at 001 for each cable type at each telecom room.
-

- .7 Telephone Cables
 - .1 Treat telephone cables as single purpose voice cables (above).
 - .8 Payphone Cables
 - .1 Treat pay telephone cables as single purpose (POTS) cables (above).
 - .9 Monitored Line Cables
 - .1 Treat power utility monitoring cables as single purpose (POTS) cables (above).
 - .10 Intercom Cables
 - .1 Not specified
 - .11 Work Area Outlet
 - .1 Label single use and mixed use outlets according to the respective schemes described below.
 - .2 Label the faceplate at a mixed use outlet as follows where “b” is facility prefix, “n” is terminating room identifier, “xxx” is the cable ordinal of the two cables terminating at the outlet
 - .1 b-n-xxx
 - .3 Label the jacks at the MIXED USE work area outlet faceplate
 - .1 Upper left: Voice 1
 - .2 Upper right: Voice 2
 - .3 Lower left: Data 1
 - .4 Lower right: Data 2
 - .4 Install voice (V1, V2) and data (D1, D2) jacks with the same numeric ordinal on a common faceplate.
 - .5 Label the faceplate at a single use outlet as follows where “b” is facility prefix, “n” is terminating room identifier, “X” is replaced with “V” or “W” or “P” or “E” to identify the respective cables type and “xxx” is the cable ordinal of the cable terminating at the outlet.
 - .1 b-n-X-xxx
 - .12 Telecommunications Room Horizontal Cable Patch Panel Termination
 - .1 Label each patch panel with facility prefix and room identifier as indicated above, where “b” is facility prefix, “n” is terminating room identifier
 - .1 b-n
 - .2 Label the jacks at the patch panel with the same identification as the cable connecting to the jack
 - .1 Jack connected to Cable A:A-xxx
-

- .13 Telecommunications Room Horizontal Cable Wall Mounted Panel Termination
 - .1 Label each wall mounted panel with facility prefix and room identifier as indicated above, where "b" is facility prefix, "n" is terminating room identifier
 - .1 b-n
 - .2 Label the terminations at the termination panel with the same identification as the cable connecting to the termination
 - .1 Termination for Cable B: B-xxx
 - .2 Termination for Cable V: V-xxx
 - .3 Termination for Cable W: W-xxx
 - .4 Termination for Cable P: P-xxx
 - .5 Termination for Cable E: E-xxx
 - .3 Label terminations beginning at the upper most and left most position, starting with the lowest ordinal, advancing horizontally, left to right, and progressing vertically as each row of jacks is completed. Example: B-001, B-002, B-003, etc.
 - .4 Terminate cables of only a single type on a termination block.
 - .7 Scheme E
 - .1 Generic Horizontal Cabling
 - .1 Use this scheme for converged horizontal systems with separate CCTV.
 - .2 Identifier scheme template: ITx-nnn or ITx-Cppp
 - .1 IT: Literal to indicate IT room or enclosure.
 - .2 X: Ordinal from 0 through 6 to indicate different communication wiring hubs as shown on the layout drawings.
 - .3 Nnn: Consecutive cable ordinals to identify each cable with a unique identifier. Series resets to 001 at each IT room or enclosure.
 - .4 C: Identifier to distinguish cables for CCTV camera connections.
 - .5 Ppp: Three digit identifier to uniquely distinguish each camera. Same ordinal used to identify cable to the camera.
 - .3 Telecommunications Room Horizontal Cable Patch Panel Termination
 - .1 Label the data termination field beginning at the upper most and left most jack position, starting with the lowest ordinal, advancing horizontally left to right, and progressing vertically as each row of jacks is completed.
 - .2 Repeat for CCTV. Segregate CCTV cables from other cables.
-

- .3 Label the cable at the patch panel with the same identification as the jack to which the cable is connected.
 - .4 Cable Count Ordinals
 - .1 Select the lowest numeric value as the starting value in an ordinal series to avoid duplication of identification with existing cabling, padded left to three characters using zero and the pad character.
 - .5 Work Area Outlet
 - .1 Label the jacks at the work area outlet faceplate with the same identification as the cable connecting to the jack.
 - .2 Presto horizontal cabling
 - .1 Use this scheme for cables specific to Presto systems
 - .2 Identifier scheme template:
 - .1 Label each cable as indicated on the riser diagram and layout drawings.
 - .2 Cable identification strings:
SPAAC
TPT-P
DRD-P
SPOS-P
DSC-P
SPOS-T1 through SPOS-T2
WP-1 through WP-9
 - .3 Cabinet identification strings:
CC-P1 through CC-P3
DC-P
CC-T
 - .4 Telecommunications room horizontal cable patch panel termination.
 - .5 Label the data termination field beginning at the upper most and left most jack position.
 - .6 Label the cable at the patch panel with the same identification as the jack to which the cable is connected.
 - .3 Work Area Outlet
 - .1 Label the jacks at the work area outlet faceplate with the same identification as the cable connecting to the jack.
 - .8 Scheme U: Unified Numbering – Single Outlet
 - .1 General
 - .1 Use this scheme where an outlet is indicated on the Contract Drawings as data, or IP phone, or POTS, or red phone.
-

.2 Identifier Scheme

.1 Scheme template: DxxxTTTTTcccYYY where

- .1 D (literal) indicates DATA cable; P (literal) indicates POTS telephone.
- .2 XXX (variable, ordinal) indicates building floor of outlet.
- .3 TTTTT (variable) indicates the telecommunication room in which the cable is terminated.
- .4 Ccc (variable, ordinal) indicates cabinet/panel identification.
- .5 YYY (variable, ordinal) indicates cable count ordinal.
- .6 Use full scheme for labels affixed to cables and jacks. Do not abbreviate.

.3 Floor Ordinal

- .1 Use the numeric value of the floor on which the Work area outlet is situated, padded left to three characters using zero as the pad character. Use numbers for floors above grade, prefix floors below grade with B or character to suit local conditions, use M to indicate mezzanine levels. In North America avoid the value "000".
- .2 Example:
 - .1 Floor main at grade: 001
 - .2 Floor 2 above grade: 002
 - .3 Mechanical mezzanine: BM1
 - .4 Mechanical main: B01
 - .5 Transformer level: B02
 - .6 Cabling level: B03

.4 Termination Identifier

- .1 Use a sequential alphanumeric identification to indicate which telecommunications room the cable is terminated: Use full room number.
- .2 Example:

.5 Telecommunications Cabinet/Panel

- .1 Use a sequential alphanumeric identification to indicate which telecommunications cabinet/panel the cable is terminated.
- .2 Example

.6 Telecommunications Room Horizontal Cable Patch Panel Termination

- .1 Select the lowest numeric value as the starting value in an ordinal series to avoid duplication of identification with existing cabling, padded left to three characters using zero and the pad character.

- .2 Label the data termination field beginning at the upper most and left most jack position, starting with the lowest ordinal, advancing horizontally left to right, and progressing vertically as each row of jacks is completed.
 - .3 Example 001, 002, etc.
 - .4 Label the cable at the patch panel with the same identification as the jack to which the cable is connected.
 - .7 Cable Count Ordinals
 - .1 Select the lowest numeric value as the starting value in an ordinal series to avoid duplication of identification with existing cabling, padded left to three characters using zero and the pad character.
 - .2 Example: Cable 32: 032.
 - .8 Work Area Outlet
 - .1 Label the jacks at the Work area outlet faceplate with the same identification as the cable connecting to the jack.
 - .9 Backbone Cabling
 - .1 General Scheme
 - .1 Designate backbone multi-pair copper cables as MC//01//02//nnn, where 01 designates the terminal in or nearest to the building entrance room, 02 designates the next telecommunications room and nnn is a unique numeric ordinal beginning at 001 to 999. The ordinal is maintained unique throughout this cable type; it does not revert to 001.
 - .1 Example
MC/A-B1-Z/A-01-A/001
Multi-pair copper cable, from: building A, basement B1, entrance room (Z); to building A, floor 01, room A; cable number 001
 - .2 Designate backbone optical fibre multimode cable as OM-01-02-nnn where 01 designates the terminal in or nearest to the building entrance room, 02 designates the next telecommunications room and nnn is a unique numeric ordinal beginning at 001 to 999. The ordinal is maintained unique throughout this cable type; it does not revert to 001.
 - .3 Designate backbone optical fibre single mode cable as OS-01-02-nnn where 01 designates the terminal in or nearest to the building entrance room, 02 designates the next telecommunications room and nnn is a unique numeric ordinal beginning at 001 to 999. The ordinal is maintained unique throughout this cable type; it does not revert to 001.
 - .4 Designate backbone crossover copper 4-pair cable as Xnnn where nnn is a unique numeric ordinal beginning at 001 to 999 and X is a literal value. The ordinal is maintained unique throughout this cable type; it does not revert to 001.
 - .2 Multi-Pair Copper Backbone Cables
 - .1 Label the termination field with the identification of the cable that terminates thereon.
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- .3 Optical Fibre Backbone Cables
 - .1 Label the optical fibre termination patch field with the identification of the cable that terminates thereon.
 - .4 Backbone Crossover Cables
 - .1 Label the crossover termination field beginning at the upper most and left most jack position, starting with the lowest ordinal, advancing horizontally, left to right, and progressing vertically as each row of jacks is completed. Example: X001, X002, X003, etc.
 - .5 Scheme D: Ottawa City
 - .1 Use “facility prefix” and “termination room identifiers” as indicated above for horizontal distribution cabling.
 - .2 Identify backbone cables as lying between the far-end facility and near-end facility where the near-end is closest to the work area.
 - .3 Label each end of every backbone cable. Label each cable with a unique identifier. Use the same identifier at each end of each respective cable.
 - .4 Label each cable within each pull box or maintenance hole.
 - .5 Identify each cable indicating the media type, shown below as “MMM”, as follows:
 - .1 Optical fibre: Multi mode: OM1
 - .2 Optical fibre: Multi mode: OM2
 - .3 Optical fibre: Multi mode: OM3
 - .4 Optical fibre: Single mode: OS1
 - .5 Copper unshielded: Cat 1: UT1
 - .6 Copper unshielded: Cat 3: UT3
 - .7 Copper unshielded: Cat 5e: UT5
 - .8 Copper shielded: Cat 1: ST1
 - .9 Copper shielded: Cat 3: ST3
 - .10 Copper shielded: Cat 5e: ST5
 - .11 Copper armoured: Cat 1: AT1
 - .12 Copper armoured: Cat 1: AT3
 - .13 Copper armoured: Cat 5e: AT5
 - .6 Multi-pair backbone copper cables
 - .1 Label the termination field with the identification of the cable that terminates thereon.
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- .2 Identify each cable as follows, where “F” facility prefix for far-end facility, “f” is terminating room identifier at the far end, “N” is the facility prefix for the near end, “n” is the termination room identifier at the near end, “MMM” indicates the media type, indicates “ppp” indicates the number of pairs, left padded with zero, “xxx” is the cable ordinal, left padded with zero
 - .1 F-f -N-n-MMM-ppp-xxx
 - .7 Multi-strand optical fibre cables
 - .1 Label the optical fibre termination patch field with the identification of the cable that terminates thereon.
 - .2 Identify each cable as follows, where “F” facility prefix for far-end facility, “f” is terminating room identifier at the far end, “N” is the facility prefix for the near end, “n” is the termination room identifier at the near end, “MMM” indicates the media type, indicates “ppp” indicates the number of strands, left padded with zero, “xxx” is the cable ordinal, left padded with zero
 - .1 F-f -N-n-MMM-ppp-xxx
 - .8 Backbone ordinals
 - .1 Number all copper cables with a common far-end identifier using unique consecutive ordinals beginning at 001.
 - .2 Number all optical fibre cables with a common far-end identifier using unique consecutive ordinals beginning at 001.
 - .6 Scheme E:
 - .1 Generic backbone cabling
 - .1 Identifier scheme template: ITx-ITy-M-nnn
 - .1 IT: Literal to indicate IT room or enclosure.
 - .2 X: Ordinal from zero through six to indicate different communication wiring hubs as shown on the layout drawings. (x) is always numerically less than (y).
 - .3 M: Identification of medium:
 - O to indicate optical fibre,
 - C to indicate copper
 - .4 Nnn: Consecutive cable ordinals to identify each cable with a unique identifier.
 - .2 Presto optical fibre backbone cabling
 - .1 Identifier scheme template: DCP-Px-M-nnn
 - .1 DCP: Literal to indicate main Presto panel
 - .2 P: Literal to indicate Presto panel
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- .3 X: Ordinal from one through three to indicate different Presto panels
- .4 M: Identification of medium:
O to indicate optical fibre,
C to indicate copper
- .5 Nnn: Consecutive cable ordinals to identify each cable with a unique identifier.

.10 Connecting Cords

- .1 Do not label connecting cords.
- .2 Identify each connecting cord with a label affixed at each end within 50 mm of the jack
 - .1 Label each cable as follows where "LL" is length expressed in meters, left padded with zero, "xxx" is cord ordinal, left padded with zero, beginning at 001. Ordinal does not reset for different values of LL
 - .1 LL-xxx

3.4 **COMMUNICATIONS PATHWAY IDENTIFICATION**

- .1 General
 - .1 Identify only those communications conduits used for backbone cabling.
 - .2 Identify communications ducts.
- .2 Mark surface mounted metallic or non-metallic conduit raceways by use of combination of coloured couplers and painted stripes, electrical identification plastic tape, or wrap-around markers.
- .3 Do not identify surface raceways mounted below ceiling line in finished areas. Do not apply colour code identifier markings to outlet faceplates.
- .4 Identify raceways at termination of raceway and transition to other raceways or enclosures. Apply markings on each side of transit through architectural partitions or floors or ceilings.
- .5 Employ system colours as indicated in table below.
- .6 Apply a small area of paint to inside of outlet, junction and pull boxes.
- .7 Apply identifying mark as paint to full surface of junction box and pull box cover panels for boxes of 150 mm x 150 mm or smaller.
- .8 Apply identifying mark as stripe for junction and pull boxes greater than 150 mm x 150 mm.
- .9 Use wrap around identification bands to identify conduit where painting is impracticable or prohibited or has potential to damage cabling or adjacent materials. Avoid obscuring labels. Avoid obscuring inspection windows.
- .10 Use wraparound identification bands to identify exposed communications cabling according to system where indicated on the Drawings.

.11 Apply one or more markings per the table below as indicated in the Contract Drawings. Refer also to Section 25 05 54. Where the Specifications differ, Section 25 05 54 will prevail.

.12 Apply a base mark of minimum 19 mm wide. Where indicated, apply stripes of minimum 8 mm maximum 12 mm each. Apply marking with separation of 12 mm to 20 mm between adjacent bands. Apply the base marking band nearest to the junction of the conduit with the junction box, outlet box or pull box.

.13 Use the following system colours

System	base colour	1 st stripe	2 nd stripe
Communications	blue		
Communications – backbone	blue	blue	
Communications – backbone – copper (public)	blue	blue	green
Communications – backbone – copper (private)	blue	blue	blue
Communications – backbone – fibre (public)	blue	blue	orange
Communications – backbone – fibre (private)	blue	blue	yellow
Communications – distribution	blue	green	
Communications – distribution – copper	blue	green	green
Communications – distribution – fibre	blue	green	orange
Security	green		
Security – access control	green	yellow	
Security – intrusion detection	green	yellow	green
Security – CCTV	green	blue	
Security – magnetic locks	green	red	
Security – duress alarms	green	red	green
Fire alarm	red		
Fire alarm – speakers	red	white	
Fire alarm – telephone	red	blue	
Distributed communications	white		
Distributed communications – intercom	white	brown	
Distributed communications – PA	white	white	
Distributed communications – AV	white	white	green
Distributed communications – radio	white	green	
Distributed communications – CATV	white	blue	

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

- .1 Telecommunications Industry Association (www.tiaonline.org)
.2 Building Industry Consulting Services International (BICSI) (www.bicsi.com)
.3 International Electrical Testing Association Inc. (www.netaworld.org)

1.3 **SUBMITTALS**

- .1 Submit test reports for review by Consultant. Include in Operating and Maintenance Manual. Comply with Section 01 33 00.
.2 Submit test data in a machine readable format approved by the Consultant. Submit a "reader" program designed and as required for use with the test data file.
.3 Submit a hard copy version of each test report. Use two-sided printing where practicable.
.4 Submit a PDF® (portable document format) version of each test report.
.5 Submit a summary report for each copper cable indicating pass/fail and length for each cable tabulating each result by cable number.
.6 Submit a summary report for each optical fibre strand indicating insertion loss for each strand tabulating each result by cable sheath and strand number.
.7 Submit detailed test results for all copper and optical fibre cables including backbone and distribution communications cables.
.8 Deliver the reports in a media format selected from the following:
.1 CD-ROM
.2 DVD/R-RW
.9 Within thirty days of award of Contract but no later than ten days before site mobilization of forces, submit evidence from each third party warranting performance guarantees of any part of the cabling system of their agreement that testing and site inspection procedures are fit for the purpose of upholding the warranty.
.10 Submit test and field reports before submitting claim for Substantial Performance.

1.4 **TEST REPORTS**

- .1 For each check and test performed prepare and submit a test report, signed by the test Engineer, and where witnessed, by the Consultant.
.2 Test reports to include a record of all tests performed, methods of calculation, date and time of test, ambient conditions, names of testing company, test Engineer and witnesses,
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also calibration record of all test instruments used together with manufacturers name, serial number and model number.

- .3 Calibration record to include performance level of test equipment.
- .4 Tests performed with instruments that have not been calibrated or certified as Fit For Purpose within twelve months preceding the date of use may be rejected at sole discretion of the Owner.
- .5 Undertake either full or sample testing daily and have reports available for review by the Consultant as an assurance that standards of working practices are being maintained.
- .6 Complete test records and certification of such records prior to Project cutover or beneficial use of the facility by Owner.
- .7 Configure the test equipment according to the cable under test. Install Product specific parameters.

1.5 **MANUFACTURER'S ATTENDANCE**

- .1 Provide manufacturer's representatives to verify installation practices for each part of the Work as may be relevant to all components including wiring and terminations.

1.6 **FIELD INSPECTION**

- .1 Provide field Engineer for inspection and certification of facilities during installation, testing and commissioning as required.
- .2 Concurrent with testing, perform visual inspection of all exposed cable to verify compliance with bend radius protection, sheath protection and protection against harsh environment.
- .3 Perform visual verification that all cables, outlets, jacks and patch cords are labelled according to this Specification. Confirm that cable numbers and jack numbers align.
- .4 Prepare and submit to the Consultant, summary report attesting to the findings of the field inspection.

1.7 **QUALITY ASSURANCE**

- .1 These Specifications supplement the Electrical and Electronic Manufacturers Association of Canada, Canadian Standards Association standards, Electronic Industries Association, Telecommunications Industries Association standards and recommendations. Conditions of the EEMAC, CSA, EIA, TIA and ISO/IEC standards and recommendations apply unless superseded or modified by this Specification.
 - .2 Where requirements of the Specifications exceed referenced standards, the Specifications apply. Where standards differ between authorities, the most rigid applies.
 - .3 Requirements of the Specifications that are substandard to referenced standards should be brought to the attention of Consultant during bidding period.
 - .4 Where any part of the Work fails tests or fails visual inspection, replace the defective material.
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- .5 Where any part of the Work fails tests and that Work is to be built without physical discontinuity, remove the offending material and install new without increase in cost to the Contract.
- .6 Identify and indicate in the test results, the type/style/category/product number of cables under test.
- .7 At the reasonable discretion of the Engineer, replace cable or cabling components that fail performance tests, or fail to comply with work practices described in TIA and BICSI published standards and with practices published by the vendor of cabling used on the Project. Make these replacements at no cost to the Project, not in material cost, nor labour charges, nor in delays incurred to make such replacements.

2 Products

2.1 **TEST INSTRUMENTS**

- .1 Use only one style of test instrument for all measurements; use instruments of only one manufacturer for all measurements.
- .2 Use instruments manufactured by one of the following:
 - .1 Agilent
 - .2 Fluke

3 Execution

3.1 **MATERIAL ACCEPTANCE**

- .1 Before installing any cable on site, perform the following material acceptance tests:
 - .1 Perform OTDR and flux loss measurements on optical fibre cable after delivery to site and before installation. Prepare summary report and submit as a Shop Drawing to the Engineer for review. Reject material which fails performance tests or appears physically damaged.
 - .2 Perform visual inspection tests on communications cables after delivery to site and before installation. Reject material which fails performance tests or appears physically damaged.
 - .3 Perform full performance testing on samples removed from each spool of communications cable after delivery to site and before installation. Submit the test results to the Engineer for review as a Shop Drawing. Record the manufacturer's production data as imprinted on the cable sheath. Use a cable sample of physical length 50 meters \pm 500 mm. Retain sample for further testing until after Shop Drawings are returned as "Reviewed as Submitted".

3.2 **VISUAL AND MECHANICAL INSPECTION**

- .1 Immediately following installation of cables and connector hardware, perform the following visual and mechanical inspections:
 - .1 Compare cable, connectors and splice data with Drawings and Specifications.
 - .2 Inspect cable and connectors and connections for physical and mechanical damage.

.3 Verify that all connectors and splices are correctly installed.

.4 Verify colour and marking identification is correctly installed.

3.3

ELECTRICAL TESTING

.1 Test horizontal and backbone copper cables according to the following criteria:

.1 Cable length measurement and construction defect inspections.

.2 Connector integrity tests.

.3 Cable and connector attenuation and performance testing.

.4 For cables up to and including Category 3, test all pairs of each horizontal and backbone cables for continuity, short circuits, open circuits, continuity to ground, correct polarity, length, attenuation and near end crosstalk to a minimum of 16 MHz. Perform tests in accordance with TIA 568B.

.5 For Category 5, and 5e cabling, test all pairs for continuity, short circuits, open circuits, continuity to ground and correct polarity. Test each cable for length, attenuation, near end crosstalk, far end cross talk, delay, delay skew to a minimum of 350 MHz. Perform tests in accordance with TIA 568B.

.6 For Category 6 cabling, test all pairs for continuity, short circuits, open circuits, continuity to ground and correct polarity. Test each cable for length, attenuation, near end crosstalk, far end cross talk, delay, delay skew to a minimum of 650 MHz. Perform tests in accordance with TIA 568B.

.7 For Category 6A cabling, test all pairs for continuity, short circuits, open circuits, continuity to ground and correct polarity. Test each cable for length, attenuation, near end crosstalk, far end cross talk, delay, delay skew to a minimum of 1000 MHz. Perform tests in accordance with TIA 568B.

.8 For Category 6A cabling, and on request of the Engineer, conduct tests to 1000 MHz for alien cross talk measurements on an audit basis as per TIA 568 B2-10 on two samples of six-around-one cable sets selected by the Engineer.

.9 Test coax cabling for center conductor continuity, shield continuity, impedance (75 ohms), attenuation to limits dependent on the application as described in TIA 942-1.

.2 Test optical fibre cable according to the following:

.1 Cable length measurement, fibre fracture inspection and construction defect inspections using an Optical Time Domain Reflectometer (OTDR).

.2 Connector and splice integrity tests using an OTDR.

.3 Cable attenuation and loss measurements using an optical power loss test set.

.4 Test every fibre of each cable with an OTDR for length and attenuation. Include a hard copy chart recording with the test documentation.

.5 Test every fibre of each cable with a power meter/light source combination in both directions. Tabulate and include test results with the test documentation.

.6 Multi Mode Fiber

- .1 Perform factory tests for loss measurements at 850 nm and 1300 nm in both directions using a source and power meter calibrated at these wavelengths. Perform the tests using an LED source. Comply with procedures described in FOTP-171 Methods A1 or D1, or FOTP-34 Method A2. Archive measurement results electronically showing pass/fail results measured using limits provided in TIA 568-C.3 and deliver with viewer/reporting software.
- .2 Perform testing with an optical time domain reflectometer using a launch fiber at both ends. Submit OTDR trace data along with a viewer program. Submit OTDR event table showing reflective events with an absolute value less than 50 dB return loss and non-reflective events with a loss value greater than 0.1 dB.

.7 Single Mode Fiber

- .1 Perform tests for loss measurements at 1310 nm and 1550 nm in both directions using a source and power meter calibrated at these wavelengths. Comply with procedures described in FOTP-171 Methods A3 or D3, or FOTP-34 Method B. Measure against limits provided in TIA-568-C.3. Archive measurement results electronically and show pass/fail results delivered with viewer/reporting software.
- .2 Perform testing with an OTDR using a launch fiber at both ends. Submit OTDR trace data along with a viewer program. Submit OTDR event table showing reflective events with an absolute value less than 50 dB return loss and non-reflective events with a loss value larger than 0.1 dB.
- .3 For single mode fiber runs longer than five km deployed for 10 Gbps or higher rates, measure chromatic dispersion showing absolute dispersion at 1550 nm and polarization mode dispersion. Record and submit results for these fibers in addition to the tests above.

.3 Test Values

- .1 Assemble test results and submit to the Engineer in a timely manner.
- .2 Analyze the results and repair or replace cabling so that the Work results comply with the Specifications.
- .3 Verify that the installed cabling conforms to the manufacture's Specifications.

3.4 **REPAIRS**

- .1 Replace defective or damaged cables and components and re-execute tests.
- .2 Replace defective cables without splicing where splicing is not permitted.

End of Section

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- 1 General
 - 1.1 **SUMMARY**
 - .1 Section Includes
 - .1 Labour, Products, equipment and services necessary to complete the Work of this section.
 - .2 Related Sections
 - .1 Refer to all divisions of Work in the Specifications.
 - 1.2 **REFERENCES**
 - .1 Safety
 - .1 National
 - .1 Canadian Standards Association CSA C22.1
 - .2 Provincial
 - .1 Ontario Electrical Safety Code
 - .2 Ontario Building Code
 - .2 Performance
 - .1 International Standards Organization
 - .1 ISO11801 Information technology — Generic cabling for customer premises
 - .2 Telecommunications Industry Association (www.tiaonline.org)
 - .1 TIA-526-7 measurement of optical power loss of installed single-mode fibre cable plant
 - .2 TIA-526-14 optical power loss measurements of installed multimode fiber cable plant
 - .3 TIA-568 commercial building telecommunications cabling standard
 - .4 TIA-569 telecommunications pathways and spaces
 - .5 TIA-598 optical fiber cable color coding
 - .6 TIA-606 administration standard for telecommunications infrastructure
 - .7 TIA-607 generic telecommunications bonding and grounding (earthing) for customer premises
 - .8 TIA-758 customer-owned outside plant telecommunications infrastructure standard
 - .9 TIA-862 building automation systems cabling standard
 - .10 TIA-942 telecommunications infrastructure standard for data centers
 - .11 TIA-1005 telecommunications infrastructure standard for industrial premises
 - .12 TIA-1152 requirements for field test instruments and measurements for balanced twisted-pair cabling
-

- .13 TIA-TSB-62 informative test methods (ITMS) for fiber-optic fibers, cables opto-electronic sources and detectors, sensors, connecting and terminating devices and other fiber-optic components
- .14 TIA-TSB-130 generic guidelines for connectorized polarization maintaining fiber and polarizing fiber cable assemblies for use in telecommunications applications
- .15 TIA-TSB-162 telecommunications cabling guidelines for wireless access points
- .16 TIA-TSB-184 guidelines for supporting power delivery over balanced twisted-pair cabling
- .17 TIA-TSB-190 guidelines on shared pathways and shared sheaths
- .3 Building Industry Consulting Services International (BICSI) (www.bicsi.com)
 - .1 ANSI/BICSI 002-2014, Data Center Design and Implementation Best Practices
 - .2 ANSI/NECA/BICSI-568-2006, Standard for Installing Commercial Building Telecommunications Cabling
 - .3 NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
 - .4 Telecommunications Distribution Methods Manual
- .4 International Electrical Testing Association Inc. (www.netaworld.org)

1.3

DEFINITIONS

- .1 Accept the following definitions of terms used within this document
 - .1 Approved sole equivalent. A single Product proposed by the Bidder to displace a named Product as being beneficial to the Contract and which has been reviewed and accepted by the Owner as suitable and acceptable as the only substitute to the named Product.
 - .2 Sole manufacturer: One only manufacturer of indicated Products to the exclusion of all other manufacturers.

1.4

ABBREVIATIONS

- .1 Not specified

1.5

SYSTEM DESCRIPTIONS

- .1 Structured Cabling – Outside Plant
 - .1 Extensions of existing outside plant facilities to new locations in doors.
 - .2 Interception, modification, expansion and improvements to existing incoming carrier pathways where previous pathways exist.
- .2 Structured Cabling – Architecture
 - .1 Organized system of information systems extra low voltage power limited copper cabling arrayed as individual communications channels between end point device connections.
 - .2 Communications channels indicated as *network channels* to operate at 1 Gbps data transfer rate consisting of 8 conductor small gauge copper conductors

- arranged as four-independently twisted pairs in a common unshielded flame spread rated plastic sheath.
 - .3 Organized systems of information systems extra low energy optical fibre cabling arrayed as individual communications channels between end point device connections.
 - .4 Communications channels indicated as *network channels* to operate at up to 10 Gbps consisting of two strands of multimode optical fibre in a common sheath sometimes shared with other like fibre strands.
 - .5 Network subscribing field devices arrayed in the work area each attached to a network channel outlet jack by work area equipment patch cord.
 - .6 Network energizing equipment aggregated in centrally located telecommunications spaces.
 - .7 Network energizing equipment attached to network channels by equipment patch cords.
 - .8 Network terminations aggregated on common rack mounted patch panels in centrally located telecommunications spaces.
 - .9 Work area network outlet terminations mounted on work area faceplates individually, or shared with other like outlet terminations.
 - .10 Work area network outlets mounted on faceplates mounted on furniture outlet mounts, electrical conduit wall and surface mounted enclosures.
 - .11 Network channels terminated at each end with a connector firmly attached to the fabric of the premises or firmly attached to a faceplate within furniture and fixed to the premises.
 - .3 Communications Pathways
 - .1 Comply with TIA 569.
 - .2 Avoid exceeding cable pathway occupancy density of 40% measured by cross section area. Report to the Consultant occurrences where occupancy density exceeds 40% in cable trays or cable runways or optical fibre overhead raceways.
 - .3 Communications pathway infrastructure complying with this document and Division 26 of this Specification.
 - .4 Cables fully enclosed by continuous conduits or continuous cable tray or optical fibre containment raceways or within electrical utility rooms or combination to achieve a fully protected cable distribution system.
 - .5 Optical fibres in medium to large telecommunications rooms or communications equipment rooms in dedicated fibre management raceways with controlled cable entry and descent pathways.
 - .6 Optical fibre cables in cable trays protected by flexible thin wall non-metallic electrical inner duct conduit.
 - .7 Optical fibre cables exposed in cable tray in airborne oil environments installed in protective flexible liquid tight conduit.
 - .8 Communications pathways supplemented with multi-cell pre-lubricated flexible cloth detectable innerduct.
 - .9 Route diversity established by use of two separate and distinct conduits or cable trays or combination within 50 m of distribution point.
-

- .4 Communications Equipment Room Fittings
 - .1 General
 - .1 Entrance protection devices to reduce damage due to overvoltage and over-current conditions on exposed cabling.
 - .2 Communications cabinets racks, frames and enclosures and overhead supporting structures and associated components.
 - .3 Cabling termination blocks, patch panels, as components of a structured cabling installation.
 - .4 Runway mounted cable management systems.
 - .5 Termination blocks for multi-pair copper cables.
 - .6 Patch panels for 4-pair copper UTP network distribution cables.
 - .7 Termination panels for optical fibre cabling.
 - .8 Rack mounted cable management systems.
 - .2 Cabinets racks, frames and enclosures
 - .1 Cabinets, racks, frames and enclosures as secure and managed spaces to support structured cabling components and network energizing equipment communications equipment, computer equipment, communication cabling terminations and power distribution strips, bars and accessories including inside mounting rails, vertical cable management accessories, air exhaust chimney, doors, side panels, air dams, door locks, with grounding bar securing and bracing brackets all by a sole manufacturer.
 - .2 Communications rack mounted power distribution, protection and power strips.
 - .3 Air management and containment systems
 - .1 Overhead supported air management system of panels and supports and doors as supplement to equipment cabinets to create hot / cold air containment system.
 - .4 Copper medium termination blocks
 - .1 Termination blocks and patch panels for structured cabling systems manufactured by a sole vendor furnished under a single manufacturer's warranty.
 - .5 IDC termination blocks and patch panels
 - .1 IDC termination blocks
 - .1 Wall or backboard mounted insulation displacement wire termination strips in multiples of fifty pins (twenty-five pair) per strip, for 22-26 AWG conductor, inserted in wall mounted panels in assemblies of increments of 300 pairs, in "110" or "BIX" format as indicated; wall or backboard mounted wire management rings, troughs and accessories to match

- .2 Communications patch panels
 - .1 Panels mounted on flat vertical surfaces, or rails within racks or frames supporting individual or modules of multiple cable terminations
 - .2 Panels supporting individual cable termination jacks
 - .3 Panels supporting cassettes of pre-terminated cable jacks
 - .4 Panels supporting individual optical fibre termination connectors
 - .5 Panels supporting cassettes of preterminated optical fibre connectors
 - .6 Communications cable management and ladder racking
 - .1 Rack mounted lateral cable retention strips; vertical rack mounted cable troughs; to retain and manage cables within a rack or enclosure.
 - .2 Cable runway supported overhead as open pathway for communications cabling and as support for cable, cable patch panels and power distribution conduits.
 - .3 Cable raceway supported overhead as protected covered pathway for optical fibre cabling, patch cables, providing support and escort into communications racks.
 - .7 Communications distributed enclosures
 - .1 Custom surface mounted enclosures to accommodate DIN rail mounted cabling terminations and DIN rail mounted network energizing equipment including DIN rail cabling termination blocks, patch panels, as components of a structured cabling installation, DIN rail mounted termination panels for optical fibre cabling, DIN rail rack mounted cable management systems. Components to support structured cabling components and network energizing equipment.
 - .2 Overhead ladder racking cable runway support including fittings, structural supports, braces, rods and brackets necessary for suspension, attachment or support of communications cabinets, racks, frames and enclosures. Cable management guides and retainers, support brackets, section joining elements, horizontal bends, vertical inside/outside bends, wall support brackets, and ground bonding links all by a sole manufacturer.
 - .3 Rack mounted power distribution and power protection strips for in-rack power distribution, monitoring and control. Mounted vertically and horizontally.
 - .5 Communications Copper Backbone Cabling
 - .1 Multi-pair copper pair cabling installed between termination panels within premises and between premises of common owner.
 - .1 Applications
 - .1 Voice frequency band telemetry
 - .2 Voice communications
 - .3 Data network 10 Mbps -100 Mbps,
 - .2 Exposed copper backbone cable protect against overvoltage conditions.
-

- .6 Communications Copper Backbone Terminations
 - .1 Multipair termination strips, wall or panel or surface mounted.
 - .7 Communications Optical Fibre Cabling
 - .1 Multi-strand optical fibre cable.
 - .1 Multi-strand optical fibre of various types as indicated in the contract drawings.
 - .2 Multi-strand optical fibre cables to suit environmental conditions including
 - .1 Physical environments including
 - .1 Indoor,
 - .2 Indoor/outdoor, and
 - .3 Outdoor
 - .2 Chemical / Climate conditions including
 - .1 Indoor – dry
 - .2 Indoor – damp
 - .3 Outdoor – damp
 - .3 Multi-strand optical fibre cables of various forms of construction including combinations of OFNP, OFNR, OFNG, loose tube, loose tube with water blocking barrier, tight buffer, tight buffer with water blocking barrier, steel armour, aluminum armour, steel armour with plastic outer jacket, aluminum armour with plastic outer jacket.
 - .4 Multi-strand field terminated and pre-terminated single mode and multimode optical fibre cable assemblies installed between termination panels within premises and between premises of common owner in support of the following applications:
 - .1 Data networking Ethernet: 1 Gbs, 10 Gbs,
 - .2 Data networking carrier: OC-3, OC-12, OC-48, OC-192
 - .8 Communications Optical Fibre Terminations
 - .1 Multi-strand optical fibre terminations and couplers
 - .1 Optical fibre terminations of various types as indicated in the Contract Drawings.
 - .2 Factory terminated factory polished cable multi strand assemblies.
 - .3 Field terminated factory polished mechanical attached single strand connectors.
 - .4 Optical fibre termination adapters.
 - .5 Optical fibre field splicing tray and cassettes.
 - .6 Optical fibre rack mounting accessories.
 - .7 Optical fibre fan out cassettes.
 - .9 Communications Optical Fibre Termination Enclosures
 - .1 Rack or wall or surface mounted enclosures or trays to accommodate optical fibre terminations, splice trays, and cable loops
-

- .2 Accommodation for connector mounting faceplate adapter panels.
- .10 Communications Horizontal Distribution Cabling
 - .1 Four-pair shielded or unshielded copper cabling installed between termination panels and work area outlet in support of the following applications:
 - .1 Voice frequency band telemetry.
 - .2 Voice communications.
 - .3 Data network 10 Mbps, 100 Mbps, 1 Gbps, 10 Gps.
 - .4 Elevator communications intercom.
 - .2 Multiple conductor cabling installed between termination panels or field devices and other field devices in support of the following applications:
 - .1 Building management systems.
 - .2 Premises security systems.
 - .3 Premises access and gate controls.
 - .3 Modular connectors as terminations of horizontal distribution cables.
 - .4 Multi-strand single mode or multimode field terminated or pre-terminated optical fibre cable installed between termination panels and work area terminations in support of the following applications:
 - .1 Data networking Ethernet: 1 Gbs, 10 Gbs, 40 Gpbs, 100 Gbps.
 - .5 Coaxial cables installed between termination panels and work area terminations in support of the following applications:
 - .1 Radio antenna connections.
 - .6 Single pair copper cabling installed between termination panels and field devices in support of the following applications:
 - .1 Public address speaker distribution.
- .11 Work Area Faceplate
 - .1 Modular faceplate adapter for mounting on conduit box enclosures to mount single or multiple fixed or modular work area outlets for copper or optical fibre horizontal distribution cables and for audio / visual cable terminations.
- .12 Communications Connecting Cords, Devices, and Adapters
 - .1 Network cords installed between devices and cabling terminations to form or complete a communications channel:
 - .1 Copper medium
 - .1 Copper four-pair, unshielded patch cords of various lengths and colour
 - .2 Optical medium
 - .1 Optical fibre two-strand optical fibre single and multi-mode patch cords of various lengths; duplex LC to duplex LC connector polarity field adjustable A-A and A-B
 - .2 Optical fibre twelve-strand, single mode and multi-mode patch cords of various length

- .3 Common cord for configuration of 40-GBASE channels using either Method A and Method B or a combination of cabling arrangements compliant with TIA-568-C.0 by manual and non-intervention manipulation of in-field setting of connector pinning polarity and key polarity without need of tools
 - .13 Antennas Communications Horizontal Cabling
 - .1 Network wireless access points
 - .1 Horizontal distribution cabling connection from wireless access point to network active device in telecommunications room or enclosure.
 - .2 Wireless access point
 - .1 Comply with Section 27 20 00
 - 1.6 **SHOP DRAWINGS SUBMITTALS**
 - .1 General Instructions
 - .1 Comply with Specification Section 01 33 00.
 - .2 Shop Drawings issued and reviewed before construction.
 - .3 Retain the services of a person accredited by BICSI as a Registered Communications Distribution Designer (RCDD) to review and stamp shop drawings submitted under this division of work to attest to compliance with contract specifications.
 - .2 Shop Drawings
 - .1 Submit Shop Drawings for field installations
 - .1 Telecommunications rack equipment elevations for telecommunications rooms, data centre, and AV systems indicating outlet placement and identification of cable terminations by type and by administration labels.
 - .2 Wall elevations for telecommunications rooms, data centre, AV equipment spaces.
 - .3 Wall elevations and floor layout for carrier entrance rooms.
 - .4 Spreadsheet file indicating location on patchpanel the termination of backbone cables and cabling with terminations in the equipment server room and telecom rooms.
 - .2 Submit Shop Drawings for communications systems Products
 - .1 Cables and connectors.
 - .2 Termination panels, patch panels, termination blocks.
 - .3 Work area faceplates and outlet connectors.
 - .4 Manufactured items.
 - .5 Enclosures and panels.
 - .6 Cable runway and racking.
 - .7 Optical fibre raceway systems and accessories
 - .8 Cable management accessories.
 - .3 Submit Shop Drawings to justify and explain proposed deviations from the design depicted in the Contract Documents.

- .4 Submit Shop Drawings for manufactured assemblies
 - .1 Telecommunications industrial wall mount enclosures.
 - .2 Overhead heat containment baffles.
- .3 Samples
 - .1 Submit test results of cable samples.
 - .2 Comply with Specification Section 27 08 00.
- .4 Manufacturer's Field Reports
 - .1 Provide manufacturer's representative to prepare pre-installation report on communications cabling infrastructure as pre-construction condition in support of manufacturer's warranty. Submit copy of report for Owner's review four weeks before installation commences.
 - .2 Obtain statement from manufacturer attesting to fulfillment of terms of manufacturer's warranty. Submit copy of statement for Owner's review four weeks before installation commences.
 - .3 Provide services of manufacturer's representative to conduct periodic site reviews and prepare summary reports of work in progress. Submit each report for Owner's review within two days of observation on site.
- .5 Close Out Submittals
 - .1 Comply with Section 01 10 00.
 - .2 Submit as-constructed drawings indicating any deviation of cabling, cable administration, and routing from as shown on Contract Drawings.

1.7

QUALITY ASSURANCE

- .1 Qualifications
 - .1 Comply with requirements of Section 27 05 00.
- .2 Certifications
 - .1 Comply with requirements of Section 27 05 00.
- .3 Field Samples
 - .1 Provide minimum of one field sample of each colour and type of component for use in the Work. Submit samples for Owner's review with sufficient lead time to allow modification of Product at Owner's discretion and with a minimum of two weeks before commencement of installation.
 - .2 Provide representative sample of factory manufactured cable assemblies. Submit samples for Owner's review with sufficient lead time to allow modification of Product at Owner's discretion.
- .4 Pre-Installation Meetings
 - .1 Arrange for and attend pre-installation design and construction meetings. Attendees at meetings to include site work supervisor and technical design supervisor.
 - .1 Minimum of one meeting to review the Contract scope of work.
 - .2 Minimum of one meeting to review the proposed execution of the work.

- .5 Site Meetings
 - .1 Arrange for and attend construction progress meetings. Attendees at meetings to include site work supervisor and technical design supervisor.
 - .1 Minimum of two site meetings per month commencing on day of mobilization and running until four weeks after site work completion.
 - 1.8 **DELIVERY, SHIPPING, HANDLING AND UNLOADING**
 - .1 Acceptance at Site
 - .1 Examine Products delivered to site.
 - .2 Reject Products that appear damaged or unfit for use.
 - .3 Verify quality of components. Comply with requirements of Section 27 08 00.
 - .2 Storage and Disposal
 - .1 Maintain a sufficient supply of components to execute and complete the Work.
 - .2 Store and protect the supply of components against loss or damage.
 - .3 Make good losses or damages without penalty to the Owner.
 - .4 Comply with conditions of site housekeeping and waste removal in the Specifications.
 - 1.9 **WARRANTY**
 - .1 General Terms
 - .1 Provide best warranty available from component vendor; provide as a minimum a warranty as described in the Project Specifications.
 - .2 Perform the Work according to the terms dictated by the manufacturer to obtain the best warranty offered by the manufacturer.
 - .3 Submit the manufacturer's warranty declaration to the Owner.
 - .4 Arrange for the Owner to receive documents to support the manufacturer's extended warranty.
 - 1.10 **COMMISSIONING**
 - .1 Execute testing and compliance measurements to comply with Section 27 08 00.
 - .2 Submit results to the Owner for review.
 - 1.11 **MAINTENANCE**
 - .1 Clean and inspect all optical fibre connections before handing over the installation.
 - .2 Provide inspection reports including photographic images of all optical fibre terminations optical mating surfaces.
 - 2 Products
 - 2.1 **MANUFACTURERS**
 - .1 Manufacturers – General
 - .1 Manufacturers - Stipulated
 - .1 Products by stipulated manufacturer or manufacturers where identified on the contract drawings without substitution.
-

- .2 Manufacturers – Equal
 - .1 Products by manufacturer or manufacturers where manufacturer's products are approved as equal and as acceptable substitution expressly by the Owner or Owner's appointed representative.
 - .3 Manufacturers- Equivalent
 - .1 Products by manufacturer or manufacturers where manufacturer's products are functionally and materially identical or superior to the specified product.
 - .2 Proof or evidence of equivalence submitted on demand by the Owner.
 - .3 Contractor accepts financial and temporal risks on failure of products to meet conditions of equivalency determined at the sole discretion of the Owner or the Owner's appointed representative.
 - .4 Manufacturers - Voluntary
 - .1 In absence of an indicated manufacturer, a sole manufacturer in common with manufacturer of specified copper cabling components.
 - .2 In absence of an indicated manufacturer or manufacturer of specified copper cabling products, a sole manufacturer selected from list of recognized manufacturers listed by class of product.
 - .5 Manufacturers – Recognized
 - .1 Manufacturers identified in the sections below by class of product.
 - .6 Manufacturers - Substitution
 - .1 Acceptable as substitution of products by a sole manufacturer are products supplied by a business joint venture between a cable manufacturer and component manufacturer represented by either party as a sole provider and furnished under a single manufacturer's warranty where such substitution is of demonstrable material or performance benefit to the Owner. Substitution conditional on express approval by the Owner or Owner representative.
 - .2 Communications Equipment Room Fittings
 - .1 Equipment racks – floor mounted
 - .1 Hammond
 - .2 Equipment frames – floor mounted
 - .1 Not specified
 - .3 Equipment cabinets – surface mount
 - .1 Hammond
 - .4 Industrial enclosures – surface mount
 - .1 Hammond
 - .5 Power distribution strips
 - .1 Liebert
 - .6 Termination blocks and patch panels
 - .1 Copper cabling termination blocks
-

- .1 Belden – BIX series
 - .2 Copper cabling patch panels
 - .1 Panduit
 - .3 Optical fibre cabling system components
 - .1 Comply with 271000.1
- .7 Overhead cable runway and accessories
 - .1 Chatsworth Products Inc.
 - .2 Cooper Industries
 - .3 Middle Atlantic
- .3 Communications Optical Fiber Cabling
 - .1 Sole manufacturer
 - .1 Optical fibre cabling of double- or multi- strand, single mode or multimode, field terminated or pre-terminated, panel mounted coupling connectors, termination panels, pre-terminated cable assemblies, work area patch cables, telecommunications room equipment patch cables, by a sole manufacturer of optical fibre products.
 - .2 Termination housings and enclosures, work area outlet, work area outlet faceplate compatible with optical fibre products
 - .2 Manufacturers
 - .1 Optical fibre cables, terminations and accessories
 - .1 Corning Cabling
 - .2 Comply with 271000.1
- .4 Communications Copper Backbone Cabling
 - .1 Sole manufacturer
 - .1 Sole manufacturer in common with copper distribution cabling and cabling components
 - .2 Manufacturers
 - .1 Copper – single pair
 - .1 Copper conductor 12 ga to 20 ga insulated to 300 V
 - .1 Comply with Division 26
 - .2 Copper – multiple conductor non-pair
 - .1 Copper conductors 12 ga to 24 ga insulated to 300 V
 - .1 Comply with Division 26
 - .3 Copper – multi pair, with pair count greater than four.
 - .1 General Cable
 - .2 Belden
 - .3 Comply with 271000.1

- .5 Communications Coaxial Cabling
 - .1 Manufacturers
 - .1 Match to existing
 - .6 Communications Coaxial Splicing and Terminations
 - .1 Coaxial cable terminations, patch panels
 - .1 Panduit
 - .7 Audio-Video Communications Cabling
 - .1 Shielded pair and multi pair
 - .1 Belden
 - .8 Paging Communications Cabling
 - .1 Copper one pair 10 ga to 20 ga, insulated 300V
 - .1 Product and manufacturer
 - .1 Not specified
 - .9 Antennas Communications Cabling
 - .1 Coaxial type, multi conductor, pre-terminated and connectorized
 - .1 Match to existing
 - .2 Wireless access points cabling and accessories
 - .1 Horizontal cabling to comply with section on communications copper distribution cabling
 - .10 Communications Copper Distribution Cabling
 - .1 Copper category four-pair unshielded cable, panel mounted connectors, termination panels, pre-terminated cable assemblies, work area outlet, work area outlet faceplate, work area patch cables, telecommunications room equipment patch cables, all products by a sole manufacturer
 - .1 Manufacturers
 - .1 General Cable
 - .2 Comply with 271000.1
 - .11 Communications Faceplates and Connectors
 - .1 Wall faceplates
 - .1 Same manufacturer as specified for horizontal data cabling.
 - .2 Furniture adapter faceplates, system furniture adapters, modular furniture adapters
 - .1 Same manufacturer as specified for modular and systems furniture.
 - .12 Communications Connecting Cords, Devices, and Adapters
 - .1 Communications copper patch cords
 - .1 Same manufacturer as specified for copper distribution cabling.
-

- .2 Communications optical fibre patch cords
 - .1 Same manufacturer as specified for optical fibre distribution or backbone cabling.

2.2 **COMPONENTS**

- .1 Communications Equipment Room Fittings
 - .1 Communications cabinets racks frames and enclosures
 - .1 General
 - .1 Cabinets, racks, frames and equipment enclosures consisting of equipment cabinets, inside mounting rails, inside power distribution strips, vertical cable management accessories, air exhaust chimney, doors, side panels, air dams, door locks, securing and bracing brackets all by a sole manufacturer
 - .2 Wall mounted optical fibre termination enclosures
 - .3 Grounding bar and grounding jumpers installed in each
 - .1 Wall mounted open frame
 - .2 Communications cabinet enclosure or
 - .3 Any other form of equipment enclosure
 - .2 Wall, pole and surface mount industrial enclosures
 - .1 Provide enclosure of Type ID indicated on Contract Drawings
 - .2 Comply with 271000.1
 - .3 Network communications / server cabinet enclosure
 - .1 General
 - .1 Provide cabinet enclosure equipment rack of Type ID indicated on drawings possessing characteristics drawn from table below for same Type ID.
 - .2 Comply with 271000.1.
 - .3 Communications floor mounted free standing cabinet for mounting network equipment and cabling terminations on 483 mm panels.
 - .4 Frame grounding lug to CAN/CSA C22.1; grounding connection to frame from grounding lugs on removable elements.
 - .2 Cabinet fixtures
 - .1 Quick release removable side panels; Solid roof plate secured to prevent removal from outside the cabinet.
 - .3 Door style
 - .1 Two sets keys milled to Owner specified combination.
 - .2 Single front ventilated door with reversible hang and
 - .3 Split rear ventilated doors;

- .4 Quick release hinges; opening range greater than 180 degrees;
 - .5 Effective ventilation ratio of 85% by area for front, rear and roof;
 - .6 Frame grounding lug to CAN/CSA C22.1; grounding connection to frame from grounding lugs on removable elements.
 - .7 Metal parts powder coat painted otherwise chrome or cadmium plated.
 - .8 Colour: Industrial light grey (RGB 215-215-215) RAL 7035.
 - .9 Flammability of plastic components to UL94V-1.
 - .10 Safety to IEC 60950.
 - .4 Door lock
 - .1 Keyed lock on front and rear keyed alike to side panel release;
 - .2 Two sets keys milled to Owner specified combination.
 - .5 Cabinet accessories
 - .1 Levelling feet; four casters.
 - .2 Vertical mounting rails adjustable without use of tools; Front and side mounting flange surface vertical mounting rails machine threaded 10-32 at spacing to EIA-310
 - .3 Front and rear equipment mounting rails adjustable forward and backward for front and optional rear support; minimum setback of 75 mm from inside surface of front door, minimum offset of 38 mm between side rails and side panels; calibrated and marked in units of 44.45 mm.
 - .4 Kit of sixty captive insert cage nuts M6 with washers and mounting bolts.
 - .6 Air management
 - .1 Front panel blanking kit; plastic front mounting panels, full height in 1RU increments, black plastic
 - .7 Instrumentation
 - .1 SNMP/Ethernet/IP monitor module to measure, report and alarm on open door, high temperature.
 - .2 Mounting for intrusion detector alarm switch.
 - .3 Door open detector switch on front and rear doors.
 - .8 Server cabinets attributes
 - .1 Provide cabinets indicated as "SERVER" with components possessing the following change of attributes
-

- .2 Change: Vertical mounting rails machine threaded 10-32 at spacing to EIA-310
Replace with: Vertical mounting rails surface square punched at spacing to EIA-310;
- .3 Kit of sixty captive insert cage nuts M6 with washers and mounting bolts.
- .4 Cable management channel - inrack
 - .1 Four vertical cable management channels within equipment enclosures and outside equipment space
 - .2 Inside cable openings of 75 mm diameter minimum and outside cable openings of minimum two 100 mm x 100 mm and three 100 mm x 200 mm openings fitted with grommets on each side.
- .2 Products
 - .1 Provide Products indicated in table below corresponding to Type ID and approved manufacturer.
 - .2 Provide approved equivalent.

Table 1 - Network Communications Cabinet Enclosure – By Properties

Type ID	IP rating	NEMA	Rail width	Width	Depth	RU
E751-44	IP21	1	483mm"	762mm	1067mm	44

Table 2 - Network Communications Cabinet Enclosures - By Manufacturer

Type ID	HP	Panduit	Rittal	WrightLine	
E751-44				Paramount-44	

- .5 Cable management side plenum chaseway
 - .1 Verical metallic chaseway to complement network rack, side mounted

Table 3 - Enclosure Side Plenum Chase - By Properties

Type ID	IP rating	NEMA	Width	Depth	RU
EC032-44	IP21	1	300mm12in	914mm	44

Table 4 - Enclosure Chase Side Plenum - By Manufacturer

Type ID	HP	Panduit	Rittal	WrightLine	
EC032-44				Paramount side cable chase 44RU x 12 x 42	

- .6 Rack grounding bar
 - .1 General
 - .1 Grounding bar kit, rack mounted, 483 mm long, tin plated, predrilled to accept twenty thread forming installed 12-24 screws spaced at 15.9 mm, two cage nut bonding screws, four bonding nuts, to C22.2 No 41-13, UL 467, EIA-310.
 - .2 Two bolt grounding jumper kit, #6 AWG ground bonding conductor, compression lug terminated one end.
 - .2 Product
 - .1 Panduit RGRB19CN

- .7 Optical fibre enclosures-Interior
 - .1 Wall or surface mount metallic enclosures identified by Type ID below
 - .2 Accommodate optical fibre termination connector couplers, splice tray, loop storage
 - .3 Provide all accessories to complete fibre splice and connector terminations
 - .4 Swing door, exterior door lock
 - .5 IP / NEMA ratings
 - .1 NEMA 1
 - .6 Independent compartments for optional patch cords
 - .7 Accommodate splice trays by same or other manufacturer
 - .8 Accommodate coupler connectors by same or other manufacturer
 - .9 Styles with capacities of
 - .1 12 to 192 LC terminations in increments of 12
 - .2 Inline splice trays
 - .10 Accessories
 - .1 Splice tray with heatshrink splice protectors
 - .2 Coupler mounting plates
 - .11 Products
 - .1 Products and fibre splice & connector accessories by sole manufacturer
 - .2 Approved Product by sole manufacturer of optical fibre cabling system products.
 - .3 Approved manufacturer identified on contract drawings.
 - .8 Optical fibre enclosures – interior/exterior
 - .1 Wall or surface mount metallic enclosures identified by Type ID below
 - .2 Stainless steel construction
 - .3 Accommodate optical fibre termination connector couplers, splice tray, loop storage
 - .4 Provide all accessories to complete fibre splice and connector terminations
 - .5 Swing door, exterior door lock
 - .6 IP / NEMA ratings
 - .1 NEMA 4X
 - .7 Accommodate splice trays by sole manufacturer
 - .8 Styles with capacities of
 - .1 144 inline splices connections
-

- .9 Accessories
 - .1 Splice tray with heatshrink splice protectors
- .10 Products
 - .1 Products and fibre splice & connector accessories by sole manufacturer
 - .2 Approved Product by sole manufacturer of optical fibre cabling system products.
 - .3 Approved manufacturer identified on contract drawings.

Table 5 - Fibre Splice Enclosures - By Properties

Type ID	Environment	Termination type	Patch cord compartment	Capacity	Rating	Size
OFSE-12	Interior	Splice/coupler	Yes	12	NEMA 1	279 x 330 x 64
OFSE-24	Interior	Splice/coupler	Yes	24	NEMA 1	279 x 330 x 64
OFSE-48	Interior	Splice/coupler	Yes	48	NEMA 1	279 x 330 x 108
OFSE-96	Interior	Splice/coupler	Yes	96	NEMA 1	279 x 330 x 152
OFSE-144E	Interior / exterior	Inline splice	None	144	NEMA 4X	472 x 422 x 262

Table 6 - Fibre Splice Enclosure - By Manufacturer

Type ID	Corning	Commscope		
OFSE-12		WBE-EMT-BK/1P		
OFSE-24		WBE-EMT-BK/2P		
OFSE-48		WBE-EMT-BK/4P		
OFSE-96		WBE-EMT-BK/8P		
OFSE-144E	SSED			

- .2 Communications Terminal Blocks, Terminations, Connectors and Patch Panels
 - .1 Copper paired cables termination block strips
 - .1 Termination of unshielded twisted pair copper multipair cables.
 - .2 Termination blocks as fixed wall or surface or rack mounted terminations of backbone or distribution cabling.
 - .3 Insulation displacement terminations for solid copper conductors between 24 AWG – 20 AWG.
 - .4 Termination of shielded twisted pair copper multipair cables with grounding bar.
 - .5 Termination strips or wafers panel mounted in groups of fifty through three hundred terminations in increments of fifty.
 - .6 Strips in industry format “110” type or “BIX” type.
 - .7 Flat wall mount panels for support of multiple BIX wafers; panels in multiples of 250 or 300 terminations; cable dressing spacers between adjacent panels.
 - .8 Flat wall mount support for single or multiple 110 type strips.

- .9 Match performance of termination block to performance of cable being terminated.

Table 7 - Termination Block Strips - By Properties

Type ID	U/S	Category	Form	Pin	Ground
B11	U/UTP	1	110	50	
B12	U/UTP	3	110	50	
B13	U/UTP	5e	110	50	
B14	U/UTP	6	110	50	
B15	U/UTP	6A	110	50	
B21	U/UTP	1	BIX	50	
B22	U/UTP	3	BIX	50	
B23	U/UTP	5e	BIX	50	
B24	U/UTP	6	BIX	50	
B25	U/UTP	6A	BIX	50	
B31	S/UTP	1	110	50	Ground
B32	S/UTP	3	110	50	Ground
B33	S/UTP	5e	110	50	Ground
B34	S/UTP	6	110	50	Ground
B35	S/UTP	6A	110	50	Ground
B41	S/UTP	1	BIX	50	Ground
B42	S/UTP	3	BIX	50	Ground
B43	S/UTP	5e	BIX	50	Ground
B44	S/UTP	6	BIX	50	Ground
B45	S/UTP	6A	BIX	50	Ground

Table 8 - Termination Block Strips - By Manufacturer

	Belden	Commscope	Panduit		
B23					
B43					

Table 9 - Vacant (Non-populated) Communications Patch Panel

Type ID	RU	Capacity	F/A/R/W	SNAP IN	Grounding	
V12W1M	1	12	Wall	Module		
V12W6F	1	12	Wall	Faceplate-4		
V24F1	1	24	Flat	Module		
V24F1S	1	24	Flat	Module	Yes	
V24A1	1	24	Angled	Module		
V24A1S	1	24	Angled	Module	Yes	
V24R1	1	24	Recessed	Module		
V24R1S	1	24	Recessed	Module	Yes	
V48F1	2	48	Flat	Module		
V48F1S	2	48	Flat	Module	Yes	
V48A1	2	48	Angled	Module		
V48A1S	2	48	Angled	Module	Yes	
V48R1	2	48	Recessed	Module		
V48R1S	2	48	Recessed	Module	Yes	

V72F1	2	72	Flat	Module		
V72F1S	2	72	Flat	Module	Yes	
V72A1	2	72	Angled	Module		
V72A1S	2	72	Angled	Module	Yes	
V72R1	2	72	Recessed	Module		
V72R1S	2	72	Recessed	Module	Yes	
V24F4	1	24	Flat	Faceplate-4		
V24A4	1	24	Angled	Faceplate-4		
V24R4	1	24	Recessed	Faceplate-4		
V24F6	1	24	Flat	Faceplate-6		
V24A6	1	24	Angled	Faceplate-6		
V24R6	1	24	Recessed	Faceplate-6		
V48F4	2	48	Flat	Faceplate-4		
V48A4	2	48	Angled	Faceplate-4		
V48R4	2	48	Recessed	Faceplate-4		
V48F6	2	48	Flat	Faceplate-6		
V48A6	2	48	Angled	Faceplate-6		
V48R6	2	48	Recessed	Faceplate-6		

Table 10 - Vacant Patch Panel - By Manufacturer

Type ID					Panduit	
V12W1M						
V12W6F						
V24F1						
V24F1S						
V24A1						
V24A1S						
V24R1						
V24R1S						
V48F1						
V48F1S						
V48A1						
V48A1S						
V48R1						
V48R1S						
V72F1						
V72F1S						
V72A1						
V72A1S						
V72R1						
V72R1S						

V24F4					CPP24WBLY	
V24A4						
V24R4						
V24F6						
V24A6						
V24R6						
V48F4					CPP48WBLY	
V48A4						
V48R4						
V48F6						
V48A6						
V48R6						

.2 UTP 4-pair cable termination rack mount patch panels

- .1 Patch panels consisting of multiple single position 8P8C (RJ45) jacks or six-position modules of preformed 8P8C (RJ45) jacks, 22-26 AWG IDC connection block for solid or stranded wire to TIA 568B pinning, panel format with lands for individual port identification labels and panel identification label, forming panels of twelve, twenty-four, or forty-eight or seventy-two ports per panel. Cable retention bar and back-of-panel cable support and strain relief bracket to secure cable perpendicular to panel; colour: Black.

.2 Products

- .1 Products of the type ID indicated on the Contract Drawings and manufactured by approved manufacturer listed in the table following.

Table 11 - Termination Patch Panels - UTP 8P8C - By Properties

Type ID	Category	U/F/S	Port	RU			
P25	6A	UTP	24	1	Flat		

Table 12 - Termination Patch Panels - UTP 8P8C - By Manufacturer

Type ID	Panduit	Commscope	Tyco	Belden		
P25	DP246X88TGY			AX103254		

.3 UTP 25 pair cable termination rack mount patch panels

- .1 Patch panels consisting of twelve or twenty-four single position 8P2C RJ45 jacks pins 4-5 active RJ21 connector panel format with lands for individual port identification labels and panel identification label, colour: Black.

.2 Products

- .1 Provide Products of the type ID indicated on the Contract Drawings and manufactured by approved manufacturer listed in the table following.

Table 13 - Termination Patch Panels UTP 8P2C - By Properties

Type ID	Category	U/F/S	Port	RU	Face	Term
V11	1	UTP	12	1	Flat	RJ21
V21	1	UTP	24	1	Flat	RJ21

Table 14 - Termination Patch Panels UTP 8P2C - By Manufacturer

Type ID	Panduit				
V11					
V21	VP24382TV25Y				

.4 Copper medium jacks

.1 UTP and STP 2-pair 4P4C jack – non-keyed

- .1 Modular plastic formed telecommunications four-pin four-conductor outlet jack non-keyed, comply with ANSI/TIA/EIA 568 specification and CSA T529, compatible with flush- and surface-mount telecommunications outlet faceplates, modular furniture faceplate adapters, utility service pole adapter plates, floor box adapter plates, conduit poke-through adapter plates for termination of unshielded and shielded twisted pair cables.

.2 Colour: Black or as indicated on the drawings.

Table 15 - Termination Jacks UTP 4P4C - By Properties

Type ID	Category	Pair	Form
J11	1	2	UTP
J12	3	2	UTP
J13	5e	2	UTP
J14	6	2	UTP
J15	6A	2	UTP

Table 16 - Termination Jacks STP 4P4C - By Properties

Type ID	Category	Pair	Form
J21	1	2	S/UTP
J22	3	2	S/UTP
J23	5e	2	S/UTP
J24	6	2	S/UTP
J25	6A	2	S/UTP

.3 Products

- .1 Provide Products of the type ID indicated on the Contract Drawings and manufactured by approved manufacturer listed in the table following.

Table 17 - Termination Jacks 4P4C - By Manufacturer

Type ID	Belden	Panduit	
J14			
J15			

.2 UTP 4-Pair 8P8C (RJ45) modular jack – non-keyed

- .1 Modular plastic formed telecommunications eight-pin eight-conductor ("RJ45") outlet jack non-keyed, comply with ANSI/TIA/EIA 568 specification and CSA T529, compatible with flush- and surface-mount telecommunications outlet faceplates, modular furniture faceplate adapters, utility service pole adapter plates, floor box adapter plates, conduit poke-through adapter

plates, rack mount modular patch panels, with colour coded removable identification icon, built in modular cable strain relief for termination for shielded and unshielded twisted pair cables.

- .2 Colour: Black or as indicated on the drawings.

Table 18 - Termination Jacks 8P8C - By Properties

Type ID	Category	Pair	Form
J51	1	4	UTP
J52	3	4	UTP
J53	5e	4	UTP
J54	6	4	UTP
J55	6A	4	UTP

- .3 Products

- .1 Provide Products of the type ID indicated on the Contract Drawings and manufactured by approved manufacturer listed in the table following.

Table 19 - Termination Jacks 8P8C - By Manufacturer

Type ID	Belden	Panduit	
J54			
J64			

- .3 UTP 4-pair 8P8C (RJ45) modular jack – non-keyed – keystone format

- .1 Modular plastic formed telecommunications eight-pin eight-conductor ("RJ45") outlet keystone jack non-keyed, comply with ANSI/TIA/EIA 568 specification and CSA T529, compatible with flush- and surface-mount telecommunications outlet faceplates, modular furniture faceplate adapters, utility service pole adapter plates, floor box adapter plates, conduit poke-through adapter plates, rack mount modular patch panels, with colour coded removable identification icon, for use with keystone jack.

- .2 Colour: Black or as indicated on the drawings.

Table 20 - Termination Jacks 8P8C Keystone - By Properties

Type ID	Category	Pair	Form
J81	1	4	UTP
J82	3	4	UTP
J83	5e	3	UTP
J84	6	4	UTP
J85	6A	4	UTP

- .3 Products

- .1 Provide Products of the type ID indicated on the Contract Drawings and manufactured by approved manufacturer listed in the table following.

- .2 Comply with 271000.1

- .5 Optical fibre termination connectors

- .1 Field installed discrete connectors as terminations for optical fibre strands in single or multi-stranded cable assemblies

- .1 For installation on fibres of 250 micron, 900 micron tight buffer, 2 mm jacketed, 3 mm jacketed

- .2 Type LC, LC duplex, SC, SC duplex, and ST
- .3 Multimode OM1, OM2, OM3, OM4 performance: Insertion loss maximum 0.5 dB, typical 0.2 dB, return loss minimum 25 dB
- .4 Single mode OS1, OS2 connectors
 - .1 Finished to UPC (Ultra Physical Contact) with insertion loss maximum 0.5 dB, typical 0.3 dB, return loss minimum 50 dB
 - .2 Finished to APC (Angled Physical Contact) with insertion loss maximum 0.5 dB, typical 0.3 dB, return loss minimum 60 dB
- .2 Field fusion splice connector pigtail assemblies as terminations of single, dual and multi-stranded optical fibre cable assemblies
 - .1 For installation on fibres of 250 micron, 900 micron tight buffer, 2 mm jacketed, 3 mm jacketed
 - .2 Type LC, LC duplex, SC, SC duplex, and ST
 - .3 Multimode OM1, OM2, OM3, OM4 performance: Insertion loss maximum 0.5 dB, typical 0.2 dB, return loss minimum 25 dB
 - .4 Single mode OS1, OS2 connectors
 - .1 Finished to UPC (Ultra Physical Contact) with insertion loss maximum 0.5 dB, typical 0.3 dB, return loss minimum 50 dB
 - .2 Finished to APC (Angled Physical Contact) with insertion loss maximum 0.5 dB, typical 0.3 dB, return loss minimum 60 dB
 - .5 Single pigtails
 - .1 900 micron tight buffered
 - .2 2 mm and 3 mm zip interconnect cable
 - .3 LC terminated in kit of 12 TIA colour coded
 - .6 Duplex pigtail
 - .1 900 micron tight buffered
 - .2 2 mm and 3 mm zip interconnect cable
 - .7 Twelve-fibre ribbon pigtails formed and made ready to mass fusion terminate twelve strand ribbon
 - .1 Jacketed or not jacketed
 - .2 MPO terminated 250 micron loose
 - .3 LC terminated in kit of twelve TIA colour coded
 - .8 Products
 - .1 Provide Products of the type ID indicated on the Contract Drawings and manufactured by approved manufacturer listed in the table following.
 - .2 Comply with 271000.1

Table 21 - Optical Fibre Terminations - Multimode

Type	Strand	Perform	Mech/Fusion
TM011M-xx	1	OM1	M
TM012M-xx	1	OM2	M
TM013M-xx	1	OM3	M
TM014M-xx	1	OM4	M
TM011F-xx	1	OM1	F
TM012F-xx	1	OM2	F
TM013F-xx	1	OM3	F
TM014F-xx	1	OM4	F
TM121M-xx	12	OM1	M
TM122M-xx	12	OM2	M
TM123M-xx	12	OM3	M
TM124M-xx	12	OM4	M
TM121F-xx	12	OM1	F
TM122F-xx	12	OM2	F
TM123F-xx	12	OM3	F
TM124F-xx	12	OM4	F

Table 22 - Optical Fibre Terminations - Single Mode

Type	Strand	Perform	Mech/Fusion
TS011M-XX	1	OS1	M
TS012M-XX	1	OS2	M
TS011F-XX	1	OS1	F
TS012F-XX	1	OS2	F
TS121M-XX	12	OS1	M
TS122M-XX	12	OS2	M
TS121F-XX	12	OS1	F
TS122F-XX	12	OS2	F

Table 23 - Optical Fibre Termination Type Modifier

-xx	LC	SC	MPO	Duplex	AP
01	Yes				
02		Yes			
04			Yes		
09	Yes			Yes	
10		Yes		Yes	
11	Yes				Yes
24		Yes			Yes
26	Yes			Yes	Yes

- .1 Optical Fibre connector adapter mounting panel
 - .1 6-port, 12 port, LC duplex mounting panel
 - .2 Provide Products of the type ID indicated on the Contract Drawings and manufactured by approved manufacturer listed in the table following.
 - .3 Manufacturer
 - .1 Corning:

Table 24 - Optical Fibre Termination Mounting Adapter - By Feature

Type ID	Description	Fibre	Class	Face	Rear
OFMA-6-LD	6-port	12 strand	OM4	LC Duplex	LC Duplex

Table 25 - Optical Fibre Termination Mounting Adapter - By Manufacturer

Type ID	Corning			
OFMA-6-LD	CCH-CP12-E4			

.2 Optical fibre termination cassette

.1 Not specified

.3 Communications Cable Management and Ladder Rack

.1 Rack mounted cable management devices and accessories. High capacity cable managers for horizontal mounting in 483 mm racks, cabinets or frames, complete with removable dual hinged covers, cable management fingers, front and optional rear pathways, suitable for cables of diameter 8.0 mm, manufactured of plastic with optional removable covers of metal or plastic, channel depth greater than 150 mm, colour black

.2 Cable managers in modular units of one, two, three or four rack units.

Table 26 - Rack Mount Cable Management - By Properties

Type ID	RU	channel
M11	1	Front
M12	2	Front
M13	3	Front
M14	4	Front
M31	1	Front/rear
M32	2	Front/rear
M33	3	Front/rear
M44	4	Front/rear

.1 Product

.1 Provide cable management accessories of type ID as shown on the Contract Drawings and of same manufacturer as communications terminations patch panels.

Table 27 - Rack Mount Cable Management - By Manufacturer

Type ID	Belden	Panduit	Commscope
M11			
M12		NMF1	
M13			
M14		NMF4	
M31			
M32			
M33			
M44			

.3 Overhead ladder racking cable runway and accessories

.1 Cable runway

- .1 UL classified 38.1 deep tubular side stringer, 25.4 x 12.7 rails, welded, spaced at 230, steel, 300 mm wide.
- .2 Length 2959 mm.
- .3 Radius bend connecting section ninety degrees vertical, external and internal.
- .4 Radius e-bend section ninety degrees horizontal.
- .5 Radius cable drop.
- .6 Radius corner bracket.
- .7 Colour: gold over zinc.
- .2 Cable runway accessories
 - .1 Support "C" clips, couplers, to match and by same manufacturer as runway.
- .3 Products
 - .1 Chatsworth Products: 11275-012
 - .2 Approved sole equivalent

Table 28 - Ladder Racking Runway - By Manufacturer

	CPI	Cooper	Middle Atlantic		
Tubular stringer	11275-012	SB17T			
Solid stringer					

- .4 Racking accessories
 - .1 Front of rack mounted shelving, 380 mm deep, ventilated, support capacity 23 kg one or two rack units high.
 - .2 Products
 - .1 Same manufacture as for equipment cabinets
- .4 Rack Mounted Power Distribution Strip
 - .1 General
 - .1 Power distribution strips fully compatible with equipment cabinets and racking
 - .2 Power strips with flexible connection whips terminated with lockable twist lock plugs of length sufficient to reach power distribution outlets
 - .2 Monitoring
 - .1 Provide distribution strips with integrated power monitoring where indicated
 - .2 Metered units with digital RMS current monitoring, local display, with SNMP reporting and alarm indication
 - .3 Power strips formats
 - .1 30A 230V L6-30P; 42 x IEC C13, Metered

Table 29 - Rack Mounted Power Strips - By Properties

TYPE ID	Voltage	Amp phas e	KW	Branc h Recept	Type	Branc h Recept	Typ e	Feed Plug	Met e r
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PDI230SM	230	30	5.5	42	IEC C13			L6-30	Yes
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.4 Products

- .1 Provide power distribution strips of type indicated by listed manufacturers

Table 30 - Rack Mounted Power Strips - By Manufacturer

TYPE ID	Server technology	Geist	APCC	Liebert	
PDI230SM				MPH2	

.5 Communications Copper Backbone Cabling

.1 General

- .1 Provide CMP rated Backbone cables except where expressly indicated otherwise.
- .2 Provide CMP or CMR rated backbone cables where no portion of the entire length of cable is exposed to air contact within an air supply or air return plenum or air within an enclosed space.
- .3 Provide CMP or CMR rated backbone cables where cables are contained within electrical communications utility rooms possessing a fire rating of one-hour or continuous electrical raceway or combination.
- .4 Avoid using cables outdoors if characterized for inside use
- .5 Comply with 271000.1
- .6 Provide cable of the type ID indicated on the Contract Drawings possessing the attributes and characteristics indicated by the table below

.2 Copper backbone cable - Inside

- .1 Multi-pair powersum 24 AWG solid annealed copper twisted pair 100 Ω characteristic impedance cable per ANSI/EIA/TIA 568 in identified binder groups, formed as compact core, covered by dual polyolefin/polyvinyl chloride insulation and an Alplast sheath, cable jacket

.3 Apply the following definitions to the terms appearing in the table:

- .1 Type ID: The cable designation as it appears in the Contract Documents
- .2 Pair: The number of twisted pairs of conductors in a common sheath
- .3 Form:
 - .1 U designates unshielded cable;
 - .2 S designates cable protected by an overall electromagnetic shield;
 - .3 F designates cable or individual pairs protected by individual foil electromagnetic shielding.
- .4 Cat: The performance of the cable further defined within TIA-568 as the performance category of cable
- .5 Outdoor: Indicates the cable construction is suitable for use outdoors
- .6 Armour: The cable is protected by an outer protective armoured casing
- .7 Blocked: The cable is protected against ingress of water
- .8 Bury: The cable is suitable for direct burial applications

.4 Manufacturer

- .1 Use products where specifically identified by Manufacturer in the tables below

Table 31- Unshielded Copper Backbone Cabling – By Properties

Type ID	Pair	Form	Cat	Outdoor	Armour	Blocked	Bury
C52	25	U/UTP	3	No	No	No	No

Table 32 - Unshielded Copper Backbone Cabling – By Manufacturer

Type ID	Belden	Panduit	Systemax	General Cable
C52	DPLN25			2131505

.6 Communications Optical Fibre Backbone Cabling

.1 General

- .1 Cable of type indicated Contract Drawings possessing characteristics identified in tables below.

.2 Manufacturer

- .1 Use products identified by Manufacturer in the tables below
.2 Use products manufactured by Corning to exclusion of all others.

.3 Fire rating

- .1 Cable jacket rated OFNP or OFCP.
.2 Cable jacket rated OFNR or OFCR or OFNG or OFCG where permitted by local electrical and building safety codes, unless specifically excluded in this contract.

.4 Comply with Section 27 10 00.1

Table 33 - Multimode Fibre, Indoor/Outdoor (Service) by Strand Count, Performance

Type ID	Strand	Env	Purpose	Construction	Armor	dia		Core	Perf	Term
MS1241	12	In/out	Backbone	Tight buffer	Yes	250		50	OM4	

Table 34 - Multimode (Service) Type Cable - By Manufacturer

Type ID	Belden	Corning	Panduit	
MS1241		012T8P-31190-A3		

.7 Communications Optical Fibre Trunk cabling: modular terminated

.1 General

- .1 Ribbon cable assemblies of twelve or twenty-four strand factory made consisting of multi-strand cable factory terminated with multi-fibre push-on pull-off (MPO) connecto(s) at two ends
.2 Pigtail assemblies, same as ribbon assembly with one end not terminated
.3 LC Duplex break out cables, same as Ribbon assemblies with near end MPO termination, far end LC Duplex

.2 Cable

- .1 Ribbon cable
.1 Jacket diameter, nominally 2 mm, 3 mm
.2 Performance type OM3, OM4, OM5, OS2

- .3 12 or 24 Strand
- .2 Fibre cable assembly with modular connector terminations of type ID indicated in table below
- .3 Terminations
 - .1 MPO style
 - .2 Polished to PC, UPC, APC.
 - .3 Multi strand with Polarity Maintenance
 - .4 Pinned (Male) or Not pinned (Female) and Gender field adjustable
 - .5 Not termination (pigtail)
 - .6 LC Duplex termination
 - .7 Fibre cable assembly termination of type modifier indicated in tables below
- .4 Polarity Maintenance
 - .1 Array trunk cabling using Method B polarity maintenance. Comply with TIA 568.0
 - .2 Multimode cable using Type B terminations with UPC polish
 - .1 Couplers using Type B (key up/Key up)
 - .2 Cassettes using Method B (Key up)

Table 35 - Optical Fibre Trunk Cables: Modular Connector Termination

Type ID+MODIFIER	Strand	Near Connector	Far Connector	Fibre Type
MM1204-pppp	12	MPO	MPO	OM4
MN1204-pppp	12	MPO	None	OM4
ML1204-pppp	12	MPO	LC-Duplex	OM4
ML1202-pppp	12	MPO	LC-Duplex	OS2

Table 36 - Optical Fibre Trunk Cables Termination Type Modifier

-pppp	Near Key	Near gender	Far Key	Far gender	Polish
-11	Key UP	Pinned	None	None	UPC
-11-11	Key UP	Pinned	Key UP	Pinned	UPC

- .8 Audio-Visual Communications Horizontal Cabling
 - .1 HDMI extension cabling
 - .1 Cables of length less than 10 m, Factory made cable preterminated HDMI connectors on multi conductor copper cable.
 - .2 Cables of length greater than 10 m, Factory made cable preterminated with active HDMI transducers on optical fibre cable assembly.
- .9 Paging Communications Horizontal Cabling
 - .1 Comply with manufacturer's installation instructions for 70 V PA distribution.
 - .2 2-#12 copper 300V insulated in flexible metallic armour.

.10 Communications Horizontal Distribution Cabling

.1 Cable

- .1 Four-pair twisted copper 24-23 AWG cables of characteristic impedance 100Ω; Fire rating to CMR (FT4) or CMP (FT6); performance to category class defined by TIA 568; additional EMI protection by conductive foil or metallic shield.
- .2 Provide cables of type ID possessing characteristics drawn from the table below
 - .1 Outdoor cables
 - .2 Water blocked cables
 - .3 Armoured
 - .4 Direct bury
 - .5 Other
 - .1 HT: High tensile strength
- .3 Category cables characterized to bandwidths
 - .1 Category 6A: 625 MHz
- .4 Colour
 - .1 Select cable from tables below to qualify performance criteria.
 - .2 Select cable with same performance criteria and with jacket of colour to match requirements indicated in section on Administration and Identification.
 - .3 Where not indicated otherwise, select the following colours
 - .1 CAT-6A general purpose data cabling: BLUE
- .5 Products
 - .1 Provide Products of type ID indicated on the Contract Drawing and by the indicated manufacturer.
 - .2 Provide Products same or better than Products identified below.
- .6 Comply with Section 27 10 00.1A

Table 37 - Copper Horizontal Distribution Cabling - By Properties

Type ID	Form	Cat	EMI	Placement	Waterblock	Armour	Bury	other
C15	U/UTP	6A	No Shield	Indoor	No	No	No	

Table 38 - Copper Horizontal Distribution Cabling - By Manufacturer

Type ID	Amp	Belden	Commscope	Leviton	Panduit	GeneralCable
C15		10GX			PUP6X04BU-	7141819

.2 Modular jacks

- .1 Modular jacks mounted as a component of patch panels located in telecommunications equipment rooms:
 - .1 Comply with section "communications terminal blocks and patch panels"

- .2 Modular jacks mounted on work area faceplate
 - .1 Comply with section “communications faceplates and connectors”
 - .3 Comply with 271000.1A
 - .11 Communications Faceplates and Connectors (Jacks)
 - .1 Wall faceplates
 - .1 Comply with 271000.1
 - .2 Plastic faceplate, as cover to single or multi position electrical conduit outlet box, with capacity of one, two, three, four, six, ten outlets with flat or sloping face, to suit snap-in jack.
 - .1 Colour to match electrical faceplate, or else white if not specified.
 - .2 Blank cover plate to match.
 - .3 Manufacturer same as snap in jack.
 - .3 Stainless steel faceplate, as cover to single or multi position electrical conduit outlet box, with capacity of one, two, three, four, six, ten outlets with flat or sloping face, to suit snap-in jack.
 - .1 Blank cover plate to match.
 - .2 Manufacturer same as snap in jack.
 - .4 Stainless steel faceplate, with two phone mounting lugs, as cover to single position electrical conduit outlet box, with capacity of one outlet with flat face, to suit single keystone snap-in jack.
 - .1 Blank cover plate to match.
 - .2 Manufacturer same as snap in jack.
 - .5 Plastic faceplate, as cover to single position electrical square faced decorator style conduit outlet box, with capacity of one, two, three, four outlets with flat or sloping face, to suit snap-in jack
 - .1 Blank cover plate to match.
 - .2 Manufacturer same as snap in jack.
 - .6 Comply with manufacturer specified for horizontal data cabling.
 - .2 Furniture adapter faceplates, system furniture adapters, modular furniture adapters
 - .1 Plastic faceplate, as snap in mounting plate for single position furniture mounting plate of capacity of one, two, three outlets with flat or sloping face, to suit snap-in jack.
 - .2 Plate form compatible with furniture snap in mounting bracket.
 - .1 Colour to match electrical faceplate, or else black if not specified.
 - .2 Manufacturer same as snap in jack.
 - .3 Same manufacturer as specified for modular and systems furniture.
 - .3 Modular jack
 - .1 Modular jacks, 8P8C, 6P6C, 4P4C suitable for mounting in all faceplates identified, including flush- and surface-mount telecommunications outlet
-

- faceplates, modular furniture faceplate adapters, utility service pole adapter plates, floor box adapter plates, conduit poke-through adapter plates, rack mount modular patch panels, compatible with shielded panel and shielded cable options.
- .2 Comply with Specification and manufacturer for modular jacks described in section “communications terminal blocks and patch panels”.
 - .3 Jacks with colour coded removable identification icon, and modular cable strain relief.
- .12 Communications Connecting Cords, Devices, and Adapters
- .1 Communications copper patch cords
 - .1 Factory manufactured and tested patch cords of stranded copper conductor 24 or 28 ga, Unshielded Twisted Pair (UTP), solid or stranded, construction terminated in factory installed RJ45 plugs, of category equal to category of horizontal distribution cabling, of manufacturer equal to manufacturer of horizontal distribution cabling, cords of various length, and colour; diameter 3.8 mm.
 - .2 Patch cord supplied complete with factory test report detailing at least NEXT and electrical length (m)
 - .3 Performance to ANSI/TIA/EIA-1096A, IEC 60603-7, UL1863, CSA C22.2, IEEE 802.3af, 802.3at, temperature range of -40 °C to 60 °C. Polycarbonate housing toUL94V.
 - .4 Manufacturer equal to manufacturer of copper distribution cabling.
 - .5 Provide products as indicated by Type ID on the construct drawings drawn from the table below.

Table 39 - Copper Patch Cords - By Performance

Type ID	Shield	Category	Cond	AWG	Jacket	Pinning	Length (m)
U5-ST24-B-R-210	UTP	5E	stranded	24	CMR	568-B	2.10

- .2 Communications optical fibre patch cords
 - .1 Factory manufactured and tested optical fibre patch cords, two-strand terminated duplex LC – duplex LC, cord diameter 1.6 mm, of various lengths and colours. Connectors of low connector insertion / withdrawal force, and high cable retention force; to TIA/EIA-568-c.3, TIA-604-10, ISO/IEC 1101.
 - .2 Factory manufactured and tested optical fibre patch cords, twelve-strand terminated MPO-MPO cord diameter 3 mm, of various lengths and colours. Connectors of low connector insertion / withdrawal force, and high cable retention force; connectors field modified to be male/female, key-up/key down. TIA/EIA-568-c.1, TIA-604-5, ISO/IEC 1101.
 - .3 Performance to OM3, OM4, OS1, or OS2 equal to performance of fixed link cabling.
 - .4 Manufacturer equal to manufacturer of optical fibre distribution or backbone cabling.
- 3 Execution
- 3.1 **PREPARATION**

- .1 Protect cabling during installation against damage caused by later construction or by activities by others.
 - .2 In areas exposed to welding, protect cabling against damage due to weld fragments.
- 3.2 **INSTALLATION**
- .1 Communications Equipment Room Fittings
 - .1 Communications terminal blocks and patch panels
 - .1 Install patch panels in racking.
 - .2 Install jacks and connectors in panels.
 - .3 Mount wall mounted components on walls as indicated following manufacturer's recommendations.
 - .4 Protection
 - .1 Install protection modules.
 - .2 Install protection devices on exposed copper communication cables, following manufacturer's recommendations. Bond protection grounding terminal to building ground or electrical safety ground. Do not bond to telecommunications bond.
 - .2 Equipment enclosures
 - .1 Install cabinets, racks, and enclosures. Adjust location on site to align with building, fixtures, flooring. Relocate any cabinet, rack, frame or enclosure within the same room by a horizontal distance of up to 3 m from the location shown without adjustment to Contract Price.
 - .2 Install power distribution strips in cabinets.
 - .3 Communications cable management and ladder rack
 - .1 Suspend overhead cable runway at spacing of supports of 1.5 m or less; use only manufactured accessories; avoid the use of trapeze type supports; finish exposed cut ends with end caps; finish exposed rods with acorn nuts; paint all damaged areas with matching paint.
 - .2 Install cable management accessories; follow manufacturer's recommendations.
 - .2 Communications Cabling
 - .1 General
 - .1 Cables and cable pathways run parallel or perpendicular to building lines.
 - .2 Avoid scraping, denting, crushing, twisting, kinking or otherwise damaging cables before, during, or after installation. Contractor to replace damaged cables without additional compensation.
 - .3 Install all cables in accordance with manufacturer's specifications ensuring that proper installation techniques are observed and that the cable maximum pull-force and minimum bend radius specifications are adhered to.
 - .4 Utilize all indicated and available cable pathways such as slots, sleeves, conduits, cable trays, ducts, raceways and furniture system channels except where otherwise noted to route cable vertically and horizontally through the building. Exercise caution when pulling cables in such
-

- pathways to avoid damage to any existing cables and follow manufacturer's maximum pull-force and minimum bend radii.
- .5 Where cables are exposed to risk of being damaged by sharp edges of furniture, cabletray, raceway, etc., protect cables by feeding them through a length of flexible plastic conduit.
 - .6 Neatly bundle, secure and wrap all cables. Use only flat, soft hook-and-loop fastening tape. Ensure cable wraps do not deform the cable jacket.
 - .7 Where cables are terminated on a patch panel, bundle and dress cables in groups of twelve or twenty-four, each group consisting of cables from a single twelve or twenty-four port patch panel.
 - .8 Where cables are terminated on a cross-connect field, bundle and dress cables in groups of twelve or twenty-four, each group consisting of cables from a single cross-connect panel.
 - .9 Do not maintain bundles for distances greater than 1 m in cable trays.
 - .10 Maintain clearances as indicated in Section 27 05 00.
 - .11 Place cable only in conduits and cable tray and other designated cabling pathways. Do not place cable in crevices, cracks or other gaps in the building infrastructure not expressly intended for cabling. Do not run cables on the outside of conduits or piping or building supports or anything not intended expressly for communications cables. Use only protected cable pathways such as formed slots, formed sleeves, conduits, cable trays, ducts, raceways and furniture system channels.
 - .12 Avoid scraping, denting, crushing, twisting, kinking or otherwise damaging cables before, during, or after installation. Replace damaged cables without cost to the Contract.
 - .13 Pull cables in a continuous run. Do not splice horizontal cables.
 - .14 Install cables in accordance with manufacturer's specifications. Ensure proper installation techniques are observed and cable maximum pull-force and minimum bend radius specifications are adhered to.
 - .15 Protect cables against risk of damage at edges of furniture, cable tray, raceway, etc. Install cable in flexible plastic conduit.
 - .16 Protect cable at pathway transitions by use of flexible plastic conduit or manufactured "waterfall" elements.
 - .17 Neatly bundle and secure cables. Use light pressure soft wraps.
 - .18 Bundle and dress cables in groups of twelve or twenty-four, at patch panels and within cabinets. Dress cables neatly and orderly within cabinets. Follow manufacturer's recommended practices to ensure performance compliance.
 - .19 Support cables within cabinets at rear of patch panel and at intervals of 450 mm.
 - .20 Support vertically placed cables by attaching to a support, firmly attached to the building fabric, at intervals of 600 mm.
 - .21 Separate voice and data cables. Separate copper and optical fibre cables.
 - .22 Maintain cable clearances as described in Section 27 05 00.
-

- .23 Do not maintain bundles for distances greater than 1 m in cable trays.
 - .24 Pass cables at backboard terminations from behind, through holes positioned in the center of the termination mount.
 - .25 Do not exceed manufacturer's recommended bending of cable. Maintain a radius of four times cable diameter or 25 mm for copper UTP or FTP or STP, whichever is the greater. Maintain a radius of ten times cable diameter or 30 mm for optical fibre cables.
 - .26 Do not untwist exposed pairs at terminations for more than 13 mm.
 - .27 Bond to ground all metallic cable strength members and metallic sheaths to manufacturer's specifications.
 - .2 Identification
 - .1 Comply with identification instructions described in the Contract drawings or Specification.
 - .2 Apply channel identification labels at each end of cable, on faceplates, faceplate outlets, patch panel outlets, and any point of cable termination.
 - .3 Copper backbone cabling
 - .1 Pull all UTP cables in a continuous run. Cable splices will not be accepted.
 - .2 Where voice and data cables are separately identified on the Contract Drawings, separate voice and data cable into distinct bundles.
 - .3 For cables being terminated on a backboard mounted cross-connect field, pass all cables behind backboard in bundles and pass them through holes positioned in the centre of the termination mount.
 - .4 For UTP cables, maintain a minimum bending radius of four times cable diameter or 25 mm whichever is the greater.
 - .5 Use vertical pipe split mesh grips to support the weight of the cable at the top of a vertical cable rise of 4 m or more.
 - .6 Use a minimum of five cable ties per floor to prevent side-to-side movement of the cable.
 - .7 Neatly bundle, wrap, secure and route all backbone cables.
 - .8 Separate backbone copper data cables, backbone copper voice cables and backbone fibre optic cables into separate bundles.
 - .9 Secure cable bundles to vertical and horizontal supports and neatly fasten to plywood backboards, cable tray or termination racks and cabinets.
 - .10 Exercise caution when pulling cables in pathways to avoid damage to any existing cabling and ensuring that the cable manufacturer's installation procedure is followed.
 - .11 Inform Consultant immediately of any backbone cable runs exceeding 800 m for UTP cable, 2000 m for multimode fibre and 3000 m for single-mode fibre.
 - .4 Optical fibre backbone cabling
 - .1 Use fibre fan out kit at transition from loose tube to tight buffer.
 - .2 Apply shrink wrap to prevent gel leakage.
-

- .3 Pull all optical fibre cables in a continuous run. Fibre splices will not be accepted except as a termination method.
 - .4 Follow proper installation and termination practices for optical fibre cabling. Do not kink or exceed manufacturer's restrictions on the optical fibre cable minimum bend radius.
 - .5 Maintain a minimum bending radius of ten times cable diameter or 30 mm, whichever is larger.
 - .6 Splicing of fibre cables
 - .1 Splices, except those expressly for the purpose of terminating the optical fibre strands and where expressly called for on the Contract Drawings, will not be accepted except by express and written approval by Consultant.
 - .2 Splicing of the cables is permitted only in designated junction boxes, manholes, buildings and in the fibre patch panels.
 - .3 House splices in manholes, junction boxes and the remote buildings in an outdoor splice enclosure.
 - .4 House all splices in the telecommunication closets in splice trays located in or close to the fibre patch panels.
 - .5 Splice fibres using quality fusion type splicing equipment. Splicing equipment is subject to approval by the Consultant. Provide the Consultant with Specification details of the splicing equipment prior to commencing splicing.
 - .6 Remake all splices with a forward transmission loss in excess of 0.3 dB, at no cost to the Contract.
 - .7 Replace the cable or remake at no cost to the Contract, splices in any one link where the mean splice loss exceeds 0.2 dB.
 - .8 Arrange splices neatly in the support enclosure and protect with a suitable splice protector.
 - .9 Splice and terminate all fibres including spares to provide end to end links.
 - .10 Splice and connect individual fibres so that a constant identification scheme of the fibres is maintained throughout the system.
 - .11 Label all fibres in the splice tray with permanent vinyl markers. Label cables according to the identification plan as shown on the Contract Drawings.
 - .5 Coaxial cable backbone cabling
 - .1 Pull all coaxial cables in a continuous run. Splices not accepted.
 - .2 Follow manufacturer's installation instructions. Do not kink or exceed manufacturer's restrictions on the cable minimum bend radius.
 - .3 Allow sufficient spare cable for working allowance at each termination.
 - .3 Audio-Visual Communications Horizontal Cabling
 - .1 Comply with manufacturer's installation instructions.
-

- .4 Paging Communications Horizontal Cabling
 - .1 Comply with manufacturer's installation instructions.
 - .2 Comply with Division 26
 - .5 Antennas Communications Horizontal Cabling
 - .1 Comply with manufacturer's installation instructions.
 - .6 Data Communications Horizontal Distribution Cabling
 - .1 Cabling
 - .1 Inform Consultant immediately and prior to installation of cable of any horizontal cable pathway routes exceeding 90 m in length.
 - .2 Do not strap cables to, or lay cables on, any length of conduit, pipe, ventilation duct or other building element not expressly installed for the purpose of cable support.
 - .3 When determining a cable routing pathway, give priority to air handling ducts, fire sprinkler pipes and electrical conduits.
 - .4 Except for cables expressly indicated as SPARE, terminate all pairs of UTP cable and all strands of fibre optic cable at both ends.
 - .5 Terminate all pairs of spare UTP cable in telecommunication closet and store workstation end in ceiling space by coiling neatly and suspending. Do not rest cables on ceilings or air handling ducts.
 - .6 Spare cables to be of sufficient length to permit reaching any point in the room to which they apply.
 - .7 Where practicable and where the maximum allowable cable length is not exceeded, provide 3 m of slack UTP cable and 3 m of slack optical fibre cable at the workstation end of each distribution cable. Neatly coil and store slack in cable tray.
 - .8 Where the telecommunications outlet is mounted on a wall box or floor box or system furniture, provide working slack allowance for UTP cable of 300 mm. Coil neatly and secure in the outlet box.
 - .9 Select least obstructed pathway through modular or system furniture. Where available, use eye-level pathways in preference to base-level pathways.
 - .2 Terminations
 - .1 Terminate cables at connectors in Work area and in telecommunications rooms.
 - .2 Terminate copper backbone cables at IDC blocks or patch panels as indicated on the Contract Drawings.
 - .3 Terminate optical fibre cables at patch panels or surface mount outlet assemblies as indicated on the Contract Drawings. Mount connectors or couplers or cassettes in the fibre mounting shelves or modular assemblies.
 - .4 Terminate coaxial cables at device using connectors prescribed by the device connection.
-

- .7 Communications Faceplates and Connectors (Jacks)
 - .1 Outlets
 - .1 Install blank cover plates for all unused or abandoned outlet boxes.
 - .2 Mounting heights
 - .1 Install telecommunications outlets at elevations indicated on the Contract Drawings; Measure elevations to centre line of outlet.
 - .2 Faceplates
 - .1 Install blank filler plates for all unused modular jack positions on faceplates.
- .8 Communications Connecting Cords, Devices, and Adapters
 - .1 Turn over patch cords to Owner.
- 3.3 **RE-INSTALLATION**
 - .1 General
 - .1 Where any part of the Work fails tests and that Work is to be built without physical discontinuity, remove the offending material and install new without increase in cost to the Contract.
 - .2 Where any part of the Work fails tests, repair the fault in a manner to prevent recurrence and re-test.
 - .3 Where any part of the Work fails tests and that Work is to be built without physical discontinuity, remove the offending material and install new without increase in cost to the Contract.
- 3.4 **FIELD QUALITY CONTROL**
 - .1 General
 - .1 Where any part of the Work fails tests, repair the fault in a manner to prevent recurrence and re-test.
 - .2 Test backbone cables before and after installation.
 - .3 Perform pre-installation testing of Products as detailed in Section 27 08 00.
- 3.5 **SITE TESTS, INSPECTION**
 - .1 Field Engineer Services
 - .1 Provide Field Engineer for inspection and certification of equipment during installation, testing and commissioning as required.
- 3.6 **MANUFACTURERS' FIELD SERVICES**
 - .1 Provide manufacturer's representatives to verify installation practices for each part of the Work as may be relevant to all components including wiring and terminations.
- 3.7 **ADJUSTING**
 - .1 Wireless Access Point Installation and Adjustment
 - .1 Adjust location of wireless access points and wireless access point assemblies by 10 m in any horizontal direction without additional cost to the Owner.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.
- .2 Comply with all sections of the Contract Documents.

1.2 **SPECIAL INSTRUCTIONS TO BIDDERS**

- .1 Attend one briefing session with Engineer and Owner's Representative to establish user population densities, user performance requirements and applications requiring wireless connectivity.

1.3 **SYSTEM DESCRIPTION**

- .1 Comply with scope of system described in the Contract Drawings.
 - .1 Installation of surface or suspended wireless access points at each location indicated on the Contract Drawings.
 - .2 Access point enclosure to comply with requirements of location.
 - .3 Installation of network connection patch cables.
 - .4 Onsite active survey executed by manufacturer's representative to assess.
- .2 Owner Supplied Equipment
 - .1 Access points furnished and configured by Owner. Performance parameters to Owner's Specification.
 - .2 Network switching and routing equipment for enterprise applications.
 - .3 Network switching and routing equipment for facility and building management related applications.
 - .4 VoIP routing equipment by Owner.
 - .5 Power over Ethernet midspan injection and end point power injection equipment.

1.4 **QUALITY ASSURANCE**

- .1 Where any part of the Work fails tests, repair the fault in a manner to prevent recurrence and re-test.
- .2 The Contractor shall provide a verification report to confirm data jacks and cables have been installed, terminated and tested.

1.5 **AREA CLASSIFICATION**

- .1 No area in the Work is classified as hazardous.

2 Products

2.1 **MANUFACTURERS**

.1 Wireless Access Points and Antenna

.1 Cisco

3 Execution

3.1 **WIRELESS ACCESS POINTS**

- .1 Commission access point manufacturer to perform active site survey to determine optimum set up and configuration of multiple access points. Coordinate with Owner for user population density and traffic predictions.
- .2 Comply with installation instructions provided by the manufacturer.
- .3 Provide mechanical supports to firmly support array.
- .4 Attach supports to building fabric.
- .5 In conjunction, cooperation with and witnessed by the Engineer, perform signal strength field measurements using instrumentation recognized and approved by the manufacturer to verify that better than 90% of randomly selected locations exceed the minimum signal level required for the application as indicated in the manufacturer's published reference material.
- .6 If fewer than 90% test successfully, repeat the test.
- .7 If fewer than 90% continue to test successfully, refer to the Engineer and manufacturer for recommended recourse.
- .8 Provide mounting arrangements and install access point for up to an additional 5% of the total number of wireless access points to compensate for areas of limited coverage.
- .9 Assist Owner to set in place Owner-supplied equipment including switches, routers, and wireless access points.
- .10 Configuration of same systems by Owner.

3.2 **INTERFACE WITH OTHER WORK**

- .1 Comply with the Contract Documents.
- .2 Bestow on the Owner the right to execute work on the site before Contract completion.
 - .1 Be governed by terms of this section in circumstances where the Owner is instrumental in providing or facilitating a communications network that is a necessary part of the facility operations and maintenance Building Management System or any other communications system that is necessary for the completion of the Work.
 - .2 Other communication systems will include networks to facilitate without limitation:
 - .1 CCTV and surveillance
 - .2 Intercom
 - .3 Telephone
 - .4 Access control
 - .5 Intrusion detection

- .3 Receive, uncrate, set in place and energize network devices furnished by the Owner that are required to facilitate a working Building Management System Ethernet network.
- .4 Coordinate with Owner's technician forces to provide access to equipment and equipment spaces and to enable the configuration of network switching, routing, server and data storage equipment.
- .5 Provide the Owner's technician forces necessary networking configuration parameters that describe building systems as required for the completion of a fully operational Building Management System.
- .6 Provide reasonable protection of the Owner-provided equipment against harm or loss caused by accident or negligence.
- .7 Coordinate with the Owner and establish mutually agreed dates on desired scheduling of delivery and set up of equipment.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.
- .2 Common work results as laid out in Section 27 05 00.

1.2 **MANUFACTURER'S ATTENDANCE**

- .1 Provide manufacturer's representatives to verify installation practices for each part of the Work as may be relevant to all components including wiring and terminations.

1.3 **FIELD INSPECTION**

- .1 Provide field Engineer for inspection and certification of equipment during installation, testing and commissioning as required.

1.4 **QUALITY ASSURANCE**

- .1 Where any part of the Work fails tests, repair the fault in a manner to prevent recurrence and re-test.
- .2 Where any part of the Work fails tests and that Work is to be built without physical discontinuity, remove the offending material and install new without increase in cost to the Contract.

1.5 **AREA CLASSIFICATION**

- .1 No area in the Work is classified as hazardous.
- .2 Refer to all related Drawings and Specifications in the Contract Documents.

1.6 **SYSTEM DESCRIPTION**

- .1 Voice communications system using network cabling for VoIP services.
 - .2 Telephone system using network cabling for baseband analog and/or TDM and/or POTS voice services.
 - .3 Operating in conjunction with horizontal distribution cabling indicated on Contract Drawings and in Division 27 Specification.
 - .4 System to performance specification set by Owner.
 - .1 Self contained rack mounted telephone switching unit.
 - .2 Switch to provide signal routing for extension-to-extension and extension-to-trunk. Trunk lines as required by system.
 - .3 System to operate with digital TDM desk sets and optionally configurable to VoIP desk sets on set by set basis.
 - .4 Self-contained back-up power supply to provide eight hours survival in event of loss of utility power.
 - .5 Revert to bypass mode after power supply exhausted.
-

- .6 Provision of two desk set units connected directly to POTS service.
 - .7 Desk sets and interconnecting cables supplied and installed by Owner.
 - .5 Emergency Telephone Systems
 - .1 Designated telephones connected to incoming carrier trunk services at demarcation point.
 - .2 Wall / desk mounted individual telephone set instruments directly connected to dedicated express inside wiring.
 - .3 Automatic ring down to programmed carrier assigned number.
 - .4 Wall and desk sets supplied and installed by Carrier (Bell Canada).
 - .6 Access to paging and zone selection from telephone key pad and from intercom system.
 - 1.7 **PAGING**
 - .1 Public paging system operating through speakers mounted within telephone desk set units.
 - .2 Distinctive tones created with following input:
 - .1 Request to enter push button at main entrance
 - .2 One hundred twenty second warning in advance of expiry of intrusion detection system set-back timer
 - .3 Sixty second warning in advance of expiry of intrusion detection system set-back timer
 - 1.8 **PRODUCT VENDORS**
 - .1 Manufacturer as specified by Owner.
 - 2 Products
 - 2.1 **TELEPHONE SWITCH**
 - .1 As specified by Owner.
 - .2 Manufacturer
 - .1 Representative Product: Nortel BCM50
 - 2.2 **TELEPHONE DESK SET**
 - .1 As specified by Owner.
 - .1 Representative Product: Nortel
 - 2.3 **EMERGENCY TELEPHONES**
 - .1 Indoor or outdoor industrial analog telephone with non-locking door. Cast aluminum enclosure, corrosion resistance powder coated faceplate, volume control polycarbonate handset and stainless steel hardware material. Provide pole mounting kit as required for the application.
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- .1 Acceptable Manufacturer: "ACT Series" (ACT-30 or ACT-40) by Guardian Telecom or approved equal.

3 Execution

3.1 **CARRIER SERVICES**

- .1 Cooperate with Owner and carrier to coordinate Specification and arrangement for installation of incoming trunk line carrier services.
- .2 Inform carrier of emergency telephone ring-down numbers as instructed by Owner.

3.2 **TELEPHONE SWITCH**

- .1 Set up and configuration by Owner.
- .2 Install and configure telephone switch to Owners' specification and satisfaction.

3.3 **TELEPHONE DESK SETS**

- .1 Set up and configuration by Owner.
- .2 Install and configure telephone desk sets to Owners' specification and satisfaction.

3.4 **EMERGENCY TELEPHONES**

- .1 Set up and configuration by Owner.
- .2 Install and configure telephone switch to Owners' specification and satisfaction.
- .3 Telephone to be connected within 15,000 ft. (~4,600 meters) of a main telephone switch in order to maintain voice quality.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

.1 Labour, Products, equipment and services necessary to complete the Work of this section.

.2 This section describes a portion of the Contract scope of Work. Refer to all related Drawings and Specifications in the Contract Documents for the full description of the Contract scope of Work.

1.2 **GENERAL REQUIREMENTS**

.1 Provide all components indicated on the Contract Drawings including but not limited to supports, bollards, conduits, raceways, device boxes, enclosures, cable, wires, connectors, equipment, controls, devices, controllers, master stations and substations, relays, interfaces, programming and whatever else in order to provide a completely installed and satisfactorily operating intercommunication system as indicated in the Contract Drawings.

.2 Include where applicable and without limitation, electronic switching systems, wiring, wiring conduit and raceways, cabling supports, terminal devices, terminal supporting enclosures, terminal supporting bollards, interfaces to and from other systems as further described and indicated by and in compliance with this Specification and the Contract Drawings.

.3 Confirm that the system specified herein has the capability to meet the design intent, or propose an alternative system, either fully or in part.

.4 Provide any other equipment, labour or material necessary to fulfill the functional and performance criteria of the system whether shown in the Specification or Contract Drawings or not.

1.3 **TERMS OF REFERENCE**

.1 Dimensions and Quantities

.1 Dimensions shown on Drawings are approximate. Verify dimensions by reference to Shop Drawings and field measurement.

.2 Quantities or lengths indicated in any of the Contract Documents are approximate only and are not to gauge or limit the Work.

.3 Install systems indicated as continuous on the Contract Drawings without break or interruption. Ensure electrical continuity between metallic components shown as connected.

.4 Make necessary changes to routing of cables and the like to accommodate structural, mechanical, electrical and architectural conditions. Coordinate with other trades and make allowance for conditions that will arise from work in progress under separate contract.

.2 Area Classification

.1 No area in the Work is classified as hazardous.

.3 Submissions

- .1 Submit Product data and Shop Drawings in accordance with the Contract Specification.
- .2 At time of tender submit a complete list of all components.
- .3 At time of tender submit a time schedule indicating significant milestones. Within five days of Contract Award submit a revised time schedule

.4 Manufacturer's Attendance

- .1 Provide manufacturer's representatives to verify installation practices for each part of the Work as may be relevant to all components including wiring and terminations.

.5 Field Inspection

- .1 Provide field Engineer for inspection and certification of equipment during installation, testing and commissioning as required.

.6 Quality Assurance

- .1 These Specifications supplement the Electrical and Electronic Manufacturers Association of Canada, Canadian Standards Association Standards, Electronic Industries Association, Telecommunications Industries Association standards and recommendations. Conditions of the EEMAC, CSA, EIA, TIA and ISO/IEC standards and recommendations apply unless superseded or modified by this Specification.
- .2 System compliant with FCC Part 15 Sub Part J approval as accredited by National Bureau of Standards for Emissions and Telecommunications Testing or by other approved and recognized authority.
- .3 Where requirements of the Specifications exceed referenced standards, the Specifications apply. Where standards differ between authorities, the most stringent applies.
- .4 Immediately bring to the attention of the Consultant any requirements of the Specifications that are substandard to referenced standards.
- .5 Avoid using equipment not acceptable to electrical inspection authorities.
- .6 Where any part of the Work fails tests, repair the fault in a manner to prevent recurrence and re-test.
- .7 Where any part of the Work fails tests and that Work is to be built without physical discontinuity, remove the offending material and install new without increase in cost to the Contract.

1.4 **SUBMITTALS**

- .1 Comply with submission procedures described in the Specifications Section 01 33 00.
 - .2 Comply with use and terms of use of Project Web.
-

.3 Shop Drawings

- .1 Submit Shop Drawings for Consultant's review of all component types prior to commencing use of said components. Avoid the use of components for which Shop Drawings have not been issued.
- .2 Include where applicable:
 - .1 Plan and front elevation of equipment layouts prior to assembling said equipment.
 - .2 Room plan and elevation layouts where different from Contract Drawings.
 - .3 Identification scheme prior to use of said component.
- .3 Submit functional and wiring diagrams for review showing all interconnections and equipment layouts within the systems and between systems before commencing applicable installation work.
- .4 Review all Shop Drawings before submitting to Consultant for review for clarity of print and clarity of identification of Products.
- .5 The review of the Shop Drawings by the Consultant or Owner's Representative does not relieve the Contractor of the responsibility to provide a complete and working system, based on the intent outlined in these documents.

.4 Operation and Maintenance Data

- .1 Submit Operations and Maintenance Manuals on completion of the Work.
- .2 Operating and Maintenance Manuals
 - .1 Assemble and submit Maintenance Manuals in accordance with the Contract Specification.
 - .2 Prepare and supply not fewer than six bound copies of a manual incorporating:
 - .1 System block diagrams and functional schematics.
 - .2 Schematic diagrams of all equipment and devices.
 - .3 Complete "as built" wiring diagram showing all device wiring and the connections, including colour codes, cable numbering and terminal numbering.
 - .4 Operating instructions for all supplied equipment.
 - .5 Service manuals for all supplied equipment.
 - .6 Description of system operation.
 - .7 Parts list, using component identification numbers standard to electronics industry noting address, telephone number and contact name of available Suppliers.
 - .3 Submit manuals, including as-built documents, before submitting request to Owner for final acceptance of the system

- .3 "As Built" Record Drawings
 - .1 Identify all device locations and wiring and their connections, including colour codes, cable numbering and terminal numbering.
 - .2 Where wiring is underground or under floor or below finished grade, furnish field dimension with respect to building column lines and inverts with respect to finished floor levels or grades.
 - .3 Prepare drawings clearly identifying cabling pathways where the cable is not supported along its length by raceway.

1.5 **DESCRIPTION OF SYSTEM**

- .1 Provide a system of scope and capacity as indicated in the Contract Drawings.
- .2 Not all systems described herein necessarily apply to the Contract. Ensure the parameters of the systems indicated on the Drawings govern the Products, scale and features installed. Select the appropriate system or systems from the following:
 - .1 Large scale system
 - .2 Medium scale system
 - .3 Medium scale system with security integration
 - .4 Small scale systems

1.6 **LARGE SCALE SYSTEM**

- .1 System not specified.

1.7 **MEDIUM SCALE SYSTEM**

- .1 System not specified.

1.8 **SMALL SCALE SYSTEM**

- .1 Sub-section applies to systems defined as follows:
 - .1 Fewer than twenty stations.
 - .2 System not requiring features specified elsewhere in Specification.
- .2 Intercommunications system consisting of the following components:
 - .1 Inside wall mounted (flush or surface mount depending on wall type) intercom terminal station. "Hands free" operation with integrated camera, speaker, LED indicator, magnetic hearing loop.
 - .2 External mushroom push button connected to auxiliary contact to engage intercom terminal station
 - .3 IP addressable Desk Mounted Master station with video touch screen, camera, speaker.
 - .4 Wall mounted inside enclosure boxes for intercom terminals located in unfinished areas of the premises as indicated.

- .3 Intercommunications system providing the following features and characteristics:
 - .1 Two-way voice communication.
 - .2 "Hands free" mode of operation.
 - .3 Identical wiring requirements between stations.
 - .4 Every master able to call every other station in the system including other master stations.
 - .5 Programmable for pushbutton selection of called station.
 - .6 Programming stored in a non-volatile, battery backed RAM.
 - .7 Battery back-up for autonomous operation without loss of features for one hour without external power.
- .4 System Characteristics
 - .1 Master station to other station calls placed by selecting individual station button(s).
 - .2 Ability to establish connections between stations by receiving signals created by external computer based control system.
 - .3 Ability to electronically transmit information on status of intercom system, including connected and communicating devices from intercom system to computer based control systems including CCTV controllers and access control systems.
 - .4 Connection completion indication by audible tone at the calling and the called stations to signify completion of the connection without manipulation of controls.
 - .5 Connection cancelled at master.
 - .6 Facility for hands free or handset modes in master unit; local loud-speaker disabled when unit is in handset mode.
 - .7 Single digit and/or single button speed calling individually programmable at each station.
 - .8 Display of calling party's identification number and/or alphanumeric identification or other means of identification of calling party or station at master.
 - .9 Master stations equipped with local MUTE.
- .5 Integration with Security Systems
 - .1 Security system to log time of event, door identification number, and action taken.

1.9 **CARE, OPERATION AND START-UP**

- .1 Provide instruction and demonstrate the use of the system to the Owner in three scheduled training sessions.
- .2 Provide manufacturer's factory trained service Engineers to instruct:
 - .1 Maintenance personnel in maintenance of system.

.2 Operating personnel in the use of system.

1.10 **RELATED WORK**

- .1 Extra low voltage wiring conductors and connections for intercom system as necessary to create a fully operative and functional system.
- .2 Conduits and electrical raceways to create a continuous electrical pathway from intercom terminals to within 900 of cable terminations in equipment room.

2 **Products**

2.1 **GENERAL**

- .1 Use equipment produced by a manufacturer with a minimum five year period of experience producing similar products and who can refer to similar installations now rendering satisfactory service.
- .2 Equipment of modular design and solid state devices except for electro-mechanical components.
- .3 Reference to model numbers and other information is intended to establish the standards of performance, quality, and appearance which must be met. Where Products are identified by named manufacturers on the Contract Drawings, provide Products manufactured by the named manufacturers.
- .4 Guarantee equipment to be free from defective material and workmanship for a period of one year from date of final acceptance by Owner, except where damage is caused by Owner through accident, abuse, improper operation or neglect. Provide maintenance, pursuant to this guarantee during normal working hours at no expense to the Owner.
- .5 Provide satisfactory evidence of the maintenance of a service organization capable of furnishing adequate inspection and service to the equipment and be prepared to offer a Service Contract for maintenance of the system after guarantee period.

2.2 **CABLING**

- .1 Comply with Sections 27 05 00, 27 11 00, and 27 15 00.
- .2 Supply and install cabling of a type and style required by the original equipment manufacturers so that the system may operate to the best of its published performance specifications.
- .3 Supply and install conduit and electrical raceways for exclusive use by intercommunication systems.

2.3 **INTERCOM SWITCHING SYSTEM – LARGE SCALE**

- .1 System not specified.

2.4 **INTERCOM SYSTEM – SMALL SCALE**

- .1 Inside master: Aiphone IX-MV7-HBLA or equivalent.

2.5 **INTERCOM TERMINAL DEVICES**

- .1 Devices suitable for operation with intercom switching system as indicated on the Contract Drawings. Not all devices listed below are compatible with all intercom switching systems. Select devices according to performance and systems compatibilities.

.2 Wall Mounted Station – Inside

- .1 Brushed metal faceplate, loudspeaker, integrated microphone.
- .2 Metal back-box for flush wall mounting.
- .3 Black plastic housing or metal back-box for surface wall mounting.
- .4 Push to talk transparent button with backlight.
- .5 Adjustable volume control with adaptive mode.
- .6 Video Camera
- .7 Induction Hearing Loop
- .8 12V power supply, 24 volts DC
- .9 Operating temperature -40°C to 60°C (-40°F to 140°F), 10%-95% relative humidity.
- .10 Re Product – Substations
 - .1 Aiphone IX-DVFL
 - .1 Approximate dimensions 300 mm x 150 mm x 52 mm
 - .2 2N IP Solo c/w Induction Loop (to be used in Police Buildings)
 - .1 107 mm x 130 mm x 28 mm (surface mounted)
 - .2 130 mm x 153 mm x 5 mm (flush mounted)

3 Execution

3.1 **LOCATION**

- .1 Install intercom switching equipment in the main computer equipment room or as indicated.
- .2 Verify site conditions before commencing Work. Install bollards in positions indicated.

3.2 **INSTALLATION**

- .1 Install equipment in accordance with manufacturer's instructions.
 - .2 Install cable in conduit or electrical raceway. Do not use open or unsupported cabling. Use flexible conduit to enclosed link to exposed device.
 - .3 Make splices using insulated crimp type sleeves. Make connections to devices having screw terminals with suitable lugs crimped to ends of conductors. Avoid the use of field soldered connections.
 - .4 Provide identification for wiring at outlet boxes and at accessible locations. Abide by the identification conventions as indicated in the Contract; make particular reference to Division 27 Specifications including Section 27 05 53.
 - .5 Exercise care during installation to avoid damage to cables and equipment. Replace equipment damaged or marred during installation.
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- .6 Permanently and clearly mark in a descriptive manner all switches, connectors, jacks, receptacles, outlets, terminal blocks and cable terminals if not already required by other parts of this Specification.
- .7 Take the necessary precautions to prevent and guard against electro-magnetic and electrostatic hum, to supply adequate ventilation, and to install equipment so as to provide safety for the operator.
- .8 Observe current standards for connecting the shield drain wire of shielded signal cables. Insulate cable shields at their terminated ends with sleeves or heat shrinkable tubing. Protect shield drain wires exiting from cable jacket by PVC or Teflon tubing.
- .9 Connect all audio grounds in the equipment rack to a common point on the rack. Connect the rack to the isolated ground bus bar provided.
- .10 Install power wiring to electrically operated devices. Make electrical connections.

3.3 **INTEGRATION**

- .1 Program intercommunications system to send and receive signals to and from other systems as indicated.
- .2 Provide necessary wiring and connections and make signals available to other systems to enable inter-system communications.

3.4 **TESTS**

- .1 Test entire system after completion of installation in accordance with Owner's requirements. Submit a test report to the Consultant.
- .2 Verify that all equipment is properly installed and secured in place and ensure that all warning labels, covers, etc. are in place. Verify that all wiring is complete and free of all hazards and unintentional shorts. Ensure that all grounding is complete.

3.5 **TRAINING**

- .1 Provide training to the Owner's personnel.

End of Section

1 **SCOPE OF WORK AND ASSOCIATED DELIVERABLE**

- .1 The Successful Bidder shall provide Project Management, design and coordination of all Work on the systems within this contract, and maintain all required communications between various City of Toronto divisions and third party service providers.
- .2 The Successful Bidder shall be the single point of contact and shall be responsible for all coordination of Work that pertains to the Systems, along with all required coordination and communications between Personnel and the City.
- .3 The Successful Bidder shall be in good standing with all manufacturers referenced in this this document (including but not limited to American Dynamics, Dedicated Micros, Milestones and Axis) and must have and maintain all up to date certifications.

2 **LITERATURE**

- .1 Bidders, where applicable, should submit complete literature on all products being included in their quotation including, but not limited to, standard manufacturer's warranty, model numbers, part numbers and other relevant documentation as part of their Quotation.

3 **BIDDER QUALIFICATIONS**

- .1 Bidders must be authorized sellers or resellers for the products listed section 35 Manufactures List and must hold title to any equipment that will be installed or removed. if requested by the city, bidders must submit written verification of current and valid authorization, satisfactory to the city, prior to award. failure to submit written verification of authorization, satisfactory to the city within a time frame specified by the city will result in the quotation being declared non-compliant.
- .2 Prior to award, if requested by the City, the Bidder must submit written verification that their technicians are certified and authorized to undertake the installation and delivery services described in this document. Failure to submit written verification of certification / authorization satisfactory to the City within a timeframe specified by the City will result in the Quotation being declared Non-Compliant.

Bidders must provide within five (5) business days of such a request, a copy of each person's resume and certifications for proof of meeting the requirements listed in each Mandatory Criteria. Failure to provide this information within the timeframe specified, will result in non-compliance and the Bidder's Quotation will not be considered further.

- .3 All Certificates must be valid at the time of submission and throughout the duration of this contract.

.4 **Mandatory Criteria 1:**

- .1 Bidders must maintain personal with the minimum years' experience Personnel as indicated that meet the mandatory criteria in Table 1 below

Table 1

Item Number	Years of Experience	Certification and or Training on the following systems
CCTV		
1.1	3	Milestone Certified Design Engineer
1.2	3	Milestone Certified Integration

		Technician
1.3	3	BriefCam
	3	Victor and VideoEdge Advance Installer
DSC		
1.4	3	Power Series 1864 System
1.5	3	DSC Power Neo Alarm Panels
ACS		
1.6	3	Visonic – PowerMaster 10/30
1.7	3	Key Tracer
1.8	3	Software House - CCURE 9000 Level 2

- .2 During the Term of the Contract, the Successful Bidder may substitute Personnel due to staff changes with Personnel of equal or greater qualifications and experience. Any change of Personnel shall be approved by the City prior to the substitution taking place.
- .1 All systems components and installation shall conform to the following standards and codes where appropriate:
 - .2 Manufacturing: ISO 9003
 - .3 Design: MIL 275E
 - .4 Communications: IEEE RS232C and RS485
 - .5 EMI emissions: FCC part 15
 - .6 Electrostatic immunity: IEC 801.2 level 4
 - .7 AC transients UL 964
 - .8 National Building Code
 - .9 Ontario Fire Code
 - .10 Electrical Standards Authority
 - .11 Process Control System Implementation Manual
 - .12 NFPA 730 & 731
 - .13 ULC 319/S304
 - .14 UL 1981 Central Station Automation System
 - .15 UL 681 Installation and Classification of Burglar and Hold up Alarm Systems
 - .16 UL1635 Digital Alarm Communicator System Units

4 **SECURITY CLEARANCE REQUIREMENTS**

- .1 A Clearance Letter from Toronto Police Service is a formal document produced on secure paper indicating that the subject of the inquiry has no criminal convictions in the National Repository of Criminal Records, which is maintained by the RCMP. The Successful Bidder shall provide within fifteen (15) business days after contract award to the Project Manager, a Police "Clearance Letter", obtained within the past three (3) months for each person (including Subcontractors), that may be expected and/or will be performing Work under this contract.
- .2 The Successful Bidder's employees (including Subcontractors) that may be expected and/or will be performing Work under this contract shall not pose a foreseeable security concern or hazard to the City as it relates to the protection of its assets.
- .3 Unless authorized in writing by the Project Manager, only Personnel that provided a Clearance Letter to the Project Manager shall be permitted to Work under this contract.
- .4 The Successful Bidder shall provide an original recent (obtained within the past 3 months) Clearance Letter only. No copies will be accepted.
- .5 The cost for each of the Clearance Letters shall be the complete responsibility of the Successful Bidder.
- .6 Refer to the Supplementary Forms and Policies section.

5 **SPECIFICATIONS**

5.1 **Meeting:**

- .1 A kick-off meeting will be scheduled by the Project Manager with the Successful Bidder upon award to review the roles and responsibilities of the City and the Successful Bidder.
- .2 the Successful Bidder and their qualified Personnel (including Subcontractors) assigned to this contract shall attend the kick-off meeting if requested by the Project Manager.
- .3 The Successful Bidder's Project Coordinator (or designate) shall be responsible to coordinate, plan and schedule as many subsequent meetings as necessary throughout the Term of the contract to ensure effective project stakeholder communication.
- .4 All meetings shall be held within the City of Toronto. The Successful Bidder is responsible for all costs for consultation and project/subsequent meetings.
- .5 The City reserves the right to request subsequent meetings on-demand or on short notice and may change or cancel meetings at the discretion of the Project Manager and at no cost to the City.

5.2 **Resource Commitments:**

- .1 The Successful Bidder is the Design/Builder on Record and must continue to meet all of the requirements of Systems certifications and qualifications with respect to training and staffing competency, at the sole expense of the Successful Bidder, throughout the Term of the Contract, for all of the systems and components installed and in use at the facilities.
 - .2 The Successful Bidder must continue to meet all of the mandatory conditions of the Warranty throughout the Term of the contract and Warranty periods.
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- .3 The Successful Bidder must be able to provide the necessary materials, tools, machinery and supplies to carry out all approved Work. These resources must be available at the sole responsibility of the Successful Bidder on a dedicated basis throughout the term of the contract, to coordinate and carry out all approved Work with due care, skill and efficiency. The City may request removal and replacement within five (5) calendar days of any Contract Leads at any time throughout the duration of the contract.
- .4 The Successful Bidder must guarantee to the City that their Services and performance, including those of the Subcontractor, shall be provided in a professional, good, workmanlike manner and comply with, but not be limited to the City's City-Wide Security Policy, Workplace Violence Policy and the City of Toronto's Security Video Surveillance Policy. Those deemed not complying, at the discretion of the City, will be removed from the site and all future projects for the duration of this contract. The Successful Bidder will be provided three (3) notices of non-compliance and then be in breach of this contract, which may include contract termination as per the City of Toronto policy and guidelines.
- .5 Only Personnel listed and registered with the City will be permitted to access and Work on City of Toronto sites.

5.3 **Cleaning:**

- .1 The Successful Bidder must maintain the worksite, grounds, and building free from accumulations of waste material and rubbish, and provide on-site containers for collection of waste materials and rubbish as required. On site storage areas must be coordinated through and arranged by the City. Cleaning and disposal operations must comply with local ordinances and anti-pollution laws.
- .2 The Successful Bidder must clean dust and water residue from core drilling, cutting and patching of masonry, and drywall to satisfaction of the City. Furnishings, floors and finishes must be protected prior to the commencement of Work.
- .3 Promptly as Work proceeds, and upon completion, the Successful Bidder and each of its Subcontractors shall clean up and remove from the premises all rubbish, dirt, dust, debris and surplus materials resulting from the Work.
- .4 The Successful Bidder must at all times be considerate of site security and ensure all worksites are maintained accordingly.

5.4 **Cosmetics, Protection, and Finishes:**

- .1 The same tamper proof screws and fasteners shall be used on all equipment, enclosures, cabinets and materials in public areas. Corporate Security shall be provided two sets of tools (at no charge) which are required to service security equipment that have tamper proof screws and fasteners.
 - .2 Finishes and graphics for all equipment in public areas shall be submitted to, and approved by the City.
 - .3 The Successful Bidder shall be responsible for all cutting, core drilling, and patching required for the installation of this Work. Where alterations occur or new and existing Work is required, the Successful Bidder shall join, cut, remove, patch, repair, or finish the adjacent surfaces as required to meet same or better quality at no extra costs to the City.
 - .4 Any Work likely to alter or detract from the original appearance must not commence without the City's written consent. Changes or alterations, completed without the City's consent, may be subject to restoration by the Successful Bidder. Any additional repairs required, due to unapproved Work, may be billed to the Successful Bidder for payment.
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- .5 The Successful Bidder shall protect existing furnishings by providing and maintaining adequate temporary protective coverings.
- .6 The Successful Bidder shall provide and maintain adequate fire safety in accordance with applicable fire code and Regulations.
- .7 The Successful Bidder shall be responsible for any damage to existing structure or contents arising from a lack of adequate protection.
- .8 All Work shall be performed by a qualified and skilled trade's people as defined by the Occupational Health and Safety Act, Regulation 213/91 and all finishing shall be of the highest quality. Construction and finishing techniques must preserve the original appearance of the affected areas.
- .9 Unless authorized in writing by the City, the Successful Bidder shall not post/affix any stickers, labels, signs, logos, or any kind of promotional or advertising material on any equipment or instruments, nor at any City of Toronto site. This includes decals warning of systems in use or Services provided.
- .10 All materials, accessories, special equipment, services, personnel, test equipment and tools required for installation of the equipment shall be provided by the Successful Bidder.

5.5 Codes, Permits, Fees and Inspection:

- .1 All system components shall be installed according to manufacturer's instructions and in a professional manner. Workmanship and care must encompass all aspects of the task being performed so the full intent of the project may be realized.
 - .2 All Work shall be performed in compliance with all applicable Regulations, Building Codes and Local By-laws.
 - .3 The Successful Bidder shall be responsible for all work and material including, but not limited to surveying, scanning, soil sampling, stamped engineered drawings, cutting, core drilling, patching, trenching, excavating, temporary storage of material, laying of conduits and backfilling for the installation of assigned Work.
 - .4 The Successful Bidder shall arrange for inspection of all Work by the authorities having jurisdiction over the Work. The Successful Bidder shall comply with the requirements of the authorities, federal, provincial and municipal Codes, and all other authorities having jurisdiction. These Codes and Regulations constitute an integral part of these specifications. In case of conflict, the applicable Code takes precedence over this document.
 - .5 All Work shall be executed to the approval of the City. When the Work is reported to be complete, an inspection shall be made by the City, and all deficiencies found shall be corrected by the Successful Bidder within 30 calendar days of reporting the deficiency, and before the final payment is made.
 - .6 The City may appoint and pay for an independent consultant to inspect the Work or to carry out specific tests as the Work progresses. The Successful Bidder shall notify the City and the consultant at least three calendar days prior to starting the Work, and shall provide any assistance that the consultant may require to carry out his/her inspections or tests at no additional cost to the City.
 - .7 The consultant, if any, shall act on behalf of the City to ensure that the performance of the Work is carried out according to the specification, drawings and acceptable standard practice. The Successful Bidder shall co-operate with the consultant and shall comply with
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his/her directions in making good all deficiencies and defects, and in ensuring the proper execution of the Work.

- .8 The verification or acceptance of the Work by the consultant or the City does not relieve the Successful Bidder of his/her responsibility to comply with the specifications. Any Work subsequently discovered, which does not comply with the specifications shall be rectified by the Successful Bidder at no cost to the City.

5.6 Daily Check In/Out:

- .1 Before Work commences, the Successful Bidder shall have already incorporated all site and facility constraints as it relates to on site access time and Work performance limitations.
- .2 Before commencing Work and prior to completion of any Work, the Successful Bidder's Personnel must check-in and out daily with the City of Toronto Security Control Centre at 416- 397-0000, and if available with on-site Security.
- .3 Upon check-in and check-out, the Successful Bidder's Personnel shall clearly explain what effects their Work will have on current security systems or VSS that are being monitored, and they shall identify any anticipated alarm signals, as well as any system functional limitations.

5.7 Disruptions to City Operations:

- .1 Careful consideration must be given at all times to the function of the facility and the persons contained. The Successful Bidder must make all attempts to cause as little disruption in service as possible when providing installation services. Work that may cause any type of major disruption to building operations and/or building occupants must first be cleared by the City, and may have to be completed after hours.
- .2 The Successful Bidder shall co-ordinate all Work with the City's representative to ensure minimum disruption of service.
- .3 Work shall be executed to minimize the impact or the disruption of the existing operational systems and City of Toronto facility operations. At any time during the performance of the Work, if the existing, operational systems are affected beyond the expectation approved through the Implementation Plan or there is an imminent danger to be affected beyond the approved expectation, the Successful Bidder shall stop Work and minimize the impact on the operational systems. The Successful Bidder shall immediately inform a City of Toronto Corporate Security representative. The Successful Bidder shall perform all Work to implement a temporary solution to enable 100% functionality for operational systems. The Successful Bidder is to proceed with permanent Work only after a solution is approved by City of Toronto Corporate Security.

5.8 Impact on City of Toronto Operation:

- .1 Operational restrictions may affect the scheduling of Work and may require some activities to be scheduled at night, during weekends, or during periods when facilities are not in service.
 - .2 The Successful Bidder shall perform the Work in a manner to prevent disruption of normal City of Toronto operations. Any task that may cause disruption of operations shall be approved in advance by City of Toronto Corporate Security.
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5.9 Inspection of Work:

- .1 City of Toronto Corporate Security reserves the right to inspect any and all Work and reserves the right to be present during the performance of any Work under this Contract.
- .2 City of Toronto Corporate Security will perform periodical and statistical inspections of the Work. The Successful Bidder shall provide and facilitate access to Work for inspection.
- .3 The Successful Bidder shall correct within a maximum of one week (7 calendar days) any Work deemed not satisfactory by the City of Toronto.
- .4 In the event that the Successful Bidder does not correct the Work within the time frame specified, the City reserves the right to have the Work completed by another qualified firm at the Successful Bidders expense.

5.10 Occupancy Before Completion:

- .1 The City may use portions of the Work although the same may not be entirely complete without claim of any kind by the Successful Bidder so doing, nor shall any such use relieve the Successful bidder from his/her obligation under this contract until the termination of the guarantee/Warranty period.

5.11 Monitoring/Programming:

- .1 Many of the inspected devices require confirmation of device annunciation on the monitoring screen. Personnel must arrange/coordinate with the Corporate Security Lead to change a given device's armed, controlled or online status. Personnel must ensure the previous state is restored upon completion of the inspection testing.

5.12 Equipment, Placement, Relocation, Removal, or Expansion

- .1 Some existing hardware may require removal or relocation for installation of new devices. In each instance, the Successful Bidder must advise Corporate Security, and the Successful Bidder must receive written approval prior to the removal or relocation. All costs associated with the removal or relocation are the sole responsibility of the Successful Bidder.
- .2 All placements of security devices are subject to approval by Corporate Security before final acceptance is granted.
- .3 All equipment and devices, removed by the Successful Bidder for replacement or placement of a new security device, shall remain the property of the City and shall be submitted to the City upon device removal.

5.13 Design and Installation:

- .1 The Successful Bidder is responsible to provide a fully functional system meeting the City's standards as required by this document.
 - .2 The Successful Bidder shall be the design builder required to supply and/or install fully functional integrated, Security System for the City of Toronto. The Successful Bidder shall be solely responsible for its design errors or omissions. Including, but not limited to situations where all the necessary materials to deliver a fully functional integrated CCTV and AV system have been missed. This clause shall not apply where the City requests a change to the original design request. The Successful Bidder shall be solely responsible for detailed design, project management, coordination, equipment procurement, installation,
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- component wiring, terminations, connections, labelling, programming, integration, testing, commissioning and as-built drawings of all Systems.
- .3 The Successful Bidder shall supply and/or install all required Systems electronic equipment, hardware, software, licenses and connections, to allow for City required functionality under this document.
 - .4 The systems shall consist of field, infrastructure, and monitoring devices integrated to the access control and intercom systems necessary to provide a fully automated system to control authorized traffic in and out of controlled areas of City facilities.
 - .5 The system shall be designed on a distributed processing architecture employing remote DGPs (Data Gathering Points) and operator workstations connected through TCP/IP and/or serial communication protocols, where applicable.
 - .6 As part of this document the Successful Bidder shall connect all devices to centrally located patch Panels and/or equipment located in communication rooms and /or DGP as detailed in the specification drawings and standards.
 - .7 Connectivity from the IP equipment shall be based on Ethernet IP based protocols over a City supplied network, which shall connect and be programmed to servers and remote client workstations.
 - .8 The Successful Bidder shall provide all programming data required to achieve the specified functionality (this includes situations where existing technology is being replaced with new technology). Such programming shall include (but is not limited to) programming of all alarms, events, triggers, timers, objects transmitting and receiving signals and interfaces as well as programming of signal receiving centre equipment to provide 100% full functionality.
 - .9 Any required expansion boards/nodes and ancillary equipment needed for a full operation of the system are the responsibility of the Successful Bidder.
 - .10 The Successful Bidder shall provide power supplies with battery back-up to meet NFPA 731 standards for all Systems. Failure to meet the standard will result in the Successful Bidder providing all supplies necessary at no additional cost to the City.
 - .11 The Successful Bidder shall be required to populate all items such as parts and equipment from supply and install projects into a City supplied Microsoft Office database file. Upon review and approval by the City, these database files will be imported into the City central physical asset and material management database.
 - .12 The Successful Bidder is responsible for all final wiring and terminations of all Systems.
 - .13 The Successful Bidder shall be responsible for ensuring all structured cabling and electrical including back boxes, cabling, conduit, troughs and raceways meet equipment electrical and wiring requirements throughout all phases of the project.
 - .14 The Successful Bidder shall inspect conduit, cabling, back boxes, junction boxes associated with the Systems during installation and shall notify the City Project Manager of any issues found.
 - .15 The Successful Bidder shall maintain integration to existing security systems to the maximum level supported by the systems manufacturers.
 - .16 Test and commission according to the 32.0 Compliance with Standards.
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- .17 The Successful Bidder shall review the current site conditions and existing system configurations.
- .18 The Successful Bidder shall provide at all times sufficient competent labour, materials, and equipment to properly carry on its Work and ensure completion of each part in accordance with the Work schedule and within the contractual time period.
- .19 All installation materials, accessories and special equipment, Services, Personnel, test equipment and tools required for installation of the equipment shall be provided by the Successful Bidder.
- .20 Equipment shall be installed as per the manufacturer's recommendations, programmed and integrated to City Standards and the City Project Manager.
- .21 The Successful Bidder shall secure and be responsible for the safe keeping and protection of the system equipment until the system is fully accepted by the City of Toronto after the commissioning process.
- .22 The Successful Bidder shall coordinate all network provisioning with City of Toronto IT Services.
- .23 The Successful Bidder shall start to warrant the Systems, warranty start date, when all deliverables such as as-builts of the project have been accepted by the City and deficiencies corrected.
- .24 The Successful Bidder shall maintain the System in compliance with manufacturer's specified Preventative Maintenance schedule during the project installation period.
- .25 The Successful Bidder is responsible for all System decommissioning and removal of equipment in this document, at no additional cost to the City. Including all cable removal as per ESA requirements.
- .26 The Successful Bidder shall be responsible to investigate, design and integrate to new and existing Systems.
- .27 It is the responsibility of Successful Bidder to design and finalize the System wiring diagrams, drawings, documentation and schedules in order to meet site specific conditions and provide a fully functional system.
- .28 Integration and Analytic programming for items not listed in the contract are to be shown as separate line items in quote indicating the type of integration and/or analytic to be achieved and used for the remainder of the contract term.

6

SUPPLY AND INSTALLATION PROJECT SUBMISSION REQUIREMENTS

- .1 The Successful Bidder shall (at no additional charge) submit to the Project Manager one (1) set of electronic copies of the following: project quotation, detailed project schedule, shop drawings, as-builts, warranty, and any other related supporting documents as detailed in this document.
 - .2 All electronic documents submitted to COT must be named by purchase order, site name, document type, date, and Service Request Portal Number.
 - .3 As directed by Toronto City Council in 2005 under the City's Waste Diversion Plan, where feasible and appropriate, all hardcopy prints will be double sided. Therefore the Successful Bidder will be required to comply with this plan as it relates to all hardcopy print contract documents.
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7 DETAILED PROJECT SCHEDULE

- .1 Detailed Project Schedules are to be free from error and submitted.
 - .2 The detailed project schedule shall include, but not be limited to the following information:
 - .1 Commencement date for each major activity;
 - .2 The duration of each activity;
 - .3 The proposed sequence of activities;
 - .4 Dependencies between internal activities and milestone;
 - .5 Dependencies between external activities and milestone; and,
 - .3 The schedule shall be progressively updated as the project progresses, which enables the Project Manager to readily identify activities by location and resources.
 - .4 The schedule information shall be sufficiently detailed to enable integration of all interface activities by the Project Manager.
 - .5 The schedule shall be presented in daily segments and shall include the following at a minimum:
 - .1 Site surveys (as required);
 - .2 Service Request Portal Number;
 - .3 Submission and approval of Shop drawings;
 - .4 Shipping confirmation date;
 - .5 Material delivery and installation;
 - .6 Conduit and wire pulls completed;
 - .7 Progress photographs (only of concealed work);
 - .8 Panels and power supplies installed and programmed;
 - .9 Field equipment terminated, mounted and tested;
 - .10 Security testing complete;
 - .11 Acceptance testing complete;
 - .12 As-built documents;
 - .13 Equipment integration and dry-run;
 - .14 Monitoring period (minimum one week);
 - .15 Commissioning and hand-over.
 - .6 The schedule shall be clearly identified with the following:
 - .1 Site name, if applicable and address;
 - .2 CRO number;
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- .3 Start date of the project with time;
- .4 Project Coordinator name with detailed contact information; and,
- .5 Subcontractor name; and
- .6 Project completion date.
- .7 Distribute copies of any revised schedule to:
 - .1 Project Manager; and,
 - .2 Security Project Lead
 - .3 Other Stakeholders as indicated by the Project Manager.
- .8 The Successful Bidder shall be responsible for any delay in the progress of the Work, and it being understood that no such delay shall be an "Excusable Delay" for the purposes of extending the time for performance for the Work or entitling the Successful Bidder to additional compensation. The Successful Bidder shall take all necessary steps to avoid delay in the final completion of the Work without additional cost to the City of Toronto. The City shall not be responsible for any expense or liability resulting from any such delay.

8

SHOP DRAWINGS

- .1 Shop drawings prepared are to be free from error and submitted in electronic format. Shop drawings are to include all items quoted with no substitutions without the prior consent of the City Project Manager. All documents produced shall be the property of the City of Toronto and the Successful Bidder shall have no rights over the entire documentation package or any parts of the documentation package.
 - .2 Shop Drawings shall include:
 - .1 Date and revision number;
 - .2 Project title and number;
 - .3 Service Request Portal Number;
 - .4 Contract Drawing / Specification Reference;
 - .5 Name and address of:
 - .1 Subcontractor;
 - .2 Supplier, Manufacturer; and,
 - .6 Wiring diagrams for each location (including distances);
 - .7 Details of types of wire and conduit type and sizes;
 - .8 Particular model number of hardware;
 - .9 Dedicated circuit in electrical panel to be used (for new installations);
 - .10 Progress photographs (only of areas with concealed work);
 - .11 Panels and power supplies (location to be installed);
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- .12 Field equipment (location of mounting);
 - .13 All device programming names;
 - .14 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .3 The Project Manager may change any drawing to remove, add or relocate any device. The Successful Bidder shall make any changes in the shop drawings, which the Project Manager may require consistent with the Contract Documents and resubmit unless otherwise directed by the Project Manager. The Successful Bidder shall notify the Project Manager in writing of any revisions other than those requested by the Project Manager and are subject to approval by the City Project Manager.

9 **PROJECT COMMENCEMENT**

- .1 Prior to the commencement of installation the successful bidder will submit the following:
- .1 The Security Contractor shall submit to the Corporate Security Lead the required Active and Passive network equipment specifications for all locations in scope
 - .2 The specifications and active network equipment shall be in compliance with the City Networking standard and based on Cisco active networking equipment.
 - .3 The Security Contractor shall submit a network communication and bandwidth flow chart for the proposed system this shall include communication steps between the various VSS components operating in normal and failover modes and their respective estimated network bandwidth requirements
- .2 Near project closeout and before project site acceptance testing the security contractor shall submit the following draft documentation in electronic form to the COT Project Manager:
- .1 Draft test results of device and components installed
 - .2 Draft test result of cable inspection, testing and verification
 - .3 Draft schedule of all installed and/or configured devices listing as a minimum the following (Network configuration, Switch & port connectivity, location, Name/labeling, Serial Number, Warranty Start & Expiry date, Device Username/Passwords, Device IP and MAC Address, Function, etc....) in editable MS Excel format.

10 **AS-BUILT DOCUMENTATION**

- .1 Upon successful completion and acceptance of each security project, the Successful Bidder shall submit one (1) electronic set of record documentation and drawings to City of Toronto Corporate Security within ten (10) calendar days from the date of acceptance.
- .2 As-built shall include drawings and shall be in the FORM of black line set, record drawings on AutoCAD 2005, as well as a .pdf version, and are to be provided on a clean CD-ROM, DVD, or via e-mail.
- .3 Drawings shall include:
- .1 Shop drawing submittals;
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- .2 Wiring diagrams for each location (include distances);
 - .3 Details of types of wire and conduit (include type and size);
 - .4 Particular model number of hardware (to match Summary of Security Devices Table to be provided by COT);
 - .5 Approval of drawing submittals;
 - .6 Beneficial occupancy date;
 - .7 Project Completion date;
 - .8 Equipment manufactures;
 - .9 Factory Acceptance Tests;
 - .10 Installation procedure;
 - .11 O&M manuals; and,
 - .12 Manufacturer's specification sheet.
- .4 Architectural: site plans, building plans, and floor plans showing all locations for every security device both new as well as any effected existing device.
- .5 All security devices depicted in the drawings must be individually labelled according to the programming on the security system to ensure tagging consistency.
- .6 All security device symbols depicted must be in conformance to the Security Industry Association Architectural Graphic Standards for Security System Layout SIA/IAPSC AG-01-1995.12 (R2000.03).
- .7 A Summary of Security Devices Table, as installed in Excel format. The table shall include the following for each security device: Security Device CAD Symbol, Make, Model, Serial number, IP Address, MAC address, Device Type/Function, Install Date, Installing Company, network configuration, Switch & port connectivity, VLAN, location, Name/labeling, Serial Number, Warranty Start & Expiry date and a photograph of each installed device. A template will be provided by the COT.
- .8 Wiring diagrams and/or schedules for each system defining the interconnection of all inputs and outputs for all equipment/security devices/electrical connections including description of location and/or name of each device.
- .9 Construction Typical for all security applications.
- .1 As-built shall include all information required in the prefabrication submittals revised to reflect "as installed" conditions.
 - .2 As-built shall also include one (1) sets of complete and current operation and Maintenance manuals for all devices and equipment.
 - .3 The Successful Bidder is solely responsible to include engineered stamped drawings when required by the City.
 - .4 As-builts may not have any written notes on them all entries must be electronic.
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11 **INSTALLATION STANDARDS AND REQUIREMENTS**

- .1 All direction for scope of work must be provided by the COT Project Manager. Any work completed without approval of the COT Project Manager may have to be altered at the COT request and without additional cost to the COT.
 - .2 The Successful Bidder must deliver the specified Products and/or Services as per their Quotation without substitution or deviation.
 - .3 The Successful Bidder shall be solely responsible for detailed design, project management, coordination, equipment procurement, installation, component wiring, terminations, connections, labelling, programming, integration, testing, commissioning and issuing of required documentation of City systems.
 - .4 The Successful Bidder shall restore all property temporarily removed, damaged, or destroyed during the supply, delivery, and installation, of Products to the satisfaction of the City and at no cost to the City. The Successful Bidder, before final payment, shall remove all surplus materials and any debris of every nature resulting from its operation and put the site(s) in a neat, orderly condition; thoroughly clean. If the Successful Bidder fails to clean up at the completion of the supply, delivery, and installation of the Products, then the City may do so and charge the Successful Bidder for the costs thereof, or deduct said costs from any monies still owing to the Successful Bidder.
 - .5 The Successful Bidder shall furnish all labour, materials, services, special equipment, supplies, tools, equipment, testing equipment, apparatus, trade tools, transportation, facilities and incidentals required and perform all operations necessary to accomplish the complete installation of the Product(s).
 - .6 The Successful Bidder is responsible for all final wiring, integration and terminations of all systems.
 - .7 Testing and commissioning is to be performance according to City and NFPA standards. Specific documentation to achieve this will be developed with the successful bidder and final template approved by City of Toronto (COT).
 - .8 Unless authorised by the Project Manager, the Successful Bidder must flush mount all devices. Back boxes / junction boxes, all devices, equipment and components installed must be equipped with tamper resistant screws/fasteners.
 - .9 Any back boxes / junction boxes must be installed on secure side (if applicable).
 - .10 The Successful Bidder must ensure the electronic door operators are integrated with the access control system, and only activate when a valid card is presented. If not included during the quotation process, all associated costs will be at the Successful Bidders expense.
 - .11 The Successful Bidder will ensure programming for any CCure systems is completed to Standard and report to maintenance mode Journal for a minimum of one week after successful site testing and deficiency correction. After one week, should no deficiencies exist, the Successful Bidder will remove the system from Journal and fully activate at the request of the City Corporate Security Lead.
 - .12 All card readers must be ordered and programmed to City Standard/format and as directed by the City Corporate Security Lead.
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- .13 All exit buttons are to be green in colour and embossed with the label "EXIT", no other type will be accepted even if quoted. Any errors will result in replacement by the Successful Bidder at no additional cost to the City.
 - .14 All intercoms are to have a red button with red led status indicator that is used to communicate, no other type will be accepted even if quoted. Any errors will result in replacement by the Successful Bidder at no additional cost to the City.
 - .15 Each facility covered under this contract shall be handed over to the City by the Successful Bidder as a turnkey operation.
 - .16 Any power supplies, or other parts that are required shall be supplied by the Successful Bidder and shall be included in the quoted price. Power supplies must operate all connected hardware in all conditions.
 - .17 The Successful Bidder shall be responsible for provisions of power, if it should not be present at a location. Dedicated power circuits shall be installed for each new device that will be installed as part of this project.
 - .18 Any required expansion boards, ancillary equipment, needed for a full operation of the system are the responsibility of the Successful Bidder and must be included in the quote. Should they not be included but be required to operate the system then it will be the successful bidders responsibility to provide without cost to the City.
 - .19 All device conditions and alarms shall be individually enunciated on the relevant system, as required for each specific project scope.
 - .20 The Successful Bidder shall be responsible for the installation of all the equipment, units, and sub-systems, at all sites in order to meet all requirements specified in this document, as per all applicable standards, and as per manufacturer's intent.
 - .21 All installation materials, accessories and special equipment, Services, Personnel, test equipment and tools required for installation of the equipment shall be provided by the Successful Bidder.
 - .22 The Successful Bidder shall be responsible for all required trenching, civil work, and any associated costs.
 - .23 The Successful Bidder shall provide all programming data required to achieve the specified functionality for each effected system (this includes situations where existing technology is being replaced with new technology). Such programming shall include (but is not limited to) programming of all alarms, events, triggers, timers, objects transmitting and receiving signals, networking, bandwidth settings, frame rates, images per second, permissions, integration between systems, and interfaces as well as programming of signal receiving centre equipment to provide 100% full functionality.
 - .24 It is required that disruptions be minimized keeping the existing intrusion detection systems or video surveillance systems operational during the process of upgrading to the new systems until all devices from the new system are functional and ready to be used by the end user. Consideration for the critical nature of all facilities operations and occupants is crucial to the success of the project.
 - .25 Any new materials used by the Successful Bidder to commission the existing devices to the new system shall be covered by the warranty under this contract.
 - .26 All existing devices that will be re-used by the Successful Bidder shall be commissioned to the new systems as defined by the COT.
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- .27 All existing devices that will be replaced with new devices under the scope of work of any specific project shall be removed by the Successful Bidder. The removal of existing equipment or parts which will not be used with the new installations shall be completed by the Successful Bidder. Parts in working order are to be returned to address noted below. Other parts to be disposed by bidder.

**Scarborough Civic Centre,
Lower Level, Security Storage Room
150 Borough Drive
Toronto, Ontario, Canada
M1P 4N6**

Working parts under 5 years old to be return are as follows:

- .1 Electric Strike
 - .2 DVRs, NVRs
 - .3 Servers
 - .4 Security Network Switches
 - .5 Cameras
 - .6 Camera Mounts
 - .7 Encoders
 - .8 UPS
 - .9 Request to Exit Buttons
 - .10 Intercoms
 - .11 Wall mounted duress buttons
 - .12 Sirens
 - .13 Communication Boards/Panels
 - .14 Long Range Motion Sensors
 - .15 Maglocks
- .28 Where this section applies, the Successful Bidder must provide the City a minimum of 24-hours' notice of delivery of old functioning electronic security hardware, electro-mechanical security hardware, and mechanical hardware. All other equipment not required to be delivered to the City shall be disposed of at the Bidder's expense.
- .29 All costs and expenses associated with returning old equipment shall be the responsibility of the Successful Bidder.
- .30 The Successful Bidder shall reuse existing conduit runs whenever feasible and run new cabling in the existing conduit runs. Where existing conduit is used the new and existing cables must not experience any negative performance indications. Any deficiencies found after installation must be corrected by the successful bidder at no cost to the COT.
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- .31 The Successful Bidder shall be responsible for patching up holes left by existing equipment and making good all repairs where new equipment is being installed in the same place.
 - .32 All installed equipment shall be fully functional and shall be capable to be monitored at each individual site as well as the Corporate Security Control Centre located at 703 Don Mills Road.
 - .33 Devices such as communication boards or input/output boards shall not be installed on door of panels. Additional panels shall be installed by the Successful Bidder to accommodate the installation of such devices.
 - .34 Upon completion of the installation of the equipment at each location, the Successful Bidder shall provide to the Project Manager the serial numbers and model numbers of all newly installed equipment, these are to be included in the Summary of Security Devices Table referenced in section "As-Built Documentation 10.7".
 - .35 The Successful Bidder shall install plywood backboards for mounting of all infrastructure equipment which require such backing to be able to be safely mounted to a wall such as electronic key cabinets, panels, and power supplies, etc.
 - .36 Connect equipment to the closest approved available panel/switch/computer with available inputs and outputs.
 - .37 Any new and existing cables for all devices which are exposed on the surface of a wall or ceiling or any other accessible surface shall be placed in conduit or wire moulding by the Successful Bidder as directed by the COT. This conduit/moulding shall be sized to allow for additional 25% increase in cable and include a cable pull string for future use. Type of conduit/moulding to be confirmed on specific project site meetings with COT. Plenum rated cable must be used in any spaces requiring plenum rated cabling as per building and/or electrical code. All cabling, conduit, and installation methods utilized must meet COT IT Cabling Standards, manufacturer recommendations, and both the Electrical and Building Codes.
 - .38 All infrastructure equipment including power supplies, transformers, communication devices, controllers, recording devices, etc. must be installed in secure cabinets. The Successful Bidder shall provide and install such cabinets and mount all of the equipment inside the cabinets. All costs for such cabinets shall be included in the quoted price.
 - .39 Video Surveillance installation and camera field of view shall be in compliance with applicable local privacy laws, the City video surveillance privacy policy and shall be approved by the Corporate Security Lead.
 - .40 All IP enabled devices such as IP Cameras, Encoders, iStar's, NVR's, card readers, controllers, etc. shall be tagged with an appropriate device name in coordination with the Corporate Security Lead.
 - .41 Typical naming conventions are as follows however final naming convention shall be coordinated with and approved by the Corporate Security Lead prior to the commencement of any device setup or installation:
 - .1 Site Address-NVR/Controller Number/Name
 - .2 NVR's shall be numbered sequentially as added
 - .3 Device numbers shall match port number on attached switch or controller
 - .4 Ex: 1008YNG-NVR9-CAM3
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- .42 All IP Cameras and Encoded Cameras shall be programmed on the VSS to display a short form naming. This Naming shall be coordinated with and approved by the Corporate Security Lead prior to configuring the VSS.

- .1 Typical Camera/device short FORM name on Milestone system would be:

- .1 1008YNG-F3-NW STAIR-3

- .43 The Security Contractor shall carry the cost of all required access hatches where required and shall patch and paint to match existing paint; all locations for access hatches shall be pre-approved by the Corporate Security Lead in writing before working on these access hatches.

12

VSS DESIGN CRITERIA

- .1 The VMS architecture shall permit centralized administration and management for the IP VSS and its distributed components across the City's local and wide area corporate networks. This administration shall be redundant providing seamless failover capabilities and continuous operation in the event of failure of one of the main IP VMS services.
- .2 The VMS shall allow for continuous system management and operation through resilient server clusters on the City provided domain, between 55 John Street and 703 Don Mills. This resiliency shall span the Management, SQL Database and Event servers providing continued operation at the primary and/or the secondary site depending on failure cause and location of components, infrastructure and/or related services.
- .3 The VMS shall allow for administering and managing the complete VSS system from any workstation having the Milestone XProtect® management client application installed and connected to the Corporate Security Lead's Corporate Network.
- .4 The VMS shall keep all (Audit, Event, and Rule and System logs) for duration of 60 days. Any storage or other specifications required from the Corporate Security Lead provided equipment shall be included and provided by the security contractor to the Corporate Security Lead as part of the server Specifications required.
- .5 The following will be supplied by the City of Toronto or other project Contractor (ICT):
 - .1 Microsoft SQL Software and Licenses
 - .2 Physical Servers required for Milestone VMS Management Services including Microsoft Windows Server 2008/2012 Licenses:
 - .1 Management Server
 - .2 Event Server
 - .3 SQL Server
 - .4 Mobile Server
 - .3 Client (user) Workstations
 - .4 VSS Core Network Switches (Cisco Switches)
 - .5 VSS Access Layer Switches (Cisco Switches)
 - .6 SAN Network Switches (Cisco Switches)

- .7 Ethernet Cat6A Patch Panels
- .8 Fiber Patch Panels in VSS Racks
- .9 Fiber connectivity between existing telecom rooms, entrance facilities and equipment rooms.
- .6 The Security Contractor shall specify the required Cisco switch models, and configuration required for the VSS, and the SAN to operate fully (including interface modules, IOS software, ports, Supervisor Engine, Backplane BW, POE Power/port, QOS Groups & Types, etc....). It is the responsibility of the Security Contractor to ensure specified network infrastructure is adequate for the complete system operation in normal and failover modes. The Security Contractor is responsible to coordinate and provide all detailed server specifications required for the system full operation to the Corporate Security Lead IT departments. Should the switch be determined to not be functionally appropriate by the COT, it shall be replaced by the successful bidder with an appropriate device at no additional cost to the COT.
- .7 Provide all VSS components and accessories required for achieving the full required functionality including but not limited to IP cameras, power supplies (Where Applicable), transmission media converters and extenders, modules, Video Encoders, mounts, enclosures, cables, plenum rated back boxes/enclosures/kits and IR Illuminators etc....
- .8 The only acceptable video compression (digital encoding) method shall be non-proprietary H.264 encoding (Baseline and/or Main Profile)
- .9 The VMS shall transmit and communicate over Corporate Security Lead IP network LAN/WAN, Fibre cables, Ethernet cables, Coaxial cables and Elevator installed coaxial cable infrastructure.
- .10 The Security Contractor shall warranty and ensure network bandwidth transmission performance, display, compression and network latency, PC client workstation, NVR's, SAN's and VMS server performance is designed and engineered to be sufficient, functional and in accordance with Milestone Systems VMS equipment and VSS hardware manufacturer.
- .11 The Security Contractor shall be sensitive to network bandwidth requirements and communicate all requirements to the Corporate Security Lead. It will be the sole responsibility of the Security Contractor to design and engineer all network transmission paths under the performance conditions of this specification and the requested deliverables.
- .12 All VSS Servers and workstations will have corporate antivirus agents installed by the Corporate Security Lead's IT Team prior to the installation. The additional travel time incurred by the successful bidder for deliveries to required sites for programming shall be at no charge to the COT.

13

VIDEO RECORDING

- .1 All video must be stored for 37 days. the local NVR disks must be capable of recording for the full thirty seven (37) days, at full system capacity.
- .2 Network Video Recorders:
 - .1 Minimum requirements include:
 - .1 RAID1 OS Volume array (2 x 240GB SSD)

- .2 RAID controller with minimum 512MB Battery backed cache
- .3 Enterprise Remote management capabilities, with virtual media and console access capabilities c/w out-of-band interface
- .4 RAID 1 Volume array for recording live video (15K RPM or better).
- .5 RAID 5 Volume array for archived video (7.2K RPM or better).
- .6 At least one global hot spare
- .7 All hard drives shall be Enterprise / Data centre grade
- .8 All DISK I/O's should run at no more than 80% of the maximum System capacity under normal operating conditions including Antivirus software, Encrypting Video and other required system services. 20% overhead shall remain free.
- .9 NVR's shall be equipped with Enterprise server network cards
- .10 Each NVR shall be equipped with two network ports for live viewing and two separate ports for recording video. All camera recording streams shall be on a separate VLAN.
- .11 Each NVR shall have a redundant and resilient connection to the SAN (where applicable) through a dedicated network
- .12 NVR Hardware shall be off-the shelf HP or DELL Servers
- .13 The NVR solution and design shall be certified and approved by Milestone Systems to meet the performance requirements of the VMS solution.
- .14 All Recorders to be configured and connected to COT centralized Milestone management system.

.3 Class A Recorder

- .1 Recording 16 or less local IP Video or Camera streams each streaming H.264 compressed video at a resolution of 1920x1080p, frame rate of 15fps, stream bandwidth of 2400Kbps/Stream, with 100% estimated scene motion, and continuously recording for 24hrs for a total of thirty seven [37] days retention period without any altering or compression to original recorded streams (i.e.: reducing P frames, or other compression techniques)
- .2 Allow for thirty-seven [37] days continuous recording on the local NVR RAID5 Storage Array with hot spare disk.
- .3 The following is an example of the required NVR. Equivalents, or others, approved by Milestone to be presented to City of Toronto for an approval.

Primary/Redundant NVR Specifications	
Requirements	
Processor/Chipset	1 x Intel Xeon E5-2620 v3 2.4GHz (or COT approved equivalent)
Operating System	Microsoft Windows Server 2012 x64 Standard

Monitor	<i>Refer to TR Typical for KVM requirements</i>
System Memory	Minimum 32GB 1600MHZ DDR3 Memory
Hard drives/OS	2 x 240GB Solid State SATA drives, 6Gbps 2.5in Hot-plug Drive, 3.5in (Raid 1)
Hard Drives/Live video	2 x 900GB 15K RPM SAS 2.5in Hot-plug Hard Drive, 3.5in (Raid 1)
Hard Drive/Archive	8 x 8TB 7.2K RPM SATA 6Gbps 512e 3.5in Hot-plug Hard Drive (Raid 5 + Hot spare)
RAID Controller	Enterprise Class Raid Controller with minimum 1GB Cache, supporting required disks and RAID levels with battery backup and write-back cache support.
Graphics	On board
Network	Broadcom 5720 QP 1Gb Network Daughter Card
I/O Ports	USB 2.0 or USB 3.0
Chassis Type	Rack mount, c/w pull out rails (tool-less mounting with square holes) Chassis with up to 12, 3" .5" Hard drives +2, 2.5" Flex Bay Hard Drives
Expansion Slots	Minimum 3x PCIe (2x16 Bandwidth, x8 Bandwidth)
Security	Chassis Intrusion Switch Setup/BIOS Password; lockable bezel
Remote Management	Enterprise remote virtue media and console access capabilities c/w out-of-band interface (Ex: IDRAC7 Enterprise or COT approved equivalent)
Power	Dual, Hot-plug, Redundant Power Supply (1+1), 750W
Support	4-Hour 7x24 On-Site Service with Emergency Dispatch, 3Year

.4 **Class B Recorder**

- .1 Recording 32 or less local IP Video or Camera streams each streaming H.264 compressed video at a resolution of 1920x1080p, frame rate of 15fps, stream bandwidth of 2400Kbps/Stream, with 100% estimated scene motion, and continuously recording for 24hrs for a total of thirty seven [37] days retention period without any altering or compression to original recorded streams (i.e.: reducing P frames, or other compression techniques)
- .2 Allow for thirty-seven [37] days continuous recording on the local NVR RAID5 Storage Array with hot spare disk.
- .3 The following is an example of the required NVR. Equivalents, or others, approved by Milestone to be presented to City of Toronto for an approval.

Primary/Redundant NVR Specifications	
Requirements	
Processor/Chipset	1 x Intel Xeon E5-2620 v3 2.4GHz (or COT approved equivalent)
Operating System	Microsoft Windows Server 2012 x64 Standard
Monitor	<i>Refer to TR Typical for KVM requirements</i>

System Memory	Minimum 32GB 1600MHZ DDR3 Memory
Hard drives/OS	2 x 240GB Solid State SATA drives, 6Gbps 2.5in Hot-plug Drive, 3.5in (Raid 1)
Hard Drives/Live video	2 x 900GB 15K RPM SAS 2.5in Hot-plug Hard Drive, 3.5in (Raid 1)
Hard Drive/Archive	8 x 8TB 7.2K RPM SATA 6Gbps 512e 3.5in Hot-plug Hard Drive (Raid 5 + Hot spare)
RAID Controller	Enterprise Class Raid Controller with minimum 1GB Cache, supporting required disks and RAID levels with battery backup and write-back cache support.
Graphics	On board
Network	Broadcom 5720 QP 1Gb Network Daughter Card
I/O Ports	USB 2.0 or USB 3.0
Chassis Type	Rack mount, c/w pull out rails (tool-less mounting with square holes) Chassis with up to 12, 3" .5" Hard drives +2, 2.5" Flex Bay Hard Drives
Expansion Slots	Minimum 3x PCIe (2x16 Bandwidth, x8 Bandwidth)
Security	Chassis Intrusion Switch Setup/BIOS Password; lockable bezel
Remote Management	Enterprise remote virtue media and console access capabilities c/w out-of-band interface (Ex: IDRAC7 Enterprise or COT approved equivalent)
Power	Dual, Hot-plug, Redundant Power Supply (1+1), 750W
Support	4-Hour 7x24 On-Site Service with Emergency Dispatch, 3Year

.5 Class C Recorder

- .1 Recording 64-128 local IP Video or Camera streams each streaming H.264 compressed video at a resolution of 1920x1080p, frame rate of 15fps, stream bandwidth of 2400Kbps/Stream, with 100% estimated scene motion, and continuously recording for 24hrs for a total of thirty seven [37] days retention period without any altering or compression to original recorded streams (i.e.: reducing P frames, or other compression techniques)
- .2 Allow for thirty-seven [37] days continuous recording on the local NVR RAID5 Storage Array with hot spare disk.
- .3 The following is an example of the required NVR. Equivalents, or others, approved by Milestone to be presented to City of Toronto for an approval.

Primary/Redundant NVR Specifications	
Requirements	
Processor/Chipset	2 x Intel Xeon E5-2660 v4 2.0GHz (or COT approved equivalent)
Operating System	Microsoft Windows Server 2012 x64 Standard
Monitor	<i>Refer to TR Typical for KVM requirements</i>
System Memory	Minimum 64GB 1600MHZ DDR3 Memory

Hard drives/OS	2 x 250GB Solid State SATA drives, 6Gbps 2.5in Hot-plug Drive, 3.5in (Raid 1)
Hard Drives/Live video	2 x 900GB 15K RPM SAS 2.5in Hot-plug Hard Drive, 3.5in (Raid 1)
Hard Drive/Archive	10 x 10TB 7.2K RPM SATA 6Gbps 512e 3.5in Hot-plug Hard Drive (Raid 5 + Hot spare)
RAID Controller	Enterprise Class Raid Controller with minimum 1GB Cache, supporting required disks and RAID levels with battery backup and write-back cache support.
Graphics	On board
Network	2 x Broadcom 5720 QP 1Gb Network Daughter Card
I/O Ports	USB 2.0 or USB 3.0
Chassis Type	Rack mount, c/w pull out rails (tool-less mounting with square holes) Chassis with up to 12, 3" .5" Hard drives +2, 2.5" Flex Bay Hard Drives
Expansion Slots	Minimum 3x PCIe (2x16 Bandwidth, x8 Bandwidth)
Security	Chassis Intrusion Switch Setup/BIOS Password; lockable bezel
Remote Management	Enterprise remote virtue media and console access capabilities c/w out-of-band interface (Ex: IDRAC7 Enterprise or COT approved equivalent)
Power	Dual, Hot-plug, Redundant Power Supply (1+1), 750W
Support	4-Hour 7x24 On-Site Service with Emergency Dispatch, 3Year

14 **VSS STORAGE AREA NETWORK (SAN)**

- .1 The SAN shall have the following minimum requirements:
 - .1 Equipped with redundant and hot-swappable power supplies and cooling Fans
 - .2 Support hot-swappable drives, each configured RAID 5 volume should be configured to have a hot spare disk available
 - .3 Support both iSCSI (1GB, 10GB), FCoE (10GB), FC (4-16GB) with Hot Swappable controllers
 - .4 Provide a minimum effective (Usable) total storage capacity of RAID5 configured arrays to allow for the required video storage retention of 30 days from each of the NVR's connected to it
 - .5 Expandable to allow for additional 30% effective storage capacity and the connectivity of additional two [2] NVRs
 - .6 Support redundant and load balancing SAN connectivity to each NVR Server.
 - .7 Support multiple RAID levels on connected storage within an array.
 - .8 Enough processing power and backplane bandwidth to support the total IOPS required for recording and retrieval of the video to and from the storage array.
 - .9 Enough memory bandwidth to support the buffering and queuing of system I/O's and transferred data.

- .10 Equipped with battery backed cache for all array controllers (minimum 512MB)
- .11 Intuitive enterprise level management and monitoring interface that can scale across the multiple SAN's
- .12 Preference for remote monitoring and support features.
- .2 The SAN shall be connected on its own dedicated local network; the security contractor shall provide the Cisco Network switches specifications and Media interface types required and coordinate these requirements with the Corporate Security Lead Networking Team. SAN network traffic shall not interfere with the any other network traffic.
- .3 All Patch Cables, labeling and connectivity between the SAN, Servers and SAN Network shall be the responsibility of the Security Contractor.
- .4 The management interface of the SAN shall be connected to the Corporate Security Lead's corporate network to allow for remote management and control.
- .5 The SAN solution and design shall be certified and approved by Milestone Systems to meet the performance requirements of the VMS solution.
- .6 Dell products are preferred, however alternatives approved by Milestone and which meet the above specifications will be considered.
- .7 DAS devices can be used instead of SAN where approved by the COT. The specified DAS must be approved by Milestone, achieve the desired recording duration, and allow for 25% video surveillance system growth. Dell and HP products are preferred, alternatives would have to be approved by the COT.
- .8 The below are the minimum DAS requirements. Equivalent, or others, approved by Milestone will be considered.

Minimum Specifications
Hardware
Minimum 8GB RAM
Dual Controller Array configuration
RAID Array Controller w/I GB Battery Backed Cache
DUAL Hot Swappable 10/100/1000 Ethernet Controllers with 4 ports each
Disk Configuration
SATA 7.2k RPM or better disks (Size or Disks Varies with required Storage, min 4TB disks rated for Enterprise DAS Storage and Video streaming applications)
Storage Volume to be configured as a RAID 10 Array

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CAMERAS

- .1 Install dome cameras in flush surface or drop ceiling with concealed cabling
- .2 Configure cameras internal access with a new Username/Password credentials and **remove default logins**

- .3 Configure cameras with secure access protocols, VLANs, QOS and other network settings in coordination with the Corporate Security Lead. Cameras shall be totally secured to authorized access before being connected to the Corporate Security Lead's Network
 - .4 All Cameras include elevator cab cameras shall be named in coordination with the Corporate Security Lead naming scheme and configured to sync with the Corporate Security Lead's local NTP server/VMS system
 - .5 Configure each camera stream settings including but not limited to frame rate, bitrate, compression, stream name, day night setting, and other related configuration in coordination with the Corporate Security Lead. All configurations shall be approved by the Corporate Security Lead before setting and configuring the devices
 - .6 Configure and calibrate cameras for the lighting conditions at each camera location including setting shutter speeds, AWB, Exposure levels, Day/Night mode, WDR, AGC, and other related settings to produce optimal video pictures under all operating conditions
 - .7 Ensure Cameras are operating the latest firmware version or as recommended by the manufacturer at time of installation.
 - .8 Backup all camera settings/configurations in addition to the VMS configurations to a CD/DVD and submit to Corporate Security Lead.
 - .9 Ensure outdoor cameras and their heater are properly powered to operate normally in all environmental conditions referenced in this section.
 - .10 All cameras with analytics capabilities shall be setup and calibrated for the supported alarms. Typical alarms to be configured by default for all cameras include:
 - .1 Motion in full or designated field of view zones
 - .2 Video Masking
 - .3 Video Loss/Gain
 - .4 Network Loss
 - .5 Device I/O's
 - .11 Configure logging and network troubleshooting capabilities on each IP cameras in coordination with the Corporate Security Lead.
 - .12 Configure Network Security features and settings on each camera in coordination with the Corporate Security Lead.
 - .13 For PTZ cameras configure Masks, home position, pre-sets, control sensitivity, image mode and other related settings in coordination with the Corporate Security Lead.
 - .14 All camera installations and field of view setup shall meet the VSS primary functions identified by the Corporate Security Lead. The following minimum resolution requirements are required for each of the VSS functions below:
 - .1 General Observation: >20ppf on farthestmost desired target
 - .2 Forensic Review (General Identification): >40ppf on farthestmost desired target
 - .15 Recognition including Facial, vehicle license plate, color, pattern, and cross-line recognition: > 80ppf on farthestmost desired target
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- .16 All camera views, resolution and image color and quality, shall pass the approval of the Corporate Security Lead.

15.2 **IR ILLUMINATORS**

- .1 All IR illuminators specified for specific camera installation projects are to be:
 - .1 Mounted and calibrated not to over expose the image quality during night time operation.
 - .2 All IR accessories shall be POE Powered unless otherwise approved by the Corporate Security Lead.
 - .3 All IR shall be IP66, Vandal resistant and mounted securely or be built-in to the camera. .4 IR 850nm wavelength, equipped with a Photocell and configured to activate on environmental lighting conditions.

16 **VIDEO ENCODERS**

- .1 The following are the minimum performance specifications for Video Encoders to be specified by the successful bidder:
 - .1 Rack mounted
 - .1 Flexible and Expandable allowing for hot swappable blades (applies to encoders for 1 channels or more)
 - .2 Equipped with redundant hot swappable power supply and fans (applies to encoders where more than 8 channels are required)
 - .3 Each encoder channel shall support H.264 video compression, a minimum of two simultaneous streams at 720 (horizontal) × 486 (vertical) NTSC analogue video resolution and 30fps.
 - .4 Each encoder channel shall have a minimum of one [1] configurable input/output .6 Security Contractor shall ensure the encoders support the PTZ protocols and control connectivity (RS- 485, RS-422) for connected PTZ analogue cameras
 - .5 Each encoder shall support the following analytics for each video channel and shall trigger an alarm on Milestone Systems XProtect Corporate® VMS:
 - .1 Camera repositioning
 - .2 Camera lens is masked, sprayed, covered or blocked
 - .3 Motion detection in defined zones of the camera view, minimum five [5] zones
 - .6 Each Encoder shall support the following alarms and shall be annunciated on the Milestone monitoring interface:
 - .1 .1 Video Signal loss /gained per channel
 - .2 .2 Network loss/gained
 - .7 Encoder shall be ONVIF compliant and supports (Profile S)

- .8 Encoder shall support the following protocols: IPv4/v6, HTTPS, SSL/TLS, QoS Layer 3, FTP, CIFS/SMB, SNMPv1/v2c/v3 (MIB-II), DNS, NTP, RTSP, RTP, TCP, UDP, IGMP, RTCP, ICMP, DHCP.
- .9 Shall support remote firmware upgrade.
- .2 All Encoders shall be rack mounted in a proper cabinet.
- .3 Configure each encoder interface and chassis (where applicable) with secure access protocols, VLANs, QOS and other network settings in coordination with the Corporate Security Lead. Cameras shall be totally secured to authorized access before being connected to the Corporate Security Lead's Network.
- .4 Each encoder channel shall be named in coordination with the Corporate Security Lead naming scheme and configured to sync with the Corporate Security Lead's local VSS NTP server/VMS system
- .5 Configure each channel stream settings including but not limited to frame rate, bitrate, compression, stream name, day night setting, and other related configuration in coordination with the Corporate Security Lead. All configurations shall be approved by the Corporate Security Lead before setting and configuring the devices
- .6 Ensure Encoders are operating the latest firmware version
- .7 Backup all Encoders settings/configurations in addition to the VMS configurations to a CD/DVD and submit to Corporate Security Lead.
- .8 Ensure Encoder chassis is powered through a UPS and backup power to operate normally in all environmental conditions referenced in this section
- .9 All encoder channels with analytics capabilities shall be setup and calibrated for the supported alarms. Typical alarms to be configured by default for all cameras include:
 - .1 Motion in full or designated field of view zones
 - .2 Video Masking
 - .3 Video Loss/Gain
 - .4 Network Loss
 - .5 Device I/O's
- .10 Configure logging and network troubleshooting capabilities on each channel and encoder chassis in coordination with the Corporate Security Lead.
- .11 Connect and configure PTZ Data control protocols and settings on channels that are connected to analogue PTZ.

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ETHERNET MEDIA EXTENDERS

- .1 The following are the minimum performance specifications for ethernet media extenders to be specified by the successful bidder in the event that the required product is not listed in the price form:
 - .1 Any camera that exceeds the standard 100BASE-TX connectivity distance limitation requires: 100Mbps Ethernet extenders to extend transmission with POE pass-through over standard 75Ω coaxial cables

- .2 Extended Pass-through POE: meets the IEEE 802.3af standard for Power over Ethernet
- .3 Supports Jumbo Frame Transmission
- .4 Extends up to a minimum of a minimum of 548m at 100BaseT with POE pass-through
- .5 Suitable for high bandwidth requirements of Mega-pixel cameras
- .5 Aluminum Enclosure
- .6 Meets NEMA TS-1/TS-2 environmental requirements

.2 Power and Ethernet Over Coax

- .1 The following are the minimum performance specifications for Power and Ethernet over Coax devices that are to be specified by the successful bidder:
 - .1 Proposed IP and PoE/PoE+ over Coax solution shall, as a minimum, meet the following requirements:
 - .1 Provide enough PoE or PoE+ (IEEE 802.3af/802.3at) to Power the IP devices in all conditions and up to 50W (ex: When built-in heater is activated, PTZ, blower where applicable)
 - .2 Provide adequate output power to power the devices and provide Ethernet transmission over the various types, lengths and quality of wiring existing at the locations in scope
 - .3 Has minimal end-to-end Latency of $\leq 3\text{ms}$ that shall not affect the Video/Ethernet transmission over Coax
 - .4 Transceiver unit close to the edge device shall operate normally in outdoor environmental conditions as mentioned under paragraph (2.3.2.1.2 Outdoor) and shall not require an extra power source to operate.
 - .5 Provide transient overvoltage and electrostatic discharge protection and immunity to a minimum of: $5 \times 20\mu\text{S}$ 3,000A 6,000V; ESD protection for 200pF 20KV.
 - .6 Provide an encrypted Coax link with a minimum of 128Bit AES encryption.
 - .7 Head-end transceivers shall be rack mounted in standard 19" rack cabinets, for single channel transceivers a rack mounting kit shall be used to securely and neatly mount a single transceiver to the rack (placing unit on trays or loosely in the cabinet is not acceptable).

.3 VSS Power Component

- .1 The following are the minimum performance specifications of VSS Power Components that are to be specified by the successful bidder.
 - .1 All VSS system components including but not limited to (POE Switches, Camera power Supplies, NVR Servers, VMS Servers, Encoders, Media converters, KVM Switches, Environmental and Cabinet Sensors, SAN etc....) shall be powered from a UPS backed by emergency power (where

- available) allowing for continuous, un-interrupted, operation of the complete VSS system for duration specified by COT during project quote phase. COT will require proof of MSRP from UPS manufacturer with MSRP discount applied as provided in the Price Form. The UPS system shall protect connected equipment from brownouts, overvoltage and other power irregularities.
- .2 All UPS equipment shall be securely rack mounted in cabinets. UPS equipment shall not be placed on shelves, installed on the ground or placed inside cabinets without proper rack rails or rack mounting kits unless approved by the Corporate Security Lead.
 - .3 The complete IP VSS system and its distributed components shall be connected to a UPS for continued operation (provisioned at maximum power usage) where a backup circuit is available. The required power backup operation window shall include the provisioning for future expansion.
 - .4 In addition to the above requirement the following shall apply for UPS selection and sizing:
 - .1 Securely rack mounted in a secure lockable cabinet
 - .2 Sized to allow for a minimum of 40% extra power for future expansion
 - .3 cUL listed and meets the following standards: UL 1449, UL 1778, CAN/CSA-C22.2 NO. 60950-1-07(R2012)
 - .4 Provides surge protection and filtering
 - .5 Supports USB management, c/w windows software and management application to allow for server controlled shutdown upon reaching a set low battery threshold or internal Web based management interface
 - .6 Alarms when on battery and c/w status LED indicators for normal operating mode, alerts and battery backup mode
 - .7 Maintenance-free, sealed, user-replaceable and leak proof Lead-Acid Battery w/c automatic self-testing circuitry detecting and ensuring proactive alerts for battery replacement and/or faults
 - .8 Resettable circuit breaker and automated recovery, ensures protection of connected loads from surges, spikes, lightning and other power disturbances
 - .9 Medium & Large TR's to be equipped with expandable and upgradable rack mounted UPS units including sliding rack rails allowing for ease of maintenance, upgrades and serviceability
 - .5 All new VSS IP Cameras shall be powered by PoE or PoE+ from respective PoE capable switches or Ethernet with PoE/PoE+ pass through media extenders. No exceptions are accepted unless for special purpose cameras requiring external power where applicable. This exception shall be approved in writing by the Corporate Security Lead.
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- .6 IP and PoE/PoE+ over Coax solution shall be used to power IP cameras in analogue to IP cameras retrofit scenario. All new IP cameras shall be powered by PoE/PoE+ and shall not be connected to existing power supplies that are not connected to a UPS System.
- .7 PoE power provisioning shall be communicated and coordinated with the Corporate Security Lead and Corporate Security Lead's Networking Team and specified as part of the Cisco Network equipment. No assumptions of PoE/PoE+ power availability shall be made on any Corporate Security Lead provided network access switches unless previously coordinated and requested in writing from the Corporate Security Lead.

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EQUIPMENT CABINETS/RACKS

- .1 The Security Contractor shall be sensitive of the equipment room's space availability at the various locations in scope for rack installations. High density and low profile equipment should be considered in the proposed equipment design to reduce space requirements. The security contractor shall advise the Owner of any space required for additional rack quantities beyond what is provided and specified in the project scope. Corporate Security requires a dedicated secured rack for all security installations.
- .2 The following are the minimum performance specifications of various cabinets and enclosures that are to be specified by the successful bidder:
- .3 **NEMA 12 – Rack Cabinets W/ Self-Contained Cooling Unit**
 - .1 Pre-assembled before delivery
 - .2 Fully gasketed openings including gland plate in base
 - .3 Closed loop air-conditioning system, adequately sized to match equipment heat dissipation and cooling requirements (shall not require any piping, wiring or drainage) and shall also allow for 25% increase in heat generation of specified equipment. .4 Internal evaporator to eliminate condensation
 - .4 M6 Rail Type
 - .5 Plexi or Solid Doors
 - .6 Key Lockable secure doors and side panels
 - .7 Include casters and levelers
 - .8 Compatible vertical mounted PDU's
 - .9 Include cable management (vertical and horizontal lacing bars, front to back cable managers, bottom brush grommet kit, filler panels etc....) required for a neat cable and equipment installation
 - .10 Include grounding kit and ground appropriately
 - .11 Cabinet Size and Cooling Requirements shall be approved by Corporate Security Lead
- .4 **NEMA 12 - Wall Mount Cabinets**
 - .1 Pre-assembled

- .2 Double hinged allowing access to the front and back side of cabinet
- .3 NEMA 12 Fan Assembly
- .4 Independent Key lockable from and back side
- .5 Lifetime Warranty
- .6 M6 Rail type
- .7 Include cable management (vertical and horizontal lacing bars, front to back cable managers, bottom brush grommet kit, filler panels etc....) required for a neat cable and equipment installation
- .8 Cable management trays, and arms
- .9 Include grounding kit and ground appropriately
- .5 **Standard Rack Cabinets**
 - .1 42 U, Pre-assembled before delivery
 - .2 Vented Side Panels, with key locks
 - .3 Casters and levelers
 - .4 M6 Rails
 - .5 Split doors back and front side, with key locks
 - .6 6 x 4" fans top panel
 - .7 Include grounding kit and ground appropriately
 - .8 Include Vertical PDUs
 - .9 Include cable management (vertical and horizontal lacing bars, front to back cable managers, bottom brush grommet kit, filler panels etc....) required for a neat cable and equipment installation
 - .10 Cable management trays, and arms

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REAL-TIME ENVIRONMENTAL MONITORING COMPONENT

- .1 Provide real-time, ethernet (IP) based environmental monitoring solution at each in of the existing and new VSS designated racks.
 - .2 The monitoring unit shall be rack mounted
 - .3 Shall have a dual temperature/humidity sensor, intelligent water temperature sensor and door contact sensors for each cabinet door
 - .4 The monitoring component shall be connected to the City corporate network
 - .5 Capable to notify the Owner of any changes or detections by the sensors in a variety of ways including e-mail and SNMP
 - .6 Supports SNMP v1, v2, v3
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- .7 Manageable through an intuitive web interface
- .8 **Rack KVM Tray**
 - .1 The following are the minimum performance specifications of Rack KVM Trays that are to be specified by the successful bidder.
 - .1 Integral KVM Switch with keyboard, LCD monitor, and touch pad in 1U FORM .2 Allows remote network user access through KVMoIP over WAN & LAN
 - .2 Full Sized 105-Key keyboard
 - .3 Ergonomic hand rest
 - .4 Includes Universal Rear Rail Kit
 - .5 CE, RoHS approved
 - .6 Flip Open Monitor Minimum 19" TFT LCD monitor, 1280 x 1024 @ 60 Hz
 - .8 Dual Rail Flip Open Monitor when Keyboard and Mouse are closed
 - .7 Control via on-screen display (OSD) menu, push buttons Selection Buttons on monitor bezel, hotkeys, or mouse.
 - .8 Connects to servers through CATx patch cables and required server access modules
 - .9 16-Port CATx KVM
 - .10 Provide BIOS Level Access

20 **LABELLING**

- .1 All cables shall be tagged, with a unique number, in common at both ends using a permanent method. Labelling shall agree with record drawings and point allocation tables and to indicate source and destination information.
 - .2 All terminals shall be permanently tagged and shall agree with record drawings.
 - .3 All system power supplies shall be labelled with their feed source and breaker number.
 - .4 All connectors shall be marked with common designations for mating connectors. The connector designations shall be indicated on the record drawings.
 - .5 All visible panel and control labels shall be silk-screened, engraved and filled, or engraved plastic laminate. Labels shall be permanently attached.
 - .6 Labelled Doors and Frames in no instance shall any labelled fire door or frame be cut, penetrated, drilled or modified in any way.
 - .7 Any labelled door or frame which shall require modification to meet the system specifications shall immediately be brought to the attention and written approval of the Project Manager.
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21 **CONFORMITY OF WORK WITH PLANS AND SPECIFICATIONS**

- .1 The Successful Bidder shall perform all Work and furnish all materials and complete the whole of the Work in conformance with the requirements.
- .2 Any Work or material not herein specified but which may be fairly implied as indicated in the Contract or obviously necessary for the proper delivery of a fully functional system, shall be done or furnished by the Successful Bidder as if such Work or material had been specified.
- .3 The Successful Bidder shall at all times have on the Work site, competent Personnel capable of reading and thoroughly understanding the plans and specifications, and thoroughly experienced in the type of Work being performed. Such Personnel shall include the supervision and direction of all Subcontractors, if any are used. The designated Personnel shall have available at all times the lists/floor plans required.
- .4 Upon request, the Successful Bidder shall provide the City of Toronto Corporate Security a list of all Personnel's duties, responsibilities, and obligations for the Work required.

22 **SUPPLY AND INSTALL PROJECT PROCEDURES**

- .1 The City of Toronto Corporate Security and the Successful Bidder shall follow the procedures set-out in General Contract Terms and Conditions for all supply and install Work. The standard Security Project Work Package which will be provided to the Successful Bidder has been created to ensure consistent implementation/execution of the individual projects regardless of the projects size and scope.
- .2 Prior to the execution of any supply and install projects the Successful Bidder shall familiarize and comply with the project procedures set-out in General Contract Terms and Conditions, Supply and Install Procedures Package.
- .3 **General Specifications**
 - .1 The Deliverables being supplied in this document must be new and certified by the Vendor, and free of encumbrance. Refurbished, rebuilt, or used Products will not be acceptable.
 - .2 All specifications are minimum requirements that must be met or exceeded. Bids containing one or more items that do not meet or exceed the minimum general specifications will be declared Non-Compliant.

23 **IT COORDINATION**

- .1 Coordinate with the Corporate Security Lead team for all equipment programming. Upon approval, connect, test all equipment and ensure there are fully and properly operating
 - .2 All security equipment configurations shall be performed by the Corporate Security Lead IT Team in coordination, and support from the Security Contractor
 - .3 All IP enabled devices with Username/Password parameters shall be configured with a designated temporary credentials and provided to the Corporate Security Lead. Default credentials shall be immediately removed upon initial power up and configuration of the device.
 - .4 All typical configurations shall be coordinated and approved by the Corporate Security Lead IT Team before configuring the devices. The additional travel time incurred by the
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successful bidder for deliveries to required sites for programming shall be at no charge to the COT.

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LICENSING

- .1 The City prefers any net new licenses required to be a onetime purchase. Support and maintenance agreements should be independent of the software license.
 - .2 The Vendor should be able to provide to the City at no additional cost at least one (1) copy of the Documentation for each copy of a licensed software.
 - .3 The Vendor should be able to grant to the City a perpetual, non-exclusive, irrevocable, transferable, fully paid-up, royalty-free right and license to install, use, and copy (on storage units or media for backup or other contingency purposes), all or any portion of each licensed software, together with all associated Documentation, in accordance with the Terms of the resulting Contract and:
 - .1 The Vendor should provide to the City at least one (1) copy of each licensed software in installable FORM unless it has specified a greater number of copies;
 - .2 If the City is licensed to use any licensed software on any computer or computer complex, the City may transfer the licensed software to any different computer or computer complex without any fee or other charges being due to the Licensor;
 - .3 If the City is licensed to use any licensed software in conjunction with any operating system, the City may use the licensed software in conjunction with any other operating system without any fee or other charge being due to the Vendor if the licensed software is certified to operate on that other operating system when that use commences, regardless of whether the operating system was in existence or not in existence at the time the licensed software was originally licensed by the City;
 - .4 If a CPU based license is provided, the CPU based license should be a perpetual license to use the licensed software on one physical CPU and such perpetual CPU license should not be conditional on any Terms and conditions not set out expressly in the Contract. The City may transfer the licensed software from one physical CPU to another physical CPU at any time or times without notice to the Vendor and without any fee or other charges being due to the Vendor. A CPU license for a physical CPU is not limited in any way by the use of multithreading, hyper-threading, or any quantity of logical CPU.
 - .5 If concurrent user licenses are provided, then the concurrent user license should be a perpetual license to permit the use of the licensed software on a concurrent basis (limited to the number of simultaneous users of the licensed software) and such concurrent user license should not be conditional upon any Terms and conditions not set out expressly in the Contract. The Vendor should provide in the licensed software a utility to manage the list of users who are sharing the concurrent user license(s) and provide a mechanism within the licensed software to ensure that the contracted number of concurrent user license(s) is made available for users. The City may add to the number of users who can share the concurrent user license(s) at any time without notice to the Vendor and without any fee or other charges being due to the Vendor.
 - .6 If named user licenses are provided, then the named user license should be a perpetual license to permit one (1) individual to use the licensed software and such named user license should not be conditional upon any Terms and conditions not set out expressly in the Contract. The City may transfer the named user license from one (1) individual to
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- another individual at any time or times without notice to the Vendor and without any fee or other charges being due to the Vendor;
- .7 The Vendor should have the exclusive title to the licensed software and Documentation or otherwise have the right to grant to the City each license and every right under to each licensed software and the Documentation as contemplated by the Contract without violating any third party Intellectual Property Rights;
- .8 Each licensed software and the Documentation should be free from all encumbrances, should not, and will not contain any Disabling Code;
- .9 The Documentation should be well written, readily understood, and contain clear and concise instructions for users and system administrators of the licensed software and should include meaningful instructions to enable users and systems administrators to take full advantage of all of the capabilities of the licensed software including installation and system administration documentation to enable a system administrator to allow proper control, configuration and management of the licensed software;
- .10 For the duration of the Warranty Period, the licensed software will perform in accordance with the specifications and descriptions contained in the Contract, in the Vendor's published Documentation and specifications, and in the Documentation for the version of the software in use by the City;
- .11 The licensed software should be compatible with future releases of the operating system on which it was originally installed within one hundred and twenty (120) calendar days of general availability of the operating system and shall be subsequently maintained to remain so compatible;
- .12 The Vendor shall provide to the City, without additional charge, copies of the licensed software and Documentation revised to reflect any enhancements made by the Vendor and such enhancements will be deemed to include all Versions, Releases and other modifications to the licensed software which correct errors, increase the speed, efficiency, capacity or ease of operation of the licensed software, or add additional capabilities or functions to or otherwise improve the capabilities and functions of the licensed software; and
- .13 The Warranty Period of licensed software shall commence on the Initial Install Date of such licensed software.
- .14 Each software license granted pursuant to the Agreement should survive any expiry or termination of the Agreement.

25

SOFTWARE UPDATES

- .1 The Successful Bidder shall provide all software updates and revisions to the City during the length of this contract term warranty period without cost to the City. The Successful Bidder must register and maintain all applicable Formal technical support agreements with manufacturers including but not limited to American Dynamics and Dedicated Micros, Milestones, BriefCam, Software House, CCURE9000, Key Tracer. Registration of the technical support agreements.
- .2 The Successful Bidder is responsible to maintain 100% functionality of the CCTV and AV Systems prior to and after scheduled updates are performed.
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- .3 Where there is integration between City systems, the Successful Bidder must maintain integration compatibility and advise the City if software updates may impact the current integration performance and functionality.

26 **UPGRADES AND UPDATES**

- .1 Throughout the Contract Term and its Warranty period, the Successful Bidder shall provide notice to the Project Manager within 24-hours of all manufacturers' or software developer's release of a version, firmware, and/or patch upgrade and/or update for all security systems owned or operated by the City that pertains to this Contract.
- .2 The Successful Bidder shall include; without any additional costs to the City, all manufacturer and/or City of Toronto recommended application and operating system upgrades and updates including licenses, versions, firmware, hot fixes and patches to ensure continuous performance and continuity of City CCTV and AV Systems.
- .3 The Successful Bidder shall provide the City with all software upgrades and updates, in original packaging (where available), with original manuals/documentation, and original copies (compact discs, floppies, etc.).

27 **FUTURE SYSTEM EXPANSION**

- .1 The City reserves the right to have other qualified firms expand and/or add to the systems at any time.
- .2 The City reserves the right to make changes, alterations, additions, or deletions to any of the City's equipment.

28 **DELIVERY AND INSTALLATION**

- .1 The Vendor must deliver the specified Deliverables as per their Quotation without substitution or deviation. All items shall be delivered F.O.B. Destination.
 - .2 The Successful Bidder must deliver the specified Products and/or Services as per their Quotation without substitution or deviation.
 - .3 The Successful Bidder shall provide staff who are qualified to undertake the installation Services required under the Terms of this document. The staff must be certified to install and set-up the Products produced by the manufactures that are listed in the 33.0 Manufactures List.
 - .4 The Successful Bidder shall restore all property temporarily removed, damaged, or destroyed during the supply, delivery, and installation, of Products to the satisfaction of the City and at no cost to the City. The Successful Bidder, before final payment, shall remove all surplus materials and any debris of every nature resulting from its operation and put the site(s) in a neat, orderly condition; thoroughly clean. If the Successful Bidder fails to clean up at the completion of the supply, delivery, and installation of the Products, then the City may do so and charge the Successful Bidder for the costs thereof, or deduct said costs from any monies still owing to the Successful Bidder.
 - .5 The Successful Bidder shall furnish all labour, materials, Services, supplies, tools, equipment, apparatus, transportation, facilities and incidentals required and perform all operations necessary to accomplish the complete installation of the Product(s).
-

.6 Return of Products

- .1 Should the Product fail to work upon arrival, or within thirty (30) days of arrival, the Product will be returned for a complete exchange of new working Product (same make and model), at no cost to the City. The Product must be exchanged within five (5) business days of notification. The Warranty Period of the replaced Product will be deemed to date from the day of replacement.
- .2 If the Product(s) do not function as warranted and the problem cannot be resolved to the satisfaction of the City, then the Product(s) may, at the sole discretion of the City, be returned for a full refund.
- .3 In the event an item has been discontinued by the manufacturer/supplier, the supplier must provide documentation to confirm the product is no longer available and provide a viable substitute that meets or exceeds the current specifications at the same price.
- .4 The Vendor will be responsible for all costs associated with the return and replacement of any products which have been discontinued. This will include all freight, packaging and handling costs.
- .5 The City will not accept any changes related to the discontinued product. The City will not be responsible for any restocking charges associated with returns.
- .6 Bidders must not substitute contract approved product(s), commodity(s) or service(s) without prior written approval from City of Toronto Purchasing and Materials Management staff, on either City of Toronto letter head or City of Toronto originating email. Any approved substitution must meet or exceed the approved good, approved commodity or approved service to be substituted, at no additional cost to the City of Toronto.

29

WARRANTY

- .1 The Successful Bidder shall include a two (2) year Warranty for all parts and labour as per the Warranty conditions of this document.
 - .2 Warranty shall include all Preventive Maintenance for two (2) full year periods. This entails two site visits per warranty year.
 - .3 If, within two (2) years after the date of final acceptance of the Work as determined by the Corporate Security Lead, or designated portion thereof, or within two (2) years after acceptance by the Corporate Security Lead of designated equipment, or within such longer period of time as may be prescribed by law, or by the Terms of any applicable special Warranty required by the contract, or applicable codes, any of the Work found to be defective or not in accordance with the contract, the Successful Bidder shall correct it after receipt of a written notice from the City to do so unless the City has previously given the Successful Bidder a written acceptance of such condition. This obligation shall survive termination of the contract. The City shall give such notice promptly after discovery of the condition.
 - .4 All installed equipment, shall be subjected to its own Preventative Maintenance schedule; the schedule is to be submitted after final acceptance of equipment installation with the submitted as-builts. The Preventative Maintenance must be performed in accordance to NFPA 731 throughout the Warranty period, or a minimum of two times a warranty period whichever is greater, at no further cost to the City.
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- .5 Nothing contained in the contract shall be construed to establish a period of limitation with respect to any other obligation that the Successful Bidder might have under the contract.
 - .6 The establishment of the time period of two (2) years after the date of final acceptance, or such longer period of time as may be prescribed by law, or by the Terms of any Warranty required by the contract relates only to the specific obligation of the Successful Bidder to correct the Work, and has no relationship to the time within which its obligation to comply with the contract documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Successful Bidder's liability with respect to his obligations other than specifically to correct the Work.
 - .7 If this contract in its specifications requires that specific deliverables must perform as a system, this representation and Warranty shall apply to the deliverables, individually, in combination with each other, and as a system. Where the Successful Bidder will be providing any component of a deliverable from or through a Subcontractor, the Successful Bidder shall cause its Subcontractor to comply with this representation and Warranty with respect to the component to be provided by such Subcontractor.
 - .8 Where the deliverable being provided by the Successful Bidder has an interface with any other product and such interface is necessary for the functionality, operation or performance of its deliverable, the Successful Bidder shall ensure that such product complies with this representation and Warranty and such interface does not in any way impair the ability of its deliverable to comply with this representation and Warranty.
 - .9 At the Corporate Security Lead's request made in writing at any time before or within 90 calendar days (or such other time period as designated by the City in writing) of its acceptance of the deliverable, the Successful Bidder will, at no charge to the City, demonstrate the compliance techniques and test procedures to be followed by the Successful Bidder or the City or its authorized agent to confirm that the deliverable complies with this representation and Warranty.
 - .10 Where the Successful Bidder advises the City that its deliverable is not able to comply with this representation and Warranty at this time but will be able to do so by a specified date, the City may at its sole discretion accept the deliverable on the condition that there is compliance by the specified date; however, the City is not obligated or liable to make payment for the deliverable until such condition is satisfied.
 - .11 In the event of any breach of this Warranty and representation, the remedies available to the City shall include but not be limited to:
 - .1 The Successful Bidder restoring the deliverable to the same level of performance as represented and warranted herein;
 - .2 The Successful Bidder repairing or replacing the deliverable with a deliverable conforming with this representation and Warranty;
 - .3 The Successful Bidder granting or securing for the City or its authorized agent permission to make any modifications necessary to make the deliverable compliant with this representation and Warranty and arranging for any necessary waivers of moral rights or other intellectual property rights to make such modifications; and
 - .4 The Successful Bidder granting the City or its authorized agent access to the source code for the information technology used in the deliverable in order to make any modifications necessary to make the deliverable compliant with this representation and Warranty or securing for the City the necessary permission for such access and arranging for any necessary waivers of moral rights or other
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intellectual property rights to make such modifications, in each case, so as to minimize interruption to the City's ongoing business processes, with time being of the essence, and to be done at the Successful Bidder's sole expense.

- .12 The Successful Bidder represents and warrants that any restoration, repair or replacement made will not corrupt any data of the City or introduce any viruses into the City's system. The Successful Bidder agrees that any modification made pursuant to subparagraph 30.5 or 30.6, above, is the property of the City, including all copyright and other intellectual property rights pertaining thereto.
- .13 This Warranty shall survive cancellation or other termination of this contract.
- .14 Nothing in this representation and Warranty shall be construed to limit any rights or remedies (including indemnities) otherwise available to the City under this contract or at law or equity; and nothing in the contract shall limit the scope of this representation and Warranty and any rights or remedies set out herein, and, in particular, no waiver or disclaimer set out in such agreement (or made otherwise) shall operate to limit the Successful Bidder's liability under this representation and Warranty.
- .15 In the event that the Successful Bidder fails to make good such defects within a stipulated time, the City reserves the right to have the Work performed by other qualified suppliers. All costs incurred by the City are to be paid by the Successful Bidder.
- .16 The Successful Bidder after the date of final acceptance of all work/orders as determined by the City, or designated portion thereof, provide, in addition to the Warranty Certification a preventative Maintenance schedule for the duration of the Warranty period.
- .17 The Successful Bidder shall complete all manufacturer Warranty registration for applicable Products as per the Warranty Terms purchased and provide proof of registration to the City within 30 calendar days of installation.

30

WARRANTY SERVICE

- .1 The Successful Bidder shall provide and maintain its call center telephone number(s) and call placement procedures to City of Toronto Corporate Security and the SCC for dispatching Personnel for warranty services. The telephone number(s) must be a local (Toronto) 10 digit number. The City will not accept any number that results in long distance charges for the City when placing a call from the City of Toronto.
- .2 The Successful Bidder's Call Centre telephone number(s) must be answered by a live operator and available during Daytime hours (06:00-18:00hrs, Monday through Friday), excluding statutory holidays.
- .3 The Successful Bidder must also maintain an email address for warranty service requests. Automated email responses are not acceptable.
- .4 The Successful Bidder shall provide contact lists (one list for during daytime hours and a separate list for afterhours) to ensure the required warranty service resolution times are met.

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SERVICE CALLS

- .1 The technician must report to the work site, diagnose the issue and provide a corrective maintenance solution of the initial call for corrective maintenance services. The Vendor must obtain a work order from the City Designated that details the products and number of

labour hours required prior to ordering Products and performing any warranty services resulting from the service call.

- .2 Upon arrival at the location, the technician must notify the Corporate Security Control Centre by phone at 416-397-0000;
- .3 Upon departure of the location, the technician must notify the Corporate Security Control Centre by phone at the end of each day, by email to SecSysSD@toronto.ca, and provide a required, future steps to be taken.

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SERVICE CALLS

The Warranty Service Call Priority	Resolution Time
(1) Urgent	48 HOURS
(2) High	Five (5) Business Days

33

PASS-THROUGH WARRANTIES

- .1 The Successful Bidder will, to the extent permissible, agrees to pass through to the City of Toronto any warranties given by its third party vendors in connection with hardware, software or other products or services used by the Successful Bidder to provide the Services to the extent permitted by the terms and conditions of such warranties and pass through to the City of Toronto all available warranties and provide all available (including extended) applicable original equipment manufacturer and additional warranties for third party Equipment used to provide the Services. The Successful Bidder will obtain and pass through to the City of Toronto any warranties required by the specifications for Equipment procured on behalf of the City of Toronto. The Successful Bidder will, to the extent permissible, pass through to the City of Toronto all available warranties and provide all available (including extended) applicable original equipment manufacturer and additional warranties for Equipment owned by the City of Toronto.
- .2 The Successful Bidder shall secure from the applicable Equipment or third party Software manufacturers, and assign and pass through to the City of Toronto, at no additional cost to the City of Toronto, such warranties as may be available with respect to such Equipment and Software. Such assignment shall not, however, relieve the Successful Bidder of any of the warranty obligations contained herein. In the event such warranties are not assignable to the City of Toronto, the Successful Bidder shall enforce, as necessary, such warranties on behalf of the City of Toronto.
- .3 In the event that Contractor purchases Goods or Materials in its own name for incorporation in the Work delivered to the City of Toronto, and the Successful Bidder receives a warranty from the vendor of such Goods or Materials, the Successful Bidder shall ensure that such warranty is passed through to, and is enforceable by, the City of Toronto.

34

COMPLIANCE WITH STANDARDS

- .1 The Successful Bidder shall maintain a high level of workmanship and comply with the following codes, standards and procedures. Bidders that have completed and submitted the Confidentiality Agreement will be provided with copies of the City of Toronto standards listed below at the Mandatory Site Meeting.
 - .1 City of Toronto Corporate Cabling Standards

- .2 City of Toronto Corporate IT Standards
 - .3 City of Toronto Corporate Security Standards
 - .4 City of Toronto Video Security Surveillance Policy
 - .5 City of Toronto Corporate Security Intellex DVR Installation, Configuration, Programming and Naming Standard
 - .6 City of Toronto Corporate Security CCTV and AV Systems Installation Standards
 - .7 City of Toronto Corporate Security CCTV and AV Maintenance Standards
 - .8 City's Workplace Violence Policy
 - .9 City of Toronto Corporate Security Access Control Systems Installation Standards
 - .10 City of Toronto Corporate Security Intercom System Installation Standards
 - .11 City of Toronto Corporate Security Access Control and Intercom System Maintenance Standards
 - .12 City of Toronto Corporate Security – Security Schedules – Drawing Typicals
 - .13 City of Toronto Corporate Security Structured Cabling Standards
 - .14 City of Toronto, Toronto Water Plant Structured Cabling System Standard
 - .15 City of Toronto Acceptable Use Policy
 - .16 City of Toronto CityNet Acceptable Use Agreement
 - .17 Transport Canada Reference Manual for Using Closed Circuit Television in Counter-Terrorism Activities.
 - .18 AC transients UL 964
 - .19 Access Control equipment manufacturer's specifications, latest issue
 - .20 American Society for Testing Materials (ASTM)
 - .21 ANSI/EIA-310 and its addendum
 - .22 ANSI/TIA/EIA-568-B.1 and its addendum
 - .23 ANSI/TIA/EIA-568-B.3 and its addendum
 - .24 Applicable local Building Codes
 - .25 Association Architectural Graphic Standards for Security System Layout SIA/APSC AG-01-1995.12 (R2000.03)
 - .26 BICSI Information Transport Systems Installation Manual – Most current Edition
 - .27 BICSI Network Design Reference Manual – Most current Edition
 - .28 BICSI Telecommunications Distribution Methods Manual – Most current Edition
 - .29 Communications: IEEE RS232C and RS485
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- .30 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-[98], Canadian Electrical Code, Part 1 (18th edition) Safety Standard for Electrical Installations.
 - .2 CAN/CSA-C22.3 No.1-[M87 (R1997)], Overhead Systems.
 - .31 Design: MIL 275E
 - .32 Electrical Standards Authority
 - .33 Electrostatic immunity: IEC 801.2 level 4
 - .34 EMI emissions: FCC part 15
 - .35 Institute of Electrical and Electronic Engineers (IEEE)
 - .36 Intercom equipment manufacturer's specifications, latest issue
 - .37 Manufacturing: ISO 9003
 - .38 National Fire Protection Association (NFPA®)
 - .1 NFPA® pamphlet 51B
 - .2 NFPA® 70, National Electric Code.
 - .3 NFPA® 730, Guide for Premises Security 2008 or latest edition
 - .4 NFPA® 731, Standard for the Installation of Electronic Premises Security Systems, 2008 or latest edition
 - .39 Ontario Building Code
 - .40 Ontario Fire Code
 - .41 Parks Canada - Standards and Guidelines for the Conservation of Historic Places in Canada
 - .42 Process Control System Implementation Manual
 - .43 Underwriters' Laboratories
 - .1 CAN/ULC-S302-M91 - Standard for Installation and Classification of Burglar Alarm Systems for Financial and Commercial Premises, safes and Vaults
 - .2 CAN/ULC-S304-06, Signal Receiving Centre and Premise Burglar Alarm Control Units.
 - .3 CAN/ULC-S317-[1996], Installation and Classification of Closed Circuit Video Equipment (CCVE) Systems for Institutional and Commercial Security Systems.
 - .4 CAN/ULC-S319-05 Electronic Access Control Systems
 - .5 CAN/ULC-S3-1-M88 Standard for Central and Monitoring Station Burglar Alarm systems.
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- .6 CAN/ULC-S524-06 – Installation of Fire Alarm Systems
- .7 CAN/ULC-S559-04 – Equipment for Fire Signal Receiving Centres and Systems
- .8 CAN/ULC-S561-03 – Installation and Services for Fire Receiving Centres and Systems
- .9 UL 1076-[1995], Standard for Safety for Proprietary Burglar Alarm Units and Systems.
- .10 UL 1635 Digital Alarm Communicator System Units
- .11 UL 1981 Central Station Automation Systems
- .12 UL 294-[1999], Standard for Safety for Access Control System Units.
- .13 UL 681 Installation and Classification of Burglar and Holdup Alarm Systems
- .14 UL Testing Bulletin
- .15 Underwriters Laboratories (UL) Cable Certification and Follow Up Program

35

MANUFACTURERS LIST

- .1 Aegis
 - .2 ADI
 - .3 ADT Canada
 - .4 Aiphone Corporation
 - .5 Alarm Saf
 - .6 Altronix Corporation
 - .7 Alpha Technologies
 - .8 American Dynamics
 - .9 Amseco
 - .10 Ameta International Co. Ltd.
 - .11 APC by Schneider Electric
 - .12 Arecont Vision
 - .13 Asterix Security Hardware International Inc.
 - .14 Anixer
 - .15 ASSA ABLOY Canada
 - .16 AutoGate Inc.
 - .17 Automatic Systems America Inc.
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- .18 Avigilon
 - .19 AWID
 - .20 Axis Communications, Inc.
 - .21 Berk-Tek
 - .22 Black Box Network Services
 - .23 Boon Edam, Inc.
 - .24 Bogen Communication, Inc.
 - .25 Bosch Security Systems
 - .26 Camden Door Controls
 - .27 Cansec Systems Ltd.
 - .28 CCTV Direct
 - .29 CDVI Americas Ltd.
 - .30 CDW
 - .31 Cisco Systems
 - .32 Commend Inc.
 - .33 Computar
 - .34 D-Link Canada Inc.
 - .35 Dahua Technology
 - .36 Dedicated Micros
 - .37 Detex
 - .38 Digital Watchdog
 - .39 DIRAK Inc.
 - .40 DITEK Corporation
 - .41 DoorKing Inc.
 - .42 DSC
 - .43 DWG Distribution
 - .44 Eyesonic Enterprises Inc.
 - .45 FLIR Fibre Technologies
 - .46 GAI-Tronics
 - .47 RBH Access Technologies Inc.
 - .48 RBtec Inc.
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- .49 Rofu Security International Group
 - .50 Rutherford Controls Int'l. Corp.
 - .51 Safety Technology International Inc. (STI)
 - .52 Samsung Techwin America
 - .53 Santeri Industries
 - .54 Schlage
 - .55 Schneider Electric
 - .56 Senstar Corporation
 - .57 Sentrol Inc
 - .58 Sennetech Inc.
 - .59 Sentry Security Systems
 - .60 Smart Vision Direct Inc.
 - .61 Software House
 - .62 Sony of Canada Ltd.
 - .63 Southern Folger
 - .64 Southwest Microwave, Inc.
 - .65 SPECO Technologies
 - .66 Spectris Canada Inc.
 - .67 Systech Corporation
 - .68 Talk-A-Phone
 - .69 TOA Canada Corporation
 - .70 Toppan
 - .71 Tri-Ed, an Anixter Company
 - .72 Tri Tech
 - .73 Turnstile Security Systems Inc.
 - .74 Tyco Security Products
 - .75 Ultratech
 - .76 United Security Products
 - .77 Visonic
 - .78 Von Duprin
 - .79 WatchNET Inc.
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- .80 Weiser
- .81 Winbo International Ltd.
- .82 Zebra

36 **SUPPLEMENTARY FORMS & POLICIES**

- .1 FORM 1 – Confidentiality and Non-Disclosure Declaration
- .2 FORM 2 – Programming and Installation Standards
- .3 FORM 3 - Security Typical
- .4 FORM 4 - IP CCTV Network Cabling Guideline for City Facilities
- .5 Declaration of Compliance with Anti-Harassment/Discrimination Legislation & City Policy / Workplace Violence
- .6 Statutory Declaration (Occupational Health & Safety)
- .7 IT Acceptable Usage Policy

End of Section



FORM 1

**Refer to CONFIDENTIALITY AND NON-DISCLOSURE DECLARATION
("Confidentiality Agreement") forms attached to this Section.**



FORM 2

**City of Toronto Programming and Installation Standards – released to
successful bidder after Form 1 – CONFIDENTIALITY AND NON-
DISCLOSURE DECLARATION submitted**



FORM 3

City of Toronto Security Typical – released to successful bidder after FORM 1 – CONFIDENTIALITY AND NON- DISCLOSURE DECLARATION



FORM 4

IP CCTV Network Cabling Guideline for City Facilities – released to successful bidder after FORM 1 – CONFIDENTIALITY AND NON-DISCLOSURE DECLARATION



Declaration of Compliance with Anti-Harassment/Discrimination Legislation & City Policy

Organizations/individuals in Ontario, including the City of Toronto, have obligations under the Ontario Human Rights Code, the Occupational Health and Safety Act, the Employment Standards Act, the Accessibility for Ontarians with Disabilities Act, the Criminal Code of Canada and the Charter of Rights and Freedoms. In addition, the City of Toronto also has policies that prohibit discrimination on the additional grounds of political affiliation or level of literacy, subject to the requirements of the Charter. Organizations are required to have and post policies, programs, information, instruction, plans and/or other supports, and an **appropriate** internal process available to their employees and service recipients to prevent, address and remedy discrimination, racism, harassment, hate and inaccessibility complaints under the applicable legislation and including the additional grounds of discrimination prohibited under City policy. Individuals are obliged to refrain from harassment/hate activity.

The City of Toronto requires all organizations and individuals that contract with the City to sign the following Declaration of Compliance with Anti-Harassment/Discrimination Legislation & City Policy. This Declaration must be signed by your organization and submitted with the contract or Letter of Understanding. The name of your organization and the fact that you have signed this declaration may be included in a public report to City Council.

Declaration:

I/we uphold our obligations under the above provincial and federal legislation. In addition, I/we uphold our obligations under City policies which prohibit harassment/discrimination on a number of grounds including political affiliation and level of literacy.

WHERE LEGALLY MANDATED I/we have in place the necessary policies, programs, information, instruction, plans and/or other supports that are consistent with our obligations, and I/we have an internal process available to my/our employees and service recipients to prevent, address and remedy discrimination, racism, harassment, hate and inaccessibility complaints. I/we agree that I/we shall, upon the request of the City, provide evidence of the policies, programs, information, instruction, plans and other supports and an appropriate internal complaint resolution process required under this Declaration which is sufficient to allow the City to determine compliance. I/We acknowledge that failure to demonstrate compliance with this declaration to the satisfaction of the operating Division, in consultation with the City Solicitor, may result in the termination of the contract.

Multilingual Services: 311 and TTY 416-338-0889. For further information, consult the [Equality, Diversity and Human Rights web page](http://www.toronto.ca/diversity) at <http://www.toronto.ca/diversity>

Applicant Information (Organization or Individual)

Organization Name		Position Title	
Organization Representative or Individual First Name		Organization Representative or Individual Last Name	
<input type="checkbox"/> Check this box if First Name and Last Name do not apply to you because you have either a registered Birth Certificate or Change of Name Certificate bearing a Single Name. Provide your name below.			
Single Name			
Street Number	Street Name		Suite/Unit Number
City/Town	Province	Postal Code	Telephone Number
Organization Representative or Individual Signature			Date (yyyy-mm-dd)

Human Resources Policies
Workplace Violence (2019)

Category: **Health and Safety**
Sub-Category: **General**



Policy Statement

The City of Toronto is committed to working with its employees to provide a safe work environment. The City will not tolerate any acts of violence and will take all reasonable and practical measures to prevent violence and protect employees from acts of violence. Appropriate remedial, disciplinary, and/or legal action will be taken according to the circumstances.

Purpose of Workplace Violence Policy

This policy is supported by the Guidelines for Implementing the Workplace Violence Policy, a Workplace Violence and Threat Report form, a Supervisor Checklist for Workplace Violence, and an information sheet. The policy and its supporting guidelines are intended to:

1. Maintain a work environment free from workplace violence
2. Provide a definition of workplace violence
3. Identify the responsibilities of the workplace parties to maintain a workplace free of actual, attempted or threatened violence
4. Establish measures and procedures for summoning immediate assistance when workplace violence occurs or is likely to occur
5. Establish measures and procedures for workers to report incidents of workplace violence and for the City to investigate and deal with incidents or complaints immediately
6. Provide guidance to divisions on establishing their Workplace Violence program

Application

The Workplace Violence policy applies under any circumstances in which City employees experience workplace violence, as defined below. It applies to all employees, contractors of the City, volunteers, students, clients of City services, any person engaged in business with the City, and visitors to City properties.

The City's Human Rights and Anti-Harassment Policy should be consulted regarding issues of personal harassment and harassment related to discrimination and inequitable work practices.

Definitions

For the purpose of this policy, violence includes:

- the exercise of physical force by a person against a worker, in a workplace, that causes or could cause physical injury to the worker
- the exercise of physical force by a person against another person, in a workplace, that causes or could cause physical injury to the worker
- an attempt to exercise physical force against a worker that could cause physical injury to the worker
- a statement or behaviour that it is reasonable for a worker to interpret as a threat to exercise physical force against the worker, in a workplace, that could cause physical injury to the worker

The City's Human Rights and Anti-Harassment Policy addresses harassment or intimidation (e.g., behaviours that demean, embarrass, or humiliate and are known or would be expected to be unwelcome).

Responsibilities

All employees are responsible for preventing and reporting acts of violence that threaten or perceive to threaten a safe work environment.

Divisional senior management will ensure that:

- A divisional workplace violence program is established
- Reasonable preventative measures are undertaken to protect employees and others in City workplaces from workplace violence
- Take reasonable preventative measures to protect employees and others in City workplaces from workplace violence
- Ensure that a process for centralized tracking and review of workplace violence incidents is established and implemented
- Ensure that workplace violence risk assessments are completed, reviewed, revised when needed and reported
- Post this policy in a conspicuous location in each workplace
- Establish and maintain a process for reporting and responding to incidents of violence
- Ensure that the process for reporting and responding to incidents of violence is communicated, maintained and followed
- Ensure that this policy is reviewed at least annually

Managers/supervisors will:

- Understand and uphold the principles of this policy
- Communicate this policy and its guidelines to all employees
- Conduct workplace violence risk assessments to determine whether the nature of the workplace, the type of work or conditions of work may place employees at risk of violence
- Consult with Joint Health & Safety Committees (JHSCs)/OHS Representatives, assigned People, Equity & Human Rights (PEHR) /divisional health & safety staff , and where appropriate, Corporate Security, in conducting risk assessments, and develop practical measures and procedures to control identified risks
- Take all reasonable and practical measures to minimize or eliminate risks identified through the risk assessment process, workplace inspections, or the occurrence of a workplace violence incident
- Review risk assessments at least annually, as well as when there are changes to the nature of the workplace, the type of work or the conditions of work. Revise the assessment, as needed
- Conduct further risk assessments when an increase in the number or severity of workplace violence incidents is noted to ensure that appropriate measures are in place to minimize or eliminate risks
- Communicate the results of workplace violence risk assessments and measures to minimize or eliminate risks to staff.
- Provide results of risk assessments (initial and updated) to joint health and safety committees/health and safety representatives
- Maintain and follow the process in the *City's Investigation and Reporting of Work-Related Injuries and Incidents policy* for reporting, investigating, documenting, and debriefing incidents of violence
- Respond promptly when an employee reports being subjected to, witnessing, having knowledge of workplace violence or having reason to believe that workplace violence may occur and take appropriate action.
- Address immediately all incidents of workplace violence, and not condone or permit any behaviour contrary to this policy. Exceptions to this must be clearly defined in the divisional procedures, describing specific behaviours that are unacceptable (e.g., unacceptable behaviours among a specific client group such as young children or clients with developmental, cognitive, or psychiatric disabilities). This exception must be communicated to staff but must not

- condone behaviours contrary to this policy.
- Ensure that all known incidents of workplace violence are investigated. To the extent appropriate based on the nature of each incident and the actual or potential threat it posed to worker safety:
 - consult with other parties (e.g., Corporate Security, Health & Safety staff, JHSCs/OHS Representatives, Employee Health and Rehabilitation, Employee Assistance Program, Human Rights Office, Toronto Police Services)
 - take all reasonable and practical measures to minimize or address risks identified by the incident
 - document the incident, its investigation, and corrective action taken
 - promptly share the results of the investigation and corrective actions taken with the joint health and safety committee/health and safety representative and the workers involved in the incident
 - Ensure workers are made aware of their rights to:
 - have workplace violence incidents investigated when they are reported
 - report incidents of physical assault or threats of physical assault to the police
 - support from management when reporting incidents of physical assault or threats of physical assault to the police (e.g. time for interactions with the police and making accessible to the police information in the employer's possession with respect to the incident)
 - Take all reasonable and practical measures to protect workers, acting in good faith, who report workplace violence or act as witnesses, from reprisal or further violence
 - Take every precaution reasonable in the circumstances for worker protection if they become aware, or ought reasonably to be aware, that domestic violence that would likely expose a worker to physical injury may occur in the workplace
 - Review annually, in conjunction with review of risk assessments, the effectiveness of actions taken to minimize or eliminate workplace violence and make improvements to divisional procedures, as required
 - Provide information to workers, including appropriate personal information, related to a risk of workplace violence from a person with a history of violent behaviour
 - Provide workers with information and instruction appropriate for the worker on the City's workplace violence policy and program

People, Equity & Human Rights (PEHR)/ Divisional Occupational Health and Safety staff will:

- Assist management to implement this policy, develop divisional procedures, and initiate the annual review of the policy and guidelines

Joint Health and Safety Committees/OHS Representatives will:

- Review the Workplace Violence Risk Assessment results and provide recommendations to management to reduce or eliminate the risk of violence
 - Review all reports forwarded to the JHSC regarding workplace violence and other incident reports as appropriate pertaining to incidents of workplace violence that result in personal injury or threat of personal injury, property damage, or police involvement
 - Participate in the investigation of critical injuries (e.g., incidents that place life in jeopardy, result in substantial blood loss, fracture of leg or arm, etc.)
-

- Recommend corrective measures for the improvement of the health and safety of workers
- Respond to employee concerns related to workplace violence and communicate these to management
- Participate in the review of the policy and guidelines for continuous improvement

In addition, JHSCs/OHS Representatives may participate in the investigation of reported incidents that result in personal injury or have the potential to result in injury.

The Occupational Health and Safety Coordinating Committee will:

- Review annually the effectiveness of the policy and guidelines and make changes as required by consulting with management staff and employee representatives

All employees will:

- Maintain a safe work environment, whenever possible
- Not engage in or ignore violent, threatening, intimidating or other disruptive behaviours
- Report promptly and provide details to their supervisor (or the appropriate alternative listed in the attached guidelines) any incident where the employee is subjected to, witnesses, or has knowledge of workplace violence, or has reason to believe that workplace violence may occur

Reprisal

This policy prohibits reprisals against individuals, acting in good faith, who report incidents of workplace violence or act as witnesses. Management will take all reasonable and practical measures to prevent reprisals, threats of reprisal, or further violence. Reprisal is defined as any act of retaliation, either direct or indirect.

Authorities

Occupational Health and Safety Act of Ontario (current)
Criminal Code of Canada (current)
City of Toronto Corporate Occupational Health and Safety Policy (reviewed annually)

Previous Versions

February 18, 2002
March 25, 2010
February 28, 2012
December 5, 2012
September 18, 2014
February 10, 2016
December 8, 2016
September 27, 2017
OHSCC-endorsed and City Manager-approved

Endorsed by:

Occupational Health and Safety Coordinating Committee (OHSCC), October 30, 2001
Reviewed and re-endorsed by OHSCC, December 12, 2018

Guidelines

Guidelines for Implementing the Workplace Violence Policy

Effective

January 1, 2019 - December 31, 2019

City of Toronto - Human Resources Policy - Workplace Violence (2019)

Page 5 of 5

Approved by City Manager

Date Approved February 4, 2013

**Reviewed and re-approved by
OHSCC** December 12, 2018

Related information [Human Rights and Anti-Harassment/Discrimination Policy](#)
[City of Toronto Corporate Occupational Health and Safety Policy](#)
[Investigation and Reporting of Work-Related Injuries and Incidents Policy](#)
[Guidelines for Implementing the Workplace Violence Policy](#)

Related links - external [The Occupational Health and Safety Act of Ontario](#)
[Criminal Code of Canada](#)



[Go back](#)



RFQ «QuotationRequestNumber»

STATUTORY DECLARATION
(Occupational Health & Safety)

PROVINCE OF ONTARIO)
JUDICIAL DISTRICT OF YORK)

IN THE MATTER OF RFQ NO. _____ AND ANY ENSUING CONTRACT
BETWEEN

(Company Name)

- AND -

City of Toronto

I, _____ of the City/Town/Village of _____ in the
Province
(Name)

of _____ do solemnly declare the following:
(Name of Province)

1. I am the _____ of the _____ and as such
(Insert Title) (Insert Company Name)

have knowledge of the matters herein stated.

2. _____ is a sole proprietorship/partnership/corporation with its head office
(Company Name)

located at _____ and has carried on business as
a _____ (contractor/state other type of
business)
since on or about _____
(Insert Date)

3. _____ since _____ had in place a Health and Safety
Policy
(Company Name) (Insert Date)

under Section 25(2) (j) of the *Occupational Health and Safety Act*, R.S.O. 1990, c. 0.1 as amended, (the "Act")
and

has/have developed and maintain(s) on an annual basis a program to implement the written Occupational Health
and Safety

Policy. A copy of the policy and program for _____ (Insert Company Name) will be
delivered to the

City of Toronto upon request by the City and will be available for inspection at the City of Toronto, solely for the
purposes of



the above noted Contract.

4. _____ since _____ had in place a Workplace Violence and a
(Company Name) (Insert Date)

Workplace Harassment Policy under Section 32.0.1(1) of the *Occupational Health and Safety Act*, R.S.O. 1990, c. 0.1 as amended, (the "Act") and has/have developed and maintain(s) on an annual basis a program to implement the written Workplace Violence and Workplace Harassment Policy. A copy of the policy and program for _____ (Insert Company Name) will be delivered to the City of Toronto upon request by the City and will be available for inspection at the City of Toronto, solely for the purposes of the above noted Contract.

5. _____ (Insert Company Name) will employ for the Work under this Contract a supervisor or supervisors who are competent persons as defined by section 1(1) of the Act, and specifically a person or persons who:

- (a) are qualified because of knowledge, training and experience to organize the Work and its performance;
- (b) are familiar with the Act and the regulations made thereunder that apply to the Work; and
- (c) have knowledge of any potential or actual danger to health and safety associated with the Work.

6. _____ (Insert Company Name) will employ for the purpose of

this project the following competent supervisors:

(Insert name of supervisors)

No supervisors other than those named shall work on this Contract.

7. The supervisors employed by _____ (Insert Company Name) has successfully completed the necessary health and safety courses to be considered a competent person to undertake the Work described in the Contract.

AND I/We make this solemn Declaration conscientiously believing it to be true, and knowing that it is of the same force and

effect as if made under oath and by virtue of "The Canada Evidence Act".

DECLARED BEFORE ME AT THE)
)
OF)
)
IN THE)
)
THIS DAY OF 20____.) Signing Officer for Company
)
A Commissioner etc.)

City of Toronto Acceptable Use of Information Technology Assets Policy

1. Policy Statement

- 1.1 The City of Toronto provides Authorized Users with access to the City's Information Technology Assets to be used for the purpose of conducting legitimate business activities and advancing the goals and objectives of the City of Toronto.
- 1.2 This Policy establishes principles and requirements for the acceptable use of the City's Information Technology Assets.

2. Definitions

- 2.1 **Accountability Officer(s)** refers to the Auditor General, Integrity Commissioner, Lobbyist Registrar and the Ombudsman at the City of Toronto.
- 2.2 **Authorized Users** are all individuals who have been granted access to the City's Information Technology Assets. This includes, but is not limited to, employees, consultants, contractors, subcontractors, individuals on secondment to the City, students and volunteers at the City of Toronto and Accountability Officers and anyone working or volunteering for or in their Offices subject to Section 3-10 F(5), Chapter 3, Accountability Officers, of the Toronto Municipal Code.
- 2.3 **Confidential Information** includes, but is not limited to, privileged information, draft by-laws or staff reports, third party information, personal information, technical or financial or scientific information and any other information collected, obtained or derived for or from City records that must or may be kept confidential under the *Municipal Freedom of Information of Privacy Act*, the *Personal Health Information Protection Act, 2004* or the *City of Toronto Act, 2006*.
- 2.4 **Information Technology Assets** are any system, service, hardware, and network assets that are owned by or supplied to Authorized Users by the City. This includes, but is not limited to, desktop computers, monitors, printers, notebooks, mobile devices, digital projectors, scanners, storage devices, networks and network devices, software, internet access, email, communication and business applications, telephones and voice mail, facsimile machines, and photocopiers.
- 2.5 **Systems Monitoring** refers to monitoring the City's Information Technology Assets used by Authorized Users for the collection and review of aggregate,

broad-based, or statistical data to assess, maintain, update or ensure reliability, security, confidentiality and integrity of City's Information Technology Assets. Systems monitoring is not directed at an identifiable individual(s).

- 2.6 **User Monitoring** refers to recording, accessing and reviewing or analyzing one or more identified Authorized User's activity on, or use of, the City's Information Technology Assets.

3. Application

- 3.1 This Policy applies to all Authorized Users with access to any of the City's Information Technology Assets.
- 3.2 Accountability Officers are responsible for the application of and compliance with this Policy in their Offices, including user monitoring where required, pursuant to Chapter 3, Accountability Officers, of the Toronto Municipal Code.
- 3.3 Exceptions
- 3.3.1 This Policy does not apply to Members of Council or anyone working or volunteering for or in their offices. Council Members are governed by the Code of Conduct for Members of Council, the Human Resources Management and Ethical Framework for Members' Staff, and applicable City policies and protocols.

4. Principles

- 4.1 The City's Information Technology Assets are corporate resources and are to be used in accordance with this Policy and other applicable City of Toronto by-laws, policies and relevant federal and provincial legislation.
- 4.2 Authorized Users shall exercise good judgment and responsibility when using the City's Information Technology Assets.
- 4.3 The City's Information Technology Assets shall be used in an ethical and professional manner.
- 4.4. The City's Information Technology Assets will be used in a manner that safeguards the integrity, privacy and confidentiality of the City's assets, information, and data.
- 4.5 Authorized Users are responsible for their use of the City's Information Technology Assets at all times, including non-business hours.

- 4.6 Authorized Users shall not expect absolute privacy when using the City's Information Technology Assets, including such limited personal use as permitted in accordance with Section 7 of this Policy.
- 4.7 Authorized Users shall not have any expectation that any use of City's Information Technology Assets, including limited personal use, is exempt from Systems Monitoring and/or User Monitoring in accordance with this Policy.
- 4.8 Each Authorized User's Manager or Supervisor shall ensure that the Authorized User is aware of and understands their role and responsibility under this Policy and related City by-laws, policies and relevant provincial and federal legislation.

5. User Accountability and Responsibility

5.1 Security

- 5.1.1 Authorized Users are to exercise good judgment and reasonable care in protecting Information Technology Assets from theft, damage or illegal access and against systems designed to disrupt, damage or place excessive load on the assets.
- 5.1.2 Authorized Users are responsible for safeguarding, protecting, and not sharing password(s) used to access the City's Information Technology Assets.
- 5.1.3 Any breach to the security of City's information technology systems or damage to or loss of Information Technology Assets will be immediately reported by the Authorized User to the I&T Service Desk and their Supervisor/Manager.

5.2 Information Management

- 5.2.1 All Authorized Users are responsible for the proper management of information in accordance with related provincial and federal legislation, and City of Toronto by-laws and policies referenced in Section 11 of this Policy.
- 5.2.2 Authorized Users must protect confidential information that belongs to the City, its service users, residents, partners or vendors, in accordance with the requirements of relevant provincial, and federal legislation, contractual restrictions, and related City of Toronto by-laws, and policies.

- 5.2.3 When conducting City business, Authorized Users are responsible for maintaining an accessible record and information in accordance with City by-laws, policies and relevant provincial and federal legislation.
- 5.2.4 All information, records and data related to City business and created or legally acquired using the City's Information Technology Assets must be stored on the City's network server or on an Information Technology Asset owned or under contract to the City.
- 5.2.5 Authorized Users are encouraged not to use system, service, hardware, and network assets not owned by or supplied by the City for the performance of the Authorized User's duties and responsibilities. Authorized Users shall not, under any circumstances, use any system, service, hardware, and network assets not owned by or supplied by the City for the performance of the Authorized User's duties and responsibilities where such use:
- 5.2.5.1 compromises the security of the City's Information Technology Assets;
 - 5.2.5.2 results in a breach of provincial or federal legislation, or of the City of Toronto by-laws and policies referenced in Section 11 of this Policy;
 - 5.2.5.3 results in the release of confidential information that belongs to the City, its service users, residents, partners or vendors, contrary to the requirements of relevant provincial and federal legislation contractual restrictions, or related City of Toronto by-laws and policies; and/or
 - 5.2.5.4 results in the City incurring any unauthorized costs associated with Authorized Users accessing the City's network remotely.
- 5.2.6 Authorized Users who elect to use system, service, hardware, and network assets not owned by or supplied by the City for the performance of the Authorized User's duties and responsibilities may, through such use, make the system, service, hardware, and network assets used for this purpose subject to provincial and federal access to information legislation contractual restrictions, and related City of Toronto by-laws and policies, and shall cooperate with the City in fulfilling any resultant obligations that arise from such use.
- 5.2.7 Authorized Users who elect to use system, service, hardware, and network assets not owned by or supplied by the City for the performance

of the Authorized User's duties and responsibilities shall ensure that information, records, and data created, accessed, acquired, managed, or reviewed through such use is moved to and stored on the City's Information Technology Assets at the first available opportunity, following which it is deleted from the system, service, hardware, and network assets not owned by or supplied by the City.

5.3 Remote Access

- 5.3.1 Authorized Users with remote access to the City's network must connect using authorized methods and systems and ensure that the Information Technology Asset or the system, service, hardware, and network assets not owned by or supplied by the City is safe to use and will not negatively impact the City's network.
- 5.3.2 Authorized Users must maintain the privacy, confidentiality and integrity of corporate business information accessed through remote access.
- 5.3.3 All corporate information produced, accessed, or altered through remote access must be stored on the City's network or on an Information Technology Asset owned or under contract to the City.
- 5.3.4 The City will not incur any unauthorized costs associated with Authorized Users accessing the City's network remotely.
- 5.3.5 The City retains the right to terminate Authorized Users' remote access at any time.

6. Ownership

6.1 Assets

- 6.1.1 The City's Information Technology Assets are the sole property of the City of Toronto.
- 6.1.2 All Authorized Users must provide, when requested by management or delegated staff, any Information Technology Asset.

6.2 Information and Records

- 6.2.1 All information and records created or legally acquired using the City's Information Technology Assets are the sole property of the City of Toronto with the exception of records which arise from the permitted

personal use of Information Technology Assets in accordance with Section 7.

7. Personal Use

- 7.1 Reasonable and limited personal use of Information Technology Assets is permitted, provided that it:
 - 7.1.1 Does not interfere with the Authorized User's duties and responsibilities.
 - 7.1.2 Is lawful and in compliance with applicable City of Toronto by-laws and policies, and relevant federal or provincial legislation.
 - 7.1.3 Does not compromise the security of the City's Information Technology Assets.
 - 7.1.4 Is not used for private gain, whether monetary or non-monetary, or advancement or the expectation of private gain.
 - 7.1.5 Does not result in the City incurring an expense unless it is incurred in accordance with the Business Expense Policy.
- 7.2 Authorized Users are responsible for properly managing personal files. The City is not liable nor will it incur any expense to protect or back-up personal files.
- 7.3 Authorized Users are encouraged to not store their own personal information or personal files on the City's Information Technology Assets. Users that elect to store their own personal information or personal files acknowledge that they are doing so at their own risk.

8. Unacceptable Use of Information Technology Assets

- 8.1 Unacceptable use of the City's Information Technology Assets includes, but is not limited to:
 - 8.1.1 Using the City's Information Technology Assets to access or carry out any activities that are obscene, lewd, or pornographic.
 - 8.1.2 Using the City's Information Technology Assets to carry out any activities that are harassing, embarrassing, discriminatory or defamatory to another individual, employee, or group, or that are in breach of the employee's duty of fidelity to the City of Toronto.

- 8.1.3 Using Information Technology Assets to carry out any activities that contravene federal, provincial legislation and City of Toronto by-laws and policies.
- 8.1.4 Activities that will interfere with the normal operations of the City's Information Technology Assets, including intercepting or altering information transmitted.
- 8.1.5 Violating terms of applicable software licensing agreements or intellectual property laws, including installing software without a license.
- 8.1.6 Disclosing or distributing confidential information without authorization or contrary to City policies and by-laws and relevant federal or provincial legislation.
- 8.1.7 Circumventing the City's security schemes and protection.
- 8.1.8 Unauthorized use, infringement, theft, reconfiguration, movement, or relocation of City's Information Technology Assets and/or data, information or records located on the City's Information Technology Assets.

9. Monitoring

9.1 Systems Monitoring

- 9.1.1 The City of Toronto has the right to conduct Systems Monitoring at any time, at will and in its sole discretion, including the right to filter and quarantine both inbound and outbound content, as may be necessary to protect the integrity, security, confidentiality, or reliability of the City's Information Technology Assets.
- 9.1.2 As part of System Monitoring, the City of Toronto may recover deleted files and data stored or accessed using the City's Information Technology Assets.

9.2 User Monitoring

- 9.2.1 The City of Toronto reserves the right, but does not have a duty, to conduct User Monitoring.
- 9.2.2 The City may exercise its right to perform User Monitoring:

9.2.2.1 If in the opinion of the City Solicitor there are reasonable grounds and/or a reasonable belief based on credible information received to support User Monitoring, including but not limited to information or belief that:

- i. An Authorized User is violating this Policy or other City of Toronto by-laws and policies, or any relevant federal and provincial legislation in their use of the City's Information Technology Assets.
- ii. An Authorized User is using the City's Information Technology Assets in a fashion incompatible with the User's employment with the City or grant of access to the City's Information Technology Assets.
- iii. The results from general Systems Monitoring provide reasonable grounds to focus on and review a specific Authorized User's activity.

9.2.2.2 In the alternative, if necessary to:

- i. protect and maintain the City's Information Technology Assets or other assets and interests from an immediate or imminent threat.
- ii. support the City of Toronto's efforts to comply with legal requirements, or defend itself in proceedings.

9.2.2.3 For other legitimate business, corporate or human resources purposes, including as a result of the absence of an employee.

9.2.3 User Monitoring pursuant to Section 9.2.2, User Monitoring, will be conducted in accordance with the User Monitoring Procedures referenced in Section 11.1.11, and the following principles:

9.2.3.1 If effective alternatives to User Monitoring are available in identifying inappropriate use or responding to a legitimate business, corporate, or human resources purpose, they shall be employed.

9.2.3.2 The least intrusive but effective means of User Monitoring shall be used.

- 9.2.3. Results of User Monitoring shall remain confidential, subject to the requirements of the investigation (including matters arising from the investigation), and/or other City by-laws, policies and relevant provincial and federal legislation.
- 9.2.3.4 Any decision to prosecute or refer User Monitoring or investigation results to the Toronto Police Service or other regulatory agencies for independent investigation will be made in accordance with the Toronto Public Service By-law, Chapter 192, Public Service of the Toronto Municipal Code.
- 9.2.4 User Monitoring by any individual for private or personal interest, curiosity, or without cause and appropriate authorization is prohibited and shall be considered a violation of this Policy.
- 9.3 Section 9.2 of this Policy does not apply to Accountability Officers when user monitoring is necessary as part of the fulfillment of their statutory mandate and responsibilities under Part V of the *City of Toronto Act, 2006*.
- 9.3.1 In circumstances, where an Accountability Officer is conducting user monitoring for their own Office or their staff, the Accountability Officer is responsible for applying Section 9.2 as deemed appropriate by the Accountability Officer.

10. Compliance

- 10.1 Failure to comply with this Policy may result in disciplinary action up to and including dismissal and/or legal proceedings where warranted.
- 10.2 In an event of a conflict or difference the federal and provincial legislation supersedes this Policy.
- 10.3 This Policy supersedes other City or divisional policies, standards and guidelines that govern the use of Information Technology Assets in an event of conflict or difference, subject to the principle that specific provisions of the other policies, standards, and guidelines continue to apply despite a more general provision being set out in this Policy.
- 10.4 This Policy shall be reviewed every three to five years and the City reserves the right to amend this Policy at any time.

11. Related By-Laws, Policies and Procedures

11.1 This Policy is to be implemented and interpreted with other related by-laws and policies, including:

- 11.1.1** Toronto Municipal Code, Chapter 192, Public Service
<http://www.toronto.ca/legdocs/municode/toronto-code-192.pdf>
- 11.1.2** Application of City Policies to Social Media Use:
http://insideto.toronto.ca/social_media/pdf/socialmediause.pdf
- 11.1.3** City of Toronto Human Rights and Anti-Harassment/Discrimination Policy:
[Human Rights and Anti-Harassment/Discrimination Policy](#)
- 11.1.4** Corporate Information Security Policy:
http://insideto.toronto.ca/itweb/policiesstandards/information_security.htm
- 11.1.5** IT Asset Management Policy:
<http://insideto.toronto.ca/itweb/policiesstandards/pdf/asset-management.pdf>
- 11.1.6** Toronto Municipal Code, Chapter 3, Accountability Officers
http://www.toronto.ca/legdocs/municode/1184_003.pdf
- 11.1.7** Toronto Municipal Code, Chapter 217, Records, Corporate (City)
[Toronto Municipal Code, Chapter 217](#)
- 11.1.8** Business Expense Policy
http://insideto.toronto.ca/accounting_services/pdf/business_expense_policy.pdf
- 11.1.9** Information Management Accountability Policy
<https://www.toronto.ca/wp-content/uploads/2018/07/8ec6-information-management-accountability-policy.pdf>
- 11.1.10** Protection of Privacy Policy
<https://www.toronto.ca/wp-content/uploads/2017/08/9023-ProtectionOfPrivacyFinalAODA.pdf>
- 11.1.11** User Monitoring Procedures
<http://insideto.toronto.ca/itweb/policy/pdf/user-monitoring-procedures.pdf>

Approved By:
Peter Wallace
City Manager
February 26, 2018

FORM 1

City of Toronto Corporate Security

Confidentiality and Non-Disclosure
Declaration Form

FORM 1

CITY OF TORONTO CONFIDENTIALITY AND NON-DISCLOSURE DECLARATION ("Confidentiality Agreement")

THIS ACKNOWLEDGEMENT AND DECLARATION is given to the City of Toronto (the "City") as of the ____ day of _____, 20__ by _____ (the "Company").

AND WHEREAS the City requires the Company to enter into this Confidentiality Agreement and abide by the following terms and conditions;

NOW THEREFORE for sufficient and valuable consideration received from the City, including the disclosure of certain Confidential Information, the Company agrees and declares as follows:

1. In this Confidentiality Agreement, "Confidential Information" means all information of any kind, including correspondence and documentation, which comes to the attention of the Company in connection with or arising out of this Confidentiality Agreement.
2. The Company shall maintain the absolute confidentiality of all Confidential Information and agrees not to disclose any Confidential Information to any third party, with the exception of those listed in Appendix A, for any reason whatsoever without the express written consent of the City.
3. The Company shall ensure all parties listed in Appendix A execute the Secondary Confidentiality Agreement listed in Appendix B prior maintain the absolute confidentiality of all Confidential Information and agrees not to disclose any Confidential Information to any third party, with the exceptions of, for any reason whatsoever without the express written consent of the City.
4. The Company shall maintain the security and integrity of Confidential Information in the possession or control of the Company, and shall keep such Confidential Information in a physically secure location(s) to which access is restricted.
5. The Company shall only utilize information technology that has received the prior approval of the City for the storage, receipt and transmission of the Confidential Information.
6. The Company agrees it may disclose Confidential Information only to those of its representatives who need access to the Confidential Information for the purpose of carrying out their services and on the condition that all such Confidential Information be retained by each of those representatives as strictly confidential.
7. The Company shall not have, or acquire, any right, title or interest, including intellectual property rights, in such Confidential Information, which shall remain the property of the City.
8. The Company acknowledges that the City has disclosed the Confidential Information to the Company solely in connection with carrying out its services. The Company acknowledges and agrees that unauthorized dealings with the Confidential Information would be detrimental to the interests, business and affairs of the City.

9. Upon request by the City, the Company agrees to promptly deliver, or destroy as directed by the City, the Confidential Information, together with all copies, extracts or other reproductions in whole or in part of such Confidential Information. In addition, at the City's request, the Company will destroy, promptly and irrevocably, all such copies, extracts or other reproductions of Confidential Information that exists in a form that cannot be delivered to the City.
10. The Company acknowledges and agrees that the City will be entitled to injunctive and other equitable relief to prevent or restrain breaches of any of the provisions of this Confidentiality Agreement by the Company or any of its representatives, or to enforce the terms and provisions hereof, by an action instituted in a court of competent jurisdiction, which remedy or remedies are in addition to any other remedy to which the City may be entitled at law or in equity.
11. The Company acknowledges that no delay or failure by the City in exercising any rights, powers, remedies or privileges available to it hereunder shall operate as a waiver thereof.
12. The Company confirms it has read and agreed to all the terms and conditions of this Confidentiality Agreement in full and to be bound by such.

IN WITNESS WHEREOF the Company executes this Confidentiality Agreement through the signature of its duly authorized signatory.

ON BEHALF OF

(_____)

Signature:

Name:

Title:

Date:

I have the authority to bind the Company.

Appendix A – Permitted Third Parties

{List of subcontractors, suppliers, etc. to be inserted}

CITY OF TORONTO
CONFIDENTIALITY AND NON-DISCLOSURE DECLARATION
("Secondary Confidentiality Agreement")

THIS ACKNOWLEDGEMENT AND DECLARATION is given to the City of Toronto (the "City") as of the ____ day of _____, 20__ by _____ (the "Company").

AND WHEREAS the City requires the Company to enter into this Confidentiality Agreement and abide by the following terms and conditions;

NOW THEREFORE for sufficient and valuable consideration received from the City, including the disclosure of certain Confidential Information, the Company agrees and declares as follows:

1. In this Confidentiality Agreement, "Confidential Information" means all information of any kind, including correspondence and documentation, which comes to the attention of the Company in connection with or arising out of this Secondary Confidentiality Agreement.
2. The Company shall maintain the absolute confidentiality of all Confidential Information and agrees not to disclose any Confidential Information to any third party, for any reason whatsoever without the express written consent of the City.
3. The Company shall maintain the security and integrity of Confidential Information in the possession or control of the Company, and shall keep such Confidential Information in a physically secure location(s) to which access is restricted.
4. The Company shall only utilize information technology that has received the prior approved of the City for the storage, and receipt of the Confidential Information.
5. The Company agrees it may disclose Confidential Information only to those of its representatives who need access to the Confidential Information for the purpose of carrying out their services of the Contract and on the condition that all such Confidential Information be retained by each of those representatives as strictly confidential.
6. The Company shall not have, or acquire, any right, title or interest, including intellectual property rights, in such Confidential Information, which shall remain the property of the City.
7. The Company acknowledges that the City has disclosed the Confidential Information to the Company solely in connection with carrying out its services. The Company acknowledges and agrees that unauthorized dealings with the Confidential Information would be detrimental to the interests, business and affairs of the City.
8. Upon request by the City, the Company agrees to promptly deliver, or destroy as directed by the City, the Confidential Information, together with all copies, extracts or other reproductions in whole or in part of such Confidential Information. In addition, at the City's request, the Company will destroy, promptly and irrevocably, all such copies, extracts or other reproductions of Confidential Information that exists in a form that cannot be delivered to the City.

9. The Company acknowledges and agrees that the City will be entitled to injunctive and other equitable relief to prevent or restrain breaches of any of the provisions of this Confidentiality Agreement by the Company or any of its representatives, or to enforce the terms and provisions hereof, by an action instituted in a court of competent jurisdiction, which remedy or remedies are in addition to any other remedy to which the City may be entitled at law or in equity.
10. The Company acknowledges that no delay or failure by the City in exercising any rights, powers, remedies or privileges available to it hereunder shall operate as a waiver thereof.
11. The Company confirms it has read and agreed to all the terms and conditions of this Confidentiality Agreement in full and to be bound by such.

IN WITNESS WHEREOF the Company executes this Confidentiality Agreement through the signature of its duly authorized signatory.

ON BEHALF OF

()

Signature:

Name:

Title:

Date:

I have the authority to bind the Company.

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- | | | |
|-----|--------------------|---|
| .1 | CAN/ULC-S524 | - Standard for the Installation of Fire Alarm Systems |
| .2 | CAN/ULC-S525 | - Audible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories |
| .3 | CAN/ULC-S526 | - Visual Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories |
| .4 | CAN/ULC-S528 | - Standard for Manual Stations for Fire Alarm Systems, Including Accessories |
| .5 | CAN/ULC-S529 | - Standard for Smoke Detectors for Fire Alarm Systems |
| .6 | CAN/ULC-S530 | - Standard for Heat Actuated Fire Detectors for Fire Alarm Systems |
| .7 | CAN/ULC-S536 | - Standard for Inspection and Testing of Fire Alarm Systems |
| .8 | CAN/ULC-S537 | - Standard for Verification of Fire Alarm Systems |
| .9 | CAN/ULC-S561 | - Standard for Installation and Services for Fire Signal Receiving Centres and Systems |
| .10 | ULC S527 | - Standard for Control Units for Fire Alarm Systems |
| .11 | CSA C282 | - Emergency Electrical Power Supply for Buildings |
| .12 | CSA C22.1 | - Canadian Electrical Code |
| .13 | OBC | - Ontario Building Code |
| .14 | ASME A17.1/CSA B44 | - Safety Code for Elevators and Escalators |

1.3 **SYSTEM DESCRIPTION**

.1 Single Stage Fire Alarm System

- .1 System shall be electrically supervised, zoned as indicated on Drawings and designed so that actuation of any manual pull station, smoke detector, heat detector or group of these devices in a zone shall cause the signal bells to sound throughout building. All magnetic door locks and/or door strikes to be deactivated, cause fans to shutdown as indicated, and transmit signal to fire department. Alarm shall indicate on appropriate zone light at control panel.

- .2 Wiring shall be done in class A configuration such that an open circuit in any initiating device shall not prevent alarms from being received by other devices. Each zone shall have its own alarm and trouble lamp.
 - .3 Complete system to be supervised against failure of operating power, open circuits, and grounds. All supervision is to be maintained on all circuits even in event of a power failure, when system is on battery standby. Any of above causes a Sonalert to sound at main control panel and at each remote annunciator and also light a common trouble lamp in same panels. Sonalert to produce a tone distinct from tone of alarm signals. Provide a silencing switch in main control panel, which, when operated, silences trouble bell but causes trouble lamp to remain illuminated until trouble is cleared and system returned to normal. Upon return to normal, trouble signal lamp shall be automatically reset to normal.
 - .4 Provide common control panel containing a system reset button, a system silence push button, and an LED test button. It shall not be possible to reset system until all operated initiation devices have been returned to normal. Failure of a lamp on the supervised annunciator causes a common trouble indication and causes annunciator trouble LED to light. The common control also to contain a signal silence push button. This signal silencing push button is used to silence alarm signals at any time but, if a new alarm should occur after it is pressed, all alarm signals shall again sound. When an alarm is received, the zone LED shall flash, until it has been silenced. At this time the LED indicator shall illuminate continuously. Upon receipt of a subsequent alarm, the LED for that zone shall flash, indicating in which zone the latest alarm occurred.
- .2 Two Stage Fire Alarm System
- .1 The system shall be electrically supervised, zoned as indicated on Drawings and designed so that actuation of any manual pull station, smoke detector, heat detector or group of these devices in a zone shall cause signal bells to sound throughout building, all magnetic door locks and/or door strikes to be deactivated, and cause fans to shutdown as indicated. Alarm shall indicate on the appropriate zone light at control panel.
 - .2 On receipt of an alarm from any zone, bells shall ring at twenty strokes per minute. In the event of a real fire, a general evacuation alarm can be initiated by means of a key switch in each one of the double action stations. If original alarm is not acknowledged within five minutes, general evacuation alarm shall sound automatically by means of a timer in control panel. General evacuation alarm consists of bells ringing at one hundred twenty strokes per minute.
 - .3 Wiring shall be done in class A configuration such that an open circuit in any initiating device shall not prevent alarms from being received by other devices. Each zone shall have its own alarm and trouble lamp.
 - .4 Complete system to be supervised against failure of operating power, open circuits, and grounds. Any of the above causes a Sonalert to sound at main control panel and at each remote annunciator and also light a common trouble lamp in the same panels. Sonalert to produce a tone distinct from tone of alarm signals. Provide a silencing switch in main control panel, which, when operated, silences trouble bell but causes trouble lamp to remain illuminated until trouble is cleared and system returned to normal. Upon return to normal, trouble signal lamp shall be automatically reset to normal.
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- .5 Provide common control panel containing a system reset button, a system silence push button, and an LED test button. It shall not be possible to reset system until all operated initiation devices have been returned to normal. Failure of a lamp on the supervised annunciator causes a common trouble indication and causes annunciator trouble LED to light. The common control panel also to contain a signal silence push button. This signal silencing push button is used to silence alarm signals at any time but, if a new alarm should occur after it is pressed, all alarm signals shall again sound. When an alarm is received, the zone LED shall flash until it has been silenced. At this time the LED indicator shall illuminate continuously. Upon receipt of a subsequent alarm, the LED for that zone shall flash, indicating in which zone the latest alarm occurred.

.3 Multiplex Fire Alarm System

- .1 Supervised, non-coded, annunciated, (single) (two) stage, closed circuit, twenty-four volt AC/DC multiplexed fire alarm (and security) system. (The system shall provide dual channel voice communication and firefighter phone capabilities. Both voice communication system and firefighter phone system shall be an integral part of fire alarm system).
- .2 The Central Processing Unit (CPU) shall use multiplex communication techniques to receive data from and transmit data to transponders which shall be remotely located throughout facility to minimize wiring costs, simplify design, and allow economical expansion and easy retrofit. (Multiplex communication techniques shall also be used for emergency voice circuits, and firefighter's phones located throughout building.)
- .3 The CPU shall be microprocessor-based to increase system reliability, speed response to alarm conditions, and reduce cost. CPU response time to alarm conditions shall be no more than four seconds, regardless of system size.
- .4 Fire alarm stations, thermal detectors, products of combustion detectors, (emergency evacuation speakers, emergency telephones) shall be fully supervised.
- .5 Upon operation of any manual station or detector, the following will occur:
 - .1 Actuate CPU to cause (signal bells to sound at twenty strokes per minute) (a slow rate tone on emergency evacuation speakers) throughout building. Second stage alarm can be initiated by means of a key switch in each of the double action stations. If original alarm is not acknowledged within five minutes, system automatically enters into second stage alarm which consists of (the bells ringing at one hundred twenty strokes per minute) (a high rate tone on emergency evacuation speakers).
 - .2 Initiate alarm origin on CPU and at graphic annunciator.
 - .3 Shut down air supply and return air fans.
 - .4 Transmit signal to fire department.
 - .5 Deactivate all magnetic door locks and/or door strikes.
 - .6 Activate smoke dampers.
- .6 CPU shall indicate trouble when any fault occurs within the system (or CRT and keyboard).

2 Products

2.1 **ACCEPTABLE MANUFACTURERS**

- .1 Simplex Grinnell
- .2 Siemens Building Technologies
- .3 Notifier
- .4 Mircom
- .5 Chubb/Edwards

2.2 **MATERIALS**

.1 Control Panel

- .1 Control panel shall be housed in a (free-standing) (wall-mounted) cabinet of code gauge construction with baked enamel finish, full viewing window and hinged front door cover complete with lock and two keys. Opening cabinet door shall provide access to all operating controls, but will not expose live electrical connections.
- .2 Control panel, with number of zones as shown on zone schedule containing the following:
 - .1 Reset button, LED test button, alarm signal silencing push button, ground fault indicator light, system trouble indicating light, trouble signal silencing button and annunciator trouble indicating light.
 - .2 Relays and control modules as required for door releases, fan shut-down, extinguishing system release and audible alarms.
 - .3 Alarm receiving modules for number of zones as indicated on Drawings. Zone modules shall be capable of handling any type of device including pull stations, smoke detectors, and heat detectors to allow for future changing of devices without changing modules. Each module to contain a trouble alarm indicator.
 - .4 Power supply modules as required.
 - .5 Valve supervision module as required.
 - .6 Signal control modules as required.
 - .7 Fire department connection plug-in module complete with disconnect switch and LED "disconnect" indicator.
 - .8 All modules shall have visual supervision against removal.
 - .9 A standby power module shall be provided consisting of lead calcium sealed batteries connected with sufficient amp hour capacity to operate the alarm devices under supervisory condition with AC power disconnected for twenty-four hours and at the end of this period, operate the alarm devices for thirty consecutive minutes. Note that on battery standby all building wiring must be supervised, and give an immediate trouble indication on battery backup when any problem occurs within the system. The batteries shall be sealed maintenance free type with

expected life in excess of five years. Batteries shall be enclosed in a steel housing. A fully automatic battery charger shall be provided which shall be capable of restoring 90% of a dead batteries capacity within twenty-four hours. The battery shall be protected against excessive discharge by automatically disconnecting battery from system when voltage of battery drops to 60%.

.2 Central Processing Unit (CPU)

- .1 Central processing unit shall come complete with alphanumeric display, keyboard and printer. Alphanumeric display and printer shall be fully operational while system is operating on standby batteries.
 - .2 CPU shall be housed in (flush mounted) (surface mounted) (free standing) cabinet with sufficient capacity to allow maximum system expansion and to house alphanumeric display and printer (audio system microphone) (master firefighter phone).
 - .3 The CPU electronics shall be microprocessor-based. Basic life safety software shall be retained in erasable programmable read only memory (EPROM). CPU shall have special software available in which to make changes on a temporary basis in control by event programming, and also in custom printer labels. This field editing is to enhance flexibility of the system. CPU shall be equipped with software in order to handle _____ monitor points, and _____ control points, and have ability to annunciate all of aforementioned points, including an additional _____ trouble points dedicated to system supervision. All indicators and software shall be in place within the CPU.
 - .4 System shall be multi-channel allowing a minimum of _____ monitor points per channel. One or two channels may be used for system. Each channel shall operate independently. Faults on one channel shall not affect operation of the other. System wiring requirements shall be one pair of wires per channel for data communication, two pairs for zoned dual channel audio transmissions, and one pair for a fully supervised and zoned firefighter phone system.
 - .5 CPU shall be equipped with a real time output for the purpose of synchronizing clocks.
 - .6 CPU shall display both alarm and trouble indication from each fire alarm zone, where each zone can be a device. The system shall indicate the exact location and description of activity.
 - .7 As a result of alarm conditions received at the CPU, the system shall have ability to automatically operate specified control points such as tripping municipal box to summon fire department, or stopping exhaust fans or air conditioning units and releasing magnetically held doors and other fire alarm related devices.
 - .8 System shall be equipped with a communication input/output "port" to allow use of commercially available remote printers, cathode ray tubes (CRT), and keyboards.
 - .9 Multiplex system shall be equipped with standby batteries to provide system operation and vital fire/security protection during commercial power outages. It shall also have provisions to operate an LED annunciator to provide a simple lamp type status indicator for critical system functions. These annunciators shall be operable from the system communication circuits (same wiring used to communicate with transponders), eliminating the need for special wiring.
-

- .10 CPU shall be designed for use with transponders. Transponders shall have the capability to interface with all specified peripheral devices, such as smoke and thermal detectors, door holders, (speakers). Communication between CPU and transponders shall be one twisted shielded pair.
 - .11 Voice communication system shall be an integrated dual channel system for use in fire alarm and emergency paging. Voice communication system shall have ability to sound an evacuation tone in one area of building, over that areas' speakers, while at the same time being able to sound a first stage alert tone or voice message to other parts of the building.
 - .12 Voice communication system shall provide intelligible low level reproduction and incorporate one way voice communication to each floor or compartment of building for selected evacuation and/or one way voice communication to all or any combination of floor or compartments for mass evacuation. Wiring to voice communication transponders shall be one shielded twisted pair from CPU to voice transponders.
- .3 Transponders
- .1 Transponder shall be capable of directly running two-wire ionization or photoelectric smoke detectors and shall supervise detector and signalling circuits in accordance with class "A" requirements. Unit shall be a combination of alarm monitor points, control points, supervised signalling circuits, and one detector reset point and shall respond to signal silence and detector reset commands manually initiated at CPU operator's panel.
 - .2 Transponders shall use microprocessor based electronics to ensure reliability. Sensing circuits to peripheral devices shall be supervised to provide an indication of sensing circuit faults. Sensing circuit supervision shall not reduce available system monitor points. Sensing circuits shall be capable of working with normally (open) (closed) contacts and shall detect the following conditions: open line, alarm, normal and ground.
 - .3 Transponders shall contain the zones as indicated on schedules, and shall be used for monitoring fire alarm zones, sprinkler zones, sprinkler tamper zones, (security zones), (and for monitoring and controlling emergency telephone zones), (and paging zones). Transponders shall also be used for controlling door holders, fan shutdown, and damper circuits.
- .4 Demarcation Terminal Box
- .1 A suitable terminal box to be provided as the point of demarcation between the fire alarm control unit and the signal transmitting unit.
 - .2 Alarm, trouble and supervisory contacts shall be extended from the fire alarm control unit to the demarcation terminal box.
- .5 Alarm Initiating Devices
- .1 Thermodetectors:
 - .1 Fixed temperature thermal detectors shall be of (fast action fusible) (automatic reset) type, rated at (135°F (57°C)) (200°F (93°C)) (with status LED for visual supervision). (Detector shall be addressable).

-OR-

- .2 Thermal detectors operating on rate-of-rise and fixed temperature principles shall be sensitive to a temperature rise greater than or equal to 15°F (8°C) per minute or rate fixed temperature of (135°F (57°C)) (200°F (93°C)) (with status LED for visual supervision). (Detector shall be addressable).
 - .2 Smoke detectors:
 - .1 Ionization smoke detector shall be self-compensating dual chamber type activated by products of combustion. The unit shall be plug-in, mounted to a twist/lock base complete with solid-state amplifier-switching circuit and status LED for visual supervision. (Detector shall be addressable).
 - OR-
 - .2 Ionization smoke detector shall be self-compensating dual chamber type activated by products of combustion. Detector shall contain internal chamber cover and pre-selected fixed sensitivity for use in high air velocity applications. Unit shall be plug-in, mounted to a twist/lock base complete with solid-state amplifier-switching circuit and status LED for visual supervision. (Detector shall be addressable).
 - OR-
 - .3 Photoelectric smoke detector shall be a photoelectric detection chamber type activated by light scattering of smoke particles. Unit shall be plug-in, mounted to a twist/lock base complete with status LED for visual supervision. (Detector shall have an integral fixed temperature heat detector rated at 135°F (57°C)). (Detector shall be addressable).
 - .3 Duct detectors:
 - .1 Ionization duct detector shall be dual chamber type with housing and air sampling tubes for detection of combustion products and/or smoke. Provisions shall be made for local or remote indicator lamp and/or auxiliary relay. (Detector shall be addressable).
 - OR-
 - .2 Photoelectric duct detector shall be solid state photodiode type with housing and air sampling tubes for detection of smoke using light scattering. Provisions shall be made for local or remote indicator lamp and/or auxiliary relay. (Detector shall be addressable).
 - .4 Manual stations:
 - .1 Single action station shall be non-coded (flush) (surface) mounted type consisting of a molded housing with pull-down lever and keylock switch to test and reset. Alarm switch shall be of (N/O) (N/C) sealed contact type and come complete with a normally closed auxiliary contact. (Manual station shall be addressable).
 - OR-
 - .2 Double action station shall be non-coded (flush) (surface) mounted type consisting of a molded housing with (push-in tab) (break glass), pull-down lever action and key lock switch to test and reset. Alarm switch shall be (N/O) (N/C) sealed contact type and come complete with a normally open auxiliary contact. (Manual station shall be addressable).
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.6 Signalling Devices

- .1 Bells shall be of (single stroke) (vibrating) polarized type, (flush) (surface) mounted, red in colour, for operation on (24V DC) (120V AC) audible circuit supply. Bells shall be complete with (150 mm gong) (250 mm gong) (chimes).
- .2 (Horns) (Sirens) shall be of polarized type, (plug-in) (flush) (surface) mounted, red in colour, for operation on (24V DC) (120V AC).
- .3 Speakers shall be 200 mm, of permanent magnet cone type and have an impedance of eight ohms. Speaker shall include a multiple tap transformer (one-quarter, one-half, one, two, and four watts). Frequency response at full rated power shall be 50-80,000 Hz. Baffles shall be fabricated of steel, finished in flat white baked enamel.

.7 End-of-Line Resistors

- .1 End-of-line resistors shall be mounted on a stainless steel plate and bear a ULC label.

.8 Door Holders

- .1 Door holders shall be magnetic type, (wall) (floor) mounted, with approximately 16 kg holding power, for operation on (12V DC) (24V DC) (24V AC) (120V AC).

.9 Remote Alarm Indicators

- .1 Remote alarm indicators shall be (wall) (ceiling) mounted and shall provide remote indication of a specific detector using an electrical connection. Unit shall consist of a red (LED) (lamp) on a mounting plate.

.10 Remote Test Station

- .1 Remote test station shall provide testing of a detector and indication of an alarm condition at a remote location. Unit shall consist of a key test switch and a red (LED) (lamp) mounted on a single gang plate.

.11 Graphic Building Plan

- .1 Graphic plan to be a wall mounted pictorial representation of the building indicating building outline with fire detection zones. Graphic plan shall indicate separately all levels, with appropriate zones showing exit doors, stairwells and elevators. Graphic plan to be engraved on acrylic material and installed beside annunciator panel depicting proper orientation. Annunciator location to be engraved in red.

3 Execution

3.1 **INSTALLATION**

- .1 Conductors shall be solid copper. The minimum size of conductor shall be:
 - .1 16 AWG for individual conductors.
 - .2 18 AWG for integral assembly of two or more conductor cables.
 - .3 14 AWG for control and audible signal circuits. In no case shall the voltage drop exceed 10%.

- .2 All wiring within enclosures to be identified with wire markers and termination on terminal strips. Wiring entering and exiting control enclosures shall be laid on terminal strip. Splicing of wiring is not acceptable.
- .3 Wiring entering or leaving building to be provided with lightning protection. Surge protection to be installed in junction box at floor level. Label box as "fire system surge protection".
- .4 Class A wiring shall be used for all alarm initiating devices.
- .5 Class B wiring shall be used for all notification appliances circuits.
- .6 Power to be provided by 120V AC.
- .7 Provide (EMT) (rigid) conduits with (steel set screw fittings with nylon insulated thread) (rigid coupling) as manufactured by T & B or approved equal. Size conduits to code requirements or larger sizes where indicated.
- .8 Terminal cabinets shall be 460 x 610 mm type "T" with wood back, door within the trim complete with latch and lock.
- .9 Outlet box for audible and visible devices to be a single gang, masonry box unless indicated otherwise and shall be flush mounted so that the top of the device will not be less than 2.3 m above the finished floor level in all areas with finished ceilings. In all other areas, outlet boxes shall be 100 mm square surface mounted 2.3 m above finished floor.
- .10 Wall-mounted visible signal devices shall be installed such that the entire lens is not less than 2 m and not more than 2.4 m above the finished floor.
- .11 Outlet boxes for manual stations shall be a single gang masonry box unless indicated otherwise and shall be flush mounted not less than 1.2 m and not more than 1.4 m above finished floor level to centre of box in all areas with finished ceilings. In all other areas, outlet boxes shall be flush mounted if possible.
- .12 The top of fire alarm annunciator or display and control centre legend or operating control shall be mounted not more than 1.8 m from finished floor level.
- .13 Should interference from obstructions, lamp positions or heat radiating surfaces be encountered in locating any fire alarm device where shown, the device shall be located as near as possible to indicated position, clear of obstacles, to the satisfaction of Consultant.
- .14 Detectors shall be ceiling mounted unless otherwise specified herein, at the highest point where variations in ceiling height exist and shall not be mounted on sides or underside of beams, joists, ducts, open web steel joists or any structure, etc. projecting more than 100 mm below ceiling level.

3.2 **VERIFICATION**

- .1 Manufacturer shall make an inspection of fire alarm equipment, including those components necessary to direct operation of system. Inspection shall comprise an examination of such equipment for the following:
 - .1 Person(s) carrying out verification to be CFAA certified or equivalent.
 - .2 That the type of equipment installed is that designated by the Consultant's Specifications.

- .3 That wiring connections to all equipment components show that the installer undertook to have observed ULC and CSA requirements.
- .4 The equipment of manufacturer's manufacture has been installed in accordance with manufacturer's recommendations, and that all signalling devices of whatever manufacture have been operated or tested to verify their operation; and
- .5 That supervisory wiring of those items of equipment connected to a supervised circuit is operating and that governmental regulations, if any, concerning such supervisory wiring, have been met to the satisfaction of inspecting officials.
- .6 Manufacturer will supply to Contractor reasonable amounts of technical assistance with respect to any changes necessary to conform Work to paragraphs above. During period of inspection by manufacturer, Contractor shall make available to manufacturer, electricians as designated by manufacturer.
- .2 On completion of inspection and when all of above conditions have been complied with, manufacturer shall issue to Consultant:
 - .1 A copy of inspecting technician's report showing location of each device and certifying test results of each device.
 - .2 Inspection report to be in the format as laid out in CAN/ULC S537 Appendix C.
 - .3 A certificate of verification confirming that inspection has been completed and showing conditions upon which such inspection and certification have been rendered.
 - .4 Proof of liability insurance for the inspection.

3.3 **DEMONSTRATION**

- .1 Engage a manufacturer's service representative to provide startup service and to demonstrate and train Owner's personnel for the following:
 - .1 On procedures and schedules related to startup and shutdown.
 - .2 Silencing of alarms, resetting of control panel.
 - .3 Isolating of individual detectors or areas.

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Department of Justice Canada (Jus).

- .1 Canadian Environmental Assessment Act (CEAA), 1992, c. 37.
- .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
- .3 SOR/2003-2, On-Road Vehicle and Engine Emission Regulations.
- .4 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

.2 Underwriters' Laboratories of Canada (ULC).

- .1 ULC/ORD-C107.19, Secondary Containment of Underground Piping.
- .2 ULC/ORD-C58.15, Overfill Protection Devices for Underground Tanks.
- .3 ULC/ORD-C58.19, Spill Containment Devices for Underground Tanks.

.3 Ministry of the Environment of Ontario

.4 Occupational Safety and Health Act; Ministry of Labour of Ontario

.5 Local municipal by-law

1.3 **PROJECT CONDITIONS**

.1 Site Visit

- .1 Visit the Site and determine the work extent and nature of existing conditions. In no circumstances will any claims against the Owner be allowed resulting from failure to ascertain the work herein described or implied.
- .2 Report to Consultant, in writing, any conditions which will prejudice the proper completion of the Work. Commencement of Work constitutes acceptance of existing conditions.
- .3 It must be noted that soil conditions between boreholes may be at variance with the information shown on borehole data. Borehole data is issued for information only.

.2 Protection

- .1 Establish locations of service installations existing in the areas of work and obtain service Owners' approval to work in such areas. Provide adequate markers or take protective measures to ensure that no damage is caused under the work of this section. Repair damaged Work as required without cost to Owner.

- .2 Notify Consultant and obtain clearance to proceed prior to commencement of Work.
 - .3 Temporarily cover existing catchbasins and manholes exposed to construction traffic to prevent entry of earth or debris.
 - .4 Provide all necessary hoardings, guardrails, markers, including temporary warning lights, or other means required, to ensure that no damage, injury or death is caused to persons or damage to property resulting from this work.
 - .5 Protect existing trees, shrubs, and plants to remain.
 - .6 Protect the work of other Contracts in progress or completed and protect the Owner's properties, stored Products, services and utilities from damage.
 - .3 Environmental Requirements
 - .1 Dust control: Provide and maintain, to the Consultant's satisfaction, adequate system to avoid any nuisance caused by dust and dirt rising throughout the area of operations.
 - .2 Silt control: Provide and maintain, to Consultant's satisfaction, control systems to prevent silt from entering any storm drainage system.
 - 1.4 **SUBMITTALS**
 - .1 Hazardous materials: Provide description of hazardous materials and notification of filing with proper authorities prior to beginning Work, as required.
 - 1.5 **DELIVERY, STORAGE AND HANDLING**
 - .1 Waste Management and Disposal
 - .1 Divert excess materials from landfill to site approved by Consultant.
 - .2 Source separate for recycling materials that cannot be salvaged for reuse including wood, metal, concrete and asphalt, and gypsum.
 - .3 Remove materials that cannot be salvaged for reuse or recycling and dispose of in accordance with applicable codes at licensed facilities.
 - 1.6 **SITE CONDITIONS**
 - .1 Site Environmental Requirements
 - .1 Ensure that the work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.
 - .2 Do not dispose of waste of volatile materials including but not limited to, mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers.
 - .1 Ensure proper disposal procedures are maintained throughout the Project.
 - .3 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers or onto adjacent properties.
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.4 Control disposal or runoff of water containing suspended materials or other harmful substances as directed by Consultant.

.5 Protect trees, plants and foliage on site and adjacent properties where indicated.

1.7 **ACCESS ROADS**

.1 Maintain access roads used for hauling operations clean and as required by municipal authorities.

2 **Products**

2.1 **NOT APPLICABLE**

3 **Execution**

3.1 **DEMOLITION/REMOVALS**

.1 Demolish/remove existing curbs, sidewalks, paving and granular base, bumper rails and posts and as shown.

.2 Break out and remove existing asphalt (concrete) pavement within the confines of the work. Prior to breaking out, saw cut cut-off point to avoid damage to remaining pavement.

.3 Demolish sidewalk, curb, pavement, and various other existing works within the confines of the Contract or as designated on Drawings.

3.2 **TOPSOIL STRIPPING**

.1 Strip topsoil from working area in locations shown (to depth indicated on boreholes). Load, haul and dump in stockpiles (separate from subsoil). Load, haul and dump in stockpiles of sufficient quantity to provide for 100 mm topsoil depth over areas to be seeded or sodded or as indicated on Drawings.

.2 Strip to prevent intermixing with, or removal of, underlying soil or objectionable materials.

.3 Dish topsoil surface to retain moisture in the stockpile. Crown top of subsoil stockpile to facilitate drainage.

3.3 **GRADING**

.1 Grade as necessary to bring area outside building to the required elevations. Supply additional material required to obtain new grade levels. Place and compact as specified.

.2 Grade for drainage ditches for roads and railroads and elsewhere throughout the site.

.3 Graded areas shall be smooth to profile, free of debris, with local excavations and depressions filled and compacted as specified hereunder.

.4 Supply additional material required to obtain new grade levels.

.5 Maintain positive drainage.

.6 Remove surface debris, roots, vegetation, branches and stones in excess of 50 mm in size.

.7 Do not disturb soil within branch spread of trees and shrubs remaining.

- .8 Excavate existing subsoil from on-site as required to obtain design grades. Transport, grade and compact approved earth borrow material as required for use as fill over areas indicated. Compact to 98% standard proctor maximum dry density.

3.4 **RESTORATION**

- .1 Restore areas and existing works outside areas of demolition to match condition of adjacent, undisturbed areas at no extra cost to the Contract.
- .2 Use soil treatments and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent watercourses or ground water.

3.5 **CLEANING**

- .1 Remove debris, trim surfaces and leave Work Site clean upon completion of work.
- .2 Use cleaning solutions and procedures that are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent watercourses or ground water.

3.6 **DISPOSAL OF WASTE AND SURPLUS MATERIALS**

- .1 Except where specified or indicated on Drawings to be retained on site for reuse, remove from the site and legally dispose of, all waste and surplus materials resulting from Site preparation work on a daily basis.

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the work of this Section.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- | | | | |
|----|--------------|---|---|
| .1 | ASTM D698 | - | Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort |
| .2 | ASTM E1643 | - | Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact With Earth or Granular Fill Under Concrete Slabs |
| .3 | ASTM E1745 | - | Standard Specification for Plastic Water Vapor Retarders Used in Contact With Soil or Granular Fill Under Concrete Slabs |
| .4 | CSA-A23.1 | - | Concrete Materials and Methods of Concrete Construction |
| .5 | CAN/ULC-S701 | - | Thermal Insulation, Polystyrene, Boards and Pipe Covering |
| .6 | OPSS 1010 | - | Ontario Provincial Standard Specification, Material Specification for Aggregates - Base, Subbase, Select Subgrade, and Backfill Material |
| .7 | MOE | - | Ministry of the Environment of Ontario |

1.3 **LINES AND LEVELS**

- .1 Establish lines and elevations based on geodetic benchmarks as shown on Drawings.

OR

- .2 Establish lines and elevations from existing lines and elevations shown on Drawings.
- .3 Have necessary lines and levels established by a registered Ontario land surveyor or a qualified registered Civil Engineer.
- .4 Indicate location of building walls relative to property lines on survey plan.
- .5 Protect and maintain the lines and benchmarks as long as they are required.

1.4 **ACCESS ROAD CLEANING**

- .1 Keep access roads clear of mud, debris and dirt resulting from Work of this section.

1.5 **SUBMITTALS**

- .1 Submit a certificate issued by fill Supplier to substantiate that fill materials are free of contaminants.
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- .2 If well pointing is required, submit, in accordance with Section 01 33 00, location of piping layout and depth of penetration below water table, for Consultant's review.
- .3 Submit manufacturer's Product data and mix design information of unshrinkable fill to confirm Product conformance to Specifications.

1.6 **GEOTECHNICAL INVESTIGATION**

- .1 Geotechnical investigation of the Site was carried out for the Owner as a guide in design and construction. A report and borehole logs on the investigation were prepared and are available.
- .2 No responsibility is assumed by the Owner or Consultant for the scope, accuracy, or interpretation of the geotechnical investigation report. Soil conditions between boreholes may be at variance with the information shown on the geotechnical investigation report.
- .3 Be responsible for including in the Work, costs for all conditions identified or inferred in the report, including disposal of contaminated materials, if any, in accordance with MOE regulations.

1.7 **QUALITY ASSURANCE**

- .1 Testing and Inspection
 - .1 Be responsible for granular/soil materials, placing and compaction throughout the Work of this Contract as it progresses and on completion to ensure specified materials, placing and required compaction densities are obtained.
 - .2 Owner may appoint a third party independent testing company at its own expense for checking or approval of the Contractor's material placing and compaction Work. Pay charges for re-testing after making good defective areas. Coordinate construction schedule with Consultant so that Owner's testing company can be notified in advance.
 - .3 Provide the following and pay for all associated costs as part of the Contract:
 - .1 Retain an independent, well established and qualified commercial testing agency to, a) maintain field quality control operations such as compaction tests, and, b) perform material testing in the laboratory and prepare test reports and other submittals. Testing agency shall have enough personnel and resources to perform a) and b) in a timely manner.
 - .2 The testing agency personnel shall be qualified and have had experience on projects equal to the complexity of this Project. Upon request from the Owner, submit qualifications of the testing agencies and include their personnel for approval prior to retaining either one of the agencies.
 - .3 The Owner reserves the right to request change in personnel or testing agency at any time.
 - .4 Submit proposed material, including off-site borrow material, to the testing agency for its analysis and report, in sufficient time so as not to delay the progress of the Work. The testing agency shall approve all fill material prior to placement and shall observe placement to ensure lift thickness is as specified.

- .5 Testing agency shall submit, in duplicate, test report which includes tests, investigations, findings and recommendations to the Contractor and to the Owner, within twenty-four hours of the tests.
- .6 For field quality control of operations, testing agency shall determine the compaction of material placed and shall conduct the following minimum number of in-place density tests after monitoring the placing and compacting of each lift.
 - .1 For mass filling: One test per lift of fill for each one hundred square metres.
 - .2 Floor subgrade: One test per final lift (subgrade) or fill or backfill within building wall lines, for each five hundred square metres, both after compaction and before slab construction.
 - .3 For trenches: Three tests per lift of trench backfill for each one hundred fifty linear metres.
- .7 If compaction tests indicate that a layer has not been brought to the required compaction, re-compact the area, prior to placement of additional material, until the required compaction is obtained. If the layer has been covered by a subsequent operation, remove such material before re-compacting the defective layer.
- .4 Submit a testing and inspection program to account for all the items specified above. Submit to the Consultant at pre-construction meeting or prior to start of construction.
- .2 Cementitious backfill materials will be tested for conformance to the Specifications by an independent inspection company selected and paid for by Owner. Tests include the following:
 - .1 Obtaining certification of cements.
 - .2 Cylinder test. Three test cylinders will be taken from initial pour.
- .3 Cooperate with and assist Owner's inspection/testing company's personnel during inspections and tests.
- .4 Remove defective materials and completed work which fails tests and replace as directed by Consultant.
- .5 Where work or materials fail to meet strength requirements as indicated by test results, pay costs of additional inspection and testing required for new replacement work or materials.

1.8 **PROJECT CONDITIONS**

- .1 Cultural Heritage Resources
 - .1 If cultural heritage resources (such as archaeological sites, artifacts, building and structural remains, and/or human burials) are encountered during performance of Work, contact Consultant immediately and suspend Work in immediate area until assessment has been completed by Ministry of Culture, Tourism and Recreation. Perform required measures to mitigate negative impacts on found resources to acceptance of Consultant.

.2 Protection

.1 Existing buried utilities and structures:

- .1 Prior to commencing excavation, establish locations of existing buried service installations in the construction area. Notify service owners and obtain their approval to work in such areas. Place adequate markers and take protective measures to ensure that no damage is caused under the work of this section. Repair damaged Work as required at no change in Contract Price.
- .2 Temporarily cover local existing catchbasins and manholes exposed to construction traffic to prevent entry of earth or debris.

.2 Excavations:

- .1 Erect necessary hoardings, guardrails, markers; place temporary warning lights; take all other measures required to ensure that no damage or injury is caused to persons, or damage to property resulting from this Work.
- .2 Protect excavations and maintain warning devices during construction and during time when Work is closed down for any cause.

.3 Other contracts, existing buildings and surface features:

- .1 Protect work of other trades or of other contracts in progress or completed and protect Owner's existing properties, stored Products, services and utilities from damage.

2 Products

2.1 **MATERIALS**

- .1 Granular materials - general: New materials conforming to OPSS 1010, free of organic matter, imported from off-site, and sourced from a member of the Aggregate Producers Association of Ontario. Note: The use of slag and recycled aggregates is prohibited.
 - .1 Backfill: OPSS Granular "B Type I"
 - .2 Sub-base: OPSS Granular "B Type I"
 - .3 Base: OPSS Granular "A"
 - .4 Base under oil impregnated sand: Granular "A"
 - .5 Underfloor base: OPSS Granular "A" crushed limestone
- .2 Select fill: Native excavated site material approved by Consultant and capable of being compacted to required density and free of:
 - .1 Any vegetable or organic matter and roots
 - .2 Cinders or ashes
 - .3 Building debris
 - .4 Rocks and stones larger than 75 mm

- .3 Impervious fill: Fine grain material such as clay.
- .4 Drainage channel panels: "Miradrain 6000" by Mirafi or equivalent by Terrafix.
- .5 Oil Impregnated Sand Bed
 - .1 Sand: Imported natural concrete sand having clean, hard, strong, durable uncoated grains free from lumps, soft or flaking particles, shale, clay, organic matter and other deleterious substances.
 - .2 Oil: Petroleum based (engine) oil, to provide corrosion protection to steel tank bottom.
- .6 Drainage weepers, bedding and surround: Plastic pipe by Big-O or approved equivalent, Type 2 - perforated nominal inside diameter, and complete with a seamless and knitted polyester filter fabric sleeve, non-perforated pipe sections as required for collectors, and all fittings required for the work. Clean coarse aggregate conforming to CSA-A23.1, Table 3, Group 1 (20 to 5 mm).
- .7 Perimeter foundation insulation: Styrofoam "SM" by Dow Chemical Co. or "Celfort 300" by Owens Corning conforming to CAN/ULC-S701. Use Lepage "PL Premium" adhesive for use in conjunction with installation of perimeter insulation.
- .8 Unshrinkable fill: Ready mixed Product consisting of CSA-A5, Type 10 portland cement, CSA-A363 cementitious hydraulic slag, sand and water proportioned and mixed to produce a stable, self-levelling, controlled density fill with a compressive strength of 0.7 MPa at twenty-eight days. Cement content to be at 50 kg/m³ of mix.
- .9 Vapour retarder: Minimum 0.25 mm (10 mil) thick sheet membrane conforming to ASTM E1745; Perminator by W.R. Meadows, Stego Wrap Vapor Barrier by Stego Industries or accepted equal.
 - .1 Lap tape: 100 mm wide Perminator Tape by W.R. Meadows, Stego Wrap Red Polyethylene Tape or accepted equal.

2.2 **STOCKPILING OF GRANULAR MATERIALS**

- .1 Stockpile materials in a manner to prevent segregation.
- .2 Protect materials from contamination.
- .3 Separate different aggregates by strong, full-depth bulkheads, or stockpile far enough apart to prevent intermixing.
- .4 Do not use intermixed or contaminated materials. Remove and dispose of materials rejected by Consultant within forty-eight hours of rejection.
- .5 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.

3 **Execution**

3.1 **EXCAVATION**

- .1 Remove obstructions (ice and snow) from surfaces to be excavated.
- .2 Perform excavation with proper allowance for subsequent work including shoring, bracing and formwork (sheet piling and underpinning). Excavation shall be clean and clear of

- loose material and true to size. Underpin as shown on Drawings. Also, refer to geotechnical report.
- .3 Securely shore and brace sides of trenches and excavation exceeding 1.2 m in depth with shoring and bracing extending at least 300 mm above the top of trenches or excavation.
 - .4 Do not obstruct flow of surface drainage or natural watercourses.
 - .5 Excavate to undisturbed soil, level, free from loose, soft or organic matter, and of design bearing strength.
 - .6 Perform excavation at or adjacent to existing structures or foundations in such a way that structures and foundations are not weakened or endangered in any way. Where it is required to excavate adjacent to an existing building, all fill under existing floor slabs must be contained.
 - .7 If undisturbed soil or bedrock having the required bearing capacity is not encountered at footing depths indicated, determine the possible additional volume of excavation that will be required and obtain Consultant's instructions in writing to excavate to additional required depth.
 - .8 Do not expose shale to weather in excavations and in any case, following inspection, cover with 50 mm of 15 MPa concrete within twelve hours after exposure.
 - .9 Fill excavations for building foundations which are, through error, carried below the elevation shown or approved depth, with 15 MPa concrete, or as directed by Consultant, at no increase in Contract Price.
 - .10 Notify Geotechnical Engineer when bottom of excavation is reached, and have same inspect excavation prior to resumption of Work.

3.2 **DEWATERING**

- .1 Keep excavated areas free from standing water using power operated mechanical equipment.
- .2 Protect open excavations against flooding and damage due to surface run-off.
- .3 Obtain letter of conditional approval from authorities having jurisdiction to dispose of groundwater into sewer drainage system. Apply for water disposal permit.
- .4 Keep excavations and trenches free of water throughout construction period.
- .5 Groundwater removal:
 - .1 Lower groundwater level and maintain at depth below lowest point of excavation to ensure a dry stable surface.
 - .2 Dewater to prevent loss of soil and maintain stability of sides and bottom of excavation and of adjacent structures.
 - .3 Dispose of water in conformance with applicable by-laws and in a manner not detrimental to public and private property, or portion of Work completed, or under construction.
 - .4 Supply and install flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to sewers,

water courses or drainage areas in accordance with authorities having jurisdiction. Perform testing on settlement tank discharge to confirm that effluent meets sewer bylaw requirements. Locate tanks to acceptable area determined by Consultant.

.6 Surface water removal:

- .1 Remove surface run-off in a manner that will prevent loss of soil and maintain stability of sides and bottom of excavation. Obtain Consultant's approval of dewatering method to be used.
- .2 Discharge surface water into existing storm drainage system to acceptance of Consultant and local authorities.

3.3 **PERIMETER INSULATION**

- .1 Install insulation with spot daub application of adhesive to ensure tight contact to substrate and to prevent displacement during backfilling. Butt joints tight between boards.

3.4 **DRAINAGE CHANNEL PANELS**

- .1 Secure channel panels with galvanized stick clips with lock washers in accordance with drainage channel manufacturer's directions. Set clips with adhesive compatible with clip-receiving substrate.
- .2 Trim panels and overlap and interlock same. Cover joints and edges with fabric flap.

3.5 **DRAINAGE WEEPERS**

- .1 Place 100 mm minimum thick granular bedding and tamp to grade.
- .2 Ensure pipe interior and coupling surfaces are clean before laying. Lay pipe with perforations downward. Do not use shims to establish pipe slope. Protect pipe ends from damage and ingress of foreign materials.
- .3 Have Consultant approve installed pipe before placing backfill.
- .4 Place granular surround after pipe installation, 150 mm thick each side and 300 mm minimum over pipe. Place granular material by hand. Consolidate by hand tamping slightly to prevent pipe displacement.
- .5 Backfill balance of excavation with specified granular backfill.

3.6 **BACKFILLING**

- .1 Prior to backfilling, remove loose materials, debris, etc., from excavated areas. Do not place backfill on contaminated (or frozen) ground.
 - .2 Do not use backfill material which (is frozen or which) contains ice, snow or debris.
 - .3 Place granular material, grade and compact to levels which provide for superimposed work at levels shown.
 - .4 Notify Consultant for inspection when backfill is complete to compacted levels indicated on Drawings.
 - .5 Place granular backfill in layers not exceeding 200 mm in depth and thoroughly compact. Each layer shall be compacted and accepted before next layer is placed.
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- .6 Backfill simultaneously on both sides of walls. Do not backfill until walls have reached their design strength.
- .7 Take necessary precautionary measures during compaction of fill adjacent to foundations, walls, drains, etc., that such items are not displaced from their proper location or damaged by compacting equipment. In the event damage or displacement occurs during filling or resulting from compaction of fill, correct same, to approval of Consultant, and at no increase in Contract Price.
- .8 Place select fill for backfill where shown in layers not exceeding 200 mm, with each layer thoroughly compacted.

3.7 **UNDERFLOOR GRANULAR SUB-BASE**

- .1 Prior to filling, remove loose materials, debris, etc., from areas to be filled. Do not place fill on contaminated (or frozen) ground.
- .2 Do not use fill material which (is frozen or) contains ice, snow or debris.
- .3 Proof roll existing earth sub-grade in order to identify inconsistencies or soft areas.
 - .1 If a soft area is encountered, promptly notify the Consultant and obtain his instructions in writing to rectify the soft area.
 - .2 Proceed with filling operations only after inconsistencies or soft areas have been rectified.
- .4 Place Granular "B" sub-base in loose layers not exceeding 200 mm to a compacted depth of 150 mm terminating as follows except where shown otherwise:
 - .1 For facilities with permanent, watertight enclosure installed prior to placing concrete:
 - .1 Terminate compacted granular sub-base 200 mm below underside of slab. This allows for 150 mm granular base plus 50 mm cushion to absorb bleed water from concrete allowing concrete to dry evenly on both sides.
 - .2 For facilities that are not permanently enclosed with a watertight enclosure prior to pouring concrete:
 - .1 Terminate compacted granular sub-base 150 mm below underside of floor slab.

3.8 **UNDERFLOOR GRANULAR BASE**

- .1 Prior to filling, remove loose materials, debris, etc. from areas to be filled. Do not place fill on contaminated (or frozen) ground.
 - .2 Do not use fill material which (is frozen or) contains ice, snow or debris.
 - .3 Proof roll granular sub-base in order to identify inconsistencies or soft areas.
 - .1 If a soft area is encountered, promptly notify the Consultant and obtain his instructions in writing to rectify the soft area.
 - .2 Proceed with filling operations only after inconsistencies or soft areas have been rectified.
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- .3 Place Granular "A" crushed limestone base to a compacted thickness of 150 mm in loose layers not exceeding 200 mm.

3.9 **VAPOUR RETARDER**

- .1 Ensure that granular surface is smooth and free of sharp projections that could puncture vapour retarder.
- .2 Place vapour retarder under floor slabs to receive epoxy, urethane and floor finishes installed with adhesive and thin set mortar:
 - .1 Install vapour retarder in accordance with ASTM E1643 and as specified.
 - .2 Ensure there are no discontinuities in vapour retarder at seams and penetrations.
 - .3 Unroll with the longest dimensions parallel with the direction of concrete placement.
 - .4 Join sections of vapour retarder and seal penetrations in vapour retarder with mastic tape. Ensure vapour retarder surfaces to receive mastic tape are clean and dry.
 - .5 Ensure there is no moisture entrapment by vapour retarder due to rainfall or ground water intrusion.
 - .6 Immediately repair holes in vapour retarder with self-adhesive repair tape.
 - .7 Seal around pipes and other penetrations in vapour retarder with pipe boots in accordance with manufacturer's instructions.
 - .8 Protect vapour retarder from damage during installation of reinforcing steel and utilities and during placement of concrete slab or granular materials.
 - .9 Immediately repair damaged vapour retarder in accordance with manufacturer's instructions.
- .3 Vapour Retarder Location
 - .1 If the structure is enclosed with a permanent, watertight enclosure prior to concrete placing, place a 50 mm compacted thickness of granular limestone screenings cushion on top of vapour retarder to underside of floor slab.
 - .2 If the structure is not enclosed with a permanent, watertight enclosure prior to concrete placing, place the vapour retarder directly under the floor slab. Do not use cushion method.
 - .3 In any case, extend vapour retarder 1 m into areas without vapour retarder.

3.10 **UNSHRINKABLE FILL**

- .1 Use at locations indicated (or where work area is too limited to permit proper granular material placing and compaction operations.)
 - .2 Discharge fluid backfill directly from ready mix truck to points of usage. Place in uniform lifts and simultaneously on both sides of members being backfilled to equalize loading.
 - .3 Consolidate fill with vibrators.
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- .4 If piping occurs in area being backfilled, coordinate with pipe installer to ensure disturbance of pipe alignment during backfilling is prevented.

- .5 Use temporary plates to support traffic loads over cementitious fill.

3.11 **COMPACTION**

- .1 Use compaction equipment capable of obtaining required material densities.

- .2 **Compaction Densities**

- .1 Granular materials: To 98% Standard Proctor Maximum Dry Density (SPMDD) in accordance with ASTM D698.

- .2 Earth fill and earth subgrade: To 95% Standard Proctor Maximum Dry Density (SPMDD) in accordance with ASTM D698.

- .3 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.

- .4 Apply water as necessary during compaction to obtain specified density.

- .5 In areas not accessible to rolling equipment, compact to specified density with power operated portable plate compactors.

- .6 Depth and layers specified are minimum dimensions of fill after compaction, except where loose layer is specified.

- .7 Ensure compaction operations do not cause vibration and noise levels exceeding acceptable limits established by authorities having jurisdiction.

3.12 **PROTECTION OF FILL AND BACKFILL**

- .1 Protect filled and backfilled areas against damage from any cause.

3.13 **DISPOSAL OF SURPLUS MATERIALS**

- .1 Remove from the site and legally dispose of excess excavated material, waste material, trash, debris and rubble.

- .2 Obtain and pay for all necessary regulatory approvals, consents and permits for disposal of surplus material.

OR

- .3 Deposit and spread excess excavated material on site where shown on Drawings.

End of Section

1 General

1.1 **SUMMARY**

- .1 The Contractor shall perform the Work in accordance with the requirements of Ontario Regulation 406/19 – On-Site and Excess Soil Management made under the Environmental Protection Act, RSO 1990, c E.19 (O. Reg. 406/19) and parts I and II of the "Rules for Soil Management and Excess Soil Quality Standards", 2020 (the "Soil Rules"). O. Reg. 406/19 is being implemented in phases and the Contractor shall perform the Work in accordance with the applicable requirements of the phasing.
- .2 The Contractor shall, as necessary excavate, transport, stockpile, sample, test and dispose of offsite and complete any other handling required for proper management reuse and/or disposal of soil. The Contractor shall be responsible for identifying appropriate off-project sites based on the quality, geotechnical suitability and quantity of excess soil from the Project Area and including these proposed sites in the Soil Management Plan for approval by the Consultant. The Contractor should note any reuse sites may have their own requirements for accepting excess soil based on geotechnical, aesthetic or chemical characteristics.
- .3 No claims related to delays while obtaining an approved reuse site or disposal site or delays related to acceptance of excess soil/excess material by the reuse or disposal site will be paid to the Contractor. Despite the grandfathered contracts exemption as specified in O. Reg. 406/19, the Contractor shall comply with any additional requirements the selected reuse sites have for deposit or final placement of the excess soil. Any additional chemical testing required by a reuse site shall be at the Contractor's expense.

1.2 **DEFINED TERMS**

- .1 Terms referenced in this Section shall be as defined in O. reg 406/19 unless modified below.

1.3 **SUBMITTALS**

- .1 The Contractor shall be responsible for the following submittals:
 - .1 Soil Management Plan.
 - .2 Soil Characterization Report.
 - .3 Excess Soil Destination Assessment Report, including written consent from the owner/operator of the reuse or receiving site.
 - .4 Monthly monitoring reports.
 - .5 Weekly tracking, hauling records and documentation related to excess soil management, including bills of lading.
 - .6 Project specific submittals (containment treatment, etc.)

1.4 **QUALIFICATIONS**

- .1 The Contractor shall retain a Qualified Person as defined by O.Reg. 406/19 (the "Qualified Person") who has a minimum of eight (8) years' experience conducting or supervising environmental site assessments or risk assessments and shall be familiar with O.Reg. 406/19, the Soil Rules and Soil Standards, O.Reg. 153/04 and other federal, provincial and municipal laws applicable to soil management.
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1.5 **PROVINCIAL ORDERS**

- .1 The Contractor shall promptly (within two (2) Business Days of date of receipt) furnish details and provide a copy to the Region and Consultant of any draft or final provincial officers orders issued under O. Reg. 406/19 that are related to excess soil from the Project.

1.6 **MONTHLY MONITORING RECORDS**

- .1 The Contractor shall provide a summary of excess soil management activities in a Monthly Monitoring Report, to be submitted for Consultant review. The Monthly Monitoring Report shall include:
 - .1 The total quantities of excess soil resulting from the Work.
 - .2 The total quantities of excess soil that were transported from the Project Area for reuse or disposal, including specific quantities and a location plan detailing the volume transported to each unique reuse or receiving site.
 - .3 The date and time each load of excess soil left the Project Area.
 - .4 The name of the corporation, partnership, or firm transporting the excess soil, including license plate and truck number, for excess soil leaving the Project Area.
 - .5 The total quantity of soil and/or aggregate material imported to the Site, the Source Site documentation detailing chemical and/or physical properties of the imported material, and the location of the final placement of the imported material on the Project Area.
 - .6 The name of the Qualified Person overseeing the acceptance of excess soil at the reuse and receiving site(s), if applicable.
 - .7 Any incident reports or documentation of rejected load(s).

1.7 **TRACKINGS YSTEM AND HAULING RECORDS**

- .1 The Contractor shall furnish the details and provide a copy for the hauling of each load of excess soils in accordance with O. Reg. 406/19 to the Consultant beginning the first week excess soil leaves the site until all excess soil has been removed, including but not limited to:
 - .1 The location at which the excess soil was loaded for transportation.
 - .2 The date and time the excess soil was loaded for transportation.
 - .3 The quantity of excess soil in the load.
 - .4 The name of an individual who may be contacted to respond to inquiries regarding the load, including inquiries regarding the soil quality.
 - .5 The name of the corporation, partnership or firm transporting the excess soil, the name of the driver of the vehicle and the number plates issued for the vehicle under the Highway Traffic Act.
 - .6 The location at which the excess soil is to be deposited.

- .7 The date and time the load of excess soil was deposited at the [Class 1 soil management site][Class 2 soil management site][local waste transfer facility], reuse site, landfilling site or dump.
 - .8 The name and phone number of the individual (Receiving Personnel) at the reuse site, landfilling site or dump [Class 1 soil management site][Class 2 soil management site][local waste transfer facility], who acknowledges that the excess soil has been deposited on the date and time as required above.
 - .9 A declaration by the Receiving Personnel stating that the individual acknowledges the deposit of the excess soil.
 - .2 The Contractor shall require the person who is transporting the excess soil to provide the Receiving Personnel with a copy of their declaration.
- 2 Products
- 2.1 **NOT APPLICABLE**
- 3 Execution
- 3.1 **MANAGEMENT OF EXCESS SOIL**
- .1 The Contractor shall have its Qualified Person:
 - .1 Prepare or supervise a Soil Management Plan (the "Plan" or "ESMP") that outlines the Contractor's means and methods for soil management including storage, process for segregation, handling, transport and disposal and/or reuse of soil and provide it to the Consultant for review, comment and approval sixty (60) Business Days prior to the commencement of the Work. The Plan shall be based on the preliminary soil characterization data in Geotechnical report, which is provided for information purposes only.
 - .2 The Plan shall include:
 - .1 A detailed sampling and analysis plan for all soils excavated from the Project Area as required to determine the environmental quality of soil in compliance with O. Reg. 406/19 and the Soil Rules and Excess Soil Standards.
 - .2 The quality control procedures to be applied to the sampling and analysis activities in accordance with O. Reg. 406/19 and the Soil Rules.
 - .3 The process to be used by the Qualified Person to make the waste determination for excess soils in accordance with sections 4 and 5 of O. Reg. 406/19 and the Soil Rules.
 - .4 The process to address any changes or incongruencies in preliminary environmental quality or geotechnical information.
 - .5 The means and methods of stockpiling and segregation practices to be implemented to ensure that piles of soil that are not yet sampled and analyzed or are destined for different reuse sites or meet different Excess Soil Quality Standards remain segregated.
 - .6 A description of any proposed soil processing activities that may be required and whether or not an instrument is required.
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- .7 Estimated volumes for excavation and removal from site for dry soil and liquid soil.
 - .8 Identification of the laboratory being used for analysis.
 - .9 Identification of and all supporting documentation for any Class 1, Class 2 or local waste transfer stations (temporary sites) proposed to be used to temporarily store excess soil.
 - .10 Timing, staggering or phasing of the Work to meet the construction schedule with sampling turnaround times and submittal review periods.
 - .11 Drawings depicting location of excess soil stockpiles within the Project Area, location and configuration of site entrances, truck queuing and parking locations, dust and mud-control measures, erosion and sediment control measures and proposed haul routes.
 - .3 Oversee implementation of the Plan and complete all sampling, testing, data management and interpretation required to determine the environmental quality of soil, appropriate transportation options and ultimate beneficial reuse or disposal options in accordance with O.Reg. 406/19, Reg. 347 and the Soil Rules. The results must be summarized in a Soil Characterization Report (the "Soil Characterization Report" or "SCR") and shall, as applicable, be updated on an ongoing basis where implementation of the Plan produces updated information for interpretation on soil quality and quantity. The SCR shall be provided to the Consultant for review, comment and approval thirty (30) Business Days prior to, updates shall be provided ten (10) Business Days prior to, any excess soil leaving the Project Area.
 - .4 The SCR and updates shall include, but not be limited to:
 - .1 Characterization of the excess soils based on the results from sampling and analysis completed under the Plan.
 - .2 A determination of whether or not any portion of the excess soil will be characterized as waste in accordance with O. Reg. 406/19 and the Soil Rules.
 - .3 A copy of all sampling results, chain of custody forms, map of sample locations and characterization of the soil to be updated based upon receipt of new results.
 - .4 A determination of whether the Excess Soil Destination Assessment Report (ESDAR) requires updating based on the most current version of the Report.
 - .2 Prepare or supervise an excess soil destination assessment report (the "ESDAR") prepared in accordance with the Soil Rules and provide it to the Consultant for review, comment and approval thirty (30) Business Days prior to any excess soil leaving the Project Area. The report shall include, but not be limited to
 - .1 Identification of the final reuse site or licensed waste disposal site locations to which excess soil from the Project Area will be deposited.
 - .2 Confirmation the excess soil is appropriate for the reuse site or waste disposal site and is compliant with O. Reg. 406/19 and Reg. 347.
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- .1 For reuse sites this confirmation must document consideration of the applicable reuse site instrument or Excess Soil Standard for the reuse site where no instrument exists; identification of the reuse site's beneficial use for the excess soil; the application of the quality and quantity of the excess soil to the beneficial use.
 - .3 Contingency measures to be implemented, including but not limited to, location of an alternate site in the event excess soil cannot be deposited at the locations listed.
 - .4 Process to be used to update the ESDAR, as needed, throughout the Work to avoid delays in soil movement.
 - .5 A copy of the Environmental Compliance Approval (ECA) for each Waste Disposal Facility the Contractor will be using to dispose of the excess soil to the Region.
 - .6 A copy of any instrument for a reuse site that applies to receipt of soil at each reuse site identified in the ESDAR.
 - .3 Extend reliance to the City of Toronto satisfaction on all reports prepared to the City of Toronto and extend reliance to the owner or operator of a reuse site on the SCR and ESDAR pertaining to the soil the site has consented to receive.
 - .4 Liaise with the Consultant and other qualified persons acting on behalf of any proposed reuse sites on soil management issues.
 - .5 Carry out any additional sampling and analysis and characterization of excess soil as needed in consultation with the Consultant to meet reuse site requirements.
 - .6 Notify the Consultant as soon as reasonably possible after becoming aware of circumstances that indicates information in the SCR or ESDAR is inaccurate or requires updating.
 - .7 The Contractor shall provide a monthly monitoring report within ten (10) Business Days of the end of each month to the Consultant for review. The monitoring report shall contain all records of soil management activities including:
 - .1 Total quantities of excavated soil resulting from the Work.
 - .2 Total quantities of soil that were transported from the site for reuse elsewhere or disposal, including quantities and a detailed location plan for all amounts transported to each receiver that sets out all information listed in the requirements for Hauling Records in this Section as well as the soil quality information for each load of excess soil transported off the Project Area.
 - .8 The Contractor shall obtain and provide for review and approval of the Consultant with the written consent from the owner or operator of each reuse site at which the excess soil will be deposited directed to the [municipality] ten (10) Business Days prior to removing soil from the Project Area.
 - .9 The Contractor shall submit to the Consultant a copy of any notice, results reports, certificates of analysis and other documentation related to the excess soil that the Contractor provides to the owner or operator of a reuse site under O. Reg. 406/19 or the Soil Rules.
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- .10 The Contractor shall submit to the Consultant for review a notice of final placement of all soils related to the project at the reuse or disposal site.

3.2 **ON-SITE SOIL MANAGEMENT**

.1 Soil Storage

- .1 The Contractor shall not store any soil at the Project Area without the prior written approval of the Owner and shall ensure soil management at the Project Area is in accordance with O. Reg. 406/19, the Soil Rules and municipal bylaw requirements" items (b)-(f) below can be deleted. The section below on Soil Processing should be reviewed as it will also likely be removed under these circumstances:
- .2 Soil shall be managed in such a way as to prevent any adverse effects associated with the receiving, processing, storage and movement of soil, including management of:
- .1 Noise
 - .2 Dust
 - .3 Mud tracking
 - .4 Leaching
 - .5 Run-off and erosion
 - .6 Potential outdoor air impact(s), including odour issue(s).
- .3 The soil shall be stored in stockpiles and the maximum size of each stockpile shall not exceed 2,500 cubic meters.
- .4 Soil from the Project Area that has not yet been sampled, shall remain segregated from other soil. Any soil that is sampled and analyzed shall be kept segregated from other soil of different qualities or project areas. Soil that is intended for different beneficial uses shall also be kept segregated, even where the soil is from the Project Area.
- .5 Storage of the soil shall meet the setback requirements of O. Reg. 406/19 and the Soil Rules.
- .6 Soil shall be stored in a manner that prevents any contaminants from the soil from leaching into the ground water.
- .7 Liquid soil that is stored at the Project Area shall be managed in accordance with the following:
- .1 All storage and processing locations of liquid soil, processed, dewatered or solidified soil and process residues shall be readily accessible for inspection by a provincial officer.
 - .2 No more than 10,000 cubic metres of liquid soil, processed or dewatered or solidified soil and process residues may be present at the Project Area at any one time.
 - .3 All liquid soil, processed, dewatered or solidified soil and process residues that are liquid shall be stored in a leakproof container on an

impermeable surface in a manner sufficient to contain and prevent the material from escaping into the natural environment.

.2 Soil Processing

- .1 The Contractor may only conduct soil processing at the Project Area in accordance with O. Reg. 406/19 and the Soil Rules and the means and methods outlined in the Plan as approved by the Consultant.
- .2 The Contractor shall ensure all soil processing activities at the Project Area conform to the methods described in O. Reg. 406/19 that would not result in the excavated soil at the Project Area being designated as waste due to processing.
- .3 Where soil processing by mixing excavated soil with a substance or material will occur at the Project Area, the Contractor's Qualified Person shall meet the requirements of section 6 of O. Reg. 406/19 "Excavated Soil Processed at Project Area" for any excavated soil that is processed using a natural or synthetic polymer.
- .4 The Contractor shall ensure a copy of the procedure prepared to permit the mixing of a material with liquid soil for the purpose of dewatering or solidifying the liquid soil at the Project Area is provided to the Consultant for review and approval ten (10) Business Days prior to beginning any soil mixing at the Project Area.
- .5 The Contractor shall provide the Consultant and the Region with a copy of any documentation required by O. Reg. 406/19 prepared to permit placement of dewatered or solidified soil at a reuse site.

.3 Transportation of Excess Soil

- .1 The Contractor shall ensure that the transportation of excess soil is performed in accordance with O. Reg. 406/19 including but not limited to:
 - .1 The owner and operator of a vehicle transporting excess soil that is not designated as waste shall ensure that the excess soil is collected and transported in accordance with the following:
 - .1 The excess soil shall only be collected and transported in a vehicle that has been constructed to enable the excess soil to be transferred safely and without nuisance.
 - .2 Bodies of vehicles shall be constructed to withstand abrasion and corrosion from the excess soil.
 - .3 Bodies of vehicles shall be leakproof and covered where necessary to prevent the emission of offensive odours, the falling or blowing of material from the vehicle or the release of dust or other airborne materials that may cause air pollution.
 - .4 If the excess soil is liquid soil:
 - .1 Valves that are part of the vehicle shall have a locking system and shall be locked when the vehicle contains the liquid soil and the owner or operator of the vehicle is not in attendance, and

- .2 Whenever liquid soil is being transferred to or from the vehicle, the owner or operator of the vehicle shall be present.

- .2 The owner and operator of a vehicle transporting excess soil that is designated as a waste complies with section 16 of Regulation 347 of the Revised Regulations of Ontario, 1990 (General – Waste Management). A copy of the instrument authorizing the vehicle to manage waste is provided to the Consultant for review ten (10) Business Days prior to excess soil leaving the Project Area.

3.3 **RECEIVING EXCESS SOIL FOR REUSE AT THE PROJECT AREA**

- .1 Where the Contractor intends to use excess soil from another Project Area to meet clean fill needs for the Work, the Contractor's Qualified Person shall incorporate the import of soil into its Plan and submit to the Consultant and the Owner, for review and approval, a management plan prepared by the Contractor's Qualified Person to confirm suitability of the proposed soil thirty (30) Business Days in advance of the proposed start of bringing soil to the Project Area. The management plan shall include, but not be limited to, information and characterization confirming the geotechnical suitability, proposed soil quality standard, soil sampling plan with quality control measures, a copy of the sampling and analysis results for the source material, quantity required for the Work, system for load tracking, chain of custody and record management.

3.4 **TEMPORARY STORAGE FOR EXCESS SOIL**

- .1 Where the Contractor proposes to use a temporary storage site to stage movement of excess soil for the project the Contractor shall have its Qualified Person add this information to the Plan.
 - .1 Identify the type of temporary storage site proposed: a Class 1 soil management site, a Class 2 soil management site or a local waste transfer facility.
 - .2 Identify the owner, operator and location of each proposed temporary storage site.
 - .3 Description of the measures to be implemented at the temporary storage site and regarding transportation to and from the temporary storage site to ensure no adverse effects result from soil management.
 - .4 Shall confirm that the temporary storage site will have the required capacity for the intended volume of soil.
- .2 If the Contractor intends to temporarily deposit excess soil at a temporary storage site, the following conditions shall be met ten (10) Business Days prior to any soil being removed from the Project Area.
 - .1 The Contractor shall have obtained written consent from the site owner or its authorized representative to store the excess soil at the temporary storage site and provided this notice to the Consultant for review.
 - .2 The Contractor shall have obtained written consent from the owner or operator of the reuse site at which the excess soil will be finally deposited provided this notice to the Consultant for review.
 - .3 The Contractor shall provide any instruments applicable to the management of soil at the temporary site to the Consultant for review.

- .3 The Contractor shall take measures to ensure any excess soil transported to a temporary site shall be kept segregated from soil from other Project Areas and from other soil from the Project Area that is of different or unknown quality, or that is destined for different reuse sites.
- .4 All excess soil shall be deposited in the final reuse site prior to the end of the 2 year maintenance period of this Contract.
- .5 The Contractor shall provide written notice containing all information prescribed by O. Reg. 406/19 to the MECP Director before the excess soil begins to be deposited at the Class 2 soil management site. After excess soil has been removed from the Class 2 soil management site, the Contractor or the operator shall provide written notice to the MECP Director of closure of the site in accordance with O. Reg. 406/19. A copy of all written notices shall be provided to the Owner at the time of submission to the MECP Director.
- .6 If the Contractor becomes aware that any information in a written notice mentioned above is no longer complete or accurate, the Contractor shall ensure that the MECP Director is notified and provided with the completed or corrected information within thirty (30) Calendar Days after the Day the Contractor becomes aware that the information is no longer complete or accurate.
- .7 The Contractor shall ensure the deposit of the excess soil, storage and processing at a temporary site are performed in accordance with O. Reg. 406/19 and the Soil Rules.
- .8 The Contractor shall ensure the deposit of the excess soil, storage and processing at a local waste transfer facility is performed in accordance with O. Reg. 406/19 and the Soil Rules.

3.5 **UNEXPECTED CONTAMINATED SOIL**

- .1 If any person working at the Site makes an observation during soil excavation within the Site, including any visual or olfactory observation, that suggests that the soil being excavated may be affected by the discharge of contaminant not identified in the Geotechnical report, the Contractor shall ensure the following actions are performed:
 - .1 The person shall immediately notify the Contractor of the observation of potential contamination.
 - .2 The Contractor shall immediately cease all soil excavations in the Site.
 - .3 The Contractor shall immediately notify the Owner and the Consultant of the observation.
 - .4 The Contractor shall identify the area that may be impacted by the contaminant and ensure that any excavated soils from that area are segregated from other excavated soil in the Site.
 - .5 The Contractor acknowledges that the Consultant will obtain the advice of a Qualified Person regarding what steps are necessary in order to determine the following:
 - .1 The portion of the Site that is affected by the unexpected contaminant.
 - .2 Confirmation that all excavated soil that is affected by the unexpected contaminant is identified and segregated from other excavated soil at the Site.

- .3 Appropriate disposal options for any excess soil from that portion of the Site that was affected in accordance with O. Reg. 406/19 and other applicable regulations.
- .4 Requirement for any revisions to any documents required under O. Reg. 406/19.
- .6 The Contractor shall consult with the Owner and the Consultant on the advice noted in section (e) above to identify an approach satisfactory to the Owner to manage the potential contamination prior to directing excavations be resumed.

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.
- .2 Section includes, but is not necessarily limited to, the following:
 - .1 Design, supply and installation of prebored pile and lagging shoring for excavation adjacent to existing building, preventing movement, loss of soil or other activity, so that no damage occurs to building or other existing adjacent structures.

1.2 **REFERENCES**

- .1 Conform to the latest edition of the following:
 - .1 CSA G40.20/G40.21 - General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels
 - .2 CSA-A23.1 - Concrete Materials and Methods of Concrete Construction
 - .3 CSA-A23.2 - Methods of Test for Concrete
 - .4 CISC - Code of Standard Practice for Structural Steel Published by Canadian Institute of Steel Construction

1.3 **DESIGN CRITERIA**

- .1 Design shall be carried out by a professional Structural Engineer licensed in the province of Ontario. The design shall be based on actual site conditions.
- .2 Design the pile sections to limit deflection and/or movement to 12 mm maximum.
- .3 Design piles and lagging to support lateral earth forces.

1.4 **SUBMITTALS**

- .1 Submit Shop Drawings in accordance with Section 01 33 00.
- .2 Include design calculations, details and connections, design concept, construction method, sequence, and the means by which existing structures, utilities and equipment will be protected.
- .3 Have Shop Drawings stamped and signed by the Designer.

1.5 **GEOTECHNICAL INVESTIGATION**

- .1 Geotechnical investigation of the Site was carried out for the Owner as a guide in design and construction. A report and borehole logs on the investigation were prepared and are bound into the Specifications.
 - .2 No responsibility is assumed by the Owner or Consultant for the scope, accuracy, or interpretation of the geotechnical investigation report. Soil conditions between boreholes may be at variance with the information shown on the soil investigation report.
-

- .3 Be responsible for including in the Work, costs for all conditions identified or inferred in the report, including disposal of contaminated materials, if any, in accordance with MOE regulations.

1.6 **PROJECT CONDITIONS**

- .1 Site visit: Visit the site and determine the work extent and nature of existing conditions.

2 **Products**

2.1 **MATERIAL**

- .1 Piles: Structural steel conforming to CSA-G40.20/G40.21, Grade 300W.
- .2 Lagging: Construction grade spruce, or equal.
- .3 Concrete materials: Conforming to CSA-A23.1/A23.2.

3 **Execution**

3.1 **PRE-BORED PILES**

- .1 Pre-bore for soldier piles, clean pile holes free of deleterious material before installing piles and plugs.
- .2 If movements occur, over and above that allowed for in design, stop work immediately. Employ suitable measures to prevent any further movement and notify the Consultant.
- .3 Extend piles to a minimum depth below the base of the structure as dictated by the design. Encase the bottom of piles with 20 MPa concrete and the remainder with lean concrete.
- .4 Bore pile holes to give 500 mm of concrete below the pile base.
- .5 Do not allow part of any piles to project within the neat lines of the structure, except as shown on the Drawings.
- .6 Driven soldier piles will not be permitted.
- .7 Install soldier piles with plumbness no more than 1% off vertical to a maximum of 50 mm from the centroid at bottom. The top of the pile after installation shall be no more than 50 mm maximum from the design location.

3.2 **LAGGING**

- .1 Install lagging immediately following piling to prevent the movement of adjacent soil and to ensure safety of the excavation and adjacent property. Maintain positive contact between the back of the lagging and the face of the excavation for the whole length of the lagging. Pre-load lagging by wedging each piece of lagging.
- .2 Do not allow part of lagging to project within the neat lines of the structure.

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- | | | |
|-----|------------------|--|
| .1 | ASTM A500 | - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes |
| .2 | ASTM A820 | - Standard Specification for Steel Fibres for Fibre-Reinforced Concrete |
| .3 | ASTM C260 | - Standard Specification for Air-Entraining Admixtures for Concrete |
| .4 | ASTM C309 | - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete |
| .5 | ASTM C494 | - Standard Specification for Chemical Admixtures for Concrete |
| .6 | ASTM C881 | - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete |
| .7 | CAN/CGSB 1.59 | - Alkyd Exterior Gloss Enamel |
| .8 | CSA-A23.1/A23.2 | - Concrete Materials and Methods of Concrete Construction/Test methods and Standard Practices for Concrete |
| .9 | CAN/CSA G30.18-M | - Billet-Steel Bars for Concrete Reinforcement |
| .10 | CSA G30.15-M | - Welded Deformed Steel Wire Fabric for Concrete Reinforcement Steel Wire Fabric for Concrete Reinforcement |
| .11 | AODA | - Accessibility for Ontarians with Disabilities Act |

1.3 **SUBMITTALS**

.1 Submit Shop Drawings in accordance with Section 01 33 00.

.2 Submit as Shop Drawings, Product data, performance and other criteria for each material specified in this section that is proposed for use, including:

- .1 Admixtures
.2 Joint filler
.3 Joint sealant
-

- .4 Curing compound
 - .3 Submit Shop Drawings of joint assemblies. Draw to a scale not smaller than 1:50 and include plans, sections and details.
 - .4 Concrete Supplier's latest statistical analysis of all concrete mixes to be used on this Project.
- 1.4 **QUALITY ASSURANCE**
- .1 Acceptable concrete finishing contractors for dolly pads are Diplock Floor Ltd., Duron Ontario Ltd., or Metro Concrete Floors Inc.
 - .2 Testing and Inspection
 - .1 Work will be inspected and tested for conformance to CSA-A23.1 by an independent inspection company selected and paid for by Owner.
 - .2 Notify Consultant at least twenty-four hours in advance of placing concrete to permit inspection of formwork, reinforcing, bearings, etc.
 - .3 Tests include the following:
 - .1 Obtaining verification of cement
 - .2 Tests of reinforcing
 - .3 Tests of aggregate
 - .4 Verification of steel fibre content
 - .5 Tests of setting mixes and design of mix
 - .6 Concrete cylinder test. Three cylinders from each day's pour for each 75 m³. of concrete or for each 30 m³ of concrete poured in small amounts on successive days.
 - .4 Tests will be made in accordance with CSA-A23.2.
 - .5 Inspection company's reports of tests will be forwarded to Consultant and to Contractor with an opinion or reason for any abnormalities noted thereon.
 - .6 Cooperate with and assist inspection company's personnel during inspections and tests.
 - .7 Remove defective materials and completed work which fail tests and replace as directed by Consultant.
 - .8 Where work or materials fail to meet strength requirements as indicated by test results, the costs of additional inspection and testing required for the new replacement work or materials.
- 1.5 **PRODUCT DELIVERY, STORAGE AND HANDLING**
- .1 Store materials on site in a manner to prevent damage. Protect from the weather. Comply with CSA-A23.1, Clause 5.1.
-

- .2 Protect the materials and work of this section from damage. Protect other work from damage resulting from this work. Replace damaged work which cannot be satisfactorily repaired.

2 Products

2.1 **MATERIALS**

- .1 Portland cement: CAN/CSA-A3001 Normal, Type GU Portland cement, (Moderate Type MSb - Mild Exposure) (High Early Strength Type HE) (Sulphate Resistant Type HS).
- .2 Coarse aggregate: CSA-A23.1, Clause 4.2.3.4 and Table 11, Group I, 20-5 mm, 100% crushed, in cubular size.
- .3 Fine aggregate: CSA-A23.1 Clause 4.2.3.3 and Table 10.
- .4 Reinforcing steel: CAN/CSA G30.18-M, Grade 400.
- .5 Reinforcing mesh: CSA G30.15-M, flat sheets. Rolls are not acceptable.
- .6 Shrinkage control fibres: Bekaert "Dramix" steel fibres conforming to ASTM A820, Type 1, deformed, cold drawn galvanized steel wire; RC-65/60-CN with a tensile strength of 895 MPa.
- .7 Water: CSA-A23.1, Clause 4.2.2.
- .8 Forms: New Douglas Fir plywood, G1S for all exposed concrete. Rough T and G lumber or used G1S Douglas Fir plywood for surfaces which will be concealed.
- .9 Tubular forms for lighting pole bases: Sonoco Products Ltd. "Sonotube" spirally wound fibre forms free of dents and other irregularities, treated internally with release material.
- .10 Air entraining admixture: Conforming to ASTM C260; Master Builders, "Micro-Air", Euclid "Airextra", or Grace "Darex AEA EH"/Catexol AE360 (for low slump concrete).
- .11 Water reducing admixture: Conforming to ASTM C494 Type A, Master Builders "Pozzololith 200N", Euclid "WR75", Grace "WRDA 20" or Axim "Catexol 1000N".
- .12 Pigmented curing compound: Conforming to ASTM C309, Type 2, Class B, white pigmented resin based, Master Builders "Promulsion 200", W.R. Meadows "Sealtight 1220", Euclid "Kurez E-40" or Dayton Superior "Day-Chem White Pigmented Cure (J-10)".
- .13 Form ties: Adjustable snap ties, formed to break 25 mm or more from surface of concrete after form removal, with a minimum working strength of 13 kN. Wire ties will not be permitted.
- .14 Formwork release agent: Imperial Oil "Filmo No. 40", W.R. Meadows "Duogard II", Euclid "Super Slip" or Dayton Superior "Clean Strip (J-1)".
- .15 Premoulded joint filler: Asphalt impregnated, W.R. Meadows "Fibre Expansion Joint", CPD "Flexcell" or approved equivalent. Furnish with 13 x 13 mm removable "tacked-on" strip in the formation of the joint, to provide for proper sealant depth after stripping.
- .16 Chairs or spacers: Rigid type by Drummond and Reeves Ltd., Acrow Richmond or Superior Concrete Accessories.
- .17 Hot-poured joint sealant (sawcuts): Premium quality rubberized compound, black colour:

- .1 W.R. Meadows "Hi-Spec"
- .2 Henry "590-13A"
- .3 Hydrotech "6165"

- OR -

- .18 Standard joint sealant: Two component chemically reactive polyurethane modified sealant, self-levelling type, grey colour meeting ASTM C920.
 - .1 W.R. Meadows "Sealtight Pourthane"
 - .2 Euclid "Eucolastic II"
 - .3 Sika "Sikaflex 2C NS/SL"
 - .4 Tremco "Vulkem 245"
 - .5 CPD "PSI 551"
- .19 Bonding agent: Meeting ASTM C-881, Sika "Sika-Dur Hi Mod", or W.R. Meadows "Rezi-Weld 1000", Euclid "452 MV", Cappar "Capbond E" or Dayton Superior "Resi-Bond (J-58)".

2.2 **CONCRETE PROPORTIONS**

- .1 Concrete to be ready-mixed and proportioned in accordance with CSA-A23.1 Clause 4.3.1, and as follows:
 - .1 Minimum allowable compressive strength at twenty-eight days: 32 MPa, unless otherwise noted or shown.
 - .2 Minimum cement content: 325 kg/m³
 - .3 Slump at point of deposit: 60 mm maximum and 20 mm minimum.
 - .4 Add shrinkage control fibres into the slab mix in the truck on site at the specified dosage rate to the next highest half bag. Minimum dosage rate: 19 kg/m³.
 - .5 In no case shall the total amount of steel fibres added to each load of the ready mix concrete average less than the specified dosage rate.
 - .6 Add superplasticizer as required to both fibre reinforced concrete and plain concrete.
 - .7 Confirm mix design to ensure conformance with requirements specified herein.
 - .8 Air entrain all concrete work. Conform to CSA A23.1, Clause 4.3.3, Table 4.
 - .9 Exposure classification: C-2 as defined in Table 2 of CSA A23.1.
- .2 Add admixtures to concrete mix in accordance with the manufacturer's recommendations.
- .3 The use of calcium chloride or additional admixtures, other than those specified, is prohibited.

3 Execution

3.1 **EXAMINATION**

- .1 Confirm that surfaces on which concrete is to be placed are free of frost, water and debris before placing concrete.
- .2 Ensure that substrates are compacted and acceptable, and that reinforcement, inserts and all other built-in work are in place and secured before pouring concrete.

3.2 **FORMWORK**

- .1 Construct formwork according to CSA-A23.1, except where shown otherwise. Ensure no lumber remains in concrete.
- .2 Form for depressions and recesses required in concrete to receive all other work.
- .3 Form 13 mm x 13 mm minimum chamfered edges on all exposed concrete corners.
- .4 Forms may be removed any time after seven days from date of placing concrete or otherwise as directed by the Consultant. Remove forms in accordance with CSA-A23.1.

3.3 **PLACING**

- .1 Place concrete to prevent layering and segregation and vibrate sufficiently to ensure thorough compaction, maximum density, and according to CSA-A23.1 Clause 6.8.5.4. Hand spade concrete adjacent to forms with metal spatulas.
- .2 Before placing fresh concrete against set or partially set concrete, clean surfaces to remove dirt, scum, shavings, debris, laitance, etc. On set surfaces, brush generously with bonding agent.
- .3 Check Work frequently with accurate instruments during concrete placing.

3.4 **CONCRETE FINISHING - GENERAL**

- .1 For concrete mixes containing steel fibre reinforcement, ensure that finishing process leaves surface free of protruding fibres. If fibres protrude from surface after concrete has set, remove protruding fibres.

3.5 **CONCRETE PAVING AND DOLLY PADS**

- .1 Screed concrete to required levels, with falls indicated, to tolerance of 3 mm in 3 m.
- .2 Wood float and finally, steel float or trowel concrete. Avoid excessive trowelling.
- .3 To produce a uniform, non-slip finish, apply a medium texture, non-directional machine float. Overlap adjacent strokes. The final finish shall be dense, uniform in texture and free from porous spots, irregularities, depressions, or disturbed particles of coarse aggregate.
- .4 Form construction joints as required.
- .5 Unless shown otherwise, sawcut control joints at maximum 5 m spacing. Also sawcut construction joints. Sawcut using "soft cut" system as follows:
 - .1 Perform "dry method" using "soff-cut saw" as soon as the slab will support the weight of the saw and operator without disturbing the final finish. Perform sawcutting from zero to two hours after final floor finishing or within a concrete cutability window of 1.1 MPa/10.5 kg/cm² to a maximum of 5.6 MPa/56.3 kg/cm². Replace manufacturer's patented anti-ravel skid plate with each new blade to avoid spalling and ravelling. The depth of cut is determined by aggregate size.

- .2 After sawing and grinding, blow-out joints with compressed air. Immediately broom clean residue caused by sawing operation as work progresses.
- .3 When cleaned joints are dry and prior to traffic being allowed over area, install temporary polyethylene backer rod in joints to prevent contamination of same.
- .6 Apply one coat of curing compound to finished surface immediately after sawcutting in accordance with manufacturer's printed instructions.

3.6 **CONCRETE GUTTER, CURB, CURB AND GUTTER AND OUTLETS**

- .1 Unless shown otherwise, form to the applicable OPSD. Finish concrete surface to a broom finish. Round outside curb edges to radii shown. Do not dust neat cement onto freshly placed concrete to facilitate finishing.
- .2 During pouring, properly vibrate concrete to prevent honeycombs.
- .3 Provide transverse joints by sawcutting at intervals not exceeding 5.5 m and filling with backer rod and sealant. Provide premoulded joint filler to form expansion joints between curb and abutting concrete work, and other dissimilar structures.

3.7 **SIDEWALKS**

- .1 Screed concrete sidewalks to required levels, with falls indicated, to tolerance of 6 mm in 3 m.
- .2 Wood float and finally, steel float or trowel. Avoid excessive trowelling.
- .3 Finish concrete with one directional screed and coarse broom finish.
- .4 Form dummy joints 6 mm deep at 1.5 m o.c. Tool joints with 6 mm wide steel trowel, radiusing edges 6 mm.
- .5 Form expansion joints at 6 m o.c., maximum.
- .6 Tool edges of sidewalk with 50 mm wide steel trowel, radiusing edges 6 mm.
- .7 Apply one coat of curing and sealing compound to surface immediately after final finishing in accordance with manufacturer's printed instructions.

3.8 **EXPANSION/ISOLATION JOINTS**

- .1 Form expansion/isolation joints at building face or other abutments. Place 12 mm thick joint filler keeping top 12 mm below concrete surface.

3.9 **SEALANT**

- .1 Remove tacked-on strip on top of joint filler.
- .2 Apply kraft paper or polyethylene bond breaker over premoulded filler and fill with self-levelling sealant applied in accordance with manufacturer's printed instructions.
- .3 Install sealant in sawcut joints and in expansion/isolation joints.
- .4 Comply with sealant manufacturer's primer, application and temperature requirements. After initial set, prime sealant surface and refill joints with sealant as required to produce slightly convex joint surface.

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- | | | |
|----|------------------|--|
| .1 | ASTM A820 | - Standard Specification for Steel Fibers for Fiber-Reinforced Concrete |
| .2 | ASTM C260 | - Standard Specification for Air-Entraining Admixtures for Concrete |
| .3 | ASTM C309 | - Standard Specification for Liquid Membrane-Forming Compound for Curing Concrete |
| .4 | ASTM C494 | - Standard Specification for Chemical Admixtures for Concrete |
| .5 | ASTM C881 | - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete |
| .6 | CAN/CSA-A5-M | - Portland Cement SUPERSEDED BY A3000-03 |
| .7 | CSA-A23.1/A23.2 | - Concrete Materials and Methods of Concrete Construction/Test methods and Standard Practices for Concrete |
| .8 | CSA G30.5-M | - Welded Steel Wire Fabric for Concrete Reinforcement |
| .9 | CAN/CSA G30.18-M | - Billet-Steel Bars for Concrete Reinforcement |

1.3 **SUBMITTALS**

.1 Submit Shop Drawings in accordance with Section 01 33 00.

.2 Submit as Shop Drawings, manufacturers' Product data, performance and other criteria for the following:

- .1 Admixtures
.2 Joint sealant
.3 Shrinkage control fibres

.3 Also submit the following:

- .1 Concrete Supplier's mix design information based on requirements specified in "Concrete Mix Proportions" herein.
.2 Proposed method for bulkheads, formwork, etc.
-

- .3 List of proposed concrete placement equipment.
 - .4 Drawings of joint assemblies.
 - .4 Draw Shop Drawings to a scale not smaller than 1:50 and include plans, sections and details.
 - 1.4 **QUALITY ASSURANCE**
 - .1 Testing and Inspection
 - .1 Refer to "Quality Control" in Section 01 10 00 – General Requirements.
 - .2 Work will be inspected and tested for conformance to CSA-A23.1 by an independent inspection company selected and paid for by Owner.
 - .3 Notify Consultant at least twenty-four hours in advance of placing concrete to permit inspection of formwork, reinforcing, etc.
 - .4 Testing includes the following:
 - .1 Obtaining certification of cement
 - .2 Test of reinforcing
 - .3 Test of aggregate
 - .4 Verification of steel fibre content
 - .5 Test for setting mixes of concrete and design of mix
 - .6 Concrete cylinder test. Three cylinders from each day's pour for each 75 m³ of concrete, or for each 30 m³ of concrete poured in small amounts on successive days
 - .7 Air entrainment and slump tests which will be made on the same batch of concrete from which the test cylinders are made
 - .5 Tests will be made in accordance with CSA-A23.2.
 - .6 Inspection company's reports of tests will be forwarded to the Consultant and to the Contractor with an opinion or reason for any abnormalities noted thereon.
 - .7 Ensure Work complies with the Ontario Building Code and all pertinent local by-laws and regulations. These shall govern in case of conflict with the specifications. Obtain and pay for permits before starting Work.
 - .2 Pre-Construction Meeting
 - .1 Prior to start of the Work, arrange a Project site meeting of all parties associated with the Work of this section including the Consultant and testing company's representative.
 - .2 Review the Specifications for all Work included under this section and determine a complete understanding of requirements and responsibilities relative to work included, storage and handling of materials, materials to be used, installation of materials, sequence and quality control, Project staffing, restrictions on areas of pours, and other matters affecting the construction, so as to permit compliance with the intent of this section.
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1.5 **PRODUCT DELIVERY, STORAGE AND HANDLING**

- .1 Store materials on site in a manner to prevent damage. Protect from the weather. Comply with CSA-A23.1, Clause 5.1.
- .2 Protect the materials and work of this section from damage. Protect other work from damage resulting from this work. Replace damaged Work which cannot be satisfactorily repaired.
- .3 Concrete shall be ready-mixed at plant and transported to the site by truck in accordance with CAN3-A23.1-M77. Hand mixed concrete is not allowed unless accepted in writing by the Consultant prior to starting any Work.
- .4 Maintain constant controls to ensure that finished concrete is dense, uniform, free of air holes or honeycombs and that no segregation or aggregates and cement paste occurs.
- .5 There shall be no concrete pouring in temperatures below 10°C without written permission of the Consultant.

1.6 **RECORDS**

- .1 Keep a written record of concrete pours, showing location, date, cubic metres of concrete including signed trip ticket for each truck, ambient air temperature, and unusual occurrences during placement of each pour. Permit inspection of records by Consultant at any time. At completion of Work, submit a summary of such data in triplicate to the Consultant.

1.7 **WARRANTY**

- .1 Warrant concrete pavement against spalling and/or cracks for a period of two years. Replace defective work at no cost to the Owner; perform repair or remedial work at a time convenient to the Owner.

2 Products

2.1 **MATERIALS**

- .1 Portland cement: CAN/CSA-A3001 Normal, Type GU Portland cement, (Moderate Type MSb (20S) - Mild Exposure) (High Early Strength Type HE (30)) (Sulphate Resistant Type HS (50)).
 - .2 Coarse aggregate: CSA-A23.1, Clause 4.2.3.4 and Table 11, Group I, 40-5 mm. Coarse aggregate shall be 100% crushed, in cubular size.
 - .3 Fine aggregate: CSA-A23.1, Clause 4.2.3.3 and Table 10.
 - .4 Water: CSA-A23.1, Clause 4.2.2.
 - .5 Forms: Steel, of such strength as to adequately support and maintain exact alignment under the weight of the concrete spreading and finishing equipment. Forms shall have keyways.
 - .6 Mesh reinforcing: In accordance with CSA G30.5-M.
 - .7 Shrinkage control fibres: Bekaert "Dramix" steel fibres conforming to ASTM A820, Type 1, deformed, cold drawn steel wire; (RC-65/60-BN with a tensile strength of 895 MPa (130,000 psi)).
-

- .8 Water reducing, high range admixture (superplasticizer): Conforming to ASTM C494 Type F, Master Builders, "Rheobuild 1000", Euclid "Eucon 537", or Grace "Duracem 100".
- .9 Dowels: Conforming to CAN/CSA G30.18-M, Grade 400. Use at pavement construction joints.
- .10 Chairs and spacers: Precast concrete bricks with embedded tie wires as manufactured by Drummond and Reeves Ltd., Acrow Richmond, or Superior Concrete Accessories Ltd.
- .11 Water reducing admixture: Conforming to ASTM C494 Type A; Master Builders "Pozzolith 200N", Euclid "WR75", Grace "WRDA 20" or Axim "Catexol 1000N".
- .12 Premoulded joint filler: Asphalt impregnated, W.R. Meadows "Fibre Expansion Joint", CPD "Flexcell" or approved equivalent. Furnish with 13 x 13 mm removable "tacked-on" strip in the formation of the joint, to provide for proper sealant depth after stripping.
- .13 Air entraining admixture: Master Builders "Micro-Air", Euclid "Air Extra" or Grace Darex "AEA EH"/Catexol AE360 (for low slump concrete), conforming to ASTM C260.
- .14 Formwork release agent: Imperial Oil "Filmo No. 40", Goodco Ltd. "Noxcrete", W.R. Meadows "Duogard II", Euclid "Super Slip" or Dayton Superior "Clean Strip (J-D)".
- .15 Pigmented curing compound: Conforming to ASTM C-309, Type 2, Euclid "Kurez E-40", W.R. Meadows "Sealtight 1220", Master Builders "Promulsion 200" or Dayton Superior "Day-Chem White Pigmented Cure (J-10)".
- .16 Hot poured joint sealant: Premium quality rubberized compound, black colour:
 - .1 W.R. Meadows "Hi-Spec"
 - .2 Monsey Bakor "590-13A"
 - .3 Hydrotech "6165"
- .17 Bonding agent: Meeting ASTM C-881, Sika Chemical "Sika-Dur Hi-Mod", W.R. Meadows "Rezi-Weld 1000", Euclid "452 MV" or Cappar "Capbond E".
- .18 Line painting: Paint conforming to CGSB 1-GP-149M, white (yellow).

2.2

CONCRETE MIXING

- .1 General: Concrete to be ready-mixed and proportioned in accordance with CSA-A23.1, Clause 4.3.1, and as follows:
 - .1 Proportion concrete to achieve 32 MPa minimum compressive strength at twenty-eight days.
 - .2 Slump where vibratory placing and finishing equipment is not used or where only limited vibration is possible: 31 mm, ± 19 mm.
 - .3 Slump where internal and/or vibratory placing and finishing equipment is used: Between 65 mm, ± 25 mm.
 - .4 Air entrain concrete to produce 6% (± 1) entrained air.
 - .5 Add shrinkage control fibres into the mix in the truck on site at the specified dosage rate to the next highest half bag. Minimum dosage rate: 19 kg/m³.

- .6 In no case shall the total amount of steel fibres added to each load of the ready mix concrete average less than the specified dosage rate.
- .7 Concrete Supplier to confirm mix design to ensure conformance to the foregoing and submit same to the Consultant.
- .8 Air entrain all concrete work. Conform to CSA A23.1, Clause 4.3.3, Table 4.
- .9 Exposure classification: C-2 as defined in Table 2 of CSA A23.1.

.2 Admixtures

- .1 Add admixtures to concrete mix in accordance with the manufacturer's recommendations. The manufacturer shall make available, at no cost, upon seventy-two hours notice, the services of a qualified, full-time field representative to assure proper use of admixtures.
- .2 The use of calcium chloride or additional admixtures, other than those specified, is not acceptable.

2.3 **EQUIPMENT FOR CHECKING, PLACING AND FINISHING**

- .1 Scratch template: For checking contours of base from side forms, equipped with adjustable rods projecting down to base course at maximum 300 mm intervals.
 - .2 Spreader: Mechanical self-propelled type capable of moving concrete forward and laterally, and of correcting segregated areas.
 - .3 Surface vibrators for non-strip poured concrete: Hand-held, portable vibrating screed with extension handles.
 - .4 Surface vibrators for strip poured concrete: (Vibrating screed or vibrating pan type) (Hand-held vibrating screed). Use at least one vibratory unit for each 2.4 m length of vibrating screed or each 1.8 m length of vibrating pan.
 - .1 Synchronize units on each individual screed or pan to operate at a frequency of not less than three thousand five hundred pulsations per minute.
 - .2 Use a "bullnose edge" on the leading edge of the screed or pan.
 - .3 Operate equipment in such a way that each section of pavement receives at least one pass but not more than two passes.
 - .5 Internal vibrators (for paving having a depth in excess of 200 mm): Adequate to properly consolidate the concrete.
 - .1 Frame-mounted vibratory units with vibrating tubes extending into the slab shall have a clear distance between tubes of units not exceeding 760 mm.
 - .2 Insert vibrators of this type into the concrete to a depth which will provide the best compaction but not closer than 50 mm from the subgrade or side forms. Operate internal vibrators at frequencies of not less than five thousand vibrations per minute.
 - .6 Finisher: Mechanical self-propelled, with two independently operated transverse screeds.
-

- .7 Float: Wood or metal, straight, smooth, sufficiently light to avoid sinking into concrete surface, operated mechanically or manually from edge to edge while advancing longitudinally.
- .8 Alternate equipment: Should Contractor wish to employ alternate types of equipment he shall identify such alternate as an attachment to his Bid and shall produce evidence that the alternate equipment is capable of producing a satisfactory result in accordance with this Specification.

3 Execution

3.1 **INSPECTION OF JOB CONDITIONS**

- .1 Examine previously constructed work including placement and compaction of earth subgrade. Check and review compaction test results of fill to receive this work. Report to the Consultant in writing any defects or discrepancies. Commencement of work implies acceptance of existing conditions.
- .2 Re-fine grade and recompact earth subgrade for concrete paving. Compact to densities and methods specified in Section 31 00 00.
- .3 Check subgrade between forms with scratch template in the presence of the Consultant.
- .4 Correct any irregularities or depressions that develop under rolling by loosening the material at such locations and adding or removing material and re-compacting until the surface is smooth and uniform. Dig out any soft spots which develop in the subgrade during or after compaction operations and replace as specified in Section 31 00 00.
- .5 Dampen subgrade before concrete is placed thereon. Do not place concrete until the condition of the subgrade has been inspected by the Consultant.
- .6 Repair any areas of subgrade which have been disturbed due to concreting operations ahead of concrete placing operations at no cost to the Owner.
- .7 Establish elevations of compacted subgrade base materials prior to commencing work.

3.2 **TESTING**

- .1 Arrange and pay for testing of the concrete by an independent testing agency accepted by the Consultant. Submit testing reports to the Consultant.

3.3 **FORMWORK**

- .1 Build forms and secure in place with pins, stays and braces of sufficient strength to support and keep alignment under weight of spreading and finishing equipment.
 - .2 Set forms true to line and grade, join neatly and tightly, and stake securely to resist concrete pressure and impact from tampers without springing.
 - .3 Construct forms to produce finished concrete forming to shape dimensions, locations and levels indicated within tolerances required by CSA-A23.1-94, and/or as established by accepted mock-up.
 - .4 Install keyways as indicated.
 - .5 Clean and oil forms before each use.
 - .6 Obtain Consultant's inspection of installed forms before placing concrete.
-

- .7 Leave forms in place for minimum of twenty-four hours after concrete placement.
- .8 Remove forms in a manner to prevent damage to concrete. Do not pry with crow bars or heavy tools against concrete edges.
- .9 Install sleeve for utilities as per Drawings. Coordinate with other installers and have layout accepted by the Consultant.
- .10 The cross-fall of the concrete paving shall be as indicated on the Drawings and in the direction of the slope of the surrounding grade.

3.4 **PLACING AND SPREADING**

- .1 Place reinforcing mesh on steel chairs.
- .2 Place concrete in accordance with CSA-A23.1, Clause 6.8.5.4. Place using mechanical spreader. Hand placing may be used where machine spreading is not feasible. Do not allow workers to walk on fresh concrete.
- .3 Place concrete in strip pours in alternate lane pattern at widths and in accordance with layout shown on Drawings and per sequence as reviewed by Consultant. Allow for minimum seventy-two hours between pour strips lanes to provide for initial shrinkage.
- .4 Place concrete to lines, grades and depths indicated. Do not place on a frozen surface.
- .5 Install sluices to limit height of free fall of concrete to 1.2 m maximum. Place all concrete to prevent layering and segregation.
- .6 Discharge concrete into forms as soon as practical after mixing.
- .7 Spread uniformly with thickness sufficient to allow for proper consolidation, finishing and attainment of overall pavement thickness shown.
- .8 Work concrete into complete contact with forms, reinforcement and other embedded items. Take care to avoid displacing dowel bars or embedded items from position. Consolidate concrete adjacent to side forms and joints with a vibrator along the entire length of forms or joints before finishing operations are started.
- .9 Check Work frequently for lines and levels with accurate instruments during placing of concrete.
- .10 Before placing fresh concrete against set concrete at construction joints, clean surfaces to remove all dirt, scum, debris, laitance, etc. Grease dowels generously at construction joints.
- .11 Protect freshly laid concrete from damage by rain. Place a covering material such as burlap, cotton mats, curing paper or plastic sheathing to protect surfaces in case of rain. Extend protective coverings over edges of concrete and arrange so as not to bear on unprotected edges.

3.5 **CONSOLIDATION**

- .1 Consolidate concrete by vibrating screed or vibrating pan.
 - .2 On odd shaped slabs inaccessible to the frame-mounted vibratory equipment, use hand held vibratory screed.
-

- .3 Operate vibrators only when the finishing machine is in motion. Take care to prevent over-vibration.
- .4 After concrete has been consolidated, smooth and consolidate further by means of a longitudinal float.
- .5 Scrape-off all laitance.
- .6 After the final pass of the longitudinal float, check the surface of the pavement with an approved straight edge 4.5 m in length. Correct any irregularities exceeding 6 mm immediately before any initial set has developed in the concrete.

3.6 **LONGITUDINAL, TRANSVERSE AND ISOLATION JOINTS**

- .1 Longitudinal joints, except where shown otherwise, are keyed and dowelled system; transverse joints at right angles to the centerline and extending the full width of the pavement.
- .2 Place steel dowels in all construction joints.
 - .1 Cut vertical open slots or oversized drilled holes in the header board to facilitate the placing of steel dowels and the subsequent removal of the header board.
 - .2 Upon the resumption of work, carefully remove header board; clean away any surplus concrete on the subgrade and deposit the fresh concrete directly against the previously cast concrete.
- .3 Rigidly fix steel dowels so as to retain alignment parallel to the surface of the concrete and at right angles to the joint. Uniformly coat dowels with a heavy grease for their entire length.
- .4 Construct all joints perpendicular to the pavement surface.
- .5 Install isolation joint filler where pavement is poured against vertical structures which penetrate the pavement and at such other locations as may be shown on the Drawings.
- .6 Form construction joint at the end of each day's run or where interruptions of the work for thirty minutes or more occur but only where the length of pavement laid from the last joint is more than 3 m.
 - .1 Sections less than 3 m in length between joints will not be permitted.
 - .2 If sufficient concrete is not mixed to form a slab at least 3 m in length, terminate paving at the preceding joint location and dispose of excess concrete off site or as otherwise directed by the Consultant.

3.7 **CONCRETE PAVING WITH HEAT TRACING**

- .1 Place first concrete pour as specified within this specification to 75 mm thickness and finish.
 - .2 Sawcut joints with the soft-cut method as specified in this Specification.
 - .3 After first pour initial set, install heat tracing system in accordance with manufacturer's printed instructions.
 - .4 Apply bonding agent to entire first pour surface area.
-

- .5 Place second concrete pour as specified within this specification to 75 mm thickness. Finish as specified.
- .6 Sawcut joints with the soft-cut method to coincide with initial sawcuts in first pour slab.
- .7 Using regular sawcut equipment, re-cut soft-cut joints twelve to twenty-four hours following sawcutting to widen joints to width shown as required for proper sealant adhesion.
- .8 Fill sawcut joints with joint sealant as specified within this Specification.

3.8 **FINISHING**

- .1 After concrete has been spread and consolidated, compact surface of concrete further by power mechanical self-propelled finisher. Hand methods may be used in areas inaccessible to power mechanical equipment.
- .2 The surface of the pavement shall be at the exact grade elevation indicated on the Drawings.
- .3 Apply finishing machine over each area of pavement as many times and at such intervals as is necessary to give the proper compaction and to leave a surface of uniform texture, true to grade.
 - .1 Avoid excessive operation over a given area.
 - .2 Keep the top of forms clean by a device attached to the equipment; maintain the travel of the equipment on the forms true without lift, wobbling, or other variation tending to affect the precision finish.
- .4 For concrete mixes containing steel fibre reinforcement, ensure that finishing process leaves surface free of protruding fibres. If fibres protrude from surface after concrete has set, remove protruding fibres.

3.9 **SURFACE TEXTURING**

- .1 Broom finish pavement using steel or fibre broom not less than 450 mm wide, drawing broom across the width of the pavement at right angles to the longitudinal joints to produce corrugations not exceeding 3 mm in depth. Overlap adjacent strokes. The final finish shall be uniform in texture and free from porous spots, irregularities, depressions, or disturbed particles of coarse aggregate.

- OR -

- .2 Float to a medium texture, using non-directional machine float. Overlap adjacent strokes. Finish to a surface which is uniform in texture and free from porous spots, irregularities, depressions, or disturbed particles of coarse aggregate.
- .3 After surface has set, grind any fibres protruding above the surface. Sweep surface clean.

3.10 **SAWCUTTING - TRANSVERSE JOINTS**

- .1 Sawcut joints in straight lines.
- .2 Perform dry method sawcutting using "soft-cut saw" as soon as the slab will support the weight of the saw and operator without disturbing the final finish. Perform sawcutting from zero to two hours after final floor finishing or within a concrete cutability window of 1.1 MPa/10.5 kg/cm² to a maximum of 5.6 MPa/56.3 kg/cm². Replace manufacturer's

patented anti-ravel skid plate with each new blade to avoid spalling and ravelling. The depth of cut is determined by aggregate size.

- .3 After sawing and grinding, blow-out joints with compressed air. Immediately broom clean residue caused by sawing operation as work progresses.
- .4 Using regular sawcut equipment, re-cut soft-cut joints twelve to twenty-four hours following sawcutting to widen joints to width shown as required for proper sealant adhesion.
- .5 When cleaned joints are dry and prior to traffic being allowed over area, install temporary polyethylene backer rod in joints to prevent contamination of same.

3.11 **SAWCUTTING - LONGITUDINAL JOINTS**

- .1 Sawcut longitudinal construction joints after curing application.
- .2 Use regular sawcutting methods.
- .3 After sawing and grinding, blow-out joints with compressed air. Immediately broom clean residue caused by sawing operation as work progresses.
- .4 When cleaned joints are dry and prior to traffic being allowed over area, install temporary polyethylene backer rod in joints to prevent contamination of same.

3.12 **CURING**

- .1 After finishing operation has been completed, cure with one coat of pigmented curing compound at a rate and method as recommended by manufacturer.
- .2 Block traffic from concrete pavement for a minimum of nine days, except to perform the necessary curing and sawcutting operations.

3.13 **JOINT SEALANT**

- .1 Do not fill isolation joints, longitudinal joints, and transverse joints sooner than thirty days after concrete pours. Comply with curing and sawcutting requirements as specified herein. Execute joint sealing as specified herein during cool dry ambient conditions when pavement is in a contracted state to minimize future joint separation at sealant filled joints.
- .2 Remove polyethylene rope from sawcut joints.
- .3 Remove 6 mm scored strip from top of premoulded joint filler.
- .4 Blow out joints with compressed air. Immediately broom clean residue.
- .5 Re-install polyethylene rope in sawcut joints. Push to the bottom of the joint.
- .6 Fill all sawed longitudinal and transverse joints in concrete pavement as well as isolation joints full depth with joint sealant in accordance with manufacturer's printed directions.
- .7 Comply with application and substrate temperatures requirements. Mask pavement to edge of joint and fill joint with sealant. After initial set prime sealant surface and refill joints with sealant as required to produce slightly convex joint surface.

3.14 **DEFECTIVE CONCRETE**

- .1 Concrete is defective when:
-

- .1 Containing honeycombing or embedded debris.
 - .2 Concrete damaged by freezing or which is unsatisfactory due to placement at too high a temperature.
 - .3 Surface texturing, joint type and placement and tolerances are unacceptable in the opinion of the Consultant, and/or do not reflect the standard set by the accepted mock-up.
 - .2 Repair of defective concrete work:
 - .1 Repair defective areas while concrete is still plastic; otherwise, wait until curing is completed. Use repair methods accepted by the Consultant.
 - .2 Remove and replace defective concrete where directed.
 - .3 Replace full panel for each repair. Replace with new concrete in accordance with these Specifications.
- End of Section
-

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to installation of concrete curbs and sidewalk Work in accordance with Contract Document.
- .2 Work includes concrete curbs and sidewalks.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- .1 ASTM D1751 - Standard Specification For Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)
- .2 OPSS 351 - Concrete Sidewalk.
- .3 OPSS 353 - Concrete Curb and Gutter Systems
- .4 TS 3.50 - Construction Specifications for Concrete Curb and Concrete Curb and Gutter; Toronto Engineering and Construction Services Division Standard Specifications for Road Works
- .5 TS 3.70 - Construction Specifications for Concrete Sidewalk and Concrete Raised Median; Toronto Engineering and Construction Services Division Standard Specifications for Road Works

1.3 **SUBMITTALS**

- .1 Concrete: Refer to Section 03 30 00.
- .2 Aggregates and fill: Refer to Section 31 23 03.
- .3 Tactile walking surface indicator: Submit shop drawings illustrating plate layouts for approval.

2 Products

2.1 **MATERIALS**

- .1 Materials shall be in accordance with OPSS 351 and 353.
- .2 Granular Fill: Refer to Section 31 23 03 Excavation and Backfill for Structures
- .3 Concrete: In accordance with Section 03 30 00 Cast-In-Place Concrete
- .4 Expansion joint filler: Premoulded bituminous fibre and in accordance with ASTM D1751.
- .5 Tactile walking surface indicator: Refer to Section 10 14 75 Tactile Warning Systems. Types as indicated on Drawings.

3 Execution

3.1 **INSTALLATION - SIDEWALKS**

- .1 Place concrete sidewalks as indicated on Drawings to required levels and dimensions.
- .2 Provide expansion and contraction joints as indicated on Drawings.
- .3 Place 12 mm thick bituminous fibre board to form expansion joints and against existing sidewalks and rigid structures.

3.2 **INSTALLATION – CONCRETE CURBS**

- .1 Place concrete curbs, curbs and gutters as indicated on the Contract Drawings.
- .2 Place 12 mm thick bituminous fibre board to form expansion joint and spaced to coincide with expansion joints in adjacent sidewalk and where new curb meets existing curb.
- .3 Contraction joints to coincide with and match existing joints in adjacent sidewalk.
- .4 Place reinforcing bars at base of curb at driveways as indicated on Contract Drawings.

3.3 **INSTALLATION - TACTILE WALKING SURFACE INDICATOR PLATE**

- .1 Refer to Section 10 14 75 Tactile Warning Systems.
- .2 Install plates as indicated on drawings and in accordance with manufacturer's installation instructions.

3.4 **CONCRETE FINISHES**

- .1 Curbs: Finish edges of contraction joints and expansion joints using a small radius edging tool. Final finish to have light brush texture.
- .2 Sidewalks: Finish concrete adjacent to formwork and joints with tool that produces 5 mm rounded edge and smooth, horizontal surface with maximum width of 50 mm. Final finish to have light broom or swirl float structure.
- .3 Concrete surface to have no irregularities exceeding 6 mm when checked with 3 m straight edge placed in any direction.

End of Section

1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **REFERENCES**

.1 Conform to the latest edition of the following:

- .1 OPSS 1714 - Ontario Provincial Standard Specification, Material Specification for Field Reacted Polymeric Pavement Marking Materials
- .2 OPSS 710 - Ontario Provincial Standard Specification, Construction Specification for Pavement Markings.
- .3 OPSS 1750 - Ontario Provincial Standard Specification, Traffic Paint Reflectorizing Glass Beads
- .4 OTM - Ontario Traffic Manual, Book 11

1.3 **SUBMITTALS**

.1 Submit Shop Drawings in accordance with Section 01 33 00. Submit the following:

- .1 Product Information regarding manufacture and installation of pavement markings, blackout paint, and asphalt crack sealant.

1.4 **QUALITY ASSURANCE**

- .1 Refer to "Quality Control" in Section 01 10 00 – General Requirements.
- .2 Installer qualifications: Manufacturer to certify this Subcontractor as an experienced installer who has completed thermoplastic pavement marking projects to the extent that is required for this Project.
- .3 Implement a quality control program which includes testing and inspection to comply with the intent of these Specifications.
- .4 Owner may employ an independent testing and inspection company to perform additional testing and inspection, and costs of such tests and inspections will be paid for by Owner.
- .5 Remove and replace areas of asphalt work proven defective by the tests or contrary to requirements shown and specified, as directed by Consultant and at no cost to Owner.

1.5 **PROJECT CONDITIONS**

.1 Protection

- .1 Protect Work of this section from damage according to manufacturer's recommendations. Protect buildings and work of other trades from damage and replace damaged work that cannot be satisfactorily repaired at no cost to the Owner.

2 Products

2.1 **MATERIALS**

.1 Durable Pavement Marking:

.1 Field reacted polymeric pavement marking: Flexible two-component, solvent-free, and lead-free cold-curing acrylic or methacrylate road marking material in accordance with OPSS 1714, Ontario Traffic Manual Book 11, and with glass beads for reflectorized lines conforming to OPSS 1750.

.1 Parking bays lines shall be identified with 100 mm (4") wide white or yellow painted lines in accordance with approved parking layout and/or in accordance with the requirements or authorities having jurisdiction.

.2 Blue: For barrier free accessible parking lot stalls and symbols. Barrier free accessible parking bays and refuge areas shall be identified with appropriate symbol designation and/or in accordance with the requirements or authorities having jurisdiction.

.3 Pedestrian walkways shall be identified with 150 mm (6") wide white or yellow painted lines at 45 degrees to path of travel spaced at 400 mm (16") o.c. and/or in accordance with the requirements or authorities having jurisdiction.

.2 Blackout paint: "Black Knight" polymer modified industrial grade emulsion heavy bodied sealer by Henry or Line Blackout by SealMaster or accepted equal. Use oil spot primer for oil and chemical stains, and crack filler as required, of types compatible with sealer.

.3 Asphalt crack sealant: Hot poured rubberized asphalt thermoplastic sealing compound. Hydrotech Sealz 6165 or accepted equal.

3 Execution

3.1 **EXAMINATION**

.1 Inspect state of asphalt or concrete paving and other existing conditions upon which work of this section is dependent. Report to Consultant in writing any defects or discrepancies. Commencement of Work implies acceptance of existing conditions.

3.2 **PREPARATION**

.1 Immediately prior to application, clean the asphalt surface of any contaminants that would hinder adhesion.

.2 Follow application instructions in accordance with manufacturer's recommendations.

3.3 **APPLICATION**

.1 The material shall be applied to a dry surface in temperatures no lower than 7°C (45°F).

.2 Clean prepared base of all foreign matter prior to application of the mixture to substrate.

3.4 **PAVEMENT MARKINGS**

.1 Allow paving to cure before applying markings.

- .2 Lay out pavement markings as indicated on Contract Drawings and in accordance with manufacturer's instructions.
- .3 Asphalt and concrete pavement: Use pavement marking material with reflectorizing glass beads.
- .4 Curbs and vertical surfaces: Use organic solvent based traffic paint.
- .5 Apply paint with mechanical equipment to clean, dry surface, to a minimum dry film thickness of 228 microns. Provide well defined and straight lines; do not overspray.
- .6 Take precautions to protect freshly painted line work from being marked or otherwise disturbed by traffic, by use of fluorescent cones, barricades or other means until paint is dry.
- .7 Remove spills or tracking of paint and clean up as required.

3.5 **BLACKOUT PAINTING**

- .1 Abrade existing paint for proper bonding, then solvent wipe clean.
- .2 Blow out loose paint, dirt and debris from surface using compressed air.
- .3 Treat oil and chemical stains and repair cracks as required.
- .4 Dampen surface with water and remove puddles.
- .5 Mix sealer thoroughly.
- .6 Using a squeegee or brush, apply a thin even coat of undiluted sealer. Allow to dry a minimum of twenty-four hours until no longer tacky.
- .7 Apply second coat crosswise to first coat.
- .8 Ensure blackout paint is dry prior to applying new paint markings.

3.6 **OBLITERATING EXISTING PAVEMENT MARKINGS**

- .1 Remove existing painted pavement markings by grinding or abrasive blasting.
- .2 Totally remove the pavement markings to a minimum 10 mm beyond the edge of the marking and to a maximum depth of 3 mm.

3.7 **ASPHALT CRACK REPAIR**

- .1 Clean out existing cracks with hot compressed air lance and let dry.
- .2 Fill crack with sealant to minimum depth of 10 mm in accordance with manufacturer's recommendations.

End of Section

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1 General

1.1 **SUMMARY**

.1 Section Includes

- .1 Labour, Products, equipment and services necessary to complete the Work of this section.

1.2 **PRODUCT DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, unload and store sod on pallets.
- .2 Deliver sod to site within twenty-four hours of being lifted and lay sod within thirty-six hours of being lifted.
- .3 During dry weather, prevent sod from drying.

1.3 **PROJECT CONDITIONS**

- .1 Protection: Provide warning signs and/or other means of protecting sodded areas as may be required and directed by Consultant to protect new seed growth and sod from damage by traffic.

1.4 **MAINTENANCE**

- .1 Maintain sodded areas for a minimum of sixty days after placing and as long as necessary to establish a close stand of grass free from weeds. Maintenance shall include the following:
- .1 Watering, fertilizing, weeding, rolling, mowing at least once a week, and trimming. Contractor may, at its own discretion, use an acceptable weed killer to establish lawns free of weeds. Make necessary arrangements with the Owner and the municipality for supply of water and connections at the site. Provide all hoses and equipment required. Water in sufficient quantities and at frequency required to maintain optimum soil moisture condition to a depth of 75 to 100 mm.
- .2 Repairing and re-sodding dead or bare spots to satisfaction of the Consultant.
- .3 Fertilizing and elimination of weeds.
- .4 Making good all depressions, humps, erosion, washouts or sinkages in finished grades, occurring or developing in the work.
- .5 Cut grass and remove clippings to height as follows:
- .1 40 mm during normal growing conditions
- .2 60 mm at end of growing season and during periods of high temperatures and low precipitation
- .6 Trimming grass edges around planting beds, building walls, light standards, signs and trees in neat lines to original layout.
- .7 Picking up all debris, papers, excess construction materials or similar materials from all sodded areas and removal from site.
-

2 Products

2.1 **MATERIALS**

- .1 Nursery sod: As supplied by a member of the Nursery Sod Growers Association of Ontario (NSGA), No. 1 Kentucky Bluegrass/Fine Fescue.
- .2 Turf Grass Nursery Sod quality:
 - .1 Not more than 2 broadleaf weeds or 10 other weeds per 40 square metres.
 - .2 Density of sod sufficient so that no soil is visible from height of 1500 mm when mown to height of 50 mm.
 - .3 Mowing height limit: 35 to 65 mm.
 - .4 Soil portion of sod: 6 to 15 mm in thickness.
- .3 Topsoil: Clay-sand content in accordance with ASTM D422; minimum 1%, maximum 12% regional organic matter, relatively free from sticks, weeds, brush, stones larger than 25 mm 1" diameter and all other litter.
- .4 Fertilizer: To Canada "Fertilizers Act" and "Fertilizers Regulations".
- .5 Water: Free of impurities that would inhibit germination and growth.
- .6 Wooden pegs: 16 x 16 x 200 mm spruce, pine or fir.
- .7 Herbicide: Brand specifically made for newly sodded lawns.

3 Execution

3.1 **EXAMINATION**

- .1 Inspect existing conditions upon which work of this section is dependent. Report to Consultant in writing any defects or discrepancies. Commencement of work implies acceptance of existing conditions.

3.2 **PREPARATION**

- .1 Fine grade subgrade, to eliminate uneven areas and low spots and ensure positive surface drainage. Remove debris, roots, branches, stones, in excess of 50 mm diameter and deleterious materials.
- .2 Remove subsoil that has been contaminated with oil, gasoline or calcium chloride. Legally dispose of removed materials.
- .3 Cultivate entire area which is to receive topsoil to depth of 100 mm. Repeat cultivation in those areas where equipment used for hauling and spreading has compacted subgrade.

3.3 **PLACING TOPSOIL**

- .1 Spread new topsoil as required to fill voids or depressions in final grading of areas to be sodded. Rake to remove stones over 25 mm maximum, debris, clay, lumps, vegetation, roots, rubbish and litter and produce finished grade elevations shown on the Drawings, with allowance for topsoil settlement. Ensure positive surface drainage.
-

- .2 Topsoil will be available at various stockpiles around the site. From such stockpiles, load, haul, spread, refine and grade topsoil. Rake to remove stones, vegetation, roots, rubbish and litter, and to produce finished grade.
- .3 Spread topsoil with adequate moisture in uniform layers during dry weather over dry, unfrozen subgrade, where seeding is indicated.
- .4 Keep topsoil 40 mm below finished grade.

3.4 **FERTILIZER APPLICATION**

- .1 Apply fertilizer with mechanical spreaders over areas to be sodded at rate of 0.05 kg/m² or 5 kg/100 m². Mix thoroughly into upper 50 mm of topsoil.
- .2 Mix fertilizer thoroughly into upper 50 mm of topsoil.

3.5 **SODDING**

- .1 Lay sod during growing season, and maximum thirty-six hours after being lifted.
- .2 Lay sod in rows, perpendicular to slope, smooth and even with adjoining areas, and with joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with sharp knife.
- .3 Provide close contact between sod and soil with 50 kg roller of minimum 900 mm width. Do not use a heavy roller to correct irregularities.
- .4 Use spade to provide sharp clean edge at depth of 100 mm between sodded areas and planting beds and/or individual trees.
- .5 Water sufficiently with fine sprays to thoroughly penetrate below sod. Firm at all points to ensure a close union with topsoil. Drive wood pegs on slopes 3:1 or steeper. Peg every row of sod with pegs at 600 mm o.c. maximum. Drive pegs flush with sod.
- .6 Gap in sod or bumpy, uneven areas will be rejected.

3.6 **CLEAN-UP**

- .1 Daily, and on completion of all sodding operation, remove all surplus materials from the site. Clean pavement of any accumulations of earth or surplus materials resulting from the work.
- .2 Final acceptance of this Work will be made by the Consultant upon satisfactory completion of all work including maintenance. Turn over to the Owner all sodded areas in state of recognizable good growth.

End of Section

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APPENDIX A1

Geotechnical Investigation Proposed New Interior Elevator

313 Pharmacy Avenue, West Scarborough Community
Centre

Issued December 17, 2021
by Forward Engineering & Associates Inc.

FORWARD ENGINEERING
& ASSOCIATES INC.

Geotechnical, Environmental, Inspection & Material Testing Services
244 Brockport Drive, Unit 15, Toronto, Ontario, M9W 6X9, Tel: (416)798-3500, Fax:(416)798-8481

REPORT
GEOTECHNICAL INVESTIGATION

PROPOSED
NEW INTERIOR ELEVATOR INSTALLATION
AT
WEST SCARBOROUGH COMMUNITY CENTRE
313 PHARMACY AVENUE
TORONTO, ONTARIO

PREPARED FOR:
CITY OF TORONTO

c/o

IBI GROUP
100 - 175 Galaxy Blvd
Toronto, Ontario
M9W 0C9

December 17, 2021
Ref. No. G6927

Distribution: 1 PDF Copy– IBI GROUP
1 PDF Copy–FORWARD ENGINEERING & ASSOCIATES INC.

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LIST OF ENCLOSURES:

BOREHOLE LOCATION PLAN - DRAWING NO. 1

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LOG OF BOREHOLE SHEET (BH-1) - APPENDIX A

INTRODUCTION

This report presents the results of the geotechnical investigation carried out by Forward Engineering & Associates Inc. for the proposed new elevator installation at West Scarborough Community Centre, located at 313 Pharmacy Avenue, Toronto, Ontario.

The location of the proposed elevator in relation to the ground floor plan of the existing building is shown on Drawing No. 1. The approximate location of the borehole conducted during this investigation is also presented on Drawing No. 1.

This investigation was authorized by Mr. Faraz Bolourian, of IBI Group, on behalf of the City of Toronto.

PURPOSE AND SCOPE

The objectives (purpose) of this investigation were to determine the following:

- The extent, depth, and properties of the predominant fill/soil strata as they affect the design and construction of the proposed interior elevator.
- The short-term groundwater levels, if encountered.
- The appropriate geotechnical design criteria for structure foundations, elevator pit walls, excavations, backfill, and permanent drainage.

To achieve the above noted objectives, the field program of this investigation consisted of one [1] borehole drilled to a depth of about 7.9 m below the **Existing Ground Surface Level (EGSL)**.

On completion of the field and laboratory work, an engineering analysis was carried out and this summary report was prepared.

PROPOSED DEVELOPMENT

We understand that the proposed development will consist of a new elevator to be located at the approximate centre of the existing building, as shown on Drawing No. 1.

FIELD AND LABORATORY TESTING

Field Works:

The field work for the borehole investigation consisted of one [1] borehole (BH-1) drilled on November 18, 2021, under the supervision of a member of our staff.

The drilled borehole was located outside of the existing building adjacent to the north building wall, as shown on Drawing No. 1. The borehole extended to a depth of about 7.9 m below the EGSL.

Soils were sampled in the boreholes following the Standard Penetration Test (SPT) method using the Limited Access Drill (L.A.D) Geotechnical and Environment Drill.

The samples were logged in the field and appropriately stored in plastic bags and re-examined in more detail in the laboratory. The samples will be stored for a period of three months and then discarded, unless we are instructed differently.

Groundwater observations were made in the open borehole, during and upon completion of the drilling operation. The results are recorded on the Log of Borehole sheet.

The approximate elevations referred to in this report are metric and geodetic. The ground level elevation at the top of the borehole location was referenced to the Finished Floor Elevation (FFE) of the existing building, provided to us by IBI Group as 141.38 masl. The borehole elevation was calculated by conducting a general measurement from top of the FFE to top of borehole location.

Laboratory Testing:

Laboratory testing consisted of determination of the in-situ moisture content of the retrieved and representative soil samples.

SITE CONDITIONS

Surface Conditions

The West Scarborough Community Centre is located at 313 Pharmacy Avenue,

Toronto, Ontario. At the time of our investigation the building was occupied.

The site conditions as observed during our site visit on November 18, 2021, are presented in the following *Table 1*:

Table 1 - Observed Site Conditions

East Boundaries:	Densely wooded area sloping down towards water course (Taylor Massey Creek).
North Boundaries:	Residential dwellings and Presley Avenue.
West Boundaries:	Multi-storey residential building.
South Boundaries:	Open green space followed by densely wooded area sloping down towards water course (Taylor Massey Creek).
Surface Coverage:	The ground surface of the subject site, where the borehole was conducted, is asphalt pavement.
Ground Level:	The subject site is relatively flat.
Existing Structures:	One storey building.
Basement:	A large portion of the existing building has a single level basement, however, in the area of the proposed new elevator and the area adjacent to where the borehole was conducted, no basement is present.
Ditches/Berms:	None.
Stockpiles:	None.

Subsurface Conditions

The subsurface condition encountered at the borehole location is shown on the Log of Borehole sheet, presented in Appendix A, and can be summarized as follows:

Pavement	Pavement was encountered at the surface of the drilled borehole and consisted of about 75 mm of asphalt and about 200 mm of granular (sand and gravel) base.
Fill/Disturbed Soil	<p>A layer of fill/disturbed soil was encountered below the pavement and extended to a depth of about 0.76 m below the EGSL. This layer consisted of brown fine sand and silt with occasional gravel.</p> <p>This layer was found in moist state and in compact state of packing.</p>

Sandy Silt	<p>Compact to very dense, brown, and moist to very moist sandy silt was encountered below the fill/disturbed soil layer in the drilled borehole.</p> <p>This native stratum, which contained fine sand and gravel layers and clayey silt inclusions, extended to a depth of about 3.05 m below the EGSL</p>
Sandy Silt Till	<p>Very dense/hard, greyish brown, and moist sandy silt till was encountered below the sandy silt stratum in the borehole and extended to the maximum explored depth of this single borehole investigation.</p> <p>A wet layer of more permeable soil was encountered between samples at a depth of about 6.4 m below EGSL.</p>
Groundwater	<p>Upon completion of drilling, the borehole was open and water level was measured at 6.7 m below EGSL.</p> <p>It should be noted, however, that the groundwater levels are subject to seasonal fluctuations. Consequently, definitive information on the long-term groundwater levels could not be obtained at the present time.</p>

GEOTECHNICAL DISCUSSION AND RECOMMENDATIONS

Foundations

According to available/reviewed project data and drawings provided by our client; IBI Group, the following project information can be highlighted

- Neither final selection of the proposed interior lift/elevator type nor their structural loads are available at this time.
- The existing community center building is a two (2) storey structure with a basement
- The basement floor is situated about 3.05 m (10 ft) below the ground floor FFE
- The bottom of the elevator pit pad/slab is to be established about 2.3 m (7.5 ft) below the existing basement finished floor level, i.e. about 5.35m (17.5 ft) below the ground floor FFE.

Based on the findings of this borehole investigation, the proposed new interior lift/elevator can be supported on conventional strip/wall and spread/pad/mat footings established within the native sandy silt till, at or below a depth of 3.5 m below the EGSL, as outlined in Table 3, shown below.

The size of the strip/wall and/or spread/pad/mat footings can be proportioned to the following bearing resistances.

Factored Bearing Resistance at Ultimate Limit State (ULS) = 375 kPa

Bearing Resistance at Serviceability Limit State (SLS) = 250 kPa

Table 3 –Founding Depth and Elevation of Elevator Pit Walls & Pad/mat Footings

Borehole No. and (Ground Surface Elevation)	Founding Depth below EGSL (at or Below)	Founding Elevation (at or below)
BH-1 (141.25 m)	3.5 m	137.75 m

Foundation Notes:

It should be noted that the as-built vertical/horizontal alignment and conditions of existing underground services and buried structures should be established prior to the design/construction stage.

In the areas of existing service trenches, the footings should be established below the invert of the existing services, in the original undisturbed soils, or could potentially, if practical, be bridged over the trench backfill (subject to review by a structural engineer).

For frost protection requirements, all exterior footings must have a minimum soil cover of 1.2 m.

Adjacent footings, founded at different elevations, should be stepped at 10 horizontal to 7 vertical. If this condition cannot be complied with or met, underpinning of the existing adjacent footings will be required.

Total settlements of the proposed exterior lift/elevator footings designed and constructed in accordance with the above recommended resistances at SLS should be less than the tolerable limits of 25mm. The differential settlements are expected to be less than 19mm.

More specific information, with respect to founding conditions between the boreholes will become available when the proposed construction is underway. Therefore, the encountered founding conditions must be verified in the field, and all caissons must be inspected by this office before placement of concrete.

Earthquake Considerations

For structural design seismic consideration, the seismic provisions of the Ontario Building Code (OBC 2012) outline the Classification of sites for Seismic Site Response in Table 4.1.8.4.A. of the Code, based on the average properties of the soil/rock ground profile for site under consideration.

According to Table 4.1.8.4.A. of the code and this investigation finding, the subject site Class is 'C*' provided that the Site Class selected for the existing community Centre structure was 'C' too.

* (Due to limited information obtained from one borehole that was drilled outside the existing building (not at the location of the proposed interior elevator installation, the above site Class 'C' for the elevator installation/construction has to be checked and confirmed to be the same Class as that of the existing community centre building structure).

Elevator Pit Walls

The elevator pit walls should be designed to resist a pressure "p", at any depth, "h" below the surface, as given by the expression:

$$p = 0.50 [\gamma h + q]$$

where; 0.50 is the earth pressure coefficient considered applicable
 $\gamma = 21.0 \text{ kN/m}^3$ is the unit weight of backfill
 q = an allowance for surcharge.

The above equation assumes that drains will be provided and that the backfill against the walls would be a free draining granular material. If this condition cannot be provided, the elevator pit shall be constructed as a water-tight structure, and the elevator pit walls must be designed to resist future build-up of hydrostatic pressure ($\gamma_w h_w$) in addition to earth pressure "p".

Excavation and Backfill

No major problems should be encountered for the anticipated depth of excavation. The excavation shall be back sloped at 45 degrees or flatter in accordance with the current Ontario Occupational Health and Safety Act.

The anticipated water seepage, if any, into the excavations from the more permeable seams/lenses or surface run-off can be handled by conventional pumping methods.

The material to be used for backfilling shall be suitable for compaction, i.e., free of organics and any other deleterious materials and with a natural moisture content which is within 2 percent of the optimum moisture content. The backfill material shall be compacted to at least 98 percent of the Standard Proctor Maximum Dry Density (SPMDD). The backfill against the subsurface walls, and confined spaces, should be free draining granular fill, preferably conforming to the OPSS for granular base course, Granular B.

Permanent Drainage

If it is chosen to construct the below ground elevator shaft/pit as a water-tight structure, then providing perimeter drainage system, such as the one shown on *Drawings No. 2*, becomes optional.

However, in case it is opted not to install perimeter drainage around the elevator pit, the elevator pit shall be constructed as a water-tight structure, and the elevator pit walls must be designed to resist future build-up of hydrostatic pressure ($\gamma_w h_w$) in addition to earth pressure “p”.

General Comments

This geotechnical report is provided on the basis of the terms of reference provided above, and on the assumption that the design will be in accordance with the applicable codes and standards.

If there is any change in the design features relevant to the geotechnical analyses, or if any questions arise regarding the geotechnical aspects of the codes and standards, this office should be contacted to review the design.

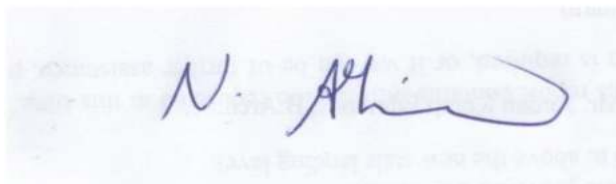
The comments given in this report are intended only for the guidance of design engineers. Contractors bidding on or undertaking the works should, in this light, decide on their own investigations, as well as their own interpretations of the factual borehole results.

This concern specifically applies to the classification of the fill/organic/topsoil cover and the potential reuse of these soils on/off site. The prospective contractors must draw their own conclusions as to how the near surface and subsurface conditions may affect them.

We trust this report contains information requested at this time. However, if any clarification is required, or if we can be of further assistance, please contact this office.

Yours truly,

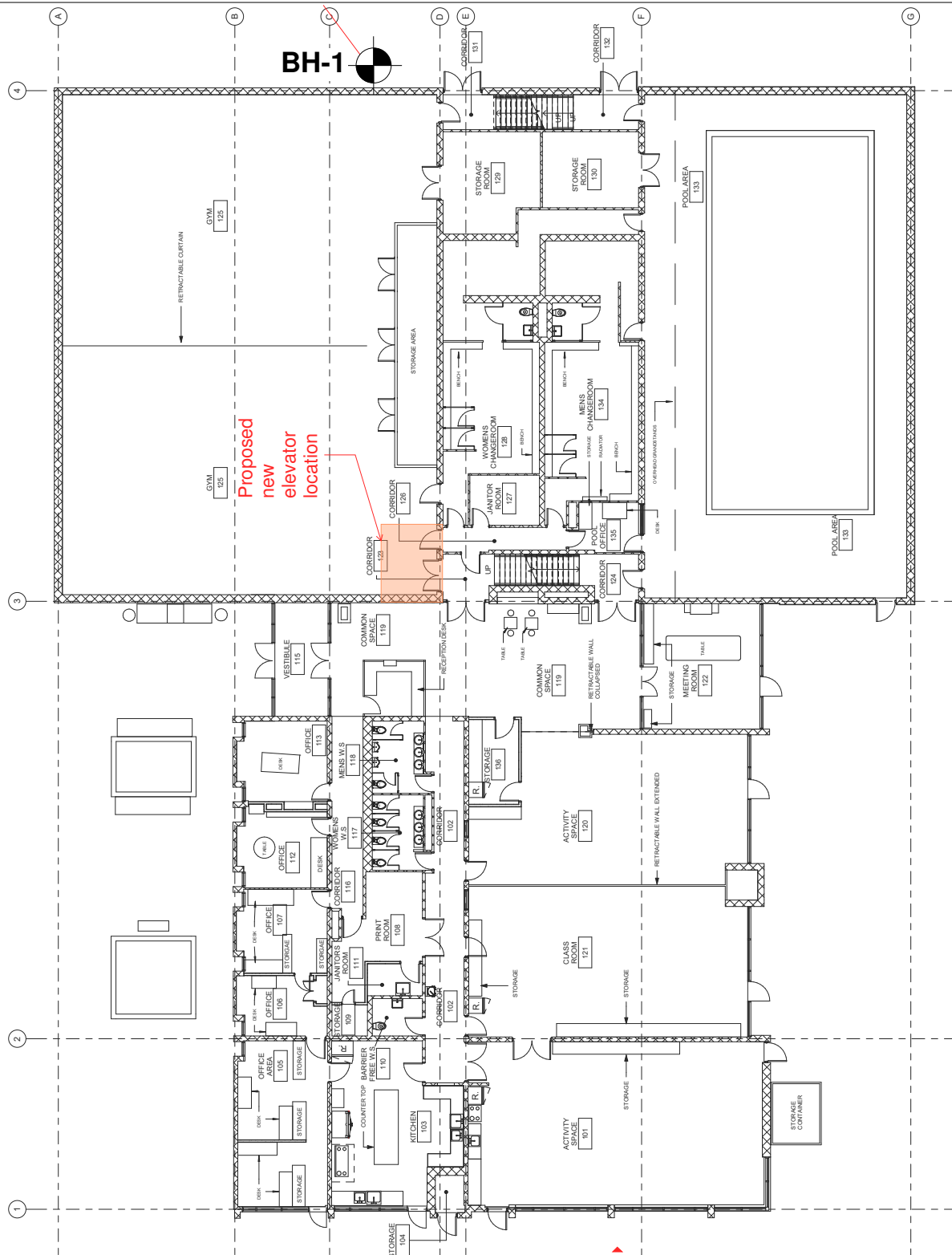
Forward Engineering & Associates Inc.



Nasser Abdelghani, M.Sc., P.Eng.
Project Geotechnical Engineer



G. S. Semaan, M.Eng., P.Eng.
Principal



NOTES:

BH

= BOREHOLE LOCATION

DRAWING No. 1

BOREHOLE LOCATION PLAN

04		
03		
02		
01		
Rev.	DATE	REVISION / ISSUE

Project Name: WEST SCARBOROUGH
COMMUNITY CENTRE - PROPOSED ELEVATOR

Address: 313 PHARMACY AVE.,
TORONTO, ON.

PROJECT No.	:6927
DESIGN BY	:P.R.
DRAWING DATE	:DEC. 09, 2021
DRAWN BY:	P.R.
CHECKED BY:	G.S.

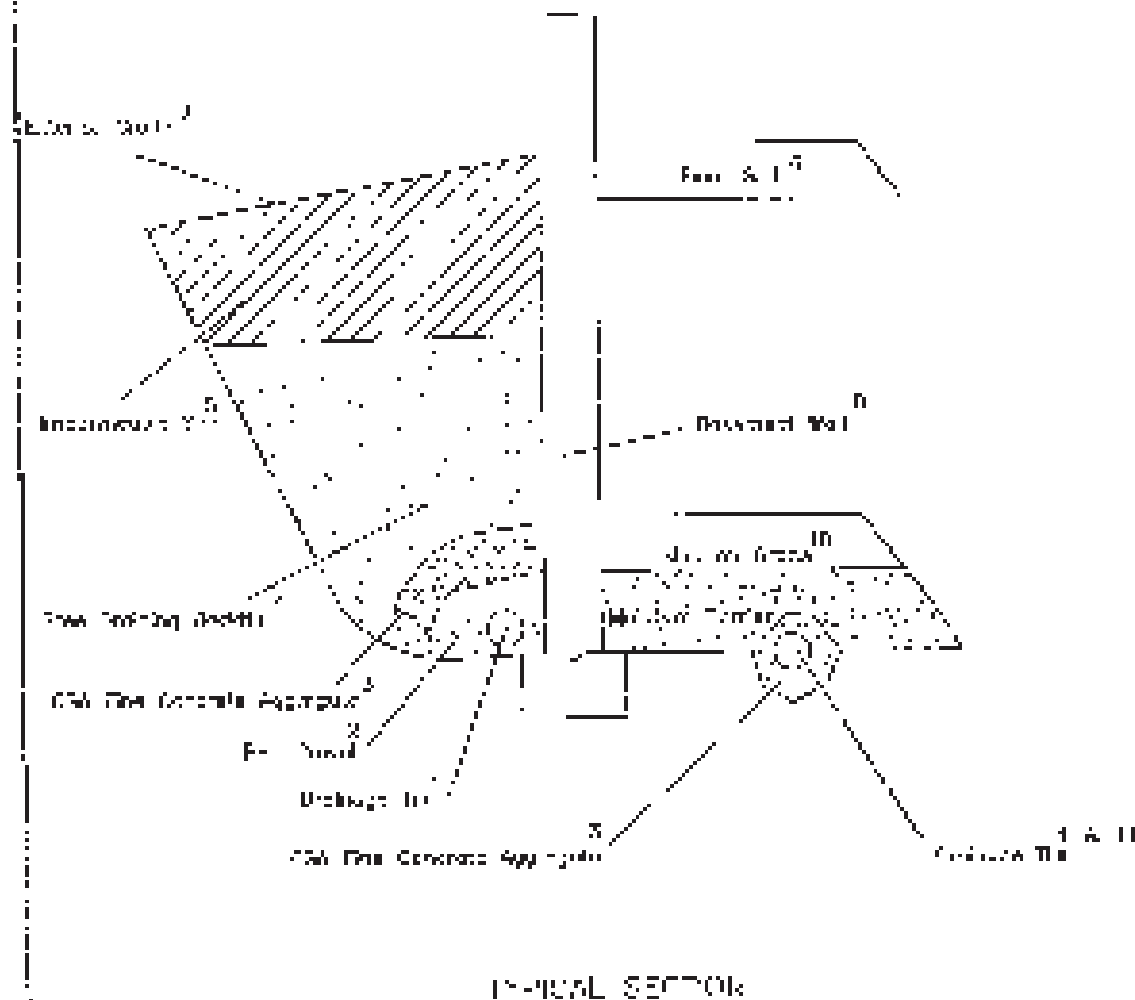
Forward Engineering & Associates Inc.

 244 Brockport Drive, Unit 15
 Toronto, Ontario M9W 6X9
 Tel: 416-798-3500 Fax: 416-798-8481

www.forwardengineering.ca

ORGANISE AND BACK ALL RECOMMENDATIONS

14.1 50 50 = 25



412133

1. Drainage line to consist of 100 (5) 1/2" clean, washed, #4 or equivalent per-wash pipe leading from the water pump or intake source to the minimum 100mm (4") inside diameter of the sump.
2. Back gravel 150mm (6") top and sides of drain. Thereafter sand on leading 100mm (4") of pipe covered with 1/4" clean (3/4") crushed stone which may be used or mixed. It covered by an approved porous material such as 1/4" (1/2") or coarsely.
3. Clean back aggregate to such as filter material. Minimum bottom 150mm (6") top and sides of the hole. This may be replaced by a gravelled across bottom and side as indicated in 2.
4. Free draining rock #4 - Clean #4 porous gravel or equivalent is applied to 60 - 45 % clearance above. Maximum dry density (BS1480).
5. Impervious wall to be completed and, if it is not sealed, the wall is free draining and may be sealed.
6. The wall, backfill, and wall to be supported by the wall and the side of the wall.
7. Making bottom in center of Area (3/4") clean sand crushed stone 150mm (6") thick.
8. Layer of sand to be 150mm (6") thick.
9. Layer of sand to be 150mm (6") thick.
10. Side of the grade should not be structurally connected to the wall.
11. Under the drain pipe to be at least 1/4" (1") below the end of the pipe. This to be placed in place of the 1/4" (1") or 1/2" (1/2") sand as a base.
12. The end of the drain pipe to be 150mm (6") thick.
13. The 150mm (6") stone to be at surface (1/4") thick. Use 1/4" (1/4") stone to be.

APPENDIX A

BOREHOLE LOG SHEETS (BH-1)

Project No: 6927

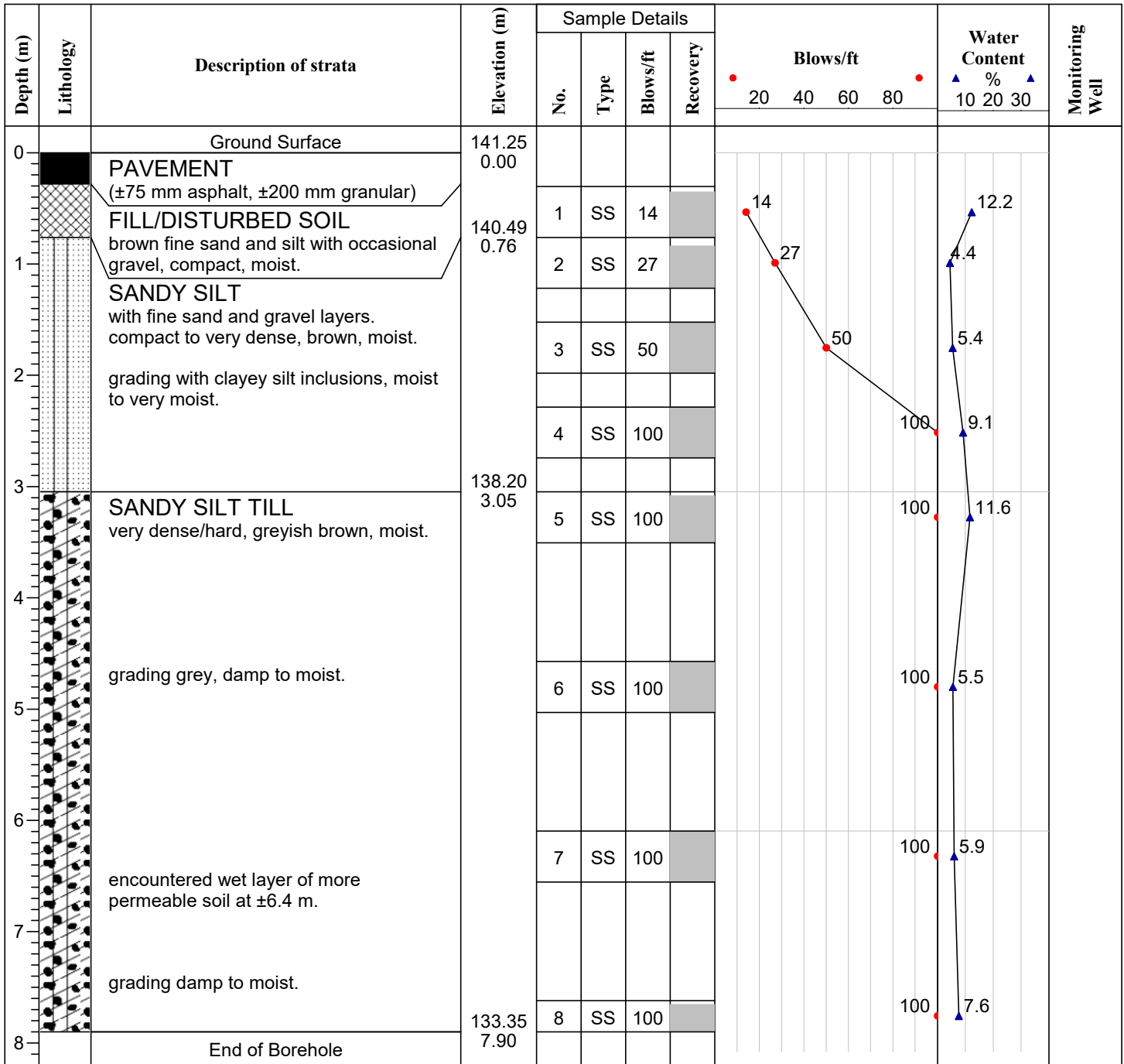
Log of Borehole BH-1

Project: WEST SCARBOROUGH COMMUNITY CENTRE - PROPOSED NEW ELEVATOR

Client: IBI GROUP

Enclosure: 2

Location: 313 PHARMACY AVENUE, TORONTO, ONTARIO

**Remarks:** Upon completion of drilling, the borehole was open and water level was measured at 6.7 m below EGSL.

Drill Method: L.A.D

Drill Date: 18 NOV. 2021

Datum: GEODETIC

Engineer: P.R.

Checked by: G.S.

Sheet No. 1 of 1

APPENDIX B2

Geotechnical Investigation Proposed New Exterior Lift

1859 Kingston Road, Scarborough Arts Council

Issued January 14, 2022

by Forward Engineering & Associates Inc.

FORWARD ENGINEERING
& ASSOCIATES INC.

Geotechnical, Environmental, Inspection & Material Testing Services
244 Brockport Drive, Unit 15, Toronto, Ontario, M9W 6X9, Tel: (416)798-3500, Fax:(416)798-8481

REPORT
GEOTECHNICAL INVESTIGATION

PROPOSED
NEW EXTERIOR LIFT
AT
SCARBOROUGH ARTS COUNCIL
1859 KINGSTON ROAD
TORONTO, ON

PREPARED FOR:
CITY OF TORONTO
c/o
IBI GROUP
100 - 175 Galaxy Blvd
Toronto ON
M9W 0C9

January 14, 2022
Ref. No. G6926

Distribution: 1 PDF Copy– IBI GROUP
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LIST OF ENCLOSURES:

BOREHOLE & TEST PIT LOCATION PLAN - DRAWING NO. 1

PERMENANT PERIMETER DRAINAGE – DRAWING NO. 2

LOG OF BOREHOLE SHEETS (BH-1) - APPENDIX A

*TEST PIT OBSERVATION SHEETS (TP-1 Top/East View) – AND TEST PIT
PHOTOS WITH ILLUSTRATION SKETCHES - APPENDIX B*

INTRODUCTION

This report presents the results of the geotechnical investigation carried out by Forward Engineering & Associates Inc. for the proposed new lift at the existing Scarborough Arts Council building located at 1859 Kingston Road, in the City of Toronto, Ontario.

The location of the existing building structure in relation to the proposed lift location is shown on Drawing No. 1. The approximate locations of the borehole and test pits conducted during this investigation are also presented on Drawing No. 1.

This investigation was authorized by Mr. Faraz Bolourian, of IBI Group, on behalf of the City of Toronto.

PURPOSE AND SCOPE

The objectives (purpose) of this investigation were to determine the following:

- The extent, depth, and properties of the predominant fill/soil strata as they affect the design and construction of the proposed lift.
- The dimensions of the existing building footing at select location.
- The short-term groundwater levels, if encountered.
- The appropriate geotechnical design criteria for structure foundations, excavations, backfill, and permanent drainage.
- Determine the type, size and depth of the foundation wall and footings of the existing structure at the proposed test pit location.

To achieve the above noted objectives, the field program of this investigation consisted of:

- one [1] borehole (BH-1) drilled to a depth of about 5.03 m below the **Existing Ground Surface Level (EGSL)**, and
- One [1] test pit (TP-1), excavated to a depth ranging from of about 1.2 m below the EGSL.

On completion of the field and laboratory work, an engineering analysis was carried out and this summary report was prepared.

PROPOSED DEVELOPMENT

We understand that the proposed work will consist of a new lift at the location shown on Drawing No. 1.

FIELD AND LABORATORY TESTING

Field Works:

Borehole Investigation:

The field work for the borehole investigation consisted of one [1] borehole (BH-1) drilled on November 18, 2021, under the supervision of a member of our staff.

The drilled borehole was located at the approximate location shown on Drawing No. 1, and it extended to a depth of about 5.03 m below the EGSL.

Soils were sampled in the boreholes following the Standard Penetration Test (SPT) method using the Limited Access Drill (L.A.D) Geotechnical and Environment Drill.

The samples were logged in the field and appropriately stored in plastic bags and re-examined in more detail in the laboratory. The samples will be stored for a period of three months and then discarded, unless we are instructed differently.

Groundwater observations were made in the open borehole, during and upon completion of the drilling operation. The results are recorded on the Log of Borehole sheets.

Elevations referred to in this report are metric and geodetic. The ground level elevations at the borehole locations were interpolated from the Utility Locates drawing conducted by Urban X, dated October 6, 2021, and provided to us by the client.

Test Pit Investigation:

The field work for the test pit investigation consisted of one [1] test pit (TP-1) carried out on December 3, 2021. The test pit was located at the approximate locations shown on Drawing No. 1 and extended to a depth of about 1.2 m below the EGSL.

The test pit findings were documented, and results are summarized in the Sub

Surface conditions section of this report and recorded in the Test Pit Observation sheets attached in Appendix B. Additional details of the test pits can be seen on the Test Pit Photo shots with Illustration Sketches also attached to Appendix B.

Laboratory Testing:

Laboratory testing consisted of determination of the in-situ moisture content of the retrieved and representative soil samples.

SITE CONDITIONS

Surface Conditions

The Scarborough Arts Council is located at 1859 Kingston Road, Toronto, Ontario. At the time of our investigation the building was occupied.

The site conditions as observed during our site visit on November 18, 2021, are presented in the following Table 1:

Table 1-Observed Site Conditions

East Boundaries:	Residential dwelling.
North Boundaries:	Kingston Road.
West Boundaries:	Residential dwelling.
South Boundaries:	Public Park (Harrison Properties) followed by steep slope towards Lake Ontario.
Surface Coverage:	The site is mainly covered by the building, pavement, and landscaping.
Ground Level:	The site slopes downward from north to south.
Existing Structures:	Single storey building with walkout basement.
Ditches:	None.
Berms:	None.
Stockpiles:	None.
Other:	Two small retaining walls near building observed.

Subsurface Conditions

Borehole Investigation Findings:

The subsurface conditions encountered at the borehole location are shown on the Log of Borehole sheet, presented in Appendix A and can be summarized as follows:

- | | |
|--------------------------------|---|
| Fill/Disturbed Soil | A layer of fill/disturbed soil was encountered at the surface of the borehole and extended to a depth of about 0.97 m below the EGSL. This layer consisted of blackish dark brown fine sand and organic soil with roots/twigs and gravel.

This layer was found in moist state and in very loose to compact state of packing. |
| Sandy and Gravelly Silt | Sandy and gravelly silt stratum was encountered below the fill/disturbed soil layer in the borehole, extending to a depth of about 3.05 m below the EGSL. This brown and moist stratum encountered stains of organics in the upper zone and was found in compact state of packing. |
| Sand & Gravel | Dense sand and gravel stratum was encountered below the sandy and gravelly silt stratum in the borehole, extending to the maximum explored depth of this investigation. This brown stratum was found in moist state. |
| Groundwater | Upon completion of drilling, the borehole was open to 4.3 m below EGSL and was dry at the bottom. |

It should be noted, however, that the groundwater levels are subject to seasonal fluctuations. Consequently, definitive information on the long-term groundwater levels could not be obtained at the present time.

Test Pit Investigation Observations/Findings:

Findings at TP-1 are detailed in the Test Pit 1 Observation sheets (Top View and East View), presented in *Appendix B*.

During the excavation at TP-1, the building foundation wall (Wall 'A' in *Appendix B*) was exposed. Another wall (Wall 'B' in *Appendix B*), extending outward and perpendicular to the exterior building, was exposed.

Upon further excavation, a concrete slab/pad was encountered at a depth of about 1.6 m below EGSL, which appeared to connect to a third concrete wall (Wall 'C' in *Appendix B*) parallel to the exterior building wall and located approximately 1.4 m away from the building exterior.

The excavation at TP-1 did not expose the existing footings to determine the type and level of the underside of the footings.

It should be noted that the exposed walls and concrete slab/pad are located within the area of the proposed lift.

GEOTECHNICAL DISCUSSION AND RECOMMENDATIONS

Foundations

The existing building consisted of a single-storey structure with a basement. Elevator pit drawing details, final selection of the proposed exterior lift/elevator type/capacity, or their final structural design loads are not available to us at this stage of the project.

Based on the encountered subsurface and founding conditions at borehole BH-1 location, the proposed new exterior lift/elevator can be supported on conventional wall footings and/or pad/mat footings established within the dense sand and gravel layer, at or below a depth/elevation presented in Table 3, shown below.

The size of the strip/wall and/or spread/pad/mat footings can be proportioned to the following bearing resistances:

Factored Bearing Resistance at Ultimate Limit State (ULS) = 225 kPa

Bearing Resistance at Serviceability Limit State (SLS) = 150 kPa

Table 3 –Founding Depth and Elevation of Elevator Pit Walls & Pad/mat Footings

Borehole No. and (Ground Surface Elevation)	Founding Depth below EGSL (at or Below)	Founding Elevation (at or below)
BH-1 (132.84 m)	1.5 m	131.34 m

It is recommended that the footings of the lift are founded at the same level as the adjacent footings of the existing building.

It should be noted that the as-built vertical/horizontal alignment, underground services, and conditions of existing buried structures shall be established prior to the design/construction stage.

It should be noted that our test pit investigation revealed walls and a concrete slab/pad within the area of the proposed lift. The contractor must be aware of that, and must deal with removal of the walls and pad/slab to allow for lift footings/pad to be established on native undisturbed soils.

Foundation General Notes

For frost protection requirements, all exterior footings must have a minimum soil cover of 1.2 m.

Adjacent footings, founded at different elevations, should be stepped at 10 horizontal to 7 vertical. If this condition cannot be complied with or met, underpinning of the existing adjacent footings will be required.

Under no circumstances should the footings be constructed over loose, soft, or frozen subgrade soil or within ponded water. During winter construction, the footings must be adequately protected against the effects of frost. Concrete should be placed without delay after excavation to avoid softening of the subgrade surface. Hand cleaning of footing bases should be carried out as directed by the field inspector.

Total settlements of the footings designed and constructed in accordance with the above recommended resistances at SLS should be less than the tolerable limits of 25mm. The differential settlements are expected to be less than 19mm.

Furthermore, the recommended bearing capacity and foundation elevations have been calculated from the limited borehole information and are intended for design purposes only.

Earthquake Considerations

For structural design seismic consideration, the seismic provisions of the Ontario Building Code (OBC 2012) outline the Classification of sites for Seismic Site Response in Table 4.1.8.4.A. of the Code, based on the average properties of the soil/rock ground profile for site under consideration.

According to Table 4.1.8.4.A. of the code and this investigation finding, the subject site Class is 'D'

Lift Pit Walls

The lift pit walls should be designed to resist a pressure "p", at any depth, "h" below the surface, as given by the expression:

$$p = 0.50 [\gamma h + q]$$

where; 0.50 is the earth pressure coefficient at rest considered applicable

$\gamma = 21.0 \text{ kN/m}^3$ is the unit weight of backfill

q = an allowance for surcharge.

The above equation assumes that drains will be provided and that the backfill against the walls would be a free draining granular material. If this condition cannot be provided, the elevator pit shall be constructed as a water-tight structure, and the elevator pit walls must be designed to resist future build-up of hydrostatic pressure ($\gamma_w h_w$) in addition to earth pressure “p”.

Excavation and Backfill

No major problems should be encountered for the anticipated depth of excavation. The excavation shall be back sloped at 45 degrees or flatter in accordance with the current Ontario Occupational Health and Safety Act.

The anticipated water seepage, if any, into the excavations from the more permeable seams/lenses or surface run-off can be handled by conventional pumping methods.

The material to be used for backfilling shall be suitable for compaction, i.e., free of organics and any other deleterious materials and with a natural moisture content which is within 2 percent of the optimum moisture content. The backfill material shall be compacted to at least 98 percent of the Standard Proctor Maximum Dry Density (SPMDD). The backfill against the subsurface walls, and confined spaces, should be free draining granular fill, preferably conforming to the OPSS for granular base course, Granular B.

Permanent Drainage

If it is chosen to construct the below ground lift shaft/pit as a water-tight structure, then providing perimeter drainage system, such as the one shown on *Drawings No. 2*, becomes optional.

However, in case it is opted not to install perimeter drainage around the elevator pit, the elevator pit shall be constructed as a water-tight structure, and the elevator pit walls must be designed to resist future build-up of hydrostatic pressure ($\gamma_w h_w$) in addition to earth pressure “p”.

General Comments

This geotechnical report is provided based on the terms of reference provided above and, on the assumption, that the design will be in accordance with the applicable codes and standards.

If there is any change in the design features relevant to the geotechnical analyses, or if any questions arise regarding the geotechnical aspects of the codes and standards, this office should be contacted to review the design.

The comments given in this report are intended only for the guidance of design engineers. Contractors bidding on or undertaking the works should, in this light, decide on their own investigations, as well as their own interpretations of the factual borehole results.

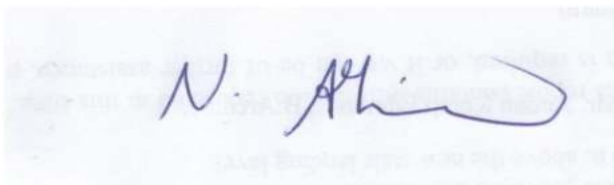
This concern specifically applies to the classification of the fill/organic/topsoil cover and the potential reuse of these soils on/off site.

The prospective contractors must draw their own conclusions as to how the near surface and subsurface conditions may affect them.

We trust this report contains information requested at this time. However, if any clarification is required, or if we can be of further assistance, please contact this office.

Yours truly,

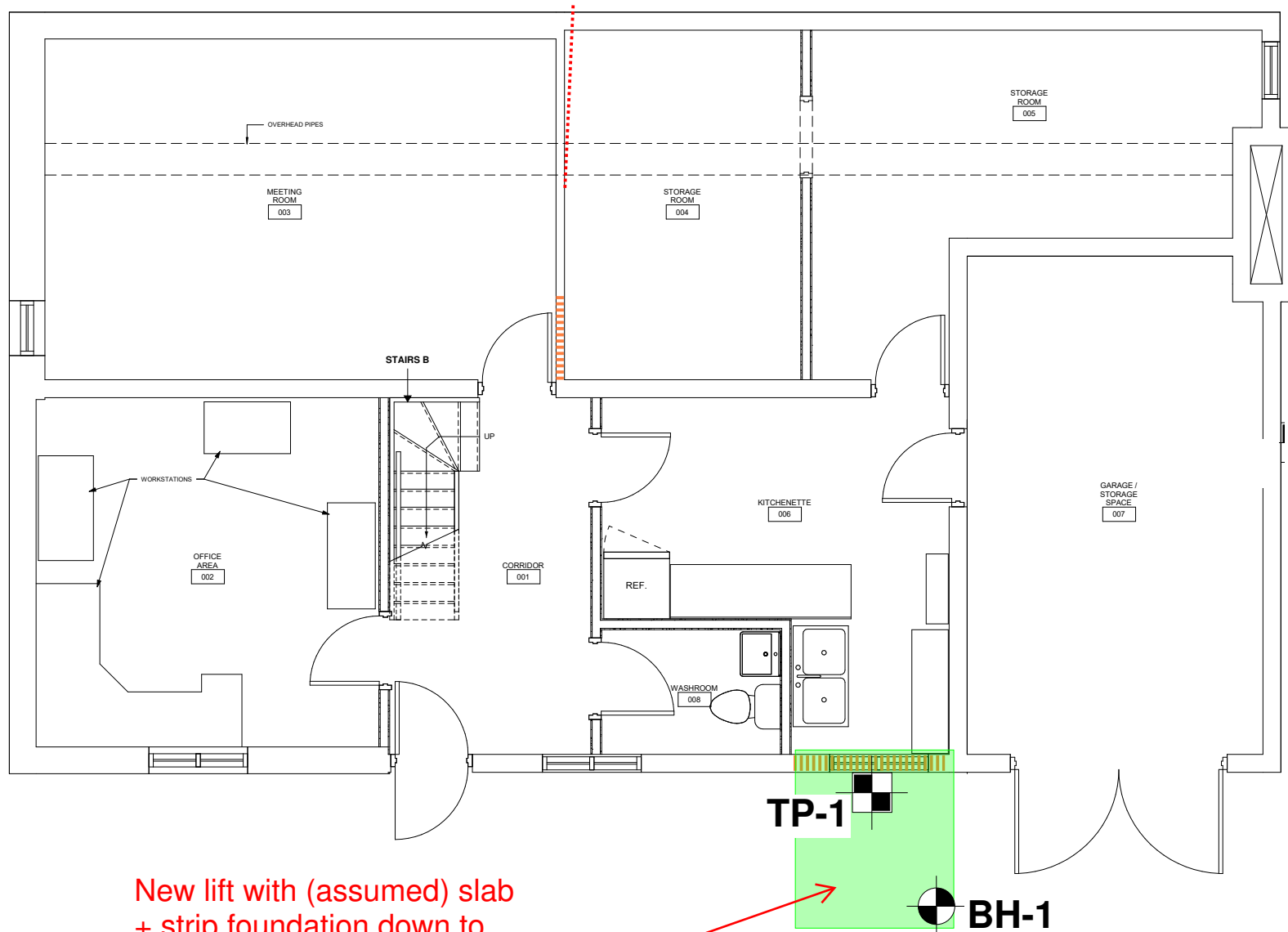
Forward Engineering & Associates Inc.

A handwritten signature in blue ink, appearing to read 'N. Alh...'.

Nasser Abdelghani, M.Sc., P.Eng.
Project Geotechnical Engineer



G. S. Semaan, M.Eng., P.Eng.
Principal



New lift with (assumed) slab
+ strip foundation down to
frost depth (1.2m)

Assumed loading is 20kN
over 1.5m x 1.5m slab

NOTES:

BH

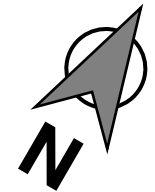


= BOREHOLE LOCATION

TP



= TEST PIT LOCATION



DRAWING No. 1 BOREHOLE AND TEST PIT LOCATION PLAN

04

03

02

01

Rev. DATE REVISION / ISSUE

Project Name: PROPOSED ACCESSIBILITY
UPGRADES - SCARBOROUGH ARTS
COUNCIL

Address: 1859 KINGSTON ROAD,
TORONTO, ON.

PROJECT No. :6926

DESIGN BY :P.R.

DRAWING DATE :DEC. 23, 2021

DRAWN BY: P.R. PAGE 1 of 1

CHECKED BY: G.S.



**FORWARD ENGINEERING
& Associates Inc.**

Forward Engineering & Associates Inc.
244 Brockport Drive, Unit 15
Toronto, Ontario M9W 6X9
Tel: 416-798-3500 Fax: 416-798-8481

www.forwardengineering.ca

APPENDIX A

BOREHOLE LOG SHEET (BH-1)

Project No: 6926

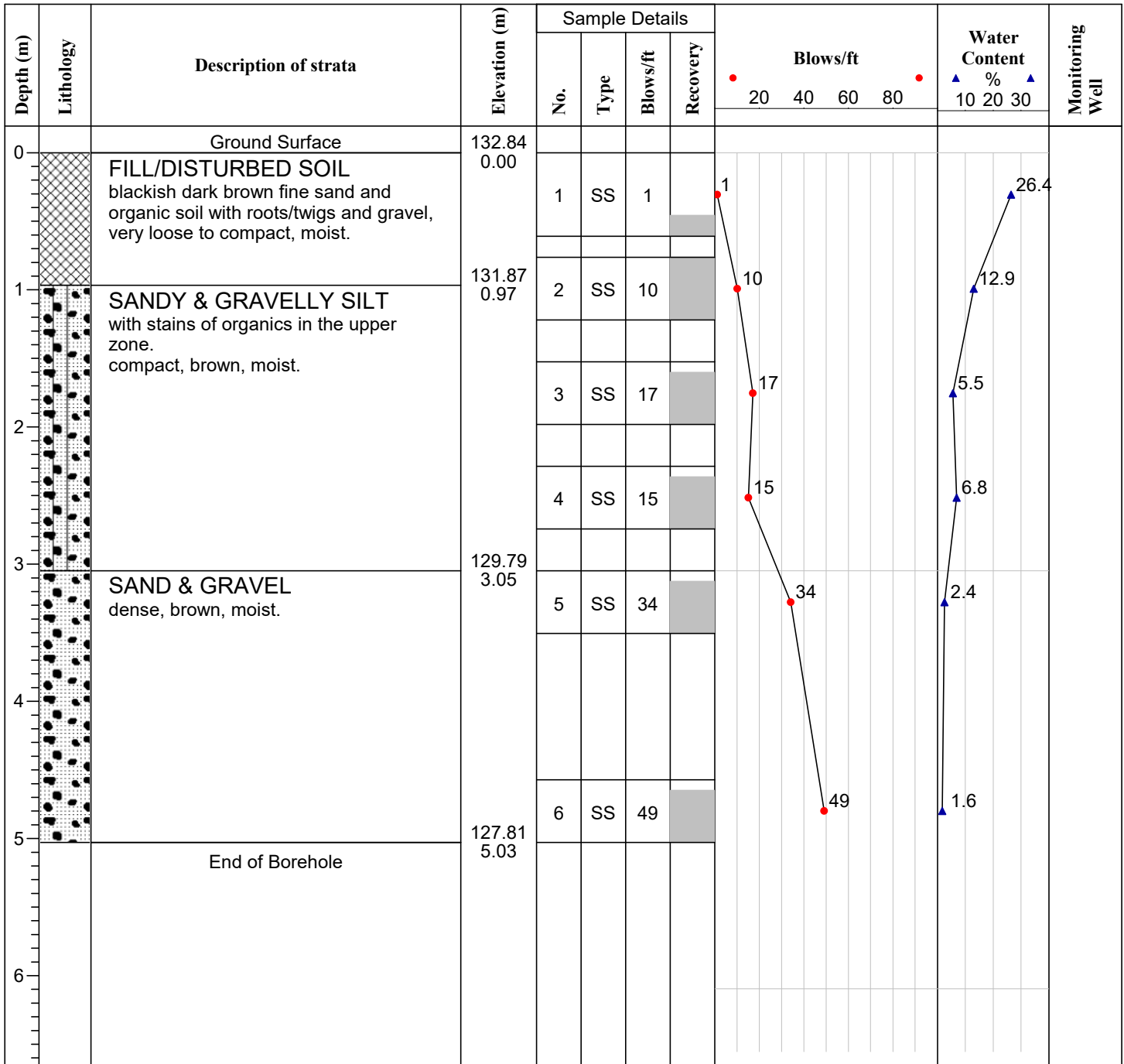
Log of Borehole BH-1

Project: PROPOSED ACCESSIBILITY UPGRADES - SCARBOROUGH ARTS COUNCIL

Client: IBI GROUP

Enclosure: 2

Location: 1859 KINGSTON ROAD, TORONTO, ONTARIO



Remarks: Upon completion of drilling, the borehole was open to 4.3 m below EGSL and dry.

Drill Method: L.A.D

Drill Date: 18 NOV. 2021

Datum: GEODETIC

Engineer: P.R.

Checked by: G.S.

Sheet No. 1 of 1

APPENDIX B

TEST PIT OBSERVATIONS AND FINDINGS SHEETS

Test Pit No.	a mm	b mm	c mm	h1 mm	h2 mm	h3 mm
1	290	1110	100	420	300	900



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244 Brockport Drive, Unit 15
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TEST PIT # 1 OBSERVATIONS EAST VIEW

Project Name: PROPOSED ACCESSIBILITY
UPGRADES - SCARBOROUGH ARTS COUNCIL

Address: 1859 KINGSTON ROAD
TORONTO, ONTARIO

PROJECT No. : 6926

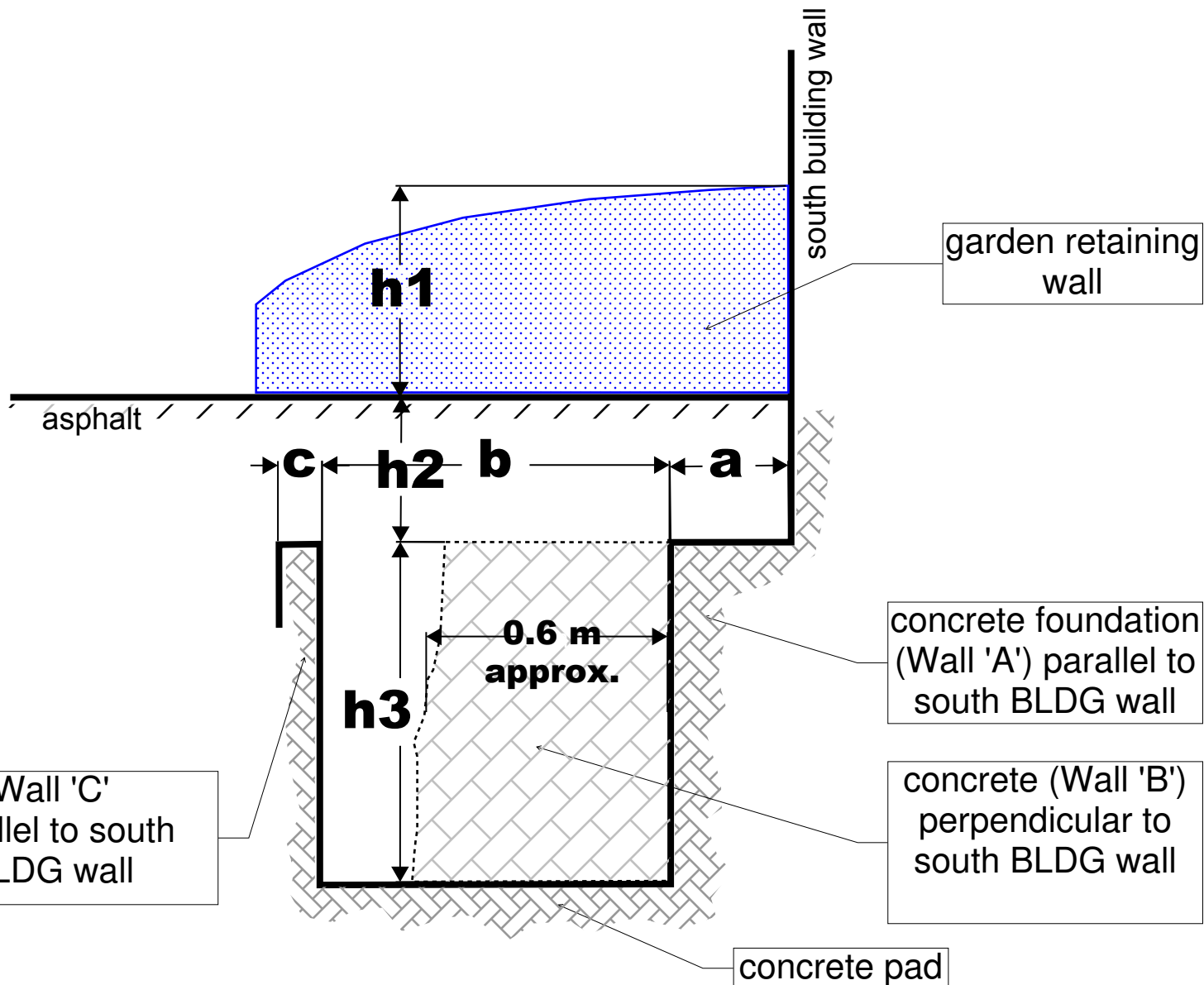
DESIGN BY : P.R.

DRAWING DATE : Jan. 19, 2022

DRAWN BY: P.R. PAGE 1 of 1

CHECKED BY: G.S.

NOTES: NOT TO SCALE



Test Pit No.	a mm	b mm	c mm			
1	290	1110	100			



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TEST PIT # 1 OBSERVATIONS TOP VIEW

Project Name: PROPOSED ACCESSIBILITY
UPGRADES - SCARBOROUGH ARTS COUNCIL

Address: 1859 KINGSTON ROAD
TORONTO, ONTARIO

PROJECT No. : 6926

DESIGN BY : P.R.

DRAWING DATE : Jan. 19, 2022

DRAWN BY: P.R. **PAGE** 1 of 1

CHECKED BY: G.S.

NOTES: NOT TO SCALE



concrete (Wall 'B')
perpendicular to
south BLDG wall

garden retaining
wall

south building wall

concrete foundation
(Wall 'A') parallel to
south BLDG wall

concrete pad

Wall 'C'
parallel to south
BLDG wall

0.6 m approx

EXTENT OF
EXCAVATION



Photo 1A: Test Pit-1



Photo 1B: Test Pit-1 Details



Photo 2A: Test Pit 1- Alternate View



Photo 2B: Alternate View Details



Photo 3A: Test Pit 1 – Reverse View facing South



Photo 3B: Reverse View facing South Details

APPENDIX B1

Designated Substances Survey

87 Main Street, Fire Hall No. 226

Issued December 2021, by Fisher Environmental Ltd.



ENGINEERING



LABORATORY



**DESIGNATED SUBSTANCES
SURVEY FOR ACCESSIBILITY
UPGRADES (IBI GROUP)**

**FIRE HALL No. 226
87 MAIN STREET
TORONTO, ONTARIO**

400 Esna Park Drive, Unit 15
Markham, ON
L3R 3K2

Tel: (905) 475-7755
Fax: (905) 475-7718
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Project No. FE-P 21-11706

December 15, 2021

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1.0. EXECUTIVE SUMMARY

Fisher Environmental Ltd. ('Fisher') was retained by IBI Group to carry out a survey for the Designated Substances and other potential hazardous materials within specified work areas for Fire Hall No. 226 building, located at 87 Main Street, Toronto, Ontario, herein after referred to as the "Site". The site inspection and sampling works were conducted on November 9, 2021.

IBI Group has been commissioned by the City of Toronto to design and implement accessibility upgrades. The scope of the Designated Substances Survey (DSS) was to identify locations and types of designated substances within the building that may be impacted by the planned renovation work, and to provide recommendations for the safe handling or abatement of these materials, if any, prior to demolition.

The purpose of the project is to do the necessary construction and renovation at the locations are outlined on drawings provided by the IBI Group on October 27, 2021.

The survey was conducted in compliance with the Ontario Ministry of Labour (MOL) regulations for designated substances; O. Reg. 490/09 - *Designated Substances* and O. Reg. 278/05 - *Asbestos on Construction Projects and in Buildings and Repair Operations* made under the Occupational Health and Safety Act (OHSA), R.S.O. 1990.

Asbestos

Fisher was provided with the report of a previous DSS, which was conducted by Fisher Environmental Ltd. on June 7, 2016. This report has indicated the only confirmed ACM was Vinyl Floor Tile 2 (9"x9" Beige with Brown & White Stripes) within the specified work area(s).

During the current survey, six (6) bulk samples of building materials found within the specified work area(s) and that could potentially contain asbestos, were collected and submitted to Fisher Environmental Laboratories for Polarised Light Microscopy (PLM) analysis, as outlined in NIOSH Method 9002. Based on the current results of laboratory analysis and information provided in the previous report, the following material are found to contain asbestos;

- Vinyl Floor Tile 2 in the second floor Corridor and Stairwell/Corridor.

Based on the findings of the survey, Fisher recommendations are as follows:

- Provide a copy of this report to contractors bidding on or performing work within the subject work areas,
- If required, remove the asbestos-containing vinyl floor tiles using Type 1 abatement procedures, as outlined in O. Reg. 278/05. Please note that if the vinyl floor tiles would be disturbed by the use of power tools during removal, abatement must be performed using Type 3 abatement procedures as outlined in O. Reg. 278/05.



Note: Fire doors, present within the specific work areas, may contain asbestos-containing thermal insulation inside the door panel. Removal of any asbestos containing fire doors, in intake condition, will require Type 1 to abatement procedures, as outlined in O. Reg. 278/05 and dispose of as asbestos waste.

Lead

Based on the age of the building, it is possible that lead-based paint and lead plumbing are present within the building. Lead can also be present in various ceramic tiles. During the current survey, two (2) bulk samples of grey & white wall paint were collected and submitted to Fisher Environmental Laboratories for lead analysis. The results of analysis revealed that grey paint contains **3,122 ppm of lead**, and the white paint contains <10 ppm of lead.

Fisher recommends that, prior to the planned renovation work, the removal of lead containing materials found within the specified work area(s), must be conducted using the appropriate lead abatement procedures. Lead abatement procedures to be used are determined by the method of disturbance employed. Refer to *MOL Guideline: Lead on Construction Projects*, for details

Mercury

Mercury is presumed to be present in fluorescent light tubes and thermostatic controls. With the exception of fluorescent light bulbs and building thermostats, no other evidence of mercury was noted during the current survey. Prior to the planned renovation work, Fisher recommends that any presumed mercury-containing fluorescent light tubes and thermostats that will be impacted are to be removed and disposed of in accordance with O. Reg. 558/00.

Silica

No sampling for silica was conducted. However, as the building is constructed of concrete, brick and/or block walls with concrete floors, silica is expected to be found within these components of the buildings. If these materials will be disturbed during the planned renovation work, appropriate precautions should be taken to protect workers from inhaling silica dusts and debris. Refer to *MOL Guideline: Silica on Construction Projects* for details.

Other Designated Substances

The other Designated Substances would not be expected to be present at the Site. No immediate actions were recommended with regard to acrylonitrile, arsenic, benzene, coke oven emissions, ethylene oxide, isocyanates, and vinyl chloride.

Mould

During the current survey, no visible mould or favourable conditions for mould growth were observed in the specified work area(s). No action is recommended with regard to mould.



2.0. INTRODUCTION

Fisher Environmental Ltd. ('Fisher') was retained by IBI Group to carry out a survey for the Designated Substances and other potential hazardous materials within specified work areas for Fire Hall No. 226 building, located at 87 Main Street, Toronto, Ontario, herein after referred to as the "Site". The site inspection and sampling works were conducted on November 9, 2021.

IBI Group has been commissioned by the City of Toronto to design and implement accessibility upgrades. The scope of the Designated Substances Survey (DSS) was to identify locations and types of designated substances within the building that may be impacted by the planned renovation work, and to provide recommendations for the safe handling or abatement of these materials, if any, prior to demolition.

The purpose of the project is to do the necessary construction and renovation at the locations are outlined on drawings provided by the IBI Group on October 27, 2021.

3.0. REGULATIONS

The survey was conducted in compliance with the Ontario Ministry of Labour (MOL) regulations for designated substances; O. Reg. 490/09 - *Designated Substances* and O. Reg. 278/05 - *Asbestos on Construction Projects and in Buildings and Repair Operations* made under the Occupational Health and Safety Act (OHSA), R.S.O. 1990.

The OHSA, R.S.O. 1990, under the Ontario MOL, defines a toxic substance as a biological, chemical or physical agent (or a combination of such agents) whose presence in the workplace may endanger the health and safety of a worker. Sections of the Act that deals with toxic substances are intended to:

1. ensure that worker exposure to toxic substances is controlled;
2. ensure that toxic substances in the workplace are clearly identified and that workers are provided with enough information to be capable of handling them safely; and,
3. provide the general public with access to information about toxic substances used by industry in their communities.

The Act makes provision for a toxic substance to be "designated", where its use in the workplace is prohibited, regulated, restricted, limited or controlled. Designation is reserved for eleven substances that are particularly hazardous, covered under O. Reg 490/09 – *Designated Substances* that was implemented on July 1, 2010, and include Acrylonitrile, Arsenic, Asbestos, Benzene, Coke Oven Emissions, Ethylene Oxides, Isocyanates, Lead, Mercury, Silica, and Vinyl Chloride. Formerly, regulations for these substances were passed separately and each



outlined exposure limits where workers were likely to inhale, ingest and / or absorb the substance.

O. Reg. 490/09 provides a consistent approach to dealing with existing requirements and provisions, and outlines steps required to control worker exposure to these substances, including by inhalation, ingestion, skin absorption or skin contact. Each designated substance has an allowable level of exposure based on a time-weighted average (TWA) limit, and may also have a short-term exposure limit (STEL) and / or ceiling limit (C) assigned to it. TWA refers to the time-weighted average airborne concentration of a biological or chemical agent to which a worker may be exposed in a work day or work week, STEL refers to the maximum airborne concentration of a biological or chemical agent to which a worker may be exposed in any 15-minute period, and C refers to the maximum airborne concentration of a biological or chemical agent to which a worker may be exposed at any time. Refer to O. Reg. 490/09 – *Designated Substances*.

A supplementary regulation regarding control of asbestos exposures in the construction industry has evolved into O. Reg. 278/05 – *Asbestos on Construction Projects and in Buildings and Repair Operations*. The regulation includes a definition of asbestos-containing materials (ACM), requirements for additional training and clearance air testing, procedures for determining materials that meet the definition of ACM and for the use of glove bags, and provisions for varying from measure and procedures set out in the regulation.

In addition to the OHSA and regulations regarding designated substances, the following regulations, guidelines and standards were also taken into account or referenced:

- O. Reg. 213/91 - *Construction Projects* regulated under the OHSA and last amended by O. Reg. 443/09;
- O. Reg. 558/00 made under the Ministry of Environment (MOE) Environmental Protection Act, amending O. Reg. 347 - *General Waste Management*;
- The Transport of Dangerous Goods Act (TDGA) provides regulations for the transport of asbestos-containing materials and wastes;
- MOL *Guideline: Lead on Construction Projects*, 2011; and,
- MOL *Guideline: Silica on Construction Projects*, 2011.

4.0. METHODOLOGY

Fisher followed the protocols outlined in O. Reg. 278/05 for collecting and analyzing bulk samples of materials suspected to contain asbestos. Visual assessment of the material was the primary method of identification with occasional physical contact for the purpose of collecting bulk samples or examining for underlying layers.



Where applicable, samples of suspect materials were collected in order to establish asbestos or lead content. Samples were grouped according to similarity of appearance (“homogeneous” materials). The frequency at which the samples were collected was sufficient to obtain a general representation of the presence of these materials at the Site. Samples collected are presumed to be representative of respective building materials in-place at the Site. However, due to potential past renovations, alterations, repairs, or phases of construction, it is possible that individual materials may not be representative of samples collected.

Sampling of roofing materials was not part of the current scope of work. Further, sampling of materials found within operating equipment, portable building articles, or generally non-accessible components such as insulation within electrical switch gears, wiring, motors, light fixtures, elevator brakes, fire door cores, etc. was not performed as part of the current survey.

Samples collected during the survey were placed in plastic zip-lock bags which were labeled and submitted for laboratory analysis. Fisher Environmental Laboratories analysed bulk samples for asbestos type and approximate percent content by performing polarized light microscopy (PLM), as outlined in NIOSH Method 9002. Fisher Environmental Laboratories analysed samples for lead content in paint by performing acid digestion followed by Inductively Coupled Plasma (ICP) analysis.

Site Plans, indicating specific work areas, and bulk sample locations, are included in Appendix A. The laboratory certificate of analysis is included in Appendix B. Site photos are included in Appendix C.

5.0. REVIEW OF PREVIOUS REPORTS

Fisher was provided with the report of a previous DSS, which was conducted by Fisher Environmental Ltd. on June 7, 2016, attached in Appendix D. This report has indicated the following previously identified confirmed ACM within the specified work area(s):

- Vinyl Floor Tile 2 (9”x9” Beige with Brown & White Stripes)

Details are provided in the summaries found in the asbestos sections of this report.

6.0. FINDINGS AND RECOMMENDATIONS

6.1. Acrylonitrile

Acrylonitrile would not be expected to be present at the Site and was not observed during the current survey. No recommendations for Acrylonitrile are warranted at this time.



6.2. Arsenic

Arsenic would not be expected to be present at the Site and was not observed during the current survey. No recommendations for Arsenic are warranted at this time.

6.3. Asbestos

6.3.1. General Information

Asbestos is the name given to a group of six different fibrous minerals (amosite, chrysotile, crocidolite, and the fibrous varieties of tremolite, actinolite and anthophyllite) that occur naturally in the environment. Asbestos minerals have separable long fibres that are strong and flexible enough to be spun and woven and are heat resistant.

Because of these characteristics, asbestos has been used for a wide range of manufactured goods, mostly in building materials (roofing shingles, ceiling and floor tiles, paper products, and asbestos cement products), friction products (automobile clutch, brake, and transmission parts), heat-resistant fabrics, packaging, gaskets, and coatings. Some vermiculite or talc products may also contain asbestos.

Asbestos fibres may be released into the air by the disturbance of ACM during product use, renovation or demolition work, building or home maintenance, repair and remodeling. In general, exposure may occur only when the ACM is disturbed in some way to release particles and fibres into the air.

6.3.2. Friable vs. Non-Friable ACM

Based on the requirements of O. Reg. 278/05 and due diligence, an asbestos survey and report must be available at any workplace where asbestos exists identifying locations and types of ACM in the building. The survey must include both friable and non-friable materials confirmed to contain asbestos, as well as any other materials which were not sampled but are suspected (presumed) ACM. The term friable refers to material(s) that could be readily reduced to dust or powder when crushed by hand or moderate pressure. Friable materials have a much greater chance of releasing airborne asbestos fibres when disturbed.

In the past, the most commonly used friable asbestos-containing building materials were surfacing materials (e.g., sprayed on fireproofing, texture, decorative or acoustic plaster) as well as thermal insulation. Examples of manufactured asbestos-containing materials include vinyl floor tiles, ceiling tiles, gasket materials, asbestos cement (Transite) pipes or boards, and asbestos textiles. Depending on the above noted formulation, these materials range from non-friable to friable. Although some products are considered non-friable when in Good condition, severe damage or deterioration may cause non-friable materials to generate airborne dust more readily. Severely damaged non-friable materials, or those to be worked on with powered tools, may be considered as friable ACM for abatement purposes.



Examples of common types of ACM by friability include:

- Friable ACM
 - Sprayed Materials (or materials installed by roller or trowel), such as fireproofing, thermal insulation, texture finishes, etc.
 - Mechanical Insulation such as boiler and breeching, ductwork, piping, tanks and associated equipment.
 - Plaster
- Potentially Friable ACM
 - Acoustic Ceiling Tiles
 - Vinyl Sheet Flooring
- Non-Friable ACM
 - Vinyl Floor Tiles
 - Asbestos cement (“transite”) piping or paneling
 - Window Caulking

6.3.3. Regulations

Exposure to asbestos is controlled by two Regulations passed under Ontario’s Occupational Health and Safety Act (OHSA), R.R.O. 1990.

- O. Reg. 490/09 – *Designated Substances* regarding asbestos applies to:
 - every employer operating a mine for the purpose of mining, crushing, grinding or sifting asbestos;
 - every employer processing, adapting or using asbestos in connection with manufacturing or assembling of goods or products;
 - every employer engaged in the repair, alteration or maintenance of machinery, equipment, aircraft, ships, locomotives, railway cars and vehicles;
 - every employer engaged in work on a building that is necessarily incidental to the repair, alteration or maintenance of machinery or equipment; and,
 - to those workers of such employers who are likely to be exposed to asbestos.

Exposure limits for this substance are set at 0.1 f/cc (TWA) for all types of asbestos.

- O. Reg. 278/05 - *Asbestos on Construction Projects and in Buildings and Repair Operations* applies to buildings that contain friable and non-friable ACM and to the repair, alteration and/or maintenance of these buildings.

In addition to regulations for controlling work around asbestos-containing building materials there are regulations for packaging, transportation and disposal of asbestos-containing waste:



- O. Reg. 558/00 made under the Ministry of Environment (MOE) Environmental Protection Act, amending O. Reg. 347 - *General Waste Management*; and,
- The Transport of Dangerous Goods Act (TDGA) provides regulations for the transport of asbestos-containing materials and wastes.

6.3.4. Findings

Samples of homogenous materials suspected to contain asbestos were collected and submitted for analysis. Fisher collected six (6) bulk samples of building materials found within the specified work areas and that could potentially contain asbestos. Findings of all building materials identified within the specified work area(s) are outlined in further detail below.

6.3.4.1. Sprayed or Troweled Fireproofing and Thermal Insulation

No indication of sprayed or troweled fireproofing and / or thermal insulation was noted in any of the specified work areas during the current survey.

6.3.4.2. Texture Finish

No indication of texture finish was noted in any of the specified work areas during the current survey.

6.3.4.3. Mechanical Insulation

The majority of mechanical insulation observed throughout the building are either not insulated or are insulated with fiberglass which is not suspected to contain asbestos.

6.3.4.4. Acoustic Ceiling Tile

During the current survey, two (2) visually distinct style of ceiling tiles were observed within the specified work areas.

- Ceiling Tile 1 (2'x4' Fissure Widthwise with Pinpoint).
- Ceiling Tile 2 (2'x4' Fissure Lengthwise).

The previous report confirmed that Ceiling Tile 1 and Ceiling Tile 2 were previously sampled for analysis. The results of analysis revealed the Ceiling Tile 1 and Ceiling Tile 2 does not contain asbestos.

6.3.4.5. Plaster / Drywall Joint Compound

Plaster was observed on the walls and ceiling in the building. The previous report indicated that plaster material samples were collected for analysis. The results of analysis revealed that the plaster does not contain asbestos.

Drywall Joint Compound (DJC) was observed throughout the building. During the current survey, three (3) samples of DJC were collected and submitted for analysis. The results of analysis revealed that the DJC does not contain asbestos.



6.3.4.6. Asbestos Cement Products

No asbestos cement products, such as Transite pipe or board, were noted in any of the specified work areas during the current survey.

6.3.4.7. Vinyl Sheet Flooring

No vinyl sheet flooring was noted in any of the specified work area(s) during the current survey.

6.3.4.8. Vinyl Floor Tile

During the current survey, five (5) varieties of vinyl floor tile were observed within the specified work area(s).

- Vinyl Floor Tile 1 (12" x 12", Beige with White Streaks),
- Vinyl Floor Tile 2 (9" x 9", Beige with Brown & White Stripes),
- Vinyl Floor Tile 3 (12" x 12", Eggshell Mosaic),
- Vinyl Floor Tile 4 (12" x 12", White & Grey Mosaic), and
- Vinyl Floor Tile 5 (12" x 12", Beige with Brown & White Fleck).

The previous report confirmed that all these varieties of vinyl floor tile were previously sampled for analysis. The results of analysis revealed that, with the exception of Vinyl Floor Tile 2, the other varieties of vinyl floor tile do not contain asbestos. However, Vinyl Floor Tile 2, observed in the second floor Corridor and Stairwell/Corridor contains **1.6% Chrysotile asbestos**.

6.3.4.9. Other ACM

Mortar

Mortar was observed on the brick wall within the specified work areas during the current survey. Three (3) samples of the mortar were collected for analysis. The results of analysis revealed that the mortar does not contain asbestos.

6.3.5. Recommendations

Prior to demolition or any renovation activities, all asbestos-containing materials must be removed from the specified work area(s) in accordance with O. Reg. 278/05 - *Asbestos on Construction Projects and in Buildings and Repair Operations*, and be disposed of at a MOE licensed landfill in accordance with O. Reg. 558/00 (amending O. Reg. 347, *General – Waste Management*).

Refer to attached Site Plans in Appendix A, which illustrate where the ACM is located within the specified work areas. Specifically, Fisher recommends the following:

- Provide a copy of this report to contractors bidding on or performing work within the subject work areas,



- If required, remove the asbestos-containing vinyl floor tiles following Type 1 abatement procedures, as outlined in O. Reg. 278/05. Please note that if the vinyl floor tiles would be disturbed by the use of power tools during removal, abatement must be performed using Type 3 abatement procedures as outlined in O. Reg. 278/05.

Note: Fire doors, present within the specific work areas, may contain asbestos-containing thermal insulation inside the door panel. Removal of any asbestos containing fire doors, in intake condition, will require Type 1 to abatement procedures, as outlined in O. Reg. 278/05 and dispose of as asbestos waste.

The presence of ACM should be presumed in locations not accessed during this survey. It is possible that ACM is present at the Site that is not identified in this report. Should additional suspected ACM be discovered, it should be presumed as ACM until sample analysis determines asbestos content.

Due to the limited nature of the current scope of work and the presence of solid building finishes (i.e., plaster or drywall walls and ceilings etc.) in many locations, the full extent of ACM may not be confirmed. Precautions should be taken when dismantling solid wall or ceiling finishes, or any other building surfaces which may conceal potential ACM. Such precautions include, but are not limited to, isolation measures and appropriate personal protective equipment.

6.4. Benzene

Benzene would not be expected to be present at the Site and was not observed during the current survey. No recommendations for Benzene are warranted at this time.

6.5. Coke Oven Emissions

Coke oven emissions would not be expected to be present at the Site and were not observed during the current survey. No recommendations for coke oven emissions are warranted at this time.

6.6. Ethylene Oxides

Ethylene oxides would not be expected to be present at the Site and were not observed during the current survey. No recommendations for ethylene oxides are warranted at this time.

6.7. Isocyanates

Isocyanates would not be expected to be present at the Site and were not observed during the current survey. No recommendations for isocyanates are warranted at this time.



6.8. Lead

6.8.1. General Information

Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. Most lead in the environment comes from human activities such as burning fossil fuels, mining and manufacturing. Lead is used in the production of batteries, ammunition, metal products (solder and pipes) and X-ray devices.

Lead does not break down but lead compounds are changed by sunlight, air and water. Exposure occurs when eating food or drinking water that contains lead. Deteriorated lead paint can contribute to lead dust. The main target for lead toxicity is the nervous system.

6.8.2. Regulations and Guidelines

The Ontario MOL has not prescribed criteria defining an analyzed sample of bulk material as "lead-containing". Further, the MOL has not established a lower limit for concentrations of lead in paint, below which precautions do not need to be considered during construction projects. However, except for very aggressive disturbance of painted finishes, (e.g., abrasive blasting, torch cutting, or grinding), Fisher believes that a lead content below 0.1% by weight (1,000 ug/g or 1000 ppm) represents a concentration in which the lead content is not the limiting hazard for construction hygiene purposes. Regular construction dust suppression techniques and worker hygiene practices are sufficient for disturbance of paint finishes determined to contain less than 0.1% lead by weight, provided that work is limited to non-aggressive operations.

The regulation for the designated substance lead applies to every employer and worker at a workplace where lead is present, produced, processed, used, handled or stored and at which a worker is likely to be exposed to lead. Exposure limits for this substance are set at 0.05 – 0.10 mg/m³ (TWA) depending on the type of lead, and for tetraethyl lead 0.30 mg/m³ (STEL).

Additionally, in 2011 the MOL revised *Guideline: Lead on Construction Projects* outlining practices that should be followed during construction projects to protect workers from exposure to lead. This includes the methods and equipment employed in the removal of lead-containing coatings that reduce the creation of dust, providing appropriate facilities for workers to wash after each shift, and providing protective clothing and respirators where necessary.

6.8.3. Findings

Based on the age of the building, it is possible that lead-based paint and lead plumbing are present within the building. Lead can also be present in various ceramic tiles. During the current survey, two (2) bulk samples of grey & white wall paints were collected and submitted to Fisher Environmental Laboratories for lead analysis. The results of analysis revealed that grey paint contains **3,122 ppm of lead**, and white paint contains <10 ppm of lead.



6.8.4. Recommendations

Where any lead-containing materials may be disturbed or removed, Fisher recommends that appropriate lead abatement procedures be used. The lead abatement procedures to be used are determined by the method(s) of disturbance employed. Regular construction dust suppression techniques and worker hygiene practices are sufficient for disturbance of paint finishes determined to contain less than 0.1% lead by weight, provided that work is limited to non-aggressive operations. The table below outlines lead abatement operations and associated respirator required, as outlined in Ontario MOL guidelines.

Classifications of Lead-Containing Operations and Required Respirator

Type 1 Operations (where concentrations of airborne lead would be expected to be < 0.05 mg/m ³)	
Activities that include; <ul style="list-style-type: none"> • Removal of lead containing coatings with chemical gel or paste and fibrous laminated cloth wrap • Removal of lead containing coatings / materials using power tool that has an effective dust collection system equipped with HEPA filter • Removal of lead containing coatings / materials using non-powered hand tools other than manual scraping or sanding 	Respirators should not be necessary if general procedures are followed and level of air is less than 0.05 mg/m ³ . However, if worker wishes to use a respirator, a half-mask particulate respirator with N-, R- or P-series filter, and 95, 99 or 100% efficiency should be provided.
Type 2a Operations (where concentrations of airborne lead would be expected to be > 0.05 to 0.50 mg/m ³)	
Activities that include; <ul style="list-style-type: none"> • Removal of lead containing coatings / materials by scraping or sanding using non-powered hand tools • Manual demolition of lead painted plaster walls / building components by striking with a sledgehammer or similar tool 	NIOSH APF = 10 Half-mask particulate respirator with N-, R- or P- series filter, and 95, 99 or 100% efficiency.
Type 2b Operations (where concentrations of airborne lead would be expected to be > 0.50 to 1.25 mg/m ³)	
Not applicable to potential renovation activities.	
Type 3a Operations (where concentrations of airborne lead would be expected to be > 1.25 to 2.50 mg/m ³)	
Activities that include; <ul style="list-style-type: none"> • Welding or high temperature cutting of lead-containing coatings or materials indoors or in a confined space. • Dry removal of lead-containing mortar using an electronic or pneumatic cutting device. • Burning of a surface containing lead • Removal of lead containing coatings / materials using power tools without an effective dust collection system equipped with HEPA filter 	NIOSH APF = 50 Full-face piece air-purifying respirator with N-, R- or P- series filter and 100% efficiency. Tight-fitting powered air-purifying respirator with high efficiency filter. Full-face piece supplied-air respirator operated in demand mode. Half-mask or full-face piece supplied air respirator operated in continuous-flow mode.
Type 3b Operations (where concentrations of airborne lead would be expected to be > 2.50 mg/m ³)	
Abrasive blasting of lead-containing coatings or materials.	NIOSH APF ≥ 1000 Type CE abrasive-blast supplied respirator operated in a positive pressure mode with a tight-fitting half-mask face piece.

Refer to MOL *Guideline: Lead on Construction Projects, 2011*, for details of the Ministry's health and safety guidelines regarding lead.



6.9. Mercury

6.9.1. General Information

Mercury is a naturally occurring metal. It is a shiny, silver-white and odourless liquid. It combines with other elements to form inorganic compounds or salts. Metallic mercury is used to produce chlorine gas and caustic soda, and is used in thermostats and thermometers, fluorescent light bulbs, dental fillings and batteries. Exposure occurs when eating fish or shellfish contaminated with methyl mercury, breathing vapors from spills, incinerators, etc.

The nervous system is very sensitive to all forms of mercury. Exposure to high levels of metallic inorganic or organic mercury can permanently damage the brain, kidneys and developing fetus. Short-term exposure may cause lung damage, nausea, vomiting and diarrhea as well as skin and eye irritation.

6.9.2. Regulations

The regulation for mercury applies to every employer and worker at a workplace where mercury is present, produced, processed, used, handled or stored and at which a worker is likely to be exposed to mercury. Exposure limits for this substance are set at 0.025 – 0.01 mg/m³ (TWA) for all forms of mercury excluding alkyl, and for alkyl compounds of mercury 0.03 mg/m³ (STEL).

6.9.3. Findings

Mercury is presumed to be present in fluorescent light tubes and thermostatic controls. With the exception of fluorescent light bulbs and building thermostats, no other evidence of mercury was noted during the current survey.

6.9.4. Recommendations

Prior to the planned renovation work, Fisher recommends that any presumed mercury-containing fluorescent light tubes and thermostats that will be impacted are to be removed and disposed of in accordance with O. Reg. 558/00.

6.10. Silica

6.10.1. General Information

Silica is a crystalline compound occurring abundantly as quartz, sand, and many other minerals, and used to manufacture a variety of materials, especially glass and concrete. When mining this substance, silica can be deadly when it becomes airborne. If inhaled, silica dust can cause silicosis which can be fatal.

Some of the following industries have a high potential for risk to workers: construction (sandblasting, rock drilling, masonry work, jack hammering, tunneling), mining (cutting or drilling through sandstone or granite), foundry work (grinding, mouldings, shakeout, core room), stone cutting (sawing, abrasive blasting, chipping, grinding), manufacturing and use of abrasives, etc.



6.10.2. Regulations

The regulation for silica applies to every employer and worker at a workplace where silica is present, produced, processed, used, handled or stored and at which a worker is likely to be exposed to silica. Exposure limits for this substance are set at 0.05 - 0.10 mg/m³ (TWA), depending on the type of silica.

Additionally, in 2011 the MOL revised *Guideline: Silica on Construction Projects* outlining practices that should be followed during construction projects to protect workers from exposure to silica. This includes the methods and equipment employed in the removal of silica-containing materials that reduce the creation of dust, providing appropriate facilities for workers to wash after each shift, and providing protective clothing and respirators where necessary.

6.10.3. Findings

No sampling for silica was conducted. However, as the building is constructed of concrete, brick and/or block walls with concrete floors, silica is expected to be found within these components of the buildings.

6.10.4. Recommendations

If these materials will be disturbed during the planned renovation work, appropriate precautions should be taken to protect workers from inhaling silica dusts and debris. Refer to MOL *Guideline: Silica on Construction Projects* for details.

6.11. Vinyl Chloride

Vinyl chloride would not be expected to be present at the Site and was not observed during the current survey. No recommendations for vinyl chloride are warranted at this time.

6.12. Mould

During the current survey, no visible mould or favourable conditions for mould growth were observed in the specified work area(s). No action is recommended with regard to mould.



7.0. LIMITATIONS

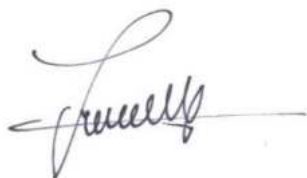
Fisher Environmental Ltd. accepts responsibility for the competent performance of its duties in executing this assignment within the normal standards of the profession, but disclaims responsibility for consequential damages, if any.

The scope of the survey is based on prior agreement with the client, and the rationale given in this report. The survey findings rely on professional interpretation of selective sampling and analysis. Sample analysis results have been applied to homogenous materials in unsampled locations; it was not within the scope of work to carry out an exhaustive sampling and analysis program. For non-accessible building spaces, the likelihood of the presence or absence of asbestos and other designated substances has been described, but such assessment is not a definitive statement of presence or absence.

This report was prepared for the IBI Group. The scope of services performed may not be appropriate for the purposes of other users, and any use or reuse of this document or its findings or recommendations represented herein is at the sole risk of any other user.

We trust that the information provided in the report meets your current requirements. If you have any questions or concerns, please do not hesitate to contact the undersigned.

Respectfully submitted,



Muhammad Junayed, B.Sc., EP.
Project Manager

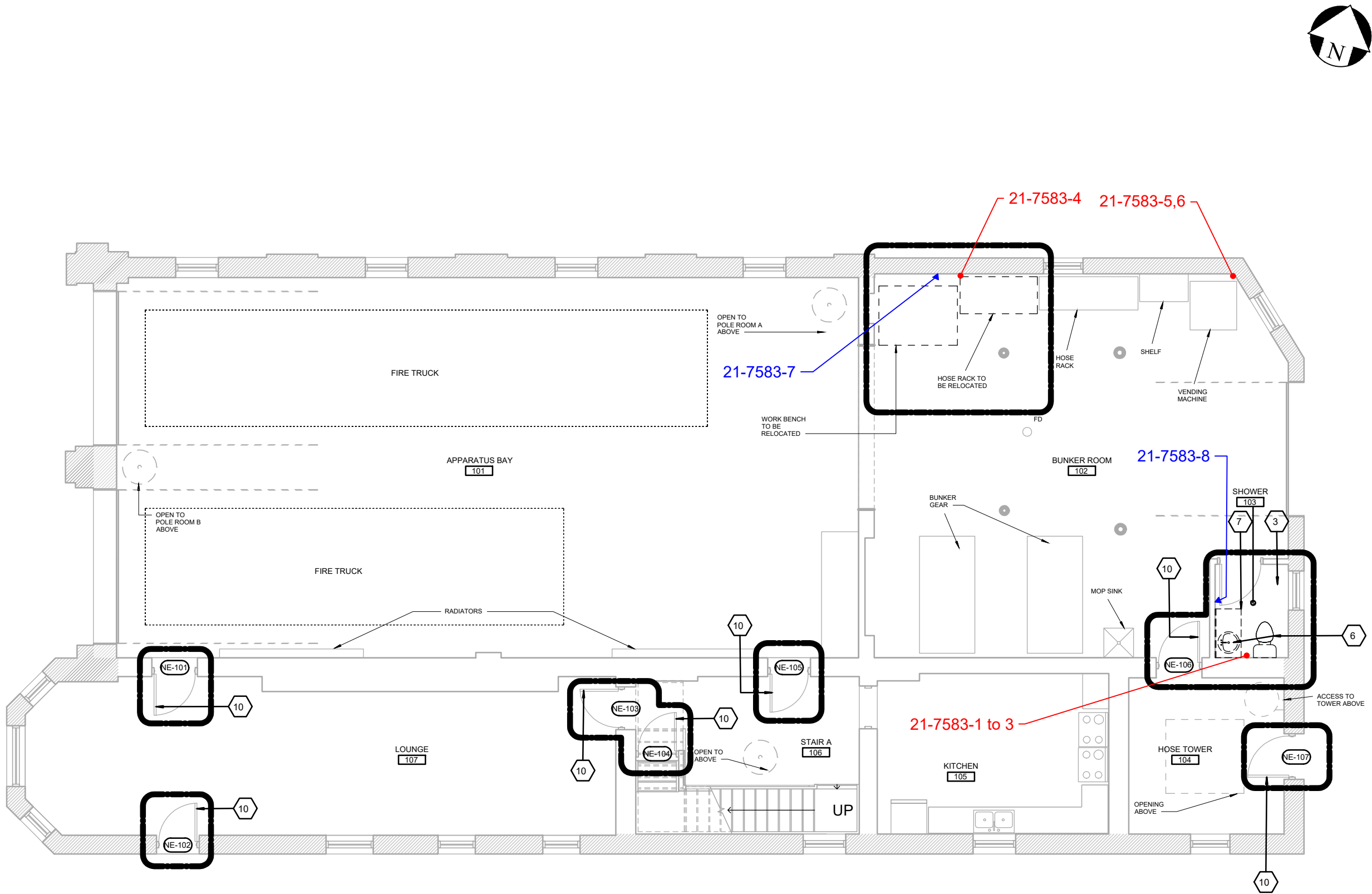


David A. Fisher, B.A.Sc., C.Chem., P.Eng.
Principal



APPENDIX A – SITE PLAN(S)





Legend




-  Area of Work
-  Asbestos Sample Location
-  Lead Sample Location

Figure 1

LOCATION: 87 Main Street
Toronto, Ontario

BUILDING NAME: Fire Hall No. 226

First Floor Plan
Pre-Reno- DSS
Asbestos and Lead Sample Locations

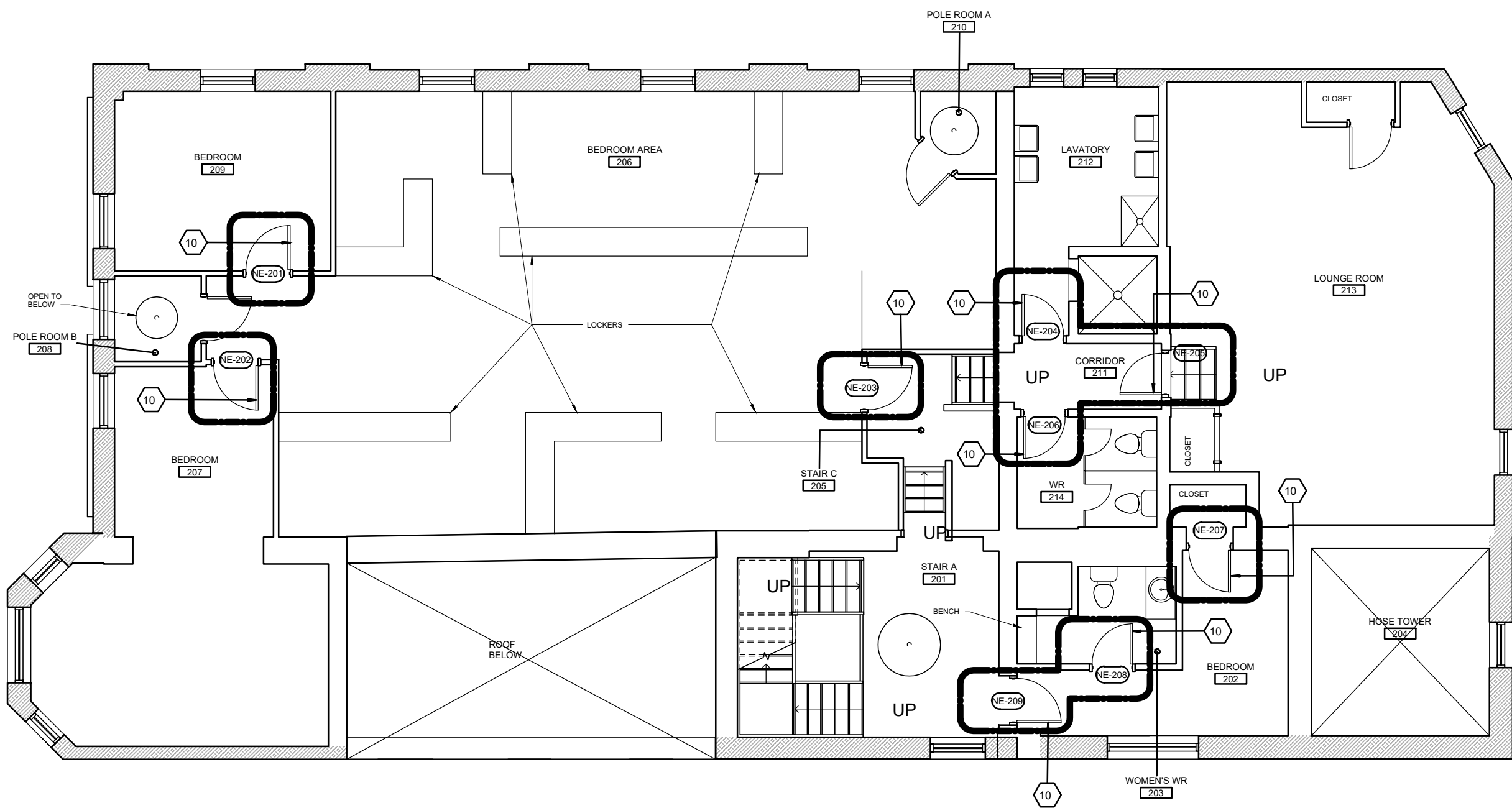
CLIENT: IBI Group

PROJECT NUMBER: FE-P 21-11706	DATE: November 2021	DRW BY: ZA
CAD FILE: FIG1	SCALE: Not to Scale	CHK BY: MJ

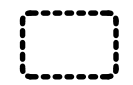


400 Esna Park Dr., #15
Markham, Ontario
L3R 3K2

Tel: 905 475-7755
Fax: 905 475-7718



Legend



Area of Work

Figure 2

LOCATION:
87 Main Street
Toronto, Ontario

BUILDING NAME:
Fire Hall No. 226

Second Floor Plan
Pre-Reno DSS

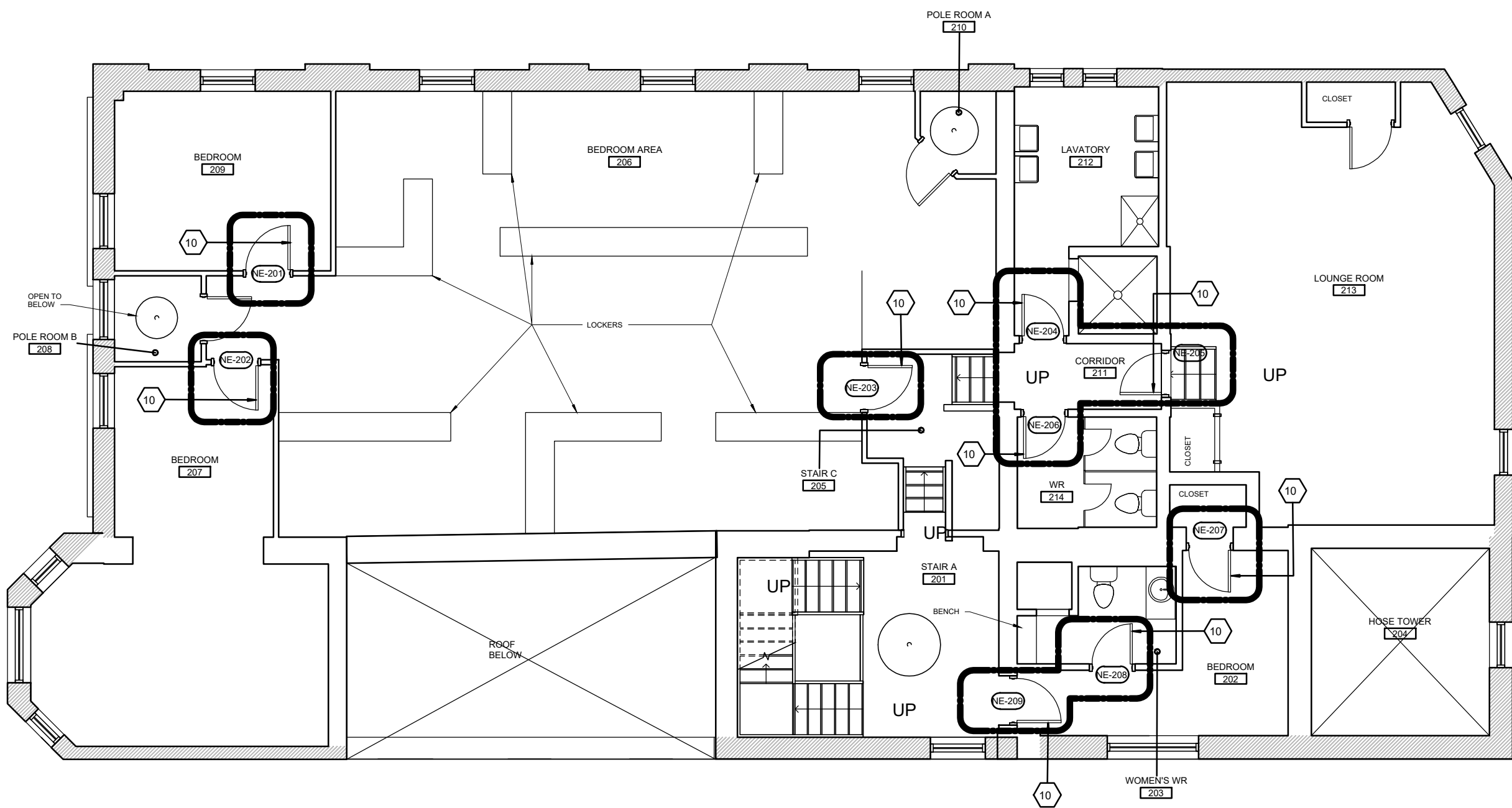
CLIENT:
IBI Group

PROJECT NUMBER: FE-P 21-11706	DATE: November 2021	DRW BY: ZA
CAD FILE: FIG2	SCALE: Not to Scale	CHK BY: MJ

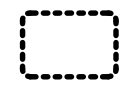


400 Esna Park Dr., #15
Markham, Ontario
L3R 3K2

Tel: 905 475-7755
Fax: 905 475-7718



Legend



Area of Work

Figure 3

LOCATION:
87 Main Street
Toronto, Ontario

BUILDING NAME:
Fire Hall No. 226

Third Floor Plan
Pre-Reno DSS

CLIENT:
IBI Group

PROJECT NUMBER: FE-P 21-11706	DATE: November 2021	DRW BY: ZA
CAD FILE: FIG3	SCALE: Not to Scale	CHK BY: MJ



400 Esna Park Dr., #15
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Fax: 905 475-7718

APPENDIX B – CERTIFICATE(S) OF ANALYSIS





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Toronto, ON
M9W 0C9
Tel.: 416-679-1930
E-mail:
Attn: Faraz Bolourian

F.E. Job #: 21-7583
Project Name: Pre-Reno DSS
Project ID: FE-P 21-11706
Date Sampled: 9-Nov-2021
Date Received: 23-Nov-2021
Date Reported: 26-Nov-2021
Location: 87 Main Street

Certificate of Analysis

Analysis Requested:	Asbestos, Lead
Sample Description:	8 Bulk Sample(s)

Client Sample ID	Lab Sample ID	Sample Matrix	Fibre Type	Asbestos Content
01A - Drywall Joint Compound, Wall	21-7583-1	Drywall Joint Compound		Not Detected
01B - Drywall Joint Compound, Wall	21-7583-2	Drywall Joint Compound		Not Detected
01C - Drywall Joint Compound, Wall	21-7583-3	Drywall Joint Compound		Not Detected
02A - Mortar, Brick Wall	21-7583-4	Mortar		Not Detected
02B - Mortar, Brick Wall	21-7583-5	Mortar		Not Detected
02C - Mortar, Brick Wall	21-7583-6	Mortar		Not Detected

Fisher Environmental Laboratories (Lab ID #: 2745) is accredited by CALA (Canadian Association for Laboratory Accreditation Inc.) for asbestos analysis by PLM.

ANALYTICAL METHOD:

Asbestos has been done in accordance with normal professional standard using the following Fisher Environmental Lab Method: Asbestos by PLM (Polarized Light Microscope) F-26, Rev.2.2.

Certificate of Analysis

Analysis Requested:	Asbestos, Lead
Sample Description:	8 Bulk Sample(s)

Client Sample ID	Lab Sample ID	Sample Matrix	Lead (ppm)	Comments
LP101 - Grey Paint with Brown & Red Layer, Wall	21-7583-7	Paint	3122	
LP102 - White Paint, Wall	21-7583-8	Paint	<10	

< result obtained was below RL (Reporting Limit).

QA/QC Report

Parameter	Blank (ppm)		LCS (%)		CRM/MS (%)	
	Result	RL	Recovery	AR	Recovery	AR
Lead	<10	10	93	80-120	95	70-130

Parameter	Duplicate (%)					
	RPD	AR				
Lead	3.8	0-30				

LEGEND:

RL - Reporting Limit

LCS - Laboratory Control Sample

MS - Matrix Spike

AR - Acceptable Range

RPD - Relative Percent Difference

ANALYTICAL METHODS:

Metals (Lead) - Method # F-1, Rev. 4.5, Standard Operation Procedure for determination of Metals by the Inductively Coupled Plasma- Optical.

Method used by Fisher Environmental Lab complies with the Standard Methods for the Examination of Water and Wastewater, 20th Ed 3120-B.

Authorized by:

Roger Lin
Roger Lin, Ph. D., C. Chem.
Laboratory Manager



APPENDIX C – SITE PHOTOS





Photo 1 – View of lead-containing grey multilayer paint observed on the wall.

APPENDIX D – PREVIOUS DSS REPORT





DESIGNATED SUBSTANCE SURVEY



TORONTO FIRE STATION 226 87 MAIN STREET

Toronto, Ontario

Presented to:

Meaghan Aldcroft

City of Toronto
Facilities Management

Fisher Environmental Ltd.
Project Number: FE-P 16-7715

JUNE, 2016

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APPENDIX III – CORRECTIVE ACTIONS INSPECTION REPORTS

APPENDIX IV – SURVEY DRAWINGS

APPENDIX V – SITE PHOTOGRAPHS

1. INTRODUCTION AND REGULATORY REQUIREMENTS

1.1 Introduction and Scope

Fisher Environmental Ltd. was retained by the City of Toronto, Facilities Management to conduct a Designated Substance Survey of building materials in Toronto Fire Station 226 located at 87 Main Street in Toronto, Ontario.

The objectives of the Designated Substance Survey (DSS) are to establish locations, conditions and types of designated substances contained within a building and, if necessary, provide recommendations to fulfill requirements set forth under the Ontario Occupational Health and Safety Act (OHSA) to achieve regulatory compliance. Preparation of the DSS report, which includes a brief description of the materials present, and the findings of the DSS, will fulfill the requirements of the Ontario Ministry of Labour (MOL) regulations for designated substances; O. Reg. 490/09 – Designated Substances and O. Reg. 278/05 – Asbestos on Construction Projects and in Buildings and Repair Operations.

The DSS should also include an examination for the presence of polychlorinated biphenyls (PCBs) and visible mould growth. . This document should be filed as an addendum to the original survey, which was conducted by ECOH Management Inc. on August 16, 2007.

The *Designated Substance Survey* report is intended for management purposes only to demonstrate compliance with regulations. It is not to be used to establish the designated substance content within building materials before renovation or demolition activities. Prior to any work activities that may disturb building materials, a thorough Pre-Renovation or Pre-Demolition survey of the work area for designated substances and hazardous materials shall be conducted. Muhammad Junayed of Fisher Environmental Ltd. performed the fieldwork on June 7, 2016.

2. SURVEY METHODOLOGY

2.1 General Approach

To ensure familiarity with the building, the Surveyor made reference to the previous assessment and reassessment reports provided by the City of Toronto prior to commencing the survey. The Surveyor also made reference to facility floor plans included in the previous assessment reports, or provided independently by the City of Toronto. Facility drawings identifying locations of asbestos-containing materials, if present, are included in Appendix IV. Site photographs are included in Appendix V.

2.2 Survey Methodology

The City of Toronto provided the consultant with the previous DSS report and / or other survey reports of designated substances identified within the facility, if available. . Prior to conducting the DSS, the reports were reviewed by Fisher Environmental Ltd. and updated with all available information regarding ACM, including that from past assessments and reassessments.

The survey was conducted in compliance with the Ontario Ministry of Labour (MOL) regulations for designated substances; O. Reg. 490/09 - *Designated Substances* and O. Reg. 278/05 - *Asbestos*

on Construction Projects and in Buildings and Repair Operations made under the Occupational Health and Safety Act (OHSA), R.S.O. 1990.

The Surveyor conducted a visual reassessment of all known and assumed asbestos-containing materials in all accessible areas of the building, as detailed in past survey reports and the Reassessment Survey Form, and recorded the condition (GOOD, FAIR or POOR) of each known or assumed ACM on the Asbestos Reassessment Survey Form. The Surveyor also recorded detailed descriptions of previously-unidentified potential ACM, if observed. Please refer to Appendix I for the updated Reassessment Survey Form.

Materials confirmed to be asbestos-containing during previous assessments were not sampled for this reassessment survey. Additionally, samples were not collected of materials that were previously confirmed to be non-asbestos by the requirements of Ontario Regulation 278/05.

Any other potential asbestos-containing materials noted during the reassessment survey that had not been identified in a previous survey, or were not sampled in accordance with the requirements of O. Reg. 278/05, were sampled as part of the reassessment.

The DSS is based on a walk-through inspection of the facility and shall be conducted room by room to establish locations, conditions and types of designated substances. The survey shall also include an examination for the presence of polychlorinated biphenyls (PCBs) and visible mould growth.

3. FINDINGS AND RECOMMENDATIONS

3.1 Asbestos

Asbestos fibres may be released into the air by the disturbance of asbestos containing material (ACM) during product use, demolition work, building or home maintenance, repair and remodeling. In general, exposure may occur only when the ACM is disturbed in some way to release particles and fibres into the air.

3.1.1 Findings

Previously identified assumed and confirmed ACM include the following:

- Window Caulking, and
- Vinyl Floor Tiles – one (1) variety.

All assumed and confirmed ACM were observed to be in GOOD condition at the time of the reassessment.

No samples were collected for analysis of asbestos type and content during the current survey.

Unless previously determined to be non-asbestos, plaster, drywall joint compound, vinyl floor tiles, mastics and window caulking in other areas of the facility should continue to be assumed to be asbestos-containing, and should be sampled prior to renovation and/or demolition activities.

3.1.2 Recommendations

All assumed and confirmed ACM were observed in GOOD condition at the time of the reassessment. Therefore, no recommended corrective actions are made at this time.

Any other building materials suspected to contain asbestos which are not outlined in this report should be assumed to be asbestos-containing until sample analysis determines asbestos content.

Ontario Ministry of Labour Regulation 278/05 requires that an Asbestos Management Program (AMP) be implemented as long as asbestos-containing materials are present in a building. The AMP, original survey report and subsequent reassessment reports must be available at the work place, and must identify the type of asbestos, and where asbestos can be found on a room-by-room basis.

NOTE: Interpretation of all sources of asbestos-related information, including but not limited to the original asbestos survey report, asbestos reassessment reports, room-by-room survey data, survey drawings and reports from previous asbestos abatement projects, should be completed by a competent person trained in the historical application of asbestos in building materials, building design and preferably by a person with site-specific knowledge and/or experience.

Information contained within any of the above-noted sources may not relieve the Regulatory responsibility of building Owners, or project Employers/Constructors, to complete a detailed site inspection prior to commencement of a project.

This report should not be used as a substitute for a detailed site inspection to identify asbestos-containing building materials, which must be specifically tailored to the scope and nature of any given project, and completed prior to any maintenance, renovation or demolition work that may cause disturbance to building materials.

3.2 *Lead*

Most lead in the environment comes from human activities such as burning fossil fuels, mining and manufacturing. Lead is used in the production of batteries, ammunition, metal products such as solder and pipes, and x-ray devices. Exposure happens when eating food or drinking water that contains lead. Deteriorated lead paint can contribute to lead dust. The main target for lead toxicity is the nervous system.

The regulation for lead applies to every employer and worker at a workplace where lead is present, produced, processed, used, handled or stored and at which a worker is likely to be exposed to lead.

Additionally, in 2004 the MOL issued *Guideline: Lead on Construction Projects* outlining practices that should be followed during construction projects to protect workers' from exposure to lead. This includes the methods and equipment employed in the removal of lead containing coatings that reduce the creation of dust, providing appropriate facilities for workers to wash after each shift, and providing protective clothing and respirators where necessary.

3.2.1 Findings

Paint finishes were generally noted to be in Good condition throughout the Site. During the current investigation, no samples were collected for lead analysis. However, approximately 300 SF of lead-containing peach window paint was in poor condition for Location 0-00 (Exterior).

No other indication of lead containing materials was observed during the building survey, with the exception of that which may be contained within batteries.

3.2.2 Recommendations

The damaged lead-containing peach paint noted on the exterior windows of Location 0-00 (Exterior) should be removed or encapsulated using appropriate Lead Abatement procedures.

During the disturbance of any painted surfaces that contain lead, it would be recommended that appropriate procedures and use of respirators be followed to protect workers.

3.3 Acrylonitrile

Acrylonitrile is used to make other chemicals such as plastics, synthetic rubber and acrylic fibres. Breathing high concentrations of acrylonitrile will cause nose and throat irritation, tightness in chest, difficulty breathing, nausea, dizziness, weakness, headache, impaired judgment and convulsions. These symptoms usually disappear when exposure has stopped. If spilled on the skin, acrylonitrile will burn the skin and cause blisters and redness. Acrylonitrile is believed to be carcinogenic.

3.3.1 Findings

Acrylonitrile based polymers may have been utilized in the production of some of the building construction materials (e.g. paints, sealants, and adhesives). Although these polymers are generally volatile, they are expected to produce significant acrylonitrile exposure only during or shortly after application of the subject material. If present on site, acrylonitrile would not be expected to be a concern during future renovation or demolition works. Acrylonitrile was not evident in its pure form anywhere within the subject areas of the building.

3.3.2 Recommendations

No immediate corrective actions were recommended with regard to acrylonitrile.

3.4 Arsenic

Inorganic arsenic compounds are mainly used to preserve wood. Organic arsenic compounds are used as pesticides. Arsenic occurs naturally in soil and minerals and therefore may enter air and water. Breathing high levels of arsenic may cause sore throat and irritated lungs. Ingesting high levels of arsenic can result in death. Arsenic is a suspected carcinogenic substance.

3.4.1 Findings

Low levels of arsenic may be contained within paints or coatings utilized on building construction materials, however exposure levels resulting from personal contact are not expected to be significant. Arsenic or arsenic containing compounds were not encountered during the building survey works.

3.4.2 Recommendations

No immediate corrective actions were recommended with regard to arsenic.

3.5 Benzene

Benzene is colourless liquid with a sweet odour. Benzene utilization has historically been associated with solvents, paints, stains, adhesives, and in the manufacturing of various rubber products. While its current use in building materials has greatly decreased due to an increased

awareness of associated health concerns, it may still be present in trace quantities in various industrial solvents. Gasoline sold in Canada contains approximately 4% benzene.

Breathing very high levels of benzene can result in death, while high levels may cause drowsiness, dizziness, rapid heart rate, headaches, and unconsciousness.

3.5.1 Findings

While it may be expected, given the age of the building, that the original construction materials utilized did contain some trace levels of benzene, it is likely that any has since volatilized and would not exceed the permissible exposure values. During future renovation or demolition works, it would not be expected to be a concern. No evidence of benzene was noted during the building survey, with the exception of that which may be contained in regular gasoline fuel burning equipment.

3.5.2 Recommendations

No immediate corrective actions were recommended with regard to benzene.

3.6 *Coke Oven Emissions*

Coke oven emissions are released during the carbonization of bituminous coal for the production of coke. Exposure routes include inhalation, skin and / or eye contact. Coke oven emissions are potential occupational carcinogens.

3.6.1 Findings

This substance would not be expected to be found in the building. No evidence of the burning of coke was found during the building survey.

3.6.2 Recommendations

No immediate corrective actions were recommended with regard to coke oven emissions.

3.7 *Ethylene Oxides*

Ethylene oxide is a man-made chemical used primarily to make ethylene glycol (antifreeze and polyester). Breathing low levels of ethylene oxides for a prolonged period of time causes eye, skin and respiratory irritations, and can affect nervous system. Higher levels of exposure for shorter time produce symptoms that are similar but more severe.

3.7.1 Findings

This substance would not be expected to be found in the building. No evidence of ethylene oxides was found during the building survey.

3.7.2 Recommendations

No immediate corrective actions were recommended with regard to ethylene oxides.

3.8 *Isocyanates*

Isocyanates are a family of highly reactive, low molecular weight chemicals. They are widely used in the manufacture of flexible and rigid foams, fibres, and coatings such as paints and varnishes, and elastomers and various building materials (e.g. spray on polyurethane products).

Isocyanates are powerful irritants to the eyes, skin, and respiratory and gastrointestinal tracts.

3.8.1 Findings

Use of isocyanates or isocyanate compounds would not be expected in the building. No evidence of isocyanates was found during the building survey.

3.8.2 Recommendations

No immediate corrective actions were recommended with regard to isocyanates.

3.9 *Mercury*

Mercury is a naturally occurring metal. It is a shiny, silver-white and odourless liquid. It combines with other elements to form inorganic compounds or salts. Metallic mercury is used to produce chlorine gas and caustic soda, and is used in thermostats and thermometers, fluorescent light bulbs, dental fillings and batteries. Exposure occurs when breathing vapors from spills, incinerators, etc.

The nervous system is very sensitive to all forms of mercury. Exposure to high levels of metallic inorganic or organic mercury can permanently damage the brain, kidneys and developing fetus. Short-term exposure may cause lung damage, nausea, vomiting and diarrhea as well as skin and eye irritation.

3.9.1 Findings

Mercury can be found in fluorescent light bulbs and building thermostats. Prior to future renovation or demolition works, it would be recommended that these products be safely removed. The disposal of mercury containing items are regulated under the Environmental Protection Act, and it would be recommended that for disposal purposes any mercury containing thermostats and fluorescent light bulbs be disposed of at an MOE licensed receiver. With the exception of fluorescent light bulbs and building thermostats, no other evidence of mercury was noted during the building survey.

3.9.2 Recommendations

No immediate corrective actions were recommended with regard to mercury.

3.10 *Silica*

Silica is a crystalline compound occurring abundantly as quartz, sand, and many other minerals, and used to manufacture a variety of materials, especially glass and concrete. When mining this substance, silica can be deadly when it becomes airborne. If inhaled, silica dust can cause silicosis which can be fatal.

Additionally, in 2004 the MOL issued *Guideline: Silica on Construction Projects* outlining practices that should be followed during construction projects to protect workers' from exposure to silica. This includes the methods and equipment employed in the removal of silica containing

materials that reduce the creation of dust, providing appropriate facilities for workers to wash after each shift, and providing protective clothing and respirators where necessary.

3.10.1 Findings

As the building is constructed of concrete block and brick, with concrete floors, silica is expected to be found within these components of the building. During any significant renovation or demolition works where concrete dust is generated, dust suppression techniques should be utilized to control worker exposure to silica. Silica is expected to be present in concrete and masonry products in the building.

3.10.2 Recommendations

No immediate corrective actions were recommended with regard to silica.

3.11 Vinyl Chloride

Vinyl chloride is used to make polyvinyl chloride (PVC) which is found in a variety of plastic products, including pipes, wires, cable coatings and packaging materials. Breathing high levels of vinyl chloride can cause dizziness, unconsciousness and death. Prolonged exposure causes changes in liver, nerve damage, immune reactions and changes in blood flow.

3.11.1 Findings

PVC pipe is generally stable and does not allow for the liberation of vinyl chloride, under normal conditions. During future renovation or demolition works, this substance would not be expected to be a concern. Vinyl chloride was not evident in its pure form, anywhere in the subject dwellings.

3.11.2 Recommendations

No immediate corrective actions were recommended with regard to vinyl chloride.

3.12 Polychlorinated Biphenyls (PCBs)

PCBs are mixtures of synthetic organic chemicals with the same basic chemical structure and similar physical properties ranging from oily liquids to waxy solids. Due to their non-flammability, chemical stability, high boiling point and electrical insulating properties, PCBs were used in hundreds of industrial and commercial applications including electrical, heat transfer, and hydraulic equipment; as plasticizers in paints, plastics and rubber products; in pigments, dyes and carbonless copy paper and many other applications.

PCBs have been demonstrated to cause a variety of adverse health effects. PCBs have been shown to cause cancer.

3.12.1 Findings

No PCB containing equipment with the potential exception of fluorescent lighting ballasts was observed on site. Fluorescent lighting was observed in use in several areas of the building and inspection of three random light ballasts revealed that they did not contain PCB's. The disposal of PCB containing equipment is regulated under MOE Reg. 558, and it would be recommended that during any ballast replacement works the generated ballasts be evaluated for PCB content, with any PCB ballasts being consolidated and sent for disposal to an MOE licensed PCB receiver under waste class 243D.

3.12.2 Recommendations

It would be recommended that during any ballast replacement works the generated ballasts be evaluated for PCB content. Any PCB ballasts identified should be consolidated and sent for disposal to an MOE licensed PCB receiver under waste class 243D.

3.13 Mould

Mould contamination inside buildings has become a concern to both building owners and occupants. Exposure to moulds is known to cause a variety of health effects in some people. Many fungal spores are considered to be allergenic to susceptible persons, though individual susceptibility varies greatly.

Elevated levels of indoor mould are usually attributed to the chronic moist conditions due to water leaks, floods or elevated humidity. Under these conditions, already low levels of fungal spores in air from plants and other sources may multiply on cellulose containing materials such as carpets, wallboards, and wood, and result in mould contamination and, if left untreated, can be destructive to certain building materials.

At present, no Federal or Provincial regulations are in effect with respect to reasonable levels of airborne mould spores and other contaminants inside buildings. Health Canada has provided strategies and guidelines related to some indoor contaminants to assist in conducting indoor air quality investigations in their publication *Indoor Air Quality in Office Buildings: A Technical Guide, 1995*. Health Canada recommends that indoor varieties of airborne mould spores should be qualitatively and quantitatively similar to those varieties found outdoors. The presence of one or more fungal species indoors that are not found outdoors suggests the presence of an amplifier in the building.

An additional resource that places numerical limits on acceptable indoor fungal spores is found in the Calgary Health Region's guidelines for *Fungal Air Testing, Investigation and Reporting* for remediated marihuana grow houses. These guidelines suggest that indoor fungal spores are acceptable if found to be elevated by as much as 2 or 3 times the outdoor measurement, depending on the type of mould spore. Refer to attached guidelines.

The Canadian Construction Association (CCA) has provided guidelines regarding investigation and remediation works in *CCA82 - 2004 Mould Guidelines for the Canadian Construction Industry* to protect the health and safety of workers who may be exposed to mould in the course of building renovations.

3.13.1 Findings

During the current investigation, no visible mould or favourable conditions for mould growth were observed in the surveyed areas.

3.13.2 Recommendations

No immediate corrective action is recommended with regard to mould contamination.

4. CORRECTIVE ACTIONS

Fisher communicated the reported deficiencies and recommendations for corrective actions to the City of Toronto; however, these activities had not been completed at the time of issuance of this report.

On completion of the recommended actions indicated above in Section 3.2.2 *Recommendations (Lead)*, an Addendum will be made to this report to confirm completion of all corrective actions.

5. STATEMENT OF LIMITATIONS

Fisher Environmental Ltd. accepts responsibility for the competent performance of its duties in executing this assignment within the normal standards of the profession, but disclaims responsibility for consequential damages, if any.

The extent of the building survey of asbestos containing materials (ACM) and other designated substances is based on prior agreement of the scope of work with the client, and the rationale given in this report. The building survey findings rely on professional interpretation of selective sampling and analysis. Sample analysis results have been applied to homogenous materials in unsampled locations; it was not within the scope of work to carry out an exhaustive sampling and analysis program. For non-accessible building spaces, the likelihood of the presence or absence of asbestos and other designated substances has been described, but such assessment is not a definitive statement of presence or absence.

This report was prepared for the City of Toronto, Facilities Management. The scope of services performed may not be appropriate for the purposes of other users, and any use or reuse of this document or its findings or recommendations represented herein is at the sole risk of any other user.

We trust that the information provided in the report meets your current requirements. If you have any questions or concerns, please do not hesitate to contact the undersigned.

6. SIGN-OFF

We trust that this report meets with City of Toronto requirements and we thank you for the opportunity to be of service. Should you have any questions, please do not hesitate to contact us.

Fisher Environmental Ltd.

Prepared By:



Muhammad Junayed, B.Sc., EP
Project Manager

Reviewed By:




David Fisher, P. Eng., C. Chem.
Principal

APPENDIX I

REASSESSMENT SURVEY FORM

APPENDIX I - REASSESSMENT SURVEY FORM

Building Address:	87 Main Street	Date(s) of Current Reassessment:	June 7, 2016
Building Name:	Toronto Fire Station 226	Organization Completing Reassessment:	Fisher Environmental Ltd. / Project FE-P 16-7715
Original Survey Conducted By:	ECOH Management Inc.	Name of Surveyor:	Muhammad Junayed
Date(s) of Original Survey:	August 16, 2007	Signature of Surveyor:	

Summary of Findings

0-00 Exterior - Approximately 300 SF of lead-containing peach window paint in POOR condition; remove using Lead Abatement procedures

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 Material	Asbestos	12352-226-01A* 12352-226-01B* 12352-226-01C*	None Detected	4,300 SF	Good	*From Certificate of Analysis, dated 2008
0-00	Exterior	Windows	Window Caulking	Asbestos	Not Sampled	ACM Assumed	All	Good	
0-00	Exterior	Windows	Peach Paint	Lead	14-9571-05*	38,400 ppm	All	Poor	*From Fisher Project No. 14-6915, dated July 2014 Approximately 300 SF in POOR condition; remove using Lead Abatement procedures
0-00	Exterior	Walls	Brick	N/A	N/A	N/A	N/A	N/A	
0-00	Exterior	Floor	Asphalt	Asbestos	15-1241-01 to 05*	None Detected	N/A	N/A	*From Fisher Project No. 15-7235, dated February 2015
B-01	Electrical Room	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
B-01	Electrical Room	Walls	Brick	N/A	N/A	N/A	N/A	N/A	
B-01	Electrical Room	Walls	Blue Paint	Lead	16-4102-01*	880 ppm	N/A	N/A	*From Fisher Project No. 16-7706, dated June 2016
B-01	Electrical Room	Ceiling	Plaster	Asbestos	12348-B-53-08a* 12348-B-53-08b* 12348-B-53-08c* 12348-B-53-08d* 12348-B-53-08e*	None Detected	100 SF	Good	*From ECOH Project No. 12180-B-53, dated July 2008
B-02	Mechanical Room	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
B-02	Mechanical Room	Walls	Brick	N/A	N/A	N/A	N/A	N/A	
B-02	Mechanical Room	Ceiling	Plaster	Asbestos	Homogeneous w / 12348-B-53-08	None Detected	600 SF	Good	*Bulkheads only
B-02	Mechanical Room	Ceiling	Concrete	N/A	N/A	N/A	N/A	N/A	
B-03	Storage	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
B-03	Storage	Walls	Brick	N/A	N/A	N/A	N/A	N/A	
B-03	Storage	Ceiling	Plaster	Asbestos	Homogeneous w / 12348-B-53-08	None Detected	600 SF	Good	

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Location Number	Location Name	Building System	Material Observed	Potential Hazardous Material	Sample ID	Analytical Result	Quantity	Condition	Notes / Recommended Actions
B-04	Storage	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
B-04	Storage	Walls	Brick	N/A	N/A	N/A	N/A	N/A	
B-04	Storage	Ceiling	Wood	N/A	N/A	N/A	N/A	N/A	
B-05	Crawlspace	Floor	Soil	N/A	N/A	N/A	N/A	N/A	NO ACCESS
B-05	Crawlspace	Walls	Sprayed Fireproofing	Asbestos	Homogeneous w / 11-3174-1,2,3	None Detected	All	Good	
B-05	Crawlspace	Ceiling	Sprayed Fireproofing	Asbestos	11-3174-1* 11-3174-2* 11-3174-3*	None Detected	All	Good	*From Fisher Project No. 11-5525, dated March 2012 collected from just inside the access door.
B-06	Crawlspace	Floor	Soil	N/A	N/A	N/A	N/A	N/A	NO ACCESS
B-06	Crawlspace	Walls	Brick	N/A	N/A	N/A	N/A	N/A	
B-06	Crawlspace	Ceiling	Wood	N/A	N/A	N/A	N/A	N/A	
B-07	Crawlspace	Floor	Soil	N/A	N/A	N/A	N/A	N/A	NO ACCESS
B-07	Crawlspace	Walls	Brick	N/A	N/A	N/A	N/A	N/A	
B-07	Crawlspace	Ceiling	Concrete	N/A	N/A	N/A	N/A	N/A	
1-01	Apparatus Bay	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-01	Apparatus Bay	Walls	Ceramic	N/A	N/A	N/A	N/A	N/A	
1-01	Apparatus Bay	Walls	Plaster	Asbestos	14-9571-01,02,03*	None Detected	1500 SF	Good	*From Fisher Project No. 14-6915, dated July 2014
1-01	Apparatus Bay	Walls	Taupe Paint	Lead	14-9571-04*	1,190 ppm	1500 SF	Good	*From Fisher Project No. 14-6915, dated July 2014
1-01	Apparatus Bay	Ceiling	Plaster	Asbestos	Homogeneous w / 12348-B-53-09	None Detected	1200 SF	Good	
1-02	Bunker Room	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-02	Bunker Room	Walls	Brick	N/A	N/A	N/A	N/A	N/A	
1-02	Bunker Room	Ceiling	Plaster	Asbestos	Homogeneous w / 12348-B-53-09	None Detected	600 SF	Good	
1-03	Washroom	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-03	Washroom	Walls	Plaster	Asbestos	Homogeneous w / 12348-B-53-09	None Detected	80 SF	Good	
1-03	Washroom	Walls	Drywall (DJC)	Asbestos	12348-B-53-06a* 12348-B-53-06b* 12348-B-53-06c* 12348-B-53-06d* 12348-B-53-06e*	None Detected	80 SF	Good	*From ECOH Project No. 12180-B-53, dated July 2008

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Location Number	Location Name	Building System	Material Observed	Potential Hazardous Material	Sample ID	Analytical Result	Quantity	Condition	Notes / Recommended Actions
1-03	Washroom	Ceiling	Plaster	Asbestos	12348-B-53-09a* 12348-B-53-09b* 12348-B-53-09c* 12348-B-53-09d* 12348-B-53-09e*	None Detected	25 SF	Good	*From ECOH Project No. 12180-B-53, dated July 2008
1-04	Hose Tower / Storage	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-04	Hose Tower / Storage	Walls	Brick	N/A	N/A	N/A	N/A	N/A	
1-04	Hose Tower / Storage	Ceiling	Wood	N/A	N/A	N/A	N/A	N/A	
1-05	Lunch Room	Floor	Vinyl Floor Tile 1	Asbestos	12348-B-53-01a* 12348-B-53-01b*	None Detected	200 SF	Good	12" x 12" Beige with Dark Streaks *From ECOH Project No. 12180-B-53, dated July 2008
1-05	Lunch Room	Floor	Mastic	Asbestos	12348-B-53-01a* 12348-B-53-01b*	None Detected	N/A	N/A	*From ECOH Project No. 12180-B-53, dated July 2008
1-05	Lunch Room	Walls	Plaster	Asbestos	Homogeneous w / 12348-B-53-09	None Detected	440 SF	Good	
1-05	Lunch Room	Ceiling	Ceiling Tile 1	Asbestos	11850-B-53-02a* 11850-B-53-02b* 11850-B-53-02c*	None Detected	170 SF	Good	2' x 4' Fissure Widthwise with Pinpoint *From ECOH Project No. 11850-B-53, dated October 2007
1-05	Lunch Room	Ceiling	Ceiling Tile 2	Asbestos	11850-B-53-01a* 11850-B-53-01b* 11850-B-53-01c*	None Detected	30 SF	Good	2' x 4' Fissure Lengthwise *From ECOH Project No. 11850-B-53, dated October 2007
1-06	Stairwell / Corridor	Floor	Vinyl Floor Tile 1	Asbestos	12348-B-53-01c*	None Detected	400 SF	Good	12" x 12" Beige with Dark Streaks *From ECOH Project No. 12180-B-53, dated July 2008
1-06	Stairwell / Corridor	Floor	Mastic	Asbestos	12348-B-53-01c*	None Detected	N/A	N/A	*From ECOH Project No. 12180-B-53, dated July 2008
1-06	Stairwell / Corridor	Floor	Vinyl Floor Tile 2	Asbestos	12348-B-53-02a*	PC** 1.6% Chrysotile	80 SF	Good	9" x 9" Beige with Brown and White Stripes *From ECOH Project No. 12180-B-53, dated July 2008 **Indicates Stratified Point Count Method performed
1-06	Stairwell / Corridor	Floor	Mastic	Asbestos	12348-B-53-02a* 12348-B-53-02b*	None Detected	N/A	N/A	*From ECOH Project No. 12180-B-53, dated July 2008
1-06	Stairwell / Corridor	Walls	Plaster	Asbestos	Homogeneous w / 12348-B-53-09	None Detected	700 SF	Good	
1-06	Stairwell / Corridor	Ceiling	Plaster	Asbestos	Homogeneous w / 12348-B-53-09	None Detected	200 SF	Good	
1-07	Lounge	Floor	Vinyl Floor Tile 3	Asbestos	12348-B-53-03a* 12348-B-53-03b* 12348-B-53-03c*	None Detected	500 SF	Good	12" x 12" Eggshell Mosaic *From ECOH Project No. 12180-B-53, dated July 2008
1-07	Lounge	Walls	Plaster	Asbestos	Homogeneous w / 12348-B-53-09	None Detected	850 SF	Good	
1-07	Lounge	Ceiling	Ceiling Tile 2	Asbestos	Homogeneous w / 11850-B-53-01	None Detected	500 SF	Good	2' x 4' Fissure Lengthwise
2-01	Bedroom	Floor	Vinyl Floor Tile 4	Asbestos	12348-B-53-04a*	None Detected	140 SF	Good	12" x 12" White and Grey Mosaic *From ECOH Project No. 12180-B-53, dated July 2008
2-01	Bedroom	Floor	Mastic	Asbestos	12348-B-53-04a*	None Detected	N/A	Good	*From ECOH Project No. 12180-B-53, dated July 2008
2-01	Bedroom	Walls	Drywall (DJC)	Asbestos	Homogeneous w / 12348-B-53-07	None Detected	200 SF	Good	
2-01	Bedroom	Walls	Plaster	Asbestos	Homogeneous w / 12348-B-53-10	None Detected	200 SF	Good	

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2-01	Bedroom	Ceiling	Plaster	Asbestos	Homogeneous w / 12348-B-53-10	None Detected	140 SF	Good	
2-02	Washroom	Floor	Vinyl Floor Tile 4	Asbestos	12348-B-53-04b* 12348-B-53-04c*	None Detected	60 SF	Good	12" x 12" White and Grey Mosaic *From ECOH Project No. 12180-B-53, dated July 2008
2-02	Washroom	Floor	Mastic	Asbestos	12348-B-53-04b* 12348-B-53-04c*	None Detected	N/A	N/A	*From ECOH Project No. 12180-B-53, dated July 2008
2-02	Washroom	Walls	Drywall (DJC)	Asbestos	12348-B-53-07a* 12348-B-53-07b* 12348-B-53-07c* 12348-B-53-07d* 12348-B-53-07e*	None Detected	250 SF	Good	*From ECOH Project No. 12180-B-53, dated July 2008
2-02	Washroom	Ceiling	Plaster	Asbestos	12348-B-53-10a* 12348-B-53-10b* 12348-B-53-10c* 12348-B-53-10d* 12348-B-53-10e*	None Detected	60 SF	Good	*From ECOH Project No. 12180-B-53, dated July 2008
2-03	Men's Washroom	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
2-03	Men's Washroom	Floor	Vinyl Floor Tile 5	Asbestos	12348-B-53-05a*	None Detected	N/A	N/A	12" x 12" Beige with Brown and White Fleck *From ECOH Project No. 12180-B-53, dated July 2008 NOT OBSERVED
2-03	Men's Washroom	Floor	Mastic	Asbestos	12348-B-53-05a*	None Detected	N/A	N/A	*From ECOH Project No. 12180-B-53, dated July 2008 NOT OBSERVED
2-03	Men's Washroom	Walls	Ceramic	N/A	N/A	N/A	N/A	N/A	
2-03	Men's Washroom	Walls	Plaster	Asbestos	Homogeneous w / 12348-B-53-10	None Detected	240 SF	Good	
2-03	Men's Washroom	Ceiling	Plaster	Asbestos	Homogeneous w / 12348-B-53-10	None Detected	50 SF	Good	
2-04	Dormitory	Floor	Vinyl Floor Tile 5	Asbestos	12348-B-53-05b*	None Detected	1350 SF	Good	12" x 12" Beige with Brown and White Fleck *From ECOH Project No. 12180-B-53, dated July 2008
2-04	Dormitory	Floor	Mastic	Asbestos	12348-B-53-05b*	None Detected	N/A	N/A	*From ECOH Project No. 12180-B-53, dated July 2008 NOT OBSERVED
2-04	Dormitory	Walls	Plaster	Asbestos	Homogeneous w / 12348-B-53-10	None Detected	1300 SF	Good	
2-04	Dormitory	Ceiling	Plaster	Asbestos	Homogeneous w / 12348-B-53-10	None Detected	1350 SF	Good	
2-05	Office	Floor	Carpet	N/A	N/A	N/A	N/A	N/A	
2-05	Office	Floor	Vinyl Floor Tile 5	Asbestos	12348-B-53-05c*	None Detected	165 SF	Good	12" x 12" Beige with Brown and White Fleck *From ECOH Project No. 12180-B-53, dated July 2008 NOT OBSERVED
2-05	Office	Floor	Mastic	Asbestos	12348-B-53-05c*	None Detected	N/A	N/A	*From ECOH Project No. 12180-B-53, dated July 2008 NOT OBSERVED
2-05	Office	Walls	Drywall (DJC)	Asbestos	Homogeneous w / 12348-B-53-07	None Detected	200 SF	Good	
2-05	Office	Walls	Plaster	Asbestos	Homogeneous w / 12348-B-53-10	None Detected	200 SF	Good	
2-05	Office	Ceiling	Plaster	Asbestos	Homogeneous w / 12348-B-53-10	None Detected	165 SF	Good	

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Location Number	Location Name	Building System	Material Observed	Potential Hazardous Material	Sample ID	Analytical Result	Quantity	Condition	Notes / Recommended Actions
2-06	Office	Floor	Carpet	N/A	N/A	N/A	N/A	N/A	
2-06	Office	Floor	Vinyl Floor Tile 5	Asbestos	Homogeneous w/ 12348-B-53-05	None Detected	215 SF	Good	12" x 12" Beige with Brown and White Fleck NOT OBSERVED
2-06	Office	Walls	Drywall (DJC)	Asbestos	Homogeneous w/ 12348-B-53-07	None Detected	330 SF	Good	
2-06	Office	Walls	Plaster	Asbestos	Homogeneous w / 12348-B-53-10	None Detected	330 SF	Good	
2-06	Office	Ceiling	Plaster	Asbestos	Homogeneous w / 12348-B-53-10	None Detected	215 SF	Good	
2-07	Corridor	Floor	Vinyl Floor Tile 5	Asbestos	Homogeneous w/ 12348-B-53-05	None Detected	140 SF	Good	12" x 12" Beige with Brown and White Fleck
2-07	Corridor	Floor	Vinyl Floor Tile 2	Asbestos	Homogeneous w/ 12348-B-53-02	PC** 1.6% Chrysotile	N/A	N/A	9" x 9" Beige with Brown and White Stripes **Indicates Stratified Point Count Method performed. NOT OBSERVED
2-07	Corridor	Floor	Mastic	Asbestos	12348-B-53-02c*	None Detected	N/A	N/A	*From ECOH Project No. 12180-B-53, dated July 2008
2-07	Corridor	Walls	Plaster	Asbestos	Homogeneous w / 12348-B-53-10	None Detected	500 SF	Good	
2-07	Corridor	Ceiling	Plaster	Asbestos	Homogeneous w / 12348-B-53-10	None Detected	140 SF	Good	
2-08	Men's Washroom	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
2-08	Men's Washroom	Walls	Ceramic	N/A	N/A	N/A	N/A	N/A	
2-08	Men's Washroom	Ceiling	Plaster	Asbestos	Homogeneous w / 12348-B-53-10	None Detected	130 SF	Good	
2-09	Recreation Room	Floor	Wood	N/A	N/A	N/A	N/A	N/A	
2-09	Recreation Room	Walls	Brick/Wood	N/A	N/A	N/A	N/A	N/A	
2-09	Recreation Room	Ceiling	Wood	N/A	N/A	N/A	N/A	N/A	
2-10	Corridor	Floor	Vinyl Floor Tile 2	Asbestos	Homogeneous w/ 12348-B-53-02	PC** 1.6% Chrysotile	50 SF	Good	9" x 9" Beige with Brown and White Stripes **Indicates Stratified Point Count Method performed.
2-10	Corridor	Walls	Plaster	Asbestos	Homogeneous w / 12348-B-53-10	None Detected	300 SF	Good	
2-10	Corridor	Ceiling	Plaster	Asbestos	Homogeneous w / 12348-B-53-10	None Detected	50 SF	Good	
2-11	North Pole Hole	Floor	Vinyl Floor Tile 5	Asbestos	Homogeneous w/ 12348-B-53-05	None Detected	16 SF	Good	12" x 12" Beige with Brown and White Fleck
2-11	North Pole Hole	Walls	Plaster	Asbestos	Homogeneous w / 12348-B-53-10	None Detected	128 SF	Good	
2-11	North Pole Hole	Ceiling	Plaster	Asbestos	Homogeneous w / 12348-B-53-10	None Detected	16 SF	Good	
2-12	West Pole Hole	Floor	Vinyl Floor Tile 5	Asbestos	Homogeneous w/ 12348-B-53-05	None Detected	16 SF	Good	12" x 12" Beige with Brown and White Fleck
2-12	West Pole Hole	Walls	Drywall (DJC)	Asbestos	Homogeneous w/ 12348-B-53-07	None Detected	128 SF	Good	
2-12	West Pole Hole	Ceiling	Drywall (DJC)	Asbestos	Homogeneous w/ 12348-B-53-07	None Detected	16 SF	Good	

APPENDIX I - REASSESSMENT SURVEY FORM

Location Number	Location Name	Building System	Material Observed	Potential Hazardous Material	Sample ID	Analytical Result	Quantity	Condition	Notes / Recommended Actions
3-01	Fitness Room	Floor	Wood/Rubber	N/A	N/A	N/A	N/A	N/A	
3-01	Fitness Room	Walls	Brick	N/A	N/A	N/A	N/A	N/A	
3-01	Fitness Room	Ceiling	Plaster	Asbestos	12348-B-53-11a* 12348-B-53-11b* 12348-B-53-11c* 12348-B-53-11d* 12348-B-53-11e*	None Detected	N/A	N/A	*From ECOH Project No. 12180-B-53, dated July 2008
Surveyor's Field Notes									

APPENDIX II

RESULTS OF BULK SAMPLE ANALYSIS

(NO INFORMATION TO REPORT)

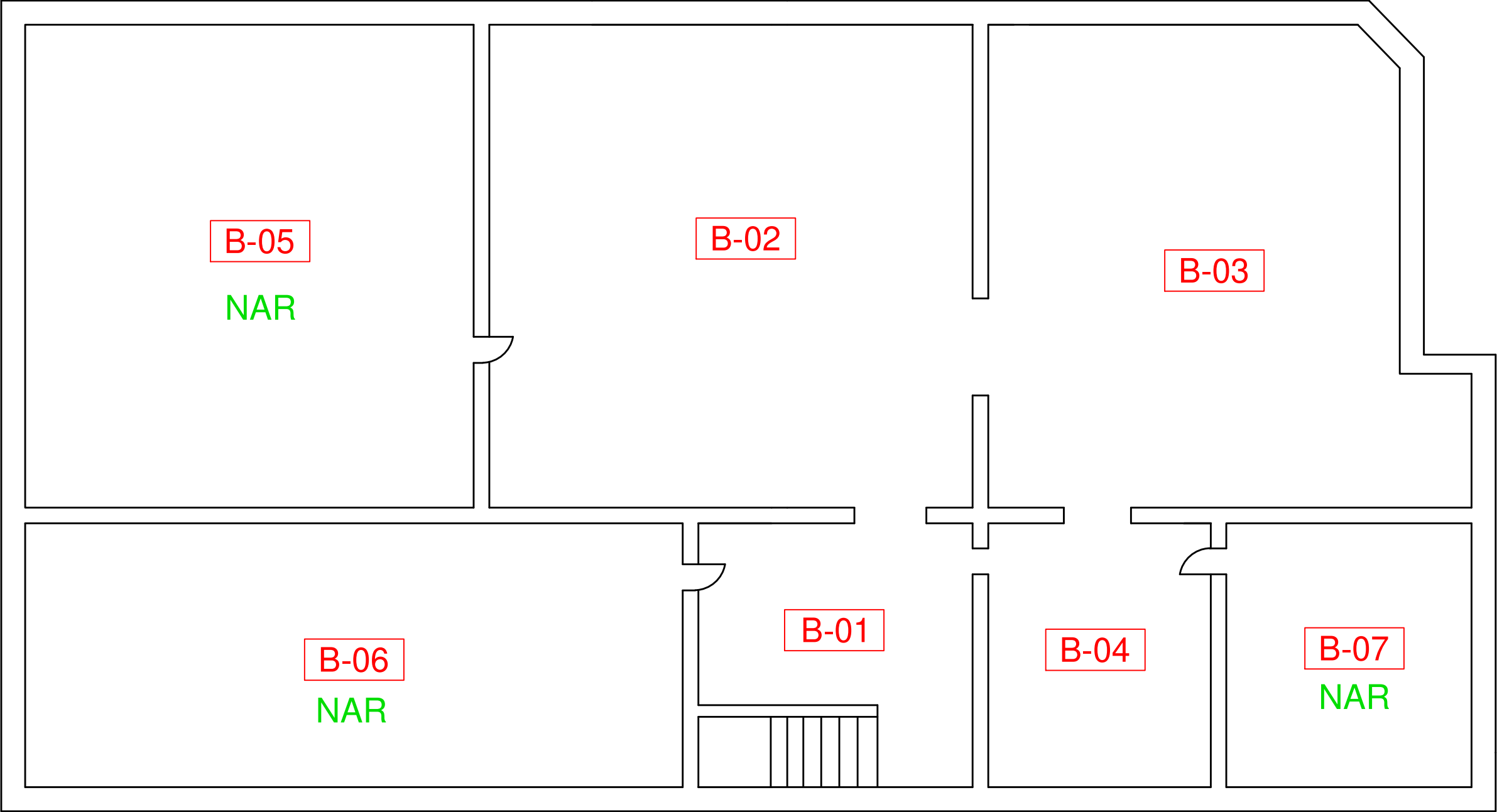
APPENDIX III

CORRECTIVE ACTIONS INSPECTION REPORT

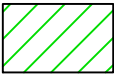
(NO INFORMATION TO REPORT)

APPENDIX IV

SURVEY DRAWINGS



Legend



Asbestos-Containing Material



Location Number

NAR

No Access to Room

The drawing does not illustrate locations of drywall joint compound, plaster, window caulking or roofing materials, for reasons discussed in Section 6 of the Standard Operating Procedure for Designated Substance Surveys. Please refer to the Designated Substance Survey Form in Appendix I for information regarding the locations and asbestos or lead-content of these materials.

Figure 1

LOCATION:
87 Main Street
Toronto, Ontario

BUILDING NAME:
Toronto Fire Station 226

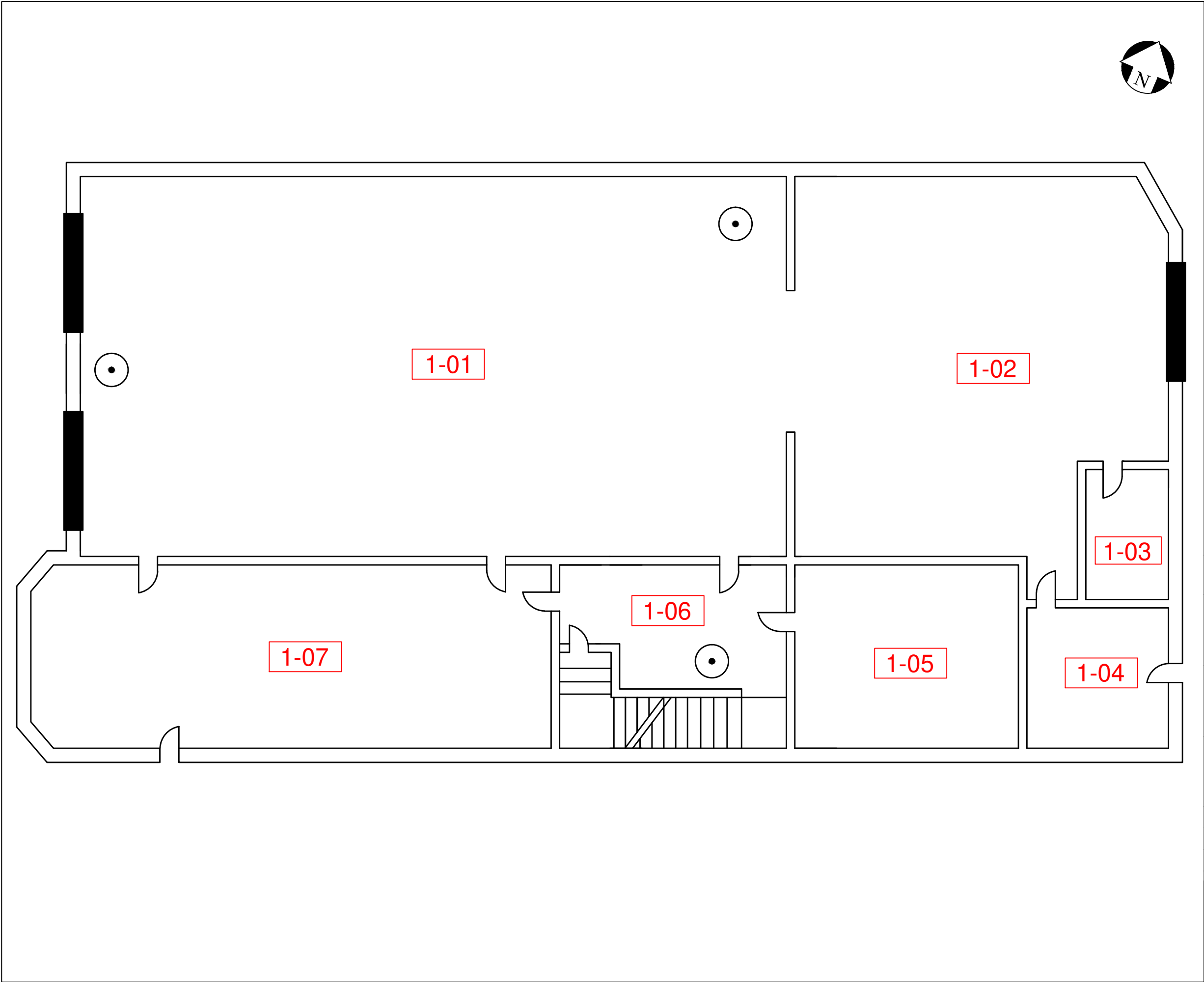
Basement Floor Plan
Asbestos-Containing Material Locations

CLIENT: City of Toronto

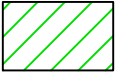
PROJECT NUMBER: FE-P 16-7715 DATE: JUNE 2016 DRW BY: AH

CAD FILE: Basement SCALE: Not to Scale CHK BY: MJ







Legend



Asbestos-Containing Material



Location Number



No Access to Room

The drawing does not illustrate locations of drywall joint compound, plaster, window caulking or roofing materials, for reasons discussed in Section 6 of the Standard Operating Procedure for Designated Substance Surveys. Please refer to the Designated Substance Survey Form in Appendix I for information regarding the locations and asbestos or lead-content of these materials.

Figure 2

LOCATION:


87 Main Street
Toronto, Ontario

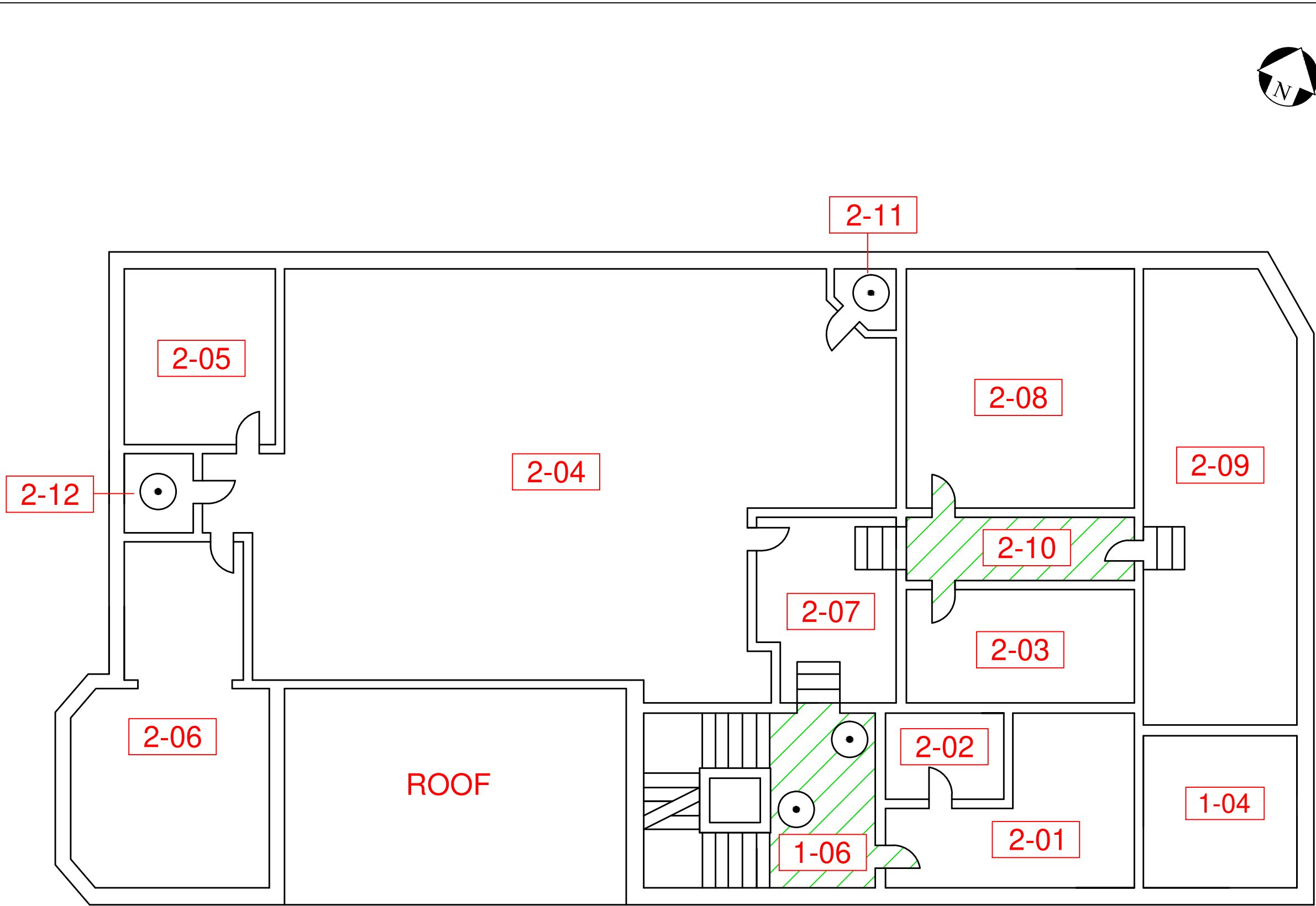
BUILDING NAME:

Toronto Fire Station 226

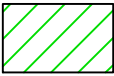
First Floor Plan
Asbestos-Containing Material Locations

CLIENT: City of Toronto		
PROJECT NUMBER: FE-P 16-7715	DATE: JUNE 2016	DRW BY: AH
CAD FILE: First Floor	SCALE: Not to Scale	CHK BY: MJ





Legend



Asbestos-Containing Material



Location Number

NAR

No Access to Room

The drawing does not illustrate locations of drywall joint compound, plaster, window caulking or roofing materials, for reasons discussed in Section 6 of the Standard Operating Procedure for Designated Substance Surveys. Please refer to the Designated Substance Survey Form in Appendix I for information regarding the locations and asbestos or lead-content of these materials.

Figure 3

LOCATION:
87 Main Street
Toronto, Ontario

BUILDING NAME:
Toronto Fire Station 226

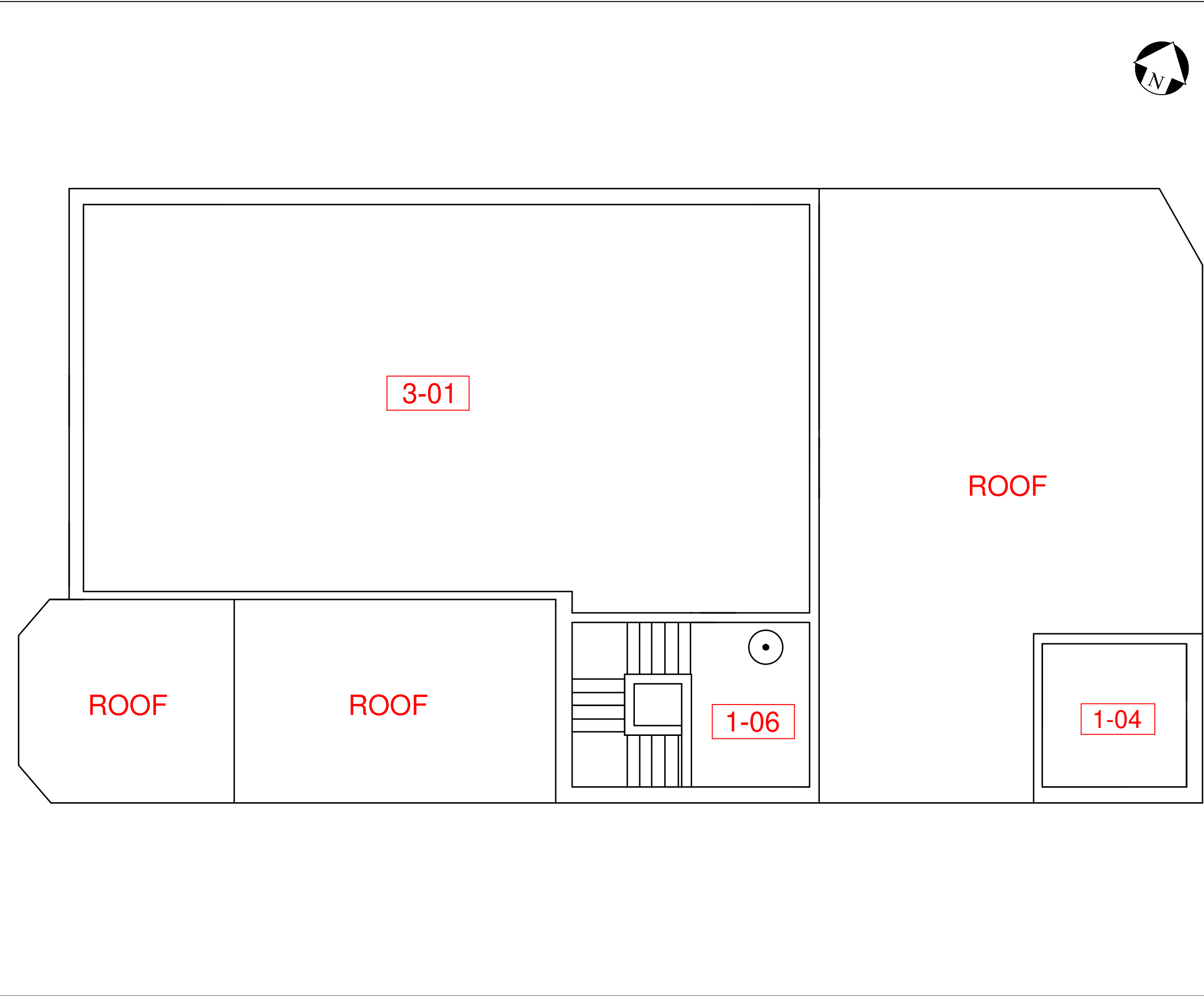
Second Floor Plan Asbestos-Containing Material Locations

CLIENT: City of Toronto

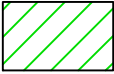
PROJECT NUMBER: FE-P 16-7715 DATE: JUNE 2016 DRW BY: AH

CAD FILE: Second Floor SCALE: Not to Scale CHK BY: MJ





Legend

Asbestos-Containing Material

1-01

Location Number

NAR

No Access to Room

The drawing does not illustrate locations of drywall joint compound, plaster, window caulking or roofing materials, for reasons discussed in Section 6 of the Standard Operating Procedure for Designated Substance Surveys. Please refer to the Designated Substance Survey Form in Appendix I for information regarding the locations and asbestos or lead-content of these materials.

Figure 4

LOCATION:


87 Main Street
Toronto, Ontario

BUILDING NAME:

Toronto Fire Station 226

Third Floor Plan
Asbestos-Containing Material Locations

CLIENT: City of Toronto		
PROJECT NUMBER: FE-P 16-7715	DATE: JUNE 2016	DRW BY: AH
CAD FILE: Third Floor	SCALE: Not to Scale	CHK BY: MJ



APPENDIX V

SITE PHOTOGRAPHS

(NO INFORMATION TO REPORT)

APPENDIX B2

Designated Substances Survey

313 Pharmacy Avenue

West Scarborough Community Centre

Issued December 2021, by Fisher Environmental Ltd.



ENGINEERING



LABORATORY



DESIGNATED SUBSTANCES SURVEY FOR ACCESSIBILITY UPGRADES (IBI GROUP)

**WEST SCARBOROUGH
COMMUNITY CENTRE
313 PHARMACY AVENUE
TORONTO, ONTARIO**

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Project No. FE-P 21-11706

December 15, 2021

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1.0. EXECUTIVE SUMMARY

Fisher Environmental Ltd. ('Fisher') was retained by IBI Group to carry out a survey for the Designated Substances and other potential hazardous materials within specified work area(s) for the West Scarborough Community Centre building, located at 313 Pharmacy Avenue, Toronto, Ontario, herein after referred to as the "Site". The site inspection and sampling works were conducted on November 10, 2021.

IBI Group has been commissioned by the City of Toronto to design and implement accessibility upgrades. The scope of the Designated Substances Survey (DSS) was to identify locations and types of designated substances within the building that may be impacted by the planned renovation work, and to provide recommendations for the safe handling or abatement of these materials, if any, prior to demolition.

The purpose of the project is to do the necessary construction and renovation at the locations are outlined on drawings provided by the IBI Group on October 27, 2021.

The survey was conducted in compliance with the Ontario Ministry of Labour (MOL) regulations for designated substances; O. Reg. 490/09 - *Designated Substances* and O. Reg. 278/05 - *Asbestos on Construction Projects and in Buildings and Repair Operations* made under the Occupational Health and Safety Act (OHSA), R.S.O. 1990.

Asbestos

Fisher was provided with the report of a previous DSS, which was conducted by ECOH Management Inc. on November 30, 2018. This report has indicated the following previously identified assumed and/or confirmed ACM within the specified work area(s):

- Caulking (windows/doors), and
- Texture Coat (confirmed)

In the current survey, twelve (12) bulk samples of building materials found within the specified work areas and that could potentially contain asbestos, were collected and submitted to Fisher Environmental Laboratories for Polarised Light Microscopy (PLM) analysis, as outlined in NIOSH Method 9002.

Based on the current results of laboratory analysis and information provided in the previous report, the following material are found to contain asbestos:

- Texture Coat on the ceilings within the specific work areas.

Based on the findings of the survey, Fisher recommendations are as follows:

- Provide a copy of this report to contractors bidding on or performing work within the subject work areas;



- Remove the asbestos-containing texture coat using Type 2 or Type 3 abatement procedures depending on the area to be removed, as outlined in O. Reg. 278/05.

Note: Fire doors, present within the specific work areas, may contain asbestos-containing thermal insulation inside the door panel. Removal of any asbestos containing fire doors, in intake condition, will require Type 1 to abatement procedures, as outlined in O. Reg. 278/05 and dispose of as asbestos waste.

Lead

Based on the age of the building, it is possible that lead-based paint and lead plumbing are present within the building. Lead can also be present in various ceramic tiles. During the current survey, eight (8) bulk samples of paint were collected and submitted to Fisher Environmental Laboratories for lead analysis. The results of analysis revealed the following:

- Elevated concentrations of lead were identified in the blue and black paint on the doors and door frames within specified work areas.
- Measurable concentration of lead was identified in the grey paint on the doors and door frames and the beige paint on the walls in the change rooms within the specified work areas.
- The lead concentrations in all other collected paints for analysis were below the limit of the detection for the analytical method used.

Fisher recommends that, prior to the planned renovation work, the removal of lead containing materials found within the specified work area(s), must be conducted using the appropriate lead abatement procedures. Lead abatement procedures to be used are determined by the method(s) of disturbance employed. Refer to *MOL Guideline: Lead on Construction Projects*, for details

Mercury

Mercury is presumed to be present in fluorescent light tubes and thermostatic controls. With the exception of fluorescent light bulbs and building thermostats, no other evidence of mercury was noted during the current survey. Prior to the planned renovation work, Fisher recommends that any presumed mercury-containing fluorescent light tubes and thermostats that will be impacted are to be removed and disposed of in accordance with O. Reg. 558/00.

Silica

No sampling for silica was conducted. However, as the building is constructed of concrete, brick and/or block walls with concrete floors, silica is expected to be found within these components of the buildings. If these materials will be disturbed during the planned renovation work, appropriate precautions should be taken to protect workers from inhaling silica dusts and debris. Refer to *MOL Guideline: Silica on Construction Projects* for details.



Other Designated Substances

The other Designated Substances would not be expected to be present at the Site. No immediate actions were recommended with regard to acrylonitrile, arsenic, benzene, coke oven emissions, ethylene oxide, isocyanates, and vinyl chloride.

Mould

During the current survey, no visible mould or favourable conditions for mould growth were observed in the specified work areas. No action is recommended with regard to mould.



2.0. INTRODUCTION

Fisher Environmental Ltd. ('Fisher') was retained by IBI Group to carry out a survey for the Designated Substances and other potential hazardous materials within specified work area(s) for the West Scarborough Community Centre building, located at 313 Pharmacy Avenue, Toronto, Ontario, herein after referred to as the "Site". The site inspection and sampling works were conducted on November 10, 2021.

IBI Group has been commissioned by the City of Toronto to design and implement accessibility upgrades. The scope of the Designated Substances Survey (DSS) was to identify locations and types of designated substances within the building that may be impacted by the planned renovation work, and to provide recommendations for the safe handling or abatement of these materials, if any, prior to demolition.

The purpose of the project is to do the necessary construction and renovation at the locations are outlined on drawings provided by the IBI Group on October 27, 2021.

3.0. REGULATIONS

The survey was conducted in compliance with the Ontario Ministry of Labour (MOL) regulations for designated substances; O. Reg. 490/09 - *Designated Substances* and O. Reg. 278/05 - *Asbestos on Construction Projects and in Buildings and Repair Operations* made under the Occupational Health and Safety Act (OHSA), R.S.O. 1990.

The OHSA, R.S.O. 1990, under the Ontario MOL, defines a toxic substance as a biological, chemical or physical agent (or a combination of such agents) whose presence in the workplace may endanger the health and safety of a worker. Sections of the Act that deals with toxic substances are intended to:

1. ensure that worker exposure to toxic substances is controlled;
2. ensure that toxic substances in the workplace are clearly identified and that workers are provided with enough information to be capable of handling them safely; and,
3. provide the general public with access to information about toxic substances used by industry in their communities.

The Act makes provision for a toxic substance to be "designated", where its use in the workplace is prohibited, regulated, restricted, limited or controlled. Designation is reserved for eleven substances that are particularly hazardous, covered under O. Reg 490/09 – *Designated Substances* that was implemented on July 1, 2010, and include Acrylonitrile, Arsenic, Asbestos, Benzene, Coke Oven Emissions, Ethylene Oxides, Isocyanates, Lead, Mercury, Silica, and Vinyl Chloride. Formerly, regulations for these substances were passed separately and each outlined exposure limits where workers were likely to inhale, ingest and / or absorb the substance.



O. Reg. 490/09 provides a consistent approach to dealing with existing requirements and provisions, and outlines steps required to control worker exposure to these substances, including by inhalation, ingestion, skin absorption or skin contact. Each designated substance has an allowable level of exposure based on a time-weighted average (TWA) limit, and may also have a short-term exposure limit (STEL) and / or ceiling limit (C) assigned to it. TWA refers to the time-weighted average airborne concentration of a biological or chemical agent to which a worker may be exposed in a work day or work week, STEL refers to the maximum airborne concentration of a biological or chemical agent to which a worker may be exposed in any 15 minute period, and C refers to the maximum airborne concentration of a biological or chemical agent to which a worker may be exposed at any time. Refer to O. Reg. 490/09 – *Designated Substances*.

A supplementary regulation regarding control of asbestos exposures in the construction industry has evolved into O. Reg. 278/05 – *Asbestos on Construction Projects and in Buildings and Repair Operations*. The regulation includes a definition of asbestos-containing materials (ACM), requirements for additional training and clearance air testing, procedures for determining materials that meet the definition of ACM and for the use of glove bags, and provisions for varying from measure and procedures set out in the regulation.

In addition to the OHSA and regulations regarding designated substances, the following regulations, guidelines and standards were also taken into account or referenced:

- O. Reg. 213/91 - *Construction Projects* regulated under the OHSA and last amended by O. Reg. 443/09;
- O. Reg. 558/00 made under the Ministry of Environment (MOE) Environmental Protection Act, amending O. Reg. 347 - *General Waste Management*;
- The Transport of Dangerous Goods Act (TDGA) provides regulations for the transport of asbestos-containing materials and wastes;
- MOL *Guideline: Lead on Construction Projects*, 2011; and,
- MOL *Guideline: Silica on Construction Projects*, 2011.

4.0. METHODOLOGY

Fisher followed the protocols outlined in O. Reg. 278/05 for collecting and analyzing bulk samples of materials suspected to contain asbestos. Visual assessment of the material was the primary method of identification with occasional physical contact for the purpose of collecting bulk samples or examining for underlying layers.

Where applicable, samples of suspect materials were collected in order to establish asbestos or lead content. Samples were grouped according to similarity of appearance (“homogeneous” materials). The frequency at which the samples were collected was sufficient to obtain a general representation of the presence of these materials at the Site. Samples collected are presumed to



be representative of respective building materials in-place at the Site. However, due to potential past renovations, alterations, repairs, or phases of construction, it is possible that individual materials may not be representative of samples collected.

Sampling of roofing materials was not part of the current scope of work. Further, sampling of materials found within operating equipment, portable building articles, or generally non-accessible components such as insulation within electrical switch gears, wiring, motors, light fixtures, elevator brakes, fire door cores, etc. was not performed as part of the current survey.

Samples collected during the survey were placed in plastic zip-lock bags which were labeled and submitted for laboratory analysis. Fisher Environmental Laboratories analyzed bulk samples for asbestos type and approximate percent content by performing polarized light microscopy (PLM), as outlined in NIOSH Method 9002. Fisher Environmental Laboratories analyzed samples for lead content in paint by performing acid digestion followed by Inductively Coupled Plasma (ICP) analysis.

Site Plan(s), indicating specific work area(s), bulk sample locations and any area(s) of asbestos, are included in Appendix A. The laboratory certificate(s) of analysis are included in Appendix B. Representative photos of Site conditions encountered at the time of the current survey are included in Appendix C.

5.0. REVIEW OF PREVIOUS REPORTS

Fisher was provided with the report of a previous DSS, which was conducted by ECOH Management Inc. on November 30, 2018, attached in Appendix D. This report has indicated the following previously identified assumed and/or confirmed ACM within the specified work area(s):

- Caulking (windows/doors), and
- Texture Coat (confirmed)

Details are provided in the summaries found in the asbestos sections of this report.

6.0. FINDINGS AND RECOMMENDATIONS

6.1. Acrylonitrile

Acrylonitrile would not be expected to be present at the Site and was not observed during the current survey. No recommendations for Acrylonitrile are warranted at this time.

6.2. Arsenic

Arsenic would not be expected to be present at the Site and was not observed during the current survey. No recommendations for Arsenic are warranted at this time.



6.3. Asbestos

6.3.1. General Information

Asbestos is the name given to a group of six different fibrous minerals (amosite, chrysotile, crocidolite, and the fibrous varieties of tremolite, actinolite and anthophyllite) that occur naturally in the environment. Asbestos minerals have separable long fibres that are strong and flexible enough to be spun and woven and are heat resistant.

Because of these characteristics, asbestos has been used for a wide range of manufactured goods, mostly in building materials (roofing shingles, ceiling and floor tiles, paper products, and asbestos cement products), friction products (automobile clutch, brake, and transmission parts), heat-resistant fabrics, packaging, gaskets, and coatings. Some vermiculite or talc products may also contain asbestos.

Asbestos fibres may be released into the air by the disturbance of ACM during product use, renovation or demolition work, building or home maintenance, repair and remodeling. In general, exposure may occur only when the ACM is disturbed in some way to release particles and fibres into the air.

6.3.2. Friable vs. Non-Friable ACM

Based on the requirements of O. Reg. 278/05 and due diligence, an asbestos survey and report must be available at any workplace where asbestos exists identifying locations and types of ACM in the building. The survey must include both friable and non-friable materials confirmed to contain asbestos, as well as any other materials which were not sampled but are suspected (presumed) ACM. The term friable refers to material(s) that could be readily reduced to dust or powder when crushed by hand or moderate pressure. Friable materials have a much greater chance of releasing airborne asbestos fibres when disturbed.

In the past, the most commonly used friable asbestos-containing building materials were surfacing materials (e.g. sprayed on fireproofing, texture, decorative or acoustic plaster) as well as thermal insulation. Examples of manufactured asbestos-containing materials include vinyl floor tiles, ceiling tiles, gasket materials, asbestos cement (Transite) pipes or boards, and asbestos textiles. Depending on the above noted formulation, these materials range from non-friable to friable. Although some products are considered non-friable when in Good condition, severe damage or deterioration may cause non-friable materials to generate airborne dust more readily. Severely damaged non-friable materials, or those to be worked on with powered tools, may be considered as friable ACM for abatement purposes.

Examples of common types of ACM by friability include:

- Friable ACM



- Sprayed Materials (or materials installed by roller or trowel), such as fireproofing, thermal insulation, texture finishes, etc.
 - Mechanical Insulation such as boiler and breeching, ductwork, piping, tanks and associated equipment.
 - Plaster
- Potentially Friable ACM
 - Acoustic Ceiling Tiles
 - Vinyl Sheet Flooring
- Non-Friable ACM
 - Vinyl Floor Tiles
 - Asbestos cement (“Transite”) piping or paneling
 - Window Caulking

6.3.3. Regulations

Exposure to asbestos is controlled by two Regulations passed under Ontario’s Occupational Health and Safety Act (OHSA), R.R.O. 1990.

- O. Reg. 490/09 – *Designated Substances* regarding asbestos applies to:
 - every employer operating a mine for the purpose of mining, crushing, grinding or sifting asbestos;
 - every employer processing, adapting or using asbestos in connection with manufacturing or assembling of goods or products;
 - every employer engaged in the repair, alteration or maintenance of machinery, equipment, aircraft, ships, locomotives, railway cars and vehicles;
 - every employer engaged in work on a building that is necessarily incidental to the repair, alteration or maintenance of machinery or equipment; and,
 - to those workers of such employers who are likely to be exposed to asbestos.

Exposure limits for this substance are set at 0.1 f/cc (TWA) for all types of asbestos.

- O. Reg. 278/05 - *Asbestos on Construction Projects and in Buildings and Repair Operations* applies to buildings that contain friable and non-friable ACM and to the repair, alteration and/or maintenance of these buildings.

In addition to regulations for controlling work around asbestos-containing building materials there are regulations for packaging, transportation and disposal of asbestos-containing waste:

- O. Reg. 558/00 made under the Ministry of Environment (MOE) Environmental Protection Act, amending O. Reg. 347 - *General Waste Management*; and,
- The Transport of Dangerous Goods Act (TDGA) provides regulations for the transport of asbestos-containing materials and wastes.



6.3.4. Findings

Samples of homogenous materials suspected to contain asbestos were collected and submitted for analysis. Fisher collected twelve (12) bulk samples of building materials found within the specified work areas and that could potentially contain asbestos. Findings of all building materials identified within the specified work area(s) are outlined in further detail below.

6.3.4.1. Sprayed or Troweled Fireproofing and Thermal Insulation

No indication of sprayed or troweled fireproofing and / or thermal insulation was noted in any of the specified work areas during the current survey.

6.3.4.2. Texture Finish

Texture finish was noted on the ceilings at multiple locations within the specific work areas. The previous report indicated that three (3) samples of the texture finish were collected and analyzed. **The results of analysis revealed that the texture finish on ceilings contains asbestos.**

6.3.4.3. Mechanical Insulation

The majority of mechanical insulation observed throughout the building are either not insulated or are insulated with fiberglass which is not suspected to contain asbestos.

6.3.4.4. Acoustic Ceiling Tile

During the current survey, three (3) visually distinct styles of ceiling tiles were observed within the specified work areas.

- Ceiling Tile 1 (2'x4' Pinprick with Fissures)
- Ceiling Tile 2 (1'x1' glued-on with Small, Medium Holes) and
- Ceiling Tile 3 (2'x4' Long Fissures)

The previous report confirmed that Ceiling Tile 1, Ceiling Tile 2 and Ceiling Tile 3 were sampled for analysis. The results of analysis revealed that all styles of ceiling tiles do not contain asbestos.

6.3.4.5. Plaster / Drywall Joint Compound

Plaster was not observed within the specified work areas at the Site.

Drywall Joint Compound (DJC) was observed at multiple locations within the specific work areas. The previous report indicated that six (6) samples of the DJC were collected for analysis. The results of analysis revealed that the DJC does not contain asbestos.

6.3.4.6. Asbestos Cement Products

No asbestos cement products, such as Transite pipe or board, were noted in any of the specified work areas during the current survey.



6.3.4.7. Vinyl Sheet Flooring

Vinyl Sheet Flooring 1 (VSF 1) - Peach with Black Dots, was observed in the kitchen on the ground floor and within the specified work areas during the current survey. The previous report indicated that three (3) samples of the VSF 1 were collected for analysis. The results of analysis revealed that the VSF 1 does not contain asbestos.

6.3.4.8. Vinyl Floor Tile

During the current survey, four (4) varieties of vinyl floor tile were observed within the specified work areas.

- Vinyl Floor Tile 1 – 12"×12", Cream with Brown Specks
- Vinyl Floor Tile 4 – 12"×12", Blue with White Marks
- Vinyl Floor Tile 5 – 12"×12", Light Brown with Streaks
- Vinyl Floor Tile 7 – 12"×12", White with Black Marks

The previous report confirmed that these varieties of vinyl floor tiles were sampled for analysis. The results of analysis revealed that all these varieties of vinyl floor tiles do not contain asbestos.

6.3.4.9. Other ACM

Tan Caulking

Tan caulking was observed along the joint of the door frames and the block walls in the basement within the specific work areas. Three (3) samples of the tan caulking were collected for analysis. The results of analysis revealed that the tan caulking does not contain asbestos.

White Caulking

White caulking was observed along the joint of the countertop and the walls in the kitchen within the specific work areas. Three (3) samples of the white caulking were collected for analysis. The results of analysis revealed that the white caulking does not contain asbestos.

Cream Caulking

Cream caulking was observed around the door frames on the first floor within the specific work areas. Three (3) samples of the cream caulking were collected for analysis. The results of analysis revealed that the cream caulking around the door frames does not contain asbestos.

Brown Caulking

Brown caulking observed along the joint of the door frame and the block wall in the stairway near pool area within the specific work areas. Three (3) samples of the brown caulking were collected for analysis. The results of analysis revealed that the brown caulking does not contain asbestos.



6.3.5. Recommendations

Prior to demolition or any renovation activities, all asbestos-containing materials must be removed from the specified work areas in accordance with O. Reg. 278/05 - *Asbestos on Construction Projects and in Buildings and Repair Operations*, and be disposed of at an MOE licensed landfill in accordance with O. Reg. 558/00 (amending O. Reg. 347, *General – Waste Management*).

Refer to attached Site Plans in Appendix A, which illustrate where the ACM is located within the specified work areas.

Specifically, Fisher recommends the following:

- Provide a copy of this report to contractors bidding on or performing work within the subject work areas;
- Remove the asbestos-containing texture coat using Type 2 or Type 3 abatement procedures depending on the area to be removed, as outlined in O. Reg. 278/05.

Note: Fire doors, present within the specific work areas, may contain asbestos-containing thermal insulation inside the door panel. Removal of any asbestos containing fire doors, in intake condition, will require Type 1 to abatement procedures, as outlined in O. Reg. 278/05 and dispose of as asbestos waste.

The presence of ACM should be presumed in locations not accessed during this survey. It is possible that ACM is present at the Site that is not identified in this report. Should additional suspected ACM be discovered, it should be presumed as ACM until sample analysis determines asbestos content.

Due to the limited nature of the current scope of work and the presence of solid building finishes (i.e., drywall walls and ceilings etc.) in many locations, the full extent of ACM may not be confirmed. Precautions should be taken when dismantling solid wall or ceiling finishes, or any other building surfaces which may conceal potential ACM. Such precautions include, but are not limited to, isolation measures and appropriate personal protective equipment.

6.4. Benzene

Benzene would not be expected to be present at the Site and was not observed during the current survey. No recommendations for Benzene are warranted at this time.

6.5. Coke Oven Emissions

Coke oven emissions would not be expected to be present at the Site and were not observed during the current survey. No recommendations for coke oven emissions are warranted at this time.



6.6. Ethylene Oxides

Ethylene oxides would not be expected to be present at the Site and were not observed during the current survey. No recommendations for ethylene oxides are warranted at this time.

6.7. Isocyanates

Isocyanates would not be expected to be present at the Site and were not observed during the current survey. No recommendations for isocyanates are warranted at this time.

6.8. Lead

6.8.1. General Information

Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. Most lead in the environment comes from human activities such as burning fossil fuels, mining and manufacturing. Lead is used in the production of batteries, ammunition, metal products (solder and pipes) and X-ray devices.

Lead does not break down but lead compounds are changed by sunlight, air and water. Exposure occurs when eating food or drinking water that contains lead. Deteriorated lead paint can contribute to lead dust. The main target for lead toxicity is the nervous system.

6.8.2. Regulations and Guidelines

The Ontario MOL has not prescribed criteria defining an analyzed sample of bulk material as "lead-containing". Further, the MOL has not established a lower limit for concentrations of lead in paint, below which precautions do not need to be considered during construction projects. However, except for very aggressive disturbance of painted finishes, (e.g., abrasive blasting, torch cutting, or grinding), Fisher believes that a lead content below 0.1% by weight (1,000 ug/g or 1000 ppm) represents a concentration in which the lead content is not the limiting hazard for construction hygiene purposes. Regular construction dust suppression techniques and worker hygiene practices are sufficient for disturbance of paint finishes determined to contain less than 0.1% lead by weight, provided that work is limited to non-aggressive operations.

The regulation for the designated substance lead applies to every employer and worker at a workplace where lead is present, produced, processed, used, handled or stored and at which a worker is likely to be exposed to lead. Exposure limits for this substance are set at 0.05 – 0.10 mg/m³ (TWA) depending on the type of lead, and for tetraethyl lead 0.30 mg/m³ (STEL).

Additionally, in 2011 the MOL revised *Guideline: Lead on Construction Projects* outlining practices that should be followed during construction projects to protect workers' from exposure to lead. This includes the methods and equipment employed in the removal of lead-containing coatings that reduce the creation of dust, providing appropriate facilities for workers to wash after each shift, and providing protective clothing and respirators where necessary.



6.8.3. Findings

Based on the age of the building, it is possible that lead-based paint and lead plumbing are present within the building. Lead can also be present in various ceramic tiles. During the current survey, eight (8) paint samples were collected for lead analysis.

The results of analysis revealed the following:

- Elevated concentrations of lead were identified in the blue and black paint on the doors and door frames within specified work areas.
- Measurable concentration of lead was identified in the grey paint on the doors and door frames and the beige paint on the walls in the change rooms within the specified work areas.
- The lead concentrations in all other collected paints for analysis were below the limit of the detection for the analytical method used.

6.8.4. Recommendations

Where any lead-containing materials may be disturbed or removed, Fisher recommends that appropriate lead abatement procedures be used. The lead abatement procedures to be used are determined by the method(s) of disturbance employed. Regular construction dust suppression techniques and worker hygiene practices are sufficient for disturbance of paint finishes determined to contain less than 0.1% lead by weight, provided that work is limited to non-aggressive operations. The table below outlines lead abatement operations and associated respirator required, as outlined in Ontario MOL guidelines.

Classifications of Lead-Containing Operations and Required Respirator

Type 1 Operations (where concentrations of airborne lead would be expected to be < 0.05 mg/m ³)	
Activities that include; <ul style="list-style-type: none"> • Removal of lead containing coatings with chemical gel or paste and fibrous laminated cloth wrap • Removal of lead containing coatings / materials using power tool that has an effective dust collection system equipped with HEPA filter • Removal of lead containing coatings / materials using non-powered hand tools other than manual scraping or sanding 	Respirators should not be necessary if general procedures are followed and level of air is less than 0.05 mg/m ³ . However, if worker wishes to use a respirator, a half-mask particulate respirator with N-, R- or P-series filter, and 95, 99 or 100% efficiency should be provided.
Type 2a Operations (where concentrations of airborne lead would be expected to be > 0.05 to 0.50 mg/m ³)	
Activities that include; <ul style="list-style-type: none"> • Removal of lead containing coatings / materials by scraping or sanding using non-powered hand tools • Manual demolition of lead painted plaster walls / building components by striking with a sledgehammer or similar tool 	NIOSH APF = 10 Half-mask particulate respirator with N-, R- or P- series filter, and 95, 99 or 100% efficiency.
Type 2b Operations (where concentrations of airborne lead would be expected to be > 0.50 to 1.25 mg/m ³)	
Not applicable to potential renovation activities.	
Type 3a Operations (where concentrations of airborne lead would be expected to be > 1.25 to 2.50 mg/m ³)	
Activities that include;	NIOSH APF = 50



<ul style="list-style-type: none"> • Welding or high temperature cutting of lead-containing coatings or materials indoors or in a confined space. • Dry removal of lead-containing mortar using an electronic or pneumatic cutting device. • Burning of a surface containing lead • Removal of lead containing coatings / materials using power tools without an effective dust collection system equipped with HEPA filter 	<p>Full-face piece air-purifying respirator with N-, R- or P- series filter and 100% efficiency.</p> <p>Tight-fitting powered air-purifying respirator with high efficiency filter.</p> <p>Full-face piece supplied-air respirator operated in demand mode.</p> <p>Half-mask or full-face piece supplied air respirator operated in continuous-flow mode.</p>
Type 3b Operations (where concentrations of airborne lead would be expected to be > 2.50 mg/m ³)	
Abrasive blasting of lead-containing coatings or materials.	<p>NIOSH APF ≥1000</p> <p>Type CE abrasive-blast supplied respirator operated in a positive pressure mode with a tight-fitting half-mask face piece.</p>

Refer to MOL *Guideline: Lead on Construction Projects, 2011*, for details of the Ministry's health and safety guidelines regarding lead.

6.9. Mercury

6.9.1. General Information

Mercury is a naturally occurring metal. It is a shiny, silver-white and odourless liquid. It combines with other elements to form inorganic compounds or salts. Metallic mercury is used to produce chlorine gas and caustic soda, and is used in thermostats and thermometers, fluorescent light bulbs, dental fillings and batteries. Exposure occurs when eating fish or shellfish contaminated with methyl mercury, breathing vapors from spills, incinerators, etc.

The nervous system is very sensitive to all forms of mercury. Exposure to high levels of metallic inorganic or organic mercury can permanently damage the brain, kidneys and developing fetus. Short-term exposure may cause lung damage, nausea, vomiting and diarrhea as well as skin and eye irritation.

6.9.2. Regulations

The regulation for mercury applies to every employer and worker at a workplace where mercury is present, produced, processed, used, handled or stored and at which a worker is likely to be exposed to mercury. Exposure limits for this substance are set at 0.025 – 0.01 mg/m³ (TWA) for all forms of mercury excluding alkyl, and for alkyl compounds of mercury 0.03 mg/m³ (STEL).

6.9.3. Findings

Mercury is presumed to be present in fluorescent light tubes and thermostatic controls. With the exception of fluorescent light bulbs and building thermostats, no other evidence of mercury was noted during the current survey.



6.9.4. Recommendations

Prior to the planned renovation work, Fisher recommends that any presumed mercury-containing fluorescent light tubes and thermostats that will be impacted are to be removed and disposed of in accordance with O. Reg. 558/00.

6.10. Silica

6.10.1. General Information

Silica is a crystalline compound occurring abundantly as quartz, sand, and many other minerals, and used to manufacture a variety of materials, especially glass and concrete. When mining this substance, silica can be deadly when it becomes airborne. If inhaled, silica dust can cause silicosis which can be fatal.

Some of the following industries have a high potential for risk to workers: construction (sandblasting, rock drilling, masonry work, jack hammering, tunneling), mining (cutting or drilling through sandstone or granite), foundry work (grinding, mouldings, shakeout, core room), stone cutting (sawing, abrasive blasting, chipping, grinding), manufacturing and use of abrasives, etc.

6.10.2. Regulations

The regulation for silica applies to every employer and worker at a workplace where silica is present, produced, processed, used, handled or stored and at which a worker is likely to be exposed to silica. Exposure limits for this substance are set at 0.05 - 0.10 mg/m³ (TWA), depending on the type of silica.

Additionally, in 2011 the MOL revised *Guideline: Silica on Construction Projects* outlining practices that should be followed during construction projects to protect workers' from exposure to silica. This includes the methods and equipment employed in the removal of silica-containing materials that reduce the creation of dust, providing appropriate facilities for workers to wash after each shift, and providing protective clothing and respirators where necessary.

6.10.3. Findings

No sampling for silica was conducted. However, as the building is constructed of concrete, brick and/or block walls with concrete floors, silica is expected to be found within these components of the buildings.

6.10.4. Recommendations

If these materials will be disturbed during the planned renovation work, appropriate precautions should be taken to protect workers from inhaling silica dusts and debris. Refer to MOL *Guideline: Silica on Construction Projects* for details.



6.11. Vinyl Chloride

Vinyl chloride would not be expected to be present at the Site and was not observed during the current survey. No recommendations for vinyl chloride are warranted at this time.

6.12. Mould

During the current survey, no visible mould or favourable conditions for mould growth were observed in the specified work areas. No action is recommended with regard to mould.

7.0. LIMITATIONS

Fisher Environmental Ltd. accepts responsibility for the competent performance of its duties in executing this assignment within the normal standards of the profession, but disclaims responsibility for consequential damages, if any.

The scope of the survey is based on prior agreement with the client, and the rationale given in this report. The survey findings rely on professional interpretation of selective sampling and analysis. Sample analysis results have been applied to homogenous materials in unsampled locations; it was not within the scope of work to carry out an exhaustive sampling and analysis program. For non-accessible building spaces, the likelihood of the presence or absence of asbestos and other designated substances has been described, but such assessment is not a definitive statement of presence or absence.

This report was prepared for the IBI Group. The scope of services performed may not be appropriate for the purposes of other users, and any use or reuse of this document or its findings or recommendations represented herein is at the sole risk of any other user.

We trust that the information provided in the report meets your current requirements. If you have any questions or concerns, please do not hesitate to contact the undersigned.

Respectfully submitted,



Iqbal Fattah, M.Sc.
Project Manager

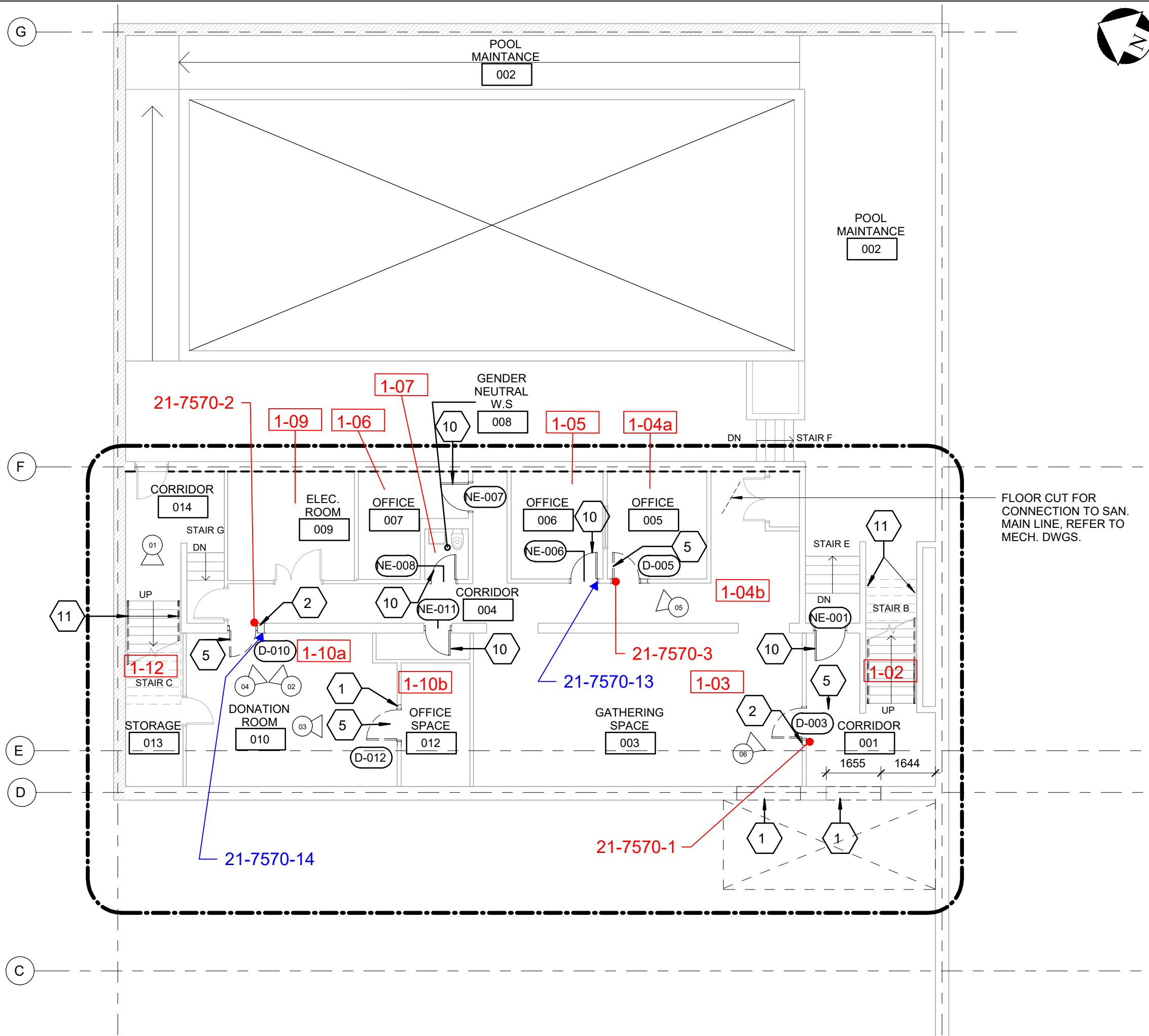


David Fisher, P. Eng., C. Chem.
Principal



APPENDIX A – SITE PLANS





Legend



Area of Work

1-01

Location Number



Asbestos Sample Location



Lead Sample Location

Figure 1

LOCATION:
313 Pharmacy Avenue
Toronto, Ontario

BUILDING NAME:
West Scarborough Community Centre

Basement Floor Plan
Asbestos and Lead Sample Locations

CLIENT:
IBI Group

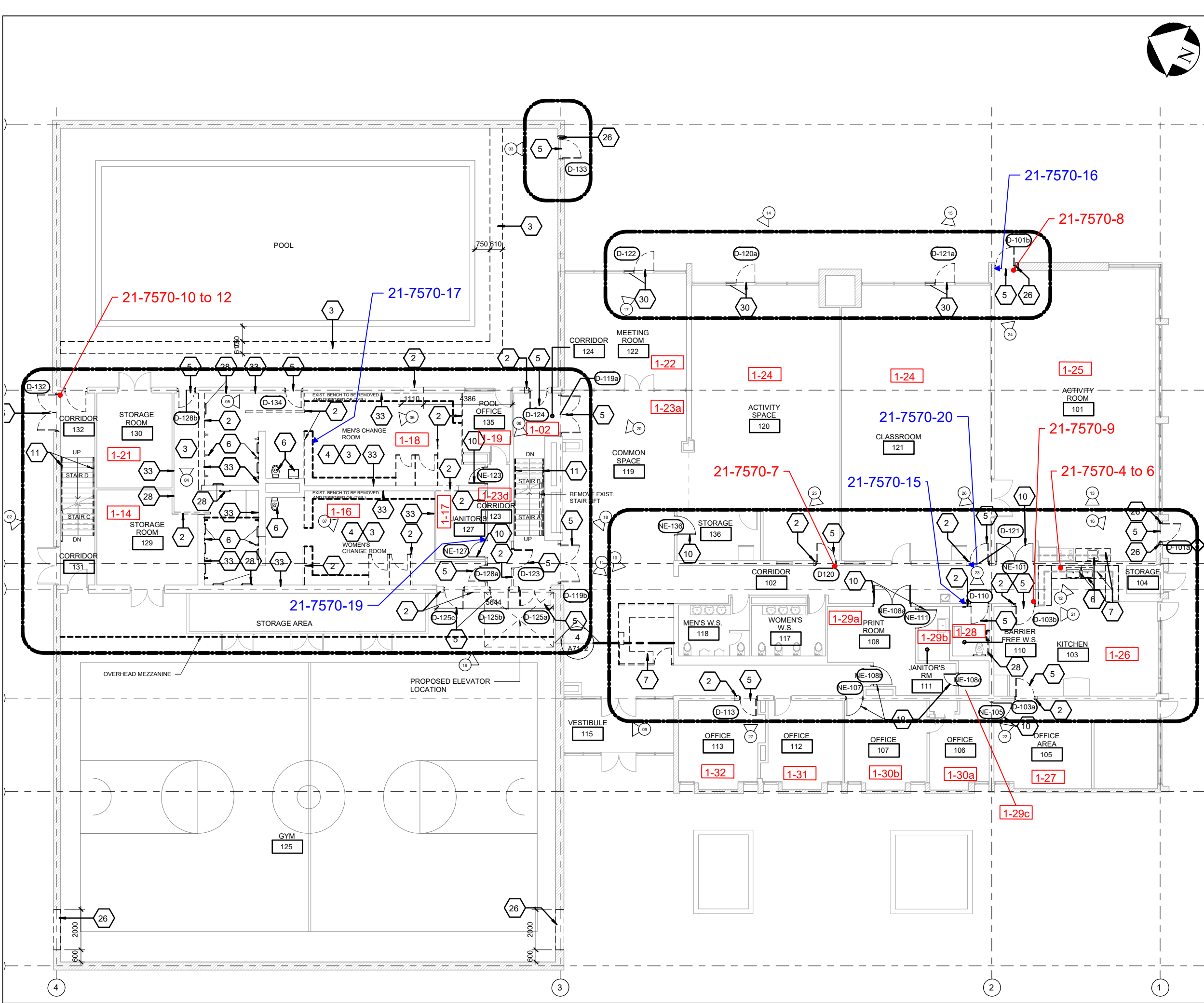
PROJECT NUMBER: FE-P 21-11706 DATE: November 2021 DRW BY: ZA

CAD FILE: FIG1 SCALE: Not to Scale CHK BY: IF



400 Esna Park Dr., #15
Markham, Ontario
L3R 3K2

Tel: 905 475-7755
Fax: 905 475-7718



Legend


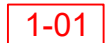


-  Area of Work
-  Location Number
-  Asbestos Sample Location
-  Lead Sample Location

Figure 2

LOCATION: 313 Pharmacy Avenue
Toronto, Ontario

BUILDING NAME: West Scarborough Community Centre

First Floor Plan
Asbestos and Lead Sample Locations

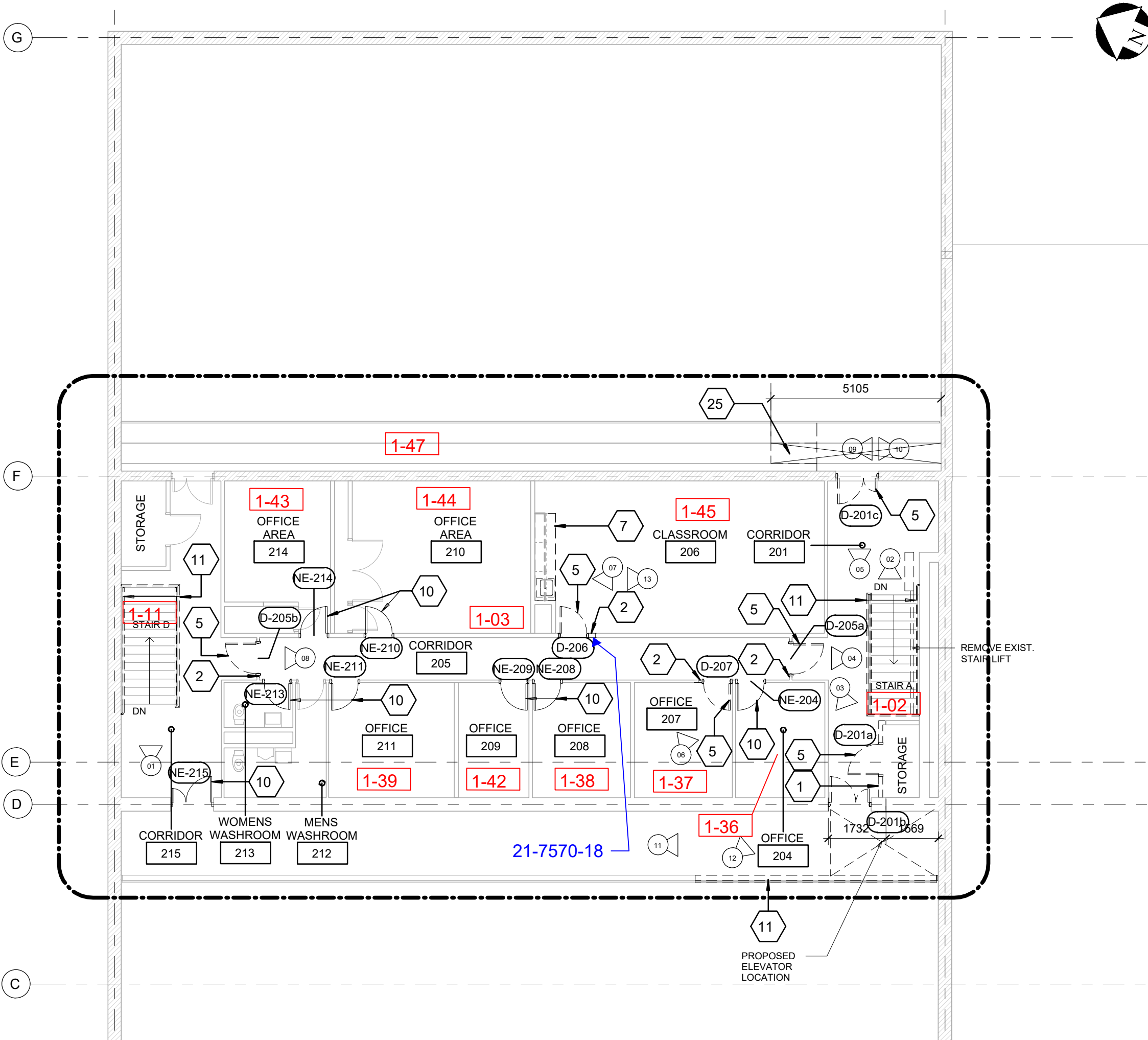
CLIENT: IBI Group

PROJECT NUMBER: FE-P 21-11706	DATE: November 2021	DRW BY: ZA
CAD FILE: FIG2	SCALE: Not to Scale	CHK BY: IF



400 Esna Park Dr., #15
Markham, Ontario
L3R 3K2

Tel: 905 475-7755
Fax: 905 475-7718



Legend



Area of Work

1-01

Location Number



Lead Sample Location

Figure 3

LOCATION:
313 Pharmacy Avenue
Toronto, Ontario

BUILDING NAME:
West Scarborough Community Centre

Second Floor Plan
Lead Sample Locations

CLIENT: IBI Group

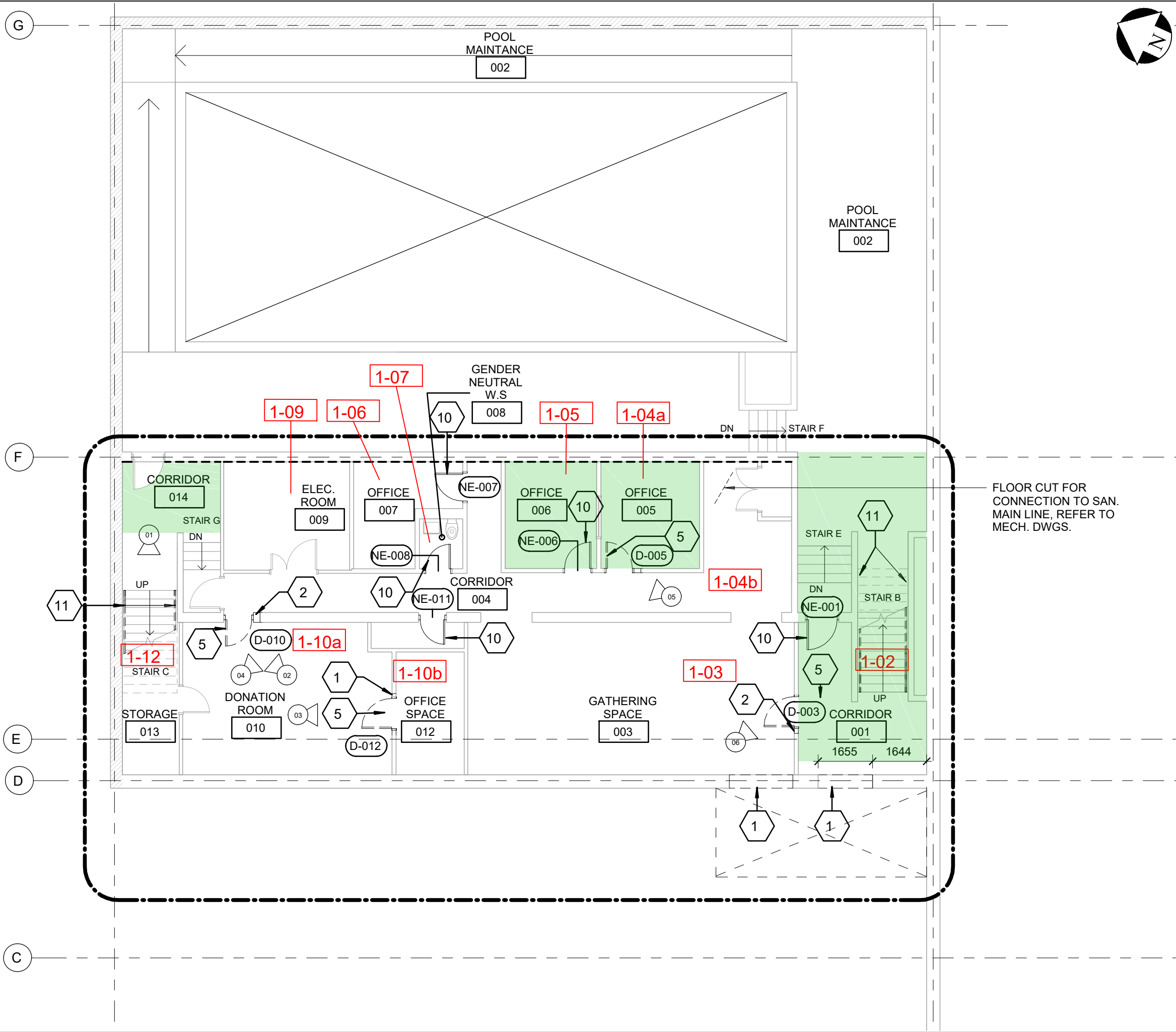
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Legend

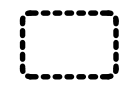
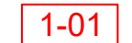

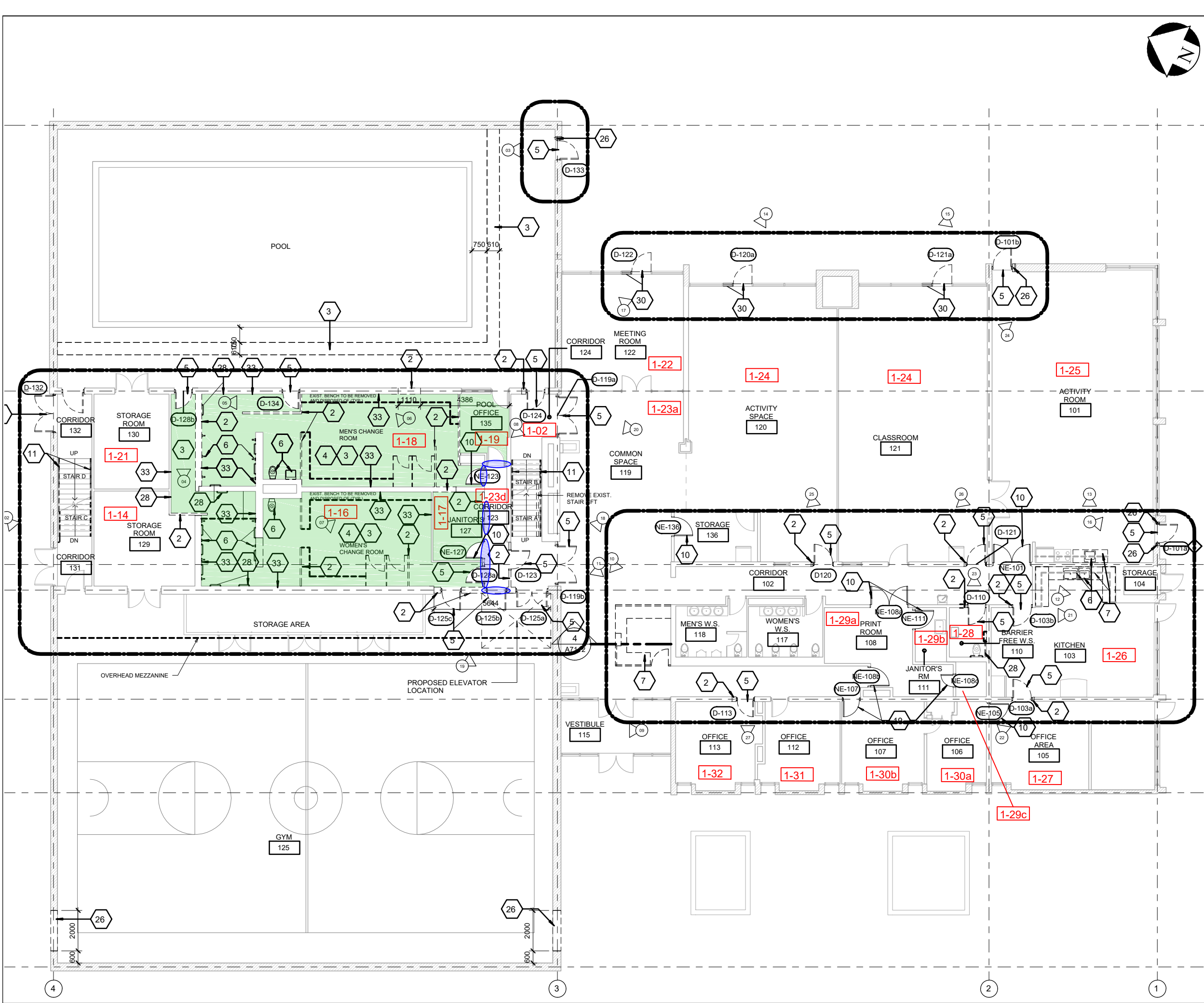
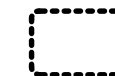
-  Area of Work
-  Location Number
-  Asbestos-Containing Texture Coat on Ceiling

Figure 4

LOCATION:		
313 Pharmacy Avenue Toronto, Ontario		
BUILDING NAME:		
West Scarborough Community Centre		
Basement Floor Plan Asbestos- Containing Material Locations		
CLIENT:		
IBI Group		
PROJECT NUMBER:	FE-P 21-11706	DATE: December 2021
DRW BY:	ZA	
CAD FILE:	FIG4	SCALE: Not to Scale
CHK BY:	IF	
		
400 Esna Park Dr., #15 Markham, Ontario L3R 3K2		
Tel: 905 475-7755 Fax: 905 475-7718		



Legend



Area of Work

1-01

Location Number



Asbestos-Containing Texture Coat on Ceiling



Lead-Containing Light-Green Paint

Figure 5

LOCATION:
313 Pharmacy Avenue
Toronto, Ontario

BUILDING NAME:
West Scarborough Community Centre

First Floor Plan
Asbestos- Containing Material Locations and
Lead- Containing Paint Locations

CLIENT:
IBI Group

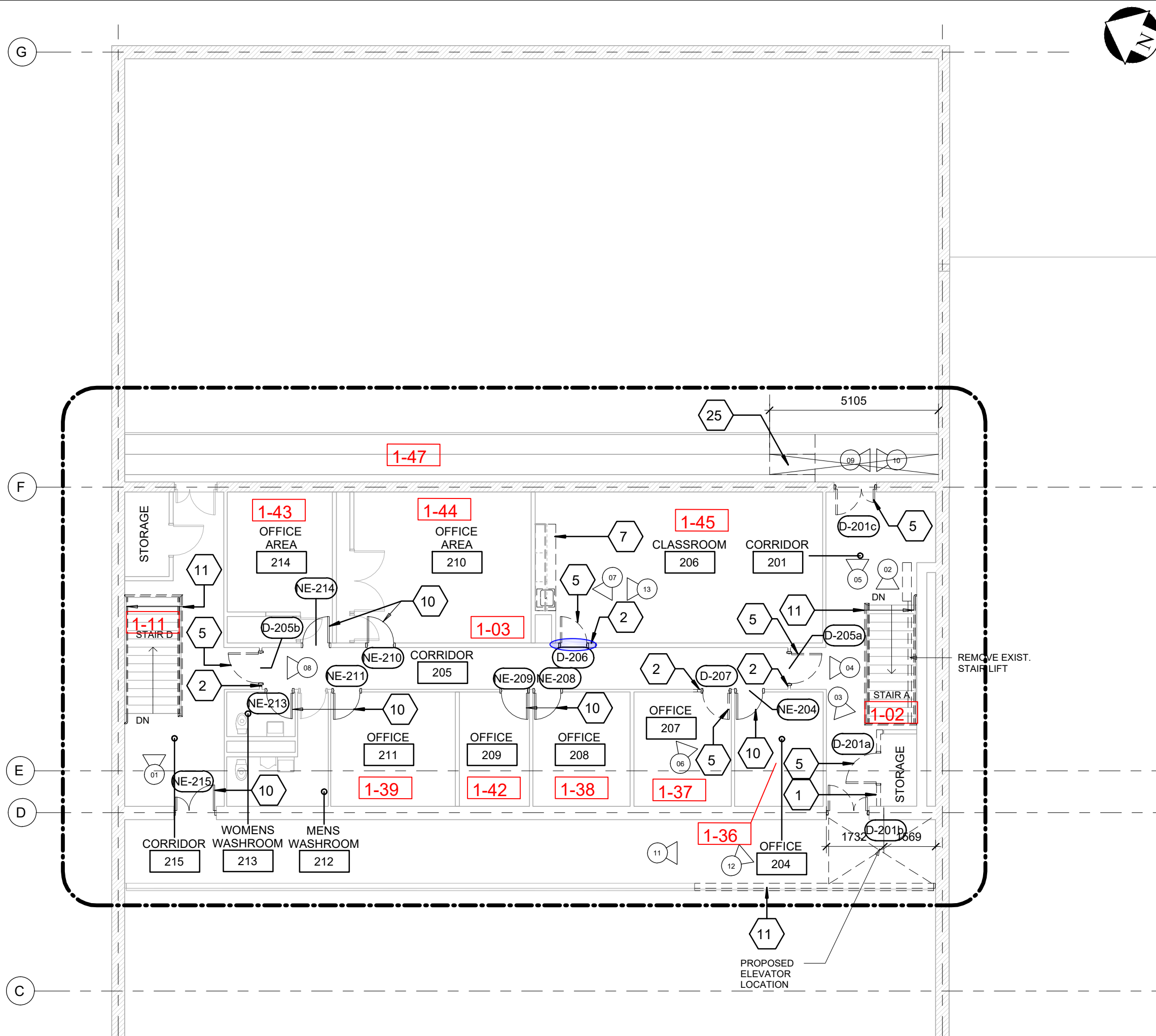
PROJECT NUMBER: FE-P 21-11706 **DATE:** November 2021 **DRW BY:** ZA

CAD FILE: FIG5 **SCALE:** Not to Scale **CHK BY:** IF

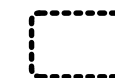


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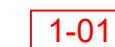
Tel: 905 475-7755
Fax: 905 475-7718



Legend



Area of Work



Location Number



Lead-Containing Light-Green Paint

Figure 6

LOCATION:
313 Pharmacy Avenue
Toronto, Ontario

BUILDING NAME:
West Scarborough Community Centre

Second Floor Plan
Lead- Containing Paint Locations

CLIENT: IBI Group

PROJECT NUMBER: FE-P 21-11706 DATE: November 2021 DRW BY: ZA

CAD FILE: FIG6 SCALE: Not to Scale CHK BY: IF



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APPENDIX B – CERTIFICATE OF ANALYSIS





FISHER ENVIRONMENTAL LABORATORIES

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Client: IBI Group
Address: 100-175 Galaxy Blvd.
Toronto, ON
M9W 0C9
Tel.:
E-mail:
Attn: Luisa Sosa

F.E. Job #: 21-7570
Project Name: DSS
Project ID: FE-P 21-11706
Date Sampled: 10-Nov-2021
Date Received: 19-Nov-2021
Date Reported: 29-Nov-2021
Location: 313 Pharmacy Avenue

Certificate of Analysis

Analysis Requested:	Asbestos, Lead
Sample Description:	20 Bulk Sample(s)

Sample Matrix and Client Sample Description	Client Sample Location	Lab Sample ID	Asbestos Content and Fibre Type
1A - Tan Caulking	Loc. 1-02, Stairwell, along the Joint of the Door Frame and the Block Wall	21-7570-1	Not Detected
1B - Tan Caulking	Loc. 1-10A, Craft Room, along the Joint of the Door Frame and the Block Wall	21-7570-2	Not Detected
1C - Tan Caulking	Lac. 1-04a, Office Room, along the Joint of the Door Frame and the Block Wall	21-7570-3	Not Detected
2A - White Caulking	Loc. 1-26, along the Joint of the Countertop and the Wall	21-7570-4	Not Detected
2B - White Caulking	Loc. 1-26, along the Joint of the Countertop and the Wall	21-7570-5	Not Detected
2C - White Caulking	Loc. 1-26, along the Joint of the Countertop and the Wall	21-7570-6	Not Detected
3A- Cream Caulking	Loc. 1-24, Activity Room, around the Door Frame	21-7570-7	Not Detected
3B- Cream Caulking	Loc. 1-25, Lounge, around the Door Frame	21-7570-8	Not Detected
3C- Cream Caulking	Loc. 1-26, Kitchen, around the Door Frame	21-7570-9	Not Detected

Certificate of Analysis

Analysis Requested:	Asbestos, Lead
Sample Description:	20 Bulk Sample(s)

4A - Brown Caulking	Loc. 1-11, Ground Floor, around the Door Frame	21-7570-10	Not Detected
4B - Brown Caulking	Loc. 1-11, Ground Floor, around the Door Frame	21-7570-11	Not Detected
4C - Brown Caulking	Loc. 1-11, Ground Floor, around the Door Frame	21-7570-12	Not Detected

Fisher Environmental Laboratories (Lab ID #: 2745) is accredited by CALA (Canadian Association for Laboratory Accreditation Inc.) for asbestos analysis by PLM.

ANALYTICAL METHOD:

Asbestos has been done in accordance with normal professional standard using the following Fisher Environmental Lab Method: Asbestos by PLM (Polarized Light Microscope) F-26, Rev.2.2.

Certificate of Analysis

Analysis Requested:	Asbestos, Lead
Sample Description:	20 Bulk Sample(s)

Sample Matrix and Client Sample Description	Client Sample Location	Lab Sample ID	Lead (ppm)
L1 - Green Paint	1-04b, Corridor, Door	21-7570-13	<10
L2 - Light Grey Paint	1-10a, Donation Room, Block Wall	21-7570-14	<10
L3 - Light Blue Paint	1-23b, Corridor, Block Wall	21-7570-15	<10
L4 - Cream Paint	Loc. 1-25, Lounge, Block Wall Corridor, Wall	21-7570-16	<10
L5 - Beige Paint	Loc. 1-18, Men's Change Room, Wall	21-7570-17	31
L6 - Black Paint	1-45, Art and Craft Room, Door Frame	21-7570-18	1656
L7 - Blue Paint	Loc. 1-17, Storage Room, Door Frame	21-7570-19	8016
L8 - Grey Paint	1-24, Activity Room, Door Frame	21-7570-20	290

< result obtained was below RL (Reporting Limit).

QA/QC Report

Parameter	Blank (ppm)		LCS (%)		CRM/MS (%)	
	Result	RL	Recovery	AR	Recovery	AR
Lead	<10	10	93	80-120	95	70-130

Parameter	Duplicate (%)					
	RPD	AR				
Lead	3.8	0-30				

LEGEND:

RL - Reporting Limit

LCS - Laboratory Control Sample

MS - Matrix Spike

AR - Acceptable Range

RPD - Relative Percent Difference

ANALYTICAL METHODS:

Metals (Lead) - Method # F-1, Rev. 4.5, Standard Operation Procedure for determination of Metals by the Inductively Coupled Plasma- Optical. Method used by Fisher Environmental Lab complies with the Standard Methods for the Examination of Water and Wastewater, 20th Ed 3120-B.

Authorized by:



Roger Lin, Ph. D., C. Chem.
Laboratory Manager



APPENDIX C – SITE PHOTOS





Photo 1: View of the asbestos-containing texture coat on the ceiling in the Men's Change Room.



Photo 2: View of the elevated concentrations of lead-containing blue paint on the doors and door frames at the Site.

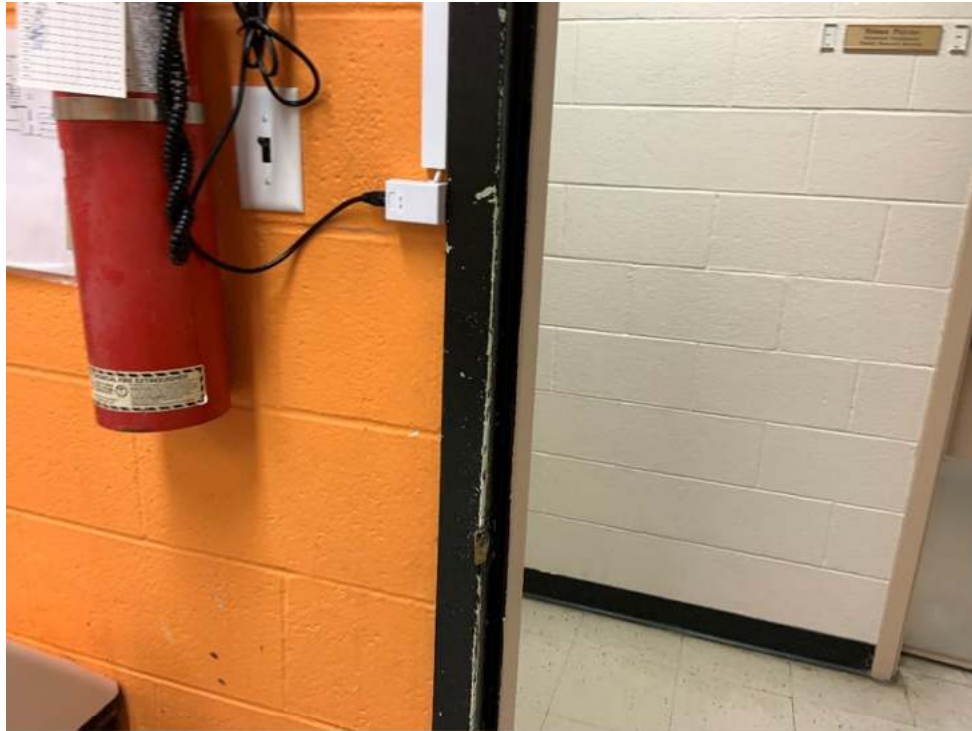


Photo 3: View of the elevated concentration of lead-containing black paint on the door frame in the basement.

APPENDIX D – PREVIOUS DSS REPORT





ECOH
Environmental Consulting
Occupational Health



ANNUAL SURVEY FOR DESIGNATED SUBSTANCES AND HAZARDOUS MATERIALS



WEST SCARBOROUGH NEIGHBOURHOOD COMMUNITY CENTRE 313 PHARMACY AVENUE Toronto, Ontario

Presented to:

Sara Reid

City of Toronto
Corporate Services
Facilities Management

Presented By:
ECOH

Project: 19181-B077

November 30, 2018

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1. INTRODUCTION AND REGULATORY REQUIREMENTS

1.1 Introduction and Scope

ECOH Management Inc. (ECOH) was retained by The City of Toronto to conduct a reassessment survey for designated substances and hazardous materials at the West Scarborough Neighbourhood Community Centre, located at 313 Pharmacy Avenue in Toronto, Ontario (hereafter referred to as the “facility” or the “project area”).

The objective of the survey was to determine the condition of previously identified asbestos-containing materials (ACM), identify and assess the condition of previously-identified designated substances and other hazardous materials, and, if necessary, provide recommendations to assist the City of Toronto in fulfilling requirements to achieve regulatory compliance, as set forth under the Ontario Occupational Health and Safety Act, and enforced by the Ontario Ministry of Labour. This document should be filed as an addendum to the original survey report, which was issued by Paradigm Environmental and Industrial Hygiene Consultants in January, 1987.

This designated substances survey report is for management purposes only. It is not intended to be used to establish the presence of designated substances or hazardous materials in building materials prior to demolition or renovation activities. **A pre-renovation/pre-demolition audit of the work area for designated substances and hazardous materials should be conducted prior to any work activities that may disturb building materials potentially containing designated materials or hazardous substances.**

Mr. Muhammad Talha Moazzam of ECOH performed the fieldwork on September 27, 2018.

The following designated substances and hazardous materials were included in the re-assessment, if previously identified in the facility:

- | | |
|------------------------|---|
| → <i>Asbestos</i> | → <i>Benzene</i> |
| → <i>Lead</i> | → <i>Coke Oven Emissions</i> |
| → <i>Mercury</i> | → <i>Ethylene Oxide</i> |
| → <i>Silica</i> | → <i>Isocyanates</i> |
| → <i>Acrylonitrile</i> | → <i>Vinyl Chloride Monomer</i> |
| → <i>Arsenic</i> | → <i>Polychlorinated Biphenyls (PCB)s</i> |
| → <i>Mould</i> | |

The following report details the project regulatory requirements, survey and analytical methodologies, findings and recommendations, and survey statement of limitations.

1.2 Regulatory Requirements

Regulatory requirements and guidelines applicable to the designated substances and hazardous materials noted above include, but are not limited to, the following:

- Ontario Occupational Health and Safety Act and applicable Regulations made under the Act including;
 - Designated Substances – Ontario Regulation 490/09, and
 - Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations – Ontario Regulation 278/05.
- Ontario Environmental Protection Act, and applicable regulations made under the Act.

- General – Waste Management – Ontario Regulation 347
- Waste Management – PCB's – Ontario Regulation 362.
- Canadian Environmental Protection Act, 1999 and applicable Regulations made under the Act, including:
 - PCB Regulations (SOR/2008-273), amended Dec 8, 2011.
- Ministry of Labour Guideline, "*Lead on Construction Projects*", dated April 2011,
- Ministry of Labour Guideline, "*Silica on Construction Projects*", dated April 2011.
- Canadian Construction Association, Standard Construction Document CCA 82, 2004; "*Mould Guidelines for the Canadian Construction Industry*",
- Environmental Abatement Council of Ontario (EACO) *Mould Abatement Guidelines*, Ed. 3, 2015.
- Environment Canada Document, "*PCB Identification of Lamp Ballasts Containing PCBs*", EPS 2/CC/2, dated August 1991.
- Environment Canada Document, "*Handbook on PCBs in Electrical Equipment*" EN 47-310/1988E, dated April 1988.

2. SURVEY METHODOLOGY

2.1 General Approach

To ensure familiarity with the building, and prior to commencing the survey, the surveyor made reference to previous surveys, facility floor plans, and other available documentation. The surveyor looked for the most common applications of building materials made with Designated Substances based on historical applications. The investigation performed was non-intrusive in nature (i.e. did not include demolition of building systems to verify concealed conditions).

Any rooms that could not be accessed during the survey are noted in the Hazardous Materials Inventory Sheet in Appendix I and on project drawings in Appendix IV.

2.2 Asbestos Survey Methodology

2.2.1 Asbestos Sampling Strategy and Analytical Methods

Where sampling was required, bulk samples of potentially asbestos-containing materials were collected for analysis. As per the requirements of Ontario Regulation 278/05, multiple samples (ranging from 3 to 7 depending on quantity and type of material) are required to confirm that asbestos is not present in that given material. Only one positive result (i.e. confirmation of the presence of asbestos) is required to classify a material as asbestos-containing. Therefore, ECOH's sampling strategy involves the collection of sufficient numbers of samples to meet regulatory requirements, followed by instructions to the laboratory to cease analysis of all remaining samples within a series when a sample within that series is determined to be asbestos-containing.

Sampling requires a small volume of material to either be removed from a damaged section of suspect material or cut from intact material, which is then repaired by sealing with tape to prevent fibre release. The collected samples are placed in plastic bags, sealed, and shipped to an independent laboratory. A formal chain of custody procedure is maintained between ECOH and the sub-contracted laboratory during sample transport. Samples are analysed following the analytical procedure prescribed by O. Reg. 278/05 U.S. Environmental Protection Agency Test Method EPA/600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials. June 1993. Although not required by provincial regulation, all laboratories used by ECOH are accredited

under the U.S. National Voluntary Laboratory Accreditation Program (NVLAP) to ensure consistent, accurate and defensible results.

Materials confirmed to be asbestos-containing during any previous assessments of the facility (if applicable) were not re-sampled for this survey. Additionally, samples were not collected of materials that were previously confirmed to be non-asbestos per the requirements of Ontario Regulation 278/05.

With the exception of window caulking and roofing materials, all other potentially asbestos-containing materials (currently recorded as “assumed to contain asbestos”) were sampled, unless materials were located at heights exceeding the reach of a surveyor using a 6’ step ladder, or were otherwise inaccessible.

Materials assumed or confirmed to contain asbestos in previous years, but not observed during the current survey, are retained in the Hazardous Materials Inventory Sheet in Appendix I with a notation that the material was not observed.

2.3 Lead Methodology

Where sampling was required (i.e. where damaged materials were observed), bulk samples of potentially lead-containing materials were collected for analysis by flame atomic absorption spectroscopy. The collected samples were placed in plastic bags, sealed, and shipped to an independent laboratory. A formal chain of custody procedure is maintained between ECOH and the sub-contracted laboratory during sample transport. All laboratories used by ECOH are accredited under the U.S. EPA National Environmental Lead Laboratory Accreditation Program (NLLAP) and/or American Industrial Hygiene Association (AIHA) Environmental Lead Laboratory Accreditation Program (ELLAP) to ensure consistent, accurate and defensible results.

Lead concentrations exceeding 1000ppm (0.1%) are considered to indicate the material is “lead-containing” per City of Toronto policy and applicable guidelines.

2.4 Mould Assessment

The mould assessment of the project area was conducted in accordance with the Canadian Construction Association, Standard Construction Document CCA 82, 2004; “*Mould Guidelines for the Canadian Construction Industry*”. Although there are no regulatory requirements or guidelines in Ontario for such an assessment, the preceding protocol has become accepted as the industry standard by most experts, consultants, and the Ontario Ministry of Labour.

2.5 Assessment for PCBs

PCBs in commercial facilities can be present in high concentrations in fluorescent or HID light fixtures, and electrical transformers.

All potential sources of PCBs identified in the Survey for Designated Substances and Hazardous Materials conducted for this facility in 2014 were re-examined. Neither dismantling the lights to investigate the ballasts, nor dismantling the transformers to investigate their interiors, was part of the scope of this survey. Without disassembly, determination of whether light ballasts are PCB-containing is often very difficult. If no labels are present, all such light fixtures are assumed to contain PCB ballasts.

Electrical transformers are not disassembled for safety reasons. Determination of PCB content relies on the comparison of information on labels and nameplates located on the exterior of the transformer with standard PCB Identifier Code literature. Transformers must be assumed to contain PCBs if the results of that comparison do not clearly and specifically indicate the transformer does not contain PCBs.

2.6 Hazardous Materials Survey Inventory

ECOH's surveyor completed a mould, lead and asbestos field data sheet for each room entered. The data sheet contains the room name, a unique room number assigned by the surveyor, the quantity, type and condition of potentially hazardous materials present in the room, and sampling information. The inventory sheet is included as Appendix I.

2.7 Survey of Other Hazardous Materials

Materials or equipment suspected of containing other Designated Substances and/or PCBs are identified by appearance, age and knowledge of historic applications.

3. FINDINGS AND RECOMMENDATIONS

3.1 Asbestos

Confirmed ACM identified within the facility includes the following:

- Texture Coat (Friable).

Assumed ACM identified within the facility includes the following:

- Mastic (Non-friable)
- Levelling Compound (Non-friable)
- Drywall Joint Compound (Non-friable)
- Plaster (Non-friable)
- Window Caulking (Non-friable), and
- Roofing Material (Non-friable).

The locations and quantities of materials assumed or confirmed to be asbestos-containing can be found in the hazardous materials inventory sheet, which is included as Appendix I.

Table 1, below, identifies any assumed and/or confirmed ACM observed to be in damaged condition at the time of the reassessment.

TABLE 1 Identified Damaged Asbestos Materials			
Location Number	Location Name	Quantity, Type and Condition of Material	Analytical Result
N/A - All Assumed and/or Confirmed ACM Observed to be in Good Condition at the Time of the Reassessment Survey			

No samples were collected for analysis of asbestos type and content during the current survey.

For the purposes of future renovation and/or demolition activities in specific locations within the facility, any building materials not specifically sampled within the renovation project area should be

treated as if their asbestos content is not known. Such materials should, therefore, be sampled prior the occurrence of renovation or demolition work.

Additional asbestos-containing materials may be present in areas of the building which were inaccessible at the time of the survey (i.e. above fixed ceilings, behind walls, under flooring, etc.).

3.2 Lead

No potentially lead-containing materials were observed to be damaged during the survey, and, therefore, no lead bulk samples were collected.

No other significant potential sources of lead or lead-containing products were identified during the survey. However, lead may be present in:

- Ceramic tile glazing,
- Internal batteries associated with emergency lighting systems,
- Wiring connectors and electric cable sheathing,
- Piping and solder joints on piping, and
- Cast iron pipe joint packing.

3.3 Mould

Table 2 below, indicates the locations where mould growth was identified during the current survey

TABLE 2 Locations of Identified Mould Growth			
Location Number	Location Name	Sample Description	Building Material on Which Mould is Growing
1-10b	Office	1 square foot of mould growth	Non-asbestos ceiling tiles (CT 1)
1-28	Washroom	1 square foot of mould growth	Non-asbestos ceiling tiles (CT 3)

3.4 Mercury

Mercury is present in minor quantities within the project area in the following forms:

- As a vapour within fluorescent light tubes that are present in the project area
- As a possible constituent of thermostats, and
- As a possible constituent of paints and adhesives.

3.5 Silica

Free crystalline silica, in the form of common construction sand, is present in all concrete and masonry products within the building.

3.6 Polychlorinated Biphenyls (PCBs)

The following potential sources of Polychlorinated Biphenyls (PCBs) were identified within the facility by ECOH in 2014 (*Survey for Designated Substances and Hazardous Materials* report) and re-evaluated during the current survey. Dismantling lights to investigate ballasts, and/or dismantling

transformers to investigate their contents, was not part of the scope of this survey. Therefore, the items listed below must be assumed to contain PCBs, unless specifically stated otherwise:

Fluorescent light ballasts:

- Approximately 500 fluorescent light fixtures are present throughout the facility. Ballasts within these fixtures are assumed to contain PCBs.

Additional mechanical equipment or components of mechanical equipment throughout the facility may contain PCBs. These may include, but are not limited to, electrical capacitors and electrical equipment containing capacitors, voltage regulators, switches, re-closers, bushings or electromagnets, cable insulation, heat transfer equipment, hydraulic equipment, vapour diffusion pumps, bridge bearings, and caulking and motor/hydraulic oils. A specific assessment prior to the removal of any mechanical equipment within the facility should be conducted to confirm if PCBs are present within the equipment.

3.7 Other Environmental Considerations

The environmental audit also included an investigation for the following compounds, none of which were found to be present:

- Acrylonitrile
- Arsenic
- Benzene
- Coke Oven Emissions
- Ethylene Oxides
- Isocyanates
- Vinyl Chloride Monomer

Please note: paint, adhesives and plastics present throughout the project area may contain trace amounts of Acrylonitrile, Arsenic, Benzene, Ethylene Oxides, Isocyanates, Lead, Mercury and Vinyl Chloride Monomer. However, none of these materials were observed in a hazardous or unsafe condition, unless noted previously in Section 3.

4. RECOMMENDATIONS

4.1 Asbestos

All assumed and/or confirmed ACM were observed to be in GOOD condition at the time of the reassessment. As such, no corrective actions are recommended at this time.

Ontario Ministry of Labour Regulation 278/05 requires that an Asbestos Management Program (AMP) be implemented as long as asbestos-containing materials are present (or assumed to be present) in a building. The AMP, original survey report and subsequent reassessment reports must be available at the work place, and must identify the type of asbestos, and where asbestos can be found on a room-by-room basis.

NOTE: Interpretation of all sources of asbestos-related information, including but not limited to the original asbestos survey report, asbestos reassessment reports, room-by-room survey data, survey drawings and reports from previous asbestos abatement projects, should be completed by a competent person trained in the historical application of asbestos in building materials, building design and preferably by a person with site-specific knowledge and/or experience.

Information contained within any of the above-noted sources may not relieve the Regulatory responsibility of building Owners, or project Employers/Constructors, to complete a detailed site inspection prior to commencement of a project.

This report should not be used as a substitute for a detailed site inspection to identify asbestos-containing building materials, which must be specifically tailored to the scope and nature of any given

project, and completed prior to any maintenance, renovation or demolition work that may cause disturbance to building materials.

4.2 Lead

No potentially damaged lead-containing materials were observed at the time of the reassessment. As such, no corrective actions are required at this time.

Renovation, demolition or general construction work involving the removal of materials containing only trace concentrations of lead (i.e. Concentrations below 0.1% (1000ppm) by dry weight) can be completed without lead specific safety precautions provided that:

- a) work does not include 'fume generating activities' (heat producing) such as welding, torching, burning, high temperature cutting, etc.,
- b) work does not include dust-generating activities such as grinding, cutting or chemical stripping,
- c) dust levels are maintained below 3mg/m³, and
- d) general health and safety construction procedures are implemented, which would include dust suppression methods, proper respiratory protection (minimum of a 1/2-face respirator) and protective clothing, as is appropriate for the work being completed.

Any work involving the disturbance of building materials assumed to contain lead (e.g. wiring connectors or electric cable sheathing) should be conducted following recommendations detailed within the Ministry of Labour document *Guideline - Lead on Construction Projects*, dated April 2011.

All lead-containing waste materials must be disposed of following requirements set forth in applicable federal and/or provincial regulations, including Ontario Regulation 347: *General – Waste Management*.

4.3 Mould

The removal of all mould-affected building materials should be conducted following recommendations detailed within the Canadian Construction Association, Standard Construction Document CCA 82, 2004; “*Mould Guidelines for the Canadian Construction Industry*” or the Environmental Abatement Council of Ontario (EACO) *Mould Abatement Guidelines*, Ed. 3 (2015). The recommended actions presented in Table 3 are intended to be used to identify the minimum safety requirements for mould abatement work operations. The full scope of work for any mould-related project should be established through consultation with a competent person who is educated in, and experienced with, mould-related construction projects.

TABLE 3 Recommendations for Corrective Action - Mould			
Location Number	Location Name	Quantity and Type of Material	Recommended Action
1-10b	Basement Office	1 SF Mould Growth on Non-Asbestos Ceiling Tile	REMOVE (Level II)
1-28	Washroom	1 SF Mould Growth on Non-Asbestos Ceiling Tile	REMOVE (Level II)

TABLE 3 Recommendations for Corrective Action - Mould			
Location Number	Location Name	Quantity and Type of Material	Recommended Action

4.4 Mercury

The presence of mercury within assembled units (e.g. fluorescent light bulbs and thermostat bulbs) should not be considered a hazard provided that the assembled units remain sealed and intact. Avoid direct skin contact with mercury and avoid inhalation of mercury vapour. If required, dispose of mercury following applicable legislative requirements.

4.5 Silica

Silica-containing building materials are present throughout the facility (e.g. concrete, brick, cement block, etc.). Any work involving the disturbance of materials that may contain silica should be conducted following recommendations detailed in the Ministry of Labour document “*Guideline - Silica on Construction Projects*”, dated April 2011.

4.6 Polychlorinated Biphenyls (PCBs)

Fluorescent light ballasts throughout the facility are assumed to contain PCBs, as neither dismantling the lights to investigate the ballasts, nor dismantling the transformers to investigate their contents, was within the scope of this survey.

PCB-containing light ballasts may legally remain in use until December 31, 2025, if they were already in use in the facility on September 5, 2008. However, it is ECOH’s general recommendation that PCB ballasts are proactively removed to eliminate the possibility of ballasts rupturing, which can cause the release of high concentrations of PCBs into indoor air for extended periods, and/or result in costly remediation. To determine whether light ballasts contain PCBs, they should be disassembled to observe serial codes and then compared to standard PCB Identifier Code literature. Ballasts with unidentifiable serial codes, or from manufacturers who are not included in the standard PCB Identifier Code literature, or which are not clearly labelled as “PCB Free”, or for which no date is clearly visible (ballasts dated 1981 or later do not contain PCBs), must be assumed to contain PCBs.

Disposal of fluorescent light ballasts that contain PCBs must follow Ontario Regulation 347, General –Waste Management, Ontario Regulation 362, Waste Management – PCB’s, and the amended PCB Regulations, 2008 established under the Canadian Environmental Protection Act, 1999.

Removal of any other PCB-containing substances or equipment in the facility should follow the amended *PCB Regulations*, 2008, made under the *Canadian Environmental Protection Act*, 1999 (CEPA).

4.7 Other Substances

Dust suppression and personal protection procedures should be implemented during the demolition of materials that may contain Acrylonitrile, Arsenic, Ethylene Oxides, Benzene, Isocyanates, and Vinyl Chloride.

5. CORRECTIVE ACTIONS

ECOH communicated the deficiencies and recommendations for corrective actions to the City of Toronto. At this time, ECOH understands removal and/or repair work is being arranged by the City of Toronto.

6. STATEMENT OF LIMITATIONS

Due to the nature of building construction, some limitations exist as to the possible thoroughness of the designated substance and hazardous materials survey. The field observations, measurements and analysis are considered sufficient in detail and scope to form a reasonable basis for the findings and conclusions presented in this report. The findings and conclusions drawn by ECOH, concerning the designated substance and hazardous materials survey, are limited to the specific scope of work for which ECOH was retained and are based solely on information generated as a result of the specific scope of work authorized by The City of Toronto. The results of the designated substance and hazardous materials survey are limited to visual inspection of areas made accessible to ECOH personnel and information obtained from facility personnel, when obtained.

ECOH warrants that the findings and conclusions contained herein have been made in accordance with generally accepted evaluation methods in the industry and applicable regulations at the time of the performance of the designated substance survey. However, there is no warranty, expressed or implied, that this building survey has uncovered all environmental considerations on the subject site. In addition, ECOH cannot guarantee the completeness or accuracy of information supplied by a third party.

This report was prepared by ECOH for The City of Toronto. The material in it reflects ECOH's professional interpretation of information available at the time of report preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

ECOH

Environmental Consulting
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APPENDIX I

HAZARDOUS MATERIALS INVENTORY SHEET

APPENDIX I - HAZARDOUS MATERIALS INVENTORY SHEET

Building Address: 313 Pharmacy Avenue					Date(s) of Current Reassessment: September 27, 2018				
Building Name: West Scarborough Neighbourhood Community Centre					Organization Completing Reassessment: ECOH				
Summary of Findings									
<p>Mastic is <u>assumed</u> to be present underneath existing Vinyl Floor Tiles and Vinyl Sheet Flooring throughout the facility. Complete sampling of mastic is recommended prior to any flooring renovations.</p> <p>1-10b (Office): 1 SF mould on water-damaged Ceiling Tile. 1-28 (Washroom): 1 SF mould on water-damaged Ceiling Tile.</p>									
Location Number	Location Name	System	Material Observed	Potential Hazardous Material	Sample ID	Asbestos Type/Content	Quantity	Condition	Notes/Required Action
0-00	Exterior	Roof	Roofing Material	Asbestos	Not Sampled	ACM Assumed	N/A	N/A	
0-00	Exterior	Windows	Window Caulking	Asbestos	Not Sampled	ACM Assumed	N/A	N/A	
1-01	Boiler Room	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	Water Meter Room
1-01	Boiler Room	Wall	Concrete Block	Asbestos	15207-03-B077-01A-C	None Detected	N/A	N/A	Sampled during ECOH 2015 DSS Survey
1-01	Boiler Room	Wall	Concrete Block	Lead	15207-03-B077-Pb-01,02	190 ppm, 57 ppm (NEGATIVE - Trace concentrations only)	N/A	N/A	Sampled during ECOH 2015 DSS Survey
1-01	Boiler Room	Ceiling	N/A	N/A	N/A	N/A	N/A	N/A	No False Ceiling
1-01	Boiler Room	Pipe	Fibreglass	N/A	N/A	N/A	N/A	N/A	
1-01	Boiler Room	Structure	Concrete	N/A	N/A	N/A	N/A	N/A	
1-02	Stairwell	Floor	Vinyl Floor Tile 1	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-01 (None Detected)	N/A	N/A	12"x12" cream with brown specks NOT OBSERVED 2018
1-02	Stairwell	Floor	Terrazzo	N/A	N/A	N/A	N/A	N/A	
1-02	Stairwell	Wall	Drywall Joint Compound	Asbestos	Not Sampled	Visually Consistent with 15833-B077-ASB-01 16608-B077-ASB-13 (None Detected)	N/A	N/A	
1-02	Stairwell	Wall	Concrete	N/A	N/A	N/A	N/A	N/A	
1-02	Stairwell	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-02	Stairwell	Ceiling	Texture Coat	Asbestos	07-3464-05	1% Chrysotile	100 ft²	Good	From Fisher 2007 Reassessment Report (FE-P-3464)
1-02	Stairwell	Ceiling	Ceiling Tile 1	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-08 (None Detected)	N/A	N/A	2'x4' Pinprick with fissure
1-03	Lounge	Floor	Vinyl Floor Tile 8	Asbestos	Not Sampled	ACM Assumed	N/A	N/A	White with black marks NOT OBSERVED 2018
1-03	Lounge	Floor	Ceramic Tile	Lead	N/A	Lead Assumed	N/A	N/A	
1-03	Lounge	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-03	Lounge	Ceiling	Ceiling Tile 1	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-08 (None Detected)	N/A	N/A	2'x4' Pinprick with fissure NOT OBSERVED 2018
1-03	Lounge	Ceiling	Ceiling Tile 3	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-10 (None Detected)	N/A	N/A	2'x4' long fissure
1-03	Lounge	Ceiling	Ceiling Tile 2	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-09 (None Detected)	N/A	N/A	1'x1' glue-on with small, medium holes Above Ceiling

APPENDIX I - HAZARDOUS MATERIALS INVENTORY SHEET

Location Number	Location Name	System	Material Observed	Potential Hazardous Material	Sample ID	Asbestos Type/Content	Quantity	Condition	Notes/Required Action
1-03	Lounge	Structure	Concrete	N/A	N/A	N/A	N/A	N/A	
1-04A	Recreational Area	Floor	Vinyl Floor Tile 8	Asbestos	Not Sampled	ACM Assumed	N/A	N/A	White with black marks NOT OBSERVED 2018
1-04A	Recreational Area	Floor	Ceramic Tile	Lead	N/A	Lead Assumed	N/A	N/A	
1-04A	Recreational Area	Wall	Drywall Joint Compound	Asbestos	Not Sampled	Visually Consistent with 15833-B077-ASB-01 16608-B077-ASB-13 (None Detected)	N/A	N/A	
1-04A	Recreational Area	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-04A	Recreational Area	Ceiling	Texture Coat	Asbestos	Not Sampled	Visually Consistent with 07-3464-02, 05 (1% Chrysotile)	500 ft²	Good	
1-04B	Corridor	Floor	Ceramic Tile	Lead	N/A	Lead Assumed	N/A	N/A	
1-04B	Corridor	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-04B	Corridor	Ceiling	Drywall Joint Compound	Asbestos	Not Sampled	ACM Assumed	250 ft²	Good	above ceiling tiles
1-05	Office	Floor	Vinyl Floor Tile 8	Asbestos	Not Sampled	ACM Assumed	N/A	N/A	White with black marks NOT OBSERVED 2018
1-05	Office	Floor	Ceramic Tile	Lead	N/A	Lead Assumed	N/A	N/A	
1-05	Office	Wall	Drywall Joint Compound	Asbestos	Not Sampled	Visually Consistent with 15833-B077-ASB-01 16608-B077-ASB-13 (None Detected)	N/A	N/A	
1-05	Office	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-05	Office	Ceiling	Texture Coat	Asbestos	Not Sampled	Visually Consistent with 07-3464-02, 05 (1% Chrysotile)	150 ft²	Good	
1-06	Office	Floor	Vinyl Floor Tile 8	Asbestos	Not Sampled	ACM Assumed	N/A	N/A	White with black marks NOT OBSERVED 2018
1-06	Office	Floor	Ceramic Tile	Lead	N/A	Lead Assumed	N/A	N/A	
1-06	Office	Wall	Drywall Joint Compound	Asbestos	Not Sampled	Visually Consistent with 15833-B077-ASB-01 16608-B077-ASB-13 (None Detected)	N/A	N/A	
1-06	Office	Ceiling	Ceiling Tile 1	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-08 (None Detected)	N/A	N/A	2'x4' Pinprick with fissure
1-07	Washroom	Floor	Ceramic Tile	Lead	N/A	Lead Assumed	N/A	N/A	
1-07	Washroom	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-07	Washroom	Ceiling	Drywall Joint Compound	Asbestos	Not Sampled	ACM Assumed	25 ft²	Good	above ceiling tiles
1-08	Janitor's Closet	Floor	Ceramic Tile	Lead	N/A	Lead Assumed	N/A	N/A	
1-08	Janitor's Closet	Wall	Drywall Joint Compound	Asbestos	Not Sampled	Visually Consistent with 15833-B077-ASB-01 16608-B077-ASB-13 (None Detected)	N/A	N/A	
1-08	Janitor's Closet	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	

APPENDIX I - HAZARDOUS MATERIALS INVENTORY SHEET

Location Number	Location Name	System	Material Observed	Potential Hazardous Material	Sample ID	Asbestos Type/Content	Quantity	Condition	Notes/Required Action
1-08	Janitor's Closet	Ceiling	Texture Coat	Asbestos	Not Sampled	Visually Consistent with 07-3464-02, 05 (1% Chrysotile)	20 ft²	Good	above ceiling tiles
1-08	Janitor's Closet	Ceiling	Ceiling Tile 1	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-08 (None Detected)	N/A	N/A	2'x4' Pinprick with fissure
1-09	Maintenance Room	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-09	Maintenance Room	Wall	Drywall Joint Compound	Asbestos	Not Sampled	Visually Consistent with 15833-B077-ASB-01 16608-B077-ASB-13 (None Detected)	N/A	N/A	
1-09	Maintenance Room	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-09	Maintenance Room	Pipe	Fibreglass	N/A	N/A	N/A	N/A	N/A	
1-09	Maintenance Room	Ceiling	Concrete	N/A	N/A	N/A	N/A	N/A	
1-10a	Craft Room	Floor	Vinyl Floor Tile 8	Asbestos	Not Sampled	ACM Assumed	N/A	N/A	White with black marks NOT OBSERVED 2018
1-10a	Craft Room	Floor	Ceramic Tile	Lead	N/A	Lead Assumed	N/A	N/A	
1-10a	Craft Room	Wall	Drywall Joint Compound	Asbestos	Not Sampled	Visually Consistent with 15833-B077-ASB-01 16608-B077-ASB-13 (None Detected)	N/A	N/A	
1-10a	Craft Room	Ceiling	Ceiling Tile 1	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-08 (None Detected)	N/A	N/A	2'x4' Pinprick with fissure
1-10b	Office	Floor	Ceramic Tile	Lead	N/A	Lead Assumed	N/A	N/A	
1-10b	Office	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-10b	Office	Wall	Drywall Joint Compound	Asbestos	Not Sampled	Visually Consistent with 15833-B077-ASB-01 16608-B077-ASB-13 (None Detected)	N/A	N/A	
1-10b	Office	Ceiling	Ceiling Tile 1	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-08 (None Detected)	N/A	N/A	2'x4' Pinprick with fissure
1-10b	Office	Ceiling	Ceiling Tile 1	Mould	Not Sampled	Visually Confirmed	1 ft²	N/A	1 SF Mould visually confirmed on water damaged Ceiling Tile (CT1)
1-11	Stairway	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-11	Stairway	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-11	Stairway	Wall	Drywall Joint Compound	Asbestos	16608-B077-ASB-13A	None Detected	N/A	N/A	Sampled during ECOH 2016 Reassessment Survey
1-11	Stairway	Ceiling	Ceiling Tile 1	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-08 (None Detected)	N/A	N/A	2'x4' Pinprick with fissure
1-12	Storage	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-12	Storage	Wall	Paint - White	Lead	15170-B077-Pb-01A,B	70 ppm (NEGATIVE - Trace concentrations only)	N/A	N/A	
1-12	Storage	Wall	Drywall Joint Compound	Asbestos	Not Sampled	Visually Consistent with 15833-B077-ASB-01 16608-B077-ASB-13 (None Detected)	N/A	N/A	

APPENDIX I - HAZARDOUS MATERIALS INVENTORY SHEET

Location Number	Location Name	System	Material Observed	Potential Hazardous Material	Sample ID	Asbestos Type/Content	Quantity	Condition	Notes/Required Action
1-12	Storage	Ceiling	Texture Coat	Asbestos	Not Sampled	Visually Consistent with 07-3464-02, 05 (1% Chrysotile)	75 ft²	Good	
1-13	Gym	Floor	Vinyl Floor Tile 3	Asbestos	16608-B077-ASB-03A-C	None Detected	N/A	N/A	12"x12" multi-coloured Sampled during ECOH 2016 Reassessment Survey
1-13	Gym	Floor	Vinyl Floor Tile 2	Asbestos	16608-B077-ASB-02A-C	None Detected	N/A	N/A	12"x12" White with Yellow Marks Sampled during ECOH 2016 Reassessment Survey
1-13	Gym	Floor	Mastic - VFT2	Asbestos	16608-B077-ASB-02A-C	None Detected	N/A	N/A	Sampled during ECOH 2016 Reassessment Survey
1-13	Gym	Floor	Leveler - VFT2	Asbestos	16608-B077-ASB-02A-C	None Detected	N/A	N/A	Sampled during ECOH 2016 Reassessment Survey
1-13	Gym	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-13	Gym	Ceiling	Plaster	Asbestos	Not Sampled	ACM Assumed	3000 ft²	Good	too high to sample
1-13	Gym	Ceiling	Texture Coat	Asbestos	Not Sampled	Visually Consistent with 07-3464-02, 05 (1% Chrysotile)	150 ft²	Good	
1-14	Storage	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-14	Storage	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-14	Storage	Ceiling	N/A	N/A	N/A	N/A	N/A	N/A	No False Ceiling
1-14	Storage	Duct	Tar	Asbestos	Not Sampled	ACM Assumed	N/A	N/A	Brown NOT OBSERVED 2018
1-14	Storage	Pipe	Fibreglass	N/A	N/A	N/A	N/A	N/A	
1-14	Storage	Structure	Concrete	N/A	N/A	N/A	N/A	N/A	
1-15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Location Number No Longer in Use
1-16	Women's Change Room	Floor	Vinyl Sheet Flooring 3	Asbestos	Not Sampled	ACM Assumed	N/A	N/A	NOT OBSERVED 2018
1-16	Women's Change Room	Floor	Terrazzo	N/A	N/A	N/A	N/A	N/A	
1-16	Women's Change Room	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-16	Women's Change Room	Ceiling	Texture Coat	Asbestos	Not Sampled	Visually Consistent with 07-3464-02, 05 (1% Chrysotile)	700 ft²	Unknown	NO ACCESS 2018
1-17	Storage	Floor	Vinyl Sheet Flooring 3	Asbestos	Not Sampled	ACM Assumed	N/A	N/A	NOT OBSERVED 2018
1-17	Storage	Floor	Terrazzo	N/A	N/A	N/A	N/A	N/A	
1-17	Storage	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-17	Storage	Ceiling	Texture Coat	Asbestos	07-3464-02	1% Chrysotile	125 ft²	Good	From Fisher 2007 Reassessment Report (FE-P-3464)
1-18	Men's Change Room	Floor	Vinyl Sheet Flooring 3	Asbestos	Not Sampled	ACM Assumed	N/A	N/A	NOT OBSERVED 2018
1-18	Men's Change Room	Floor	Terrazzo	N/A	N/A	N/A	N/A	N/A	
1-18	Men's Change Room	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-18	Men's Change Room	Ceiling	Texture Coat	Asbestos	Not Sampled	Visually Consistent with 07-3464-02, 05 (1% Chrysotile)	700 ft²	Good	

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Location Number	Location Name	System	Material Observed	Potential Hazardous Material	Sample ID	Asbestos Type/Content	Quantity	Condition	Notes/Required Action
1-19	Pool Office	Floor	Vinyl Sheet Flooring 3	Asbestos	Not Sampled	ACM Assumed	N/A	N/A	NOT OBSERVED 2018
1-19	Pool Office	Floor	Terrazzo	N/A	N/A	N/A	N/A	N/A	
1-19	Pool Office	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-19	Pool Office	Ceiling	Texture Coat	Asbestos	Not Sampled	Visually Consistent with 07-3464-02, 05 (1% Chrysotile)	60 ft²	Good	
1-20	Pool	Floor	Ceramic Tile	Lead	N/A	Lead Assumed	N/A	N/A	
1-20	Pool	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-20	Pool	Ceiling	Plaster	Asbestos	Not Sampled	ACM Assumed	3000 ft²	Good	too high to sample
1-20	Pool	Ceiling	Texture Coat	Asbestos	Not Sampled	Visually Consistent with 07-3464-02, 05 (1% Chrysotile)	200 ft²	Good	
1-20	Pool	Structure	Steel	N/A	N/A	N/A	N/A	N/A	
1-21	Storage	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-21	Storage	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-21	Storage	Ceiling	Wood	N/A	N/A	N/A	N/A	N/A	
1-21	Storage	Pipe	Fibreglass	N/A	N/A	N/A	N/A	N/A	
1-22	Conference Room	Floor	Hardwood	N/A	N/A	N/A	N/A	N/A	
1-22	Conference Room	Ceiling	Ceiling Tile 2	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-09 (None Detected)	N/A	N/A	1'x1' glue-on with small, medium holes
1-22	Conference Room	Wall	Drywall Joint Compound	Asbestos	Not Sampled	ACM Assumed	N/A	N/A	NOT OBSERVED 2018
1-22	Conference Room	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-23a	Atrium	Floor	Terrazzo	N/A	N/A	N/A	N/A	N/A	
1-23a	Atrium	Wall	Drywall Joint Compound	Asbestos	Not Sampled	Visually Consistent with 15833-B077-ASB-01 16608-B077-ASB-13 (None Detected)	N/A	N/A	
1-23a	Atrium	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-23a	Atrium	Ceiling	Ceiling Tile 2	Asbestos	16608-B077-ASB-09A-C	None Detected	N/A	N/A	1'x1' glue-on with small, medium holes Sampled during ECOH 2016 Reassessment Survey
1-23b	East Corridor	Floor	Vinyl Floor Tile 5	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-05 (None Detected)	N/A	N/A	12"x12" Light Brown with Streaks
1-23b	East Corridor	Wall	Drywall Joint Compound	Asbestos	15833-B077-ASB-01A-C 16608-B077-ASB-13B,C	None Detected None Detected	N/A	N/A	Sampled during ECOH 2015 Reassessment Survey Sampled during ECOH 2016 Reassessment Survey
1-23b	East Corridor	Ceiling	Ceiling Tile 3	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-10 (None Detected)	N/A	N/A	2'x4' long fissure
1-23c	West Corridor	Floor	Vinyl Sheet Flooring 3	Asbestos	Not Sampled	ACM Assumed	N/A	N/A	NOT OBSERVED 2018
1-23c	West Corridor	Floor	Terrazzo	N/A	N/A	N/A	N/A	N/A	

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Location Number	Location Name	System	Material Observed	Potential Hazardous Material	Sample ID	Asbestos Type/Content	Quantity	Condition	Notes/Required Action
1-23c	West Corridor	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-23c	West Corridor	Ceiling	Drywall Joint Compound	Asbestos	Not Sampled	ACM Assumed	100 ft²	Good	above ceiling tiles
1-23d	Corridor	Floor	Vinyl Sheet Flooring 3	Asbestos	Not Sampled	ACM Assumed	N/A	N/A	NOT OBSERVED 2018
1-23d	Corridor	Floor	Terrazzo	N/A	N/A	N/A	N/A	N/A	
1-23d	Corridor	Wall	Drywall Joint Compound	Asbestos	Not Sampled	Visually Consistent with 15833-B077-ASB-01 16608-B077-ASB-13 (None Detected)	N/A	N/A	NOT OBSERVED 2018
1-23d	Corridor	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-23d	Corridor	Ceiling	Texture Coat	Asbestos	Not Sampled	Visually Consistent with 07-3464-02, 05 (1% Chrysotile)	N/A	N/A	NOT OBSERVED 2018
1-23d	Corridor	Ceiling	Drywall Joint Compound	Asbestos	Not Sampled	ACM Assumed	75 ft²	Good	above ceiling tiles
1-24	Activity Room	Floor	Vinyl Floor Tile 4	Asbestos	16608-B077-ASB-04A-C	None Detected	N/A	N/A	12"x12" Blue with white marks Sampled during ECOH 2016 Reassessment Survey
1-24	Activity Room	Floor	Mastic - VFT4	Asbestos	16608-B077-ASB-04b,c	ACM Assumed	1000 ft²	Good	Insufficient samples analysed to meet regulatory requirements Sampled during ECOH 2016 Reassessment Survey
1-24	Activity Room	Wall	Drywall Joint Compound	Asbestos	Not Sampled	Visually Consistent with 15833-B077-ASB-01 16608-B077-ASB-13 (None Detected)	N/A	N/A	
1-24	Activity Room	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-24	Activity Room	Ceiling	N/A	N/A	N/A	N/A	N/A	N/A	No False Ceiling
1-24	Activity Room	Structure	Wood	N/A	N/A	N/A	N/A	N/A	
1-25	Lounge	Floor	Vinyl Floor Tile 5	Asbestos	16608-B077-ASB-05A-C	None Detected	N/A	N/A	12"x12" Light Brown with Streaks Sampled during ECOH 2016 Reassessment Survey
1-25	Lounge	Floor	Mastic - VFT5	Asbestos	16608-B077-ASB-05a-c	None Detected	N/A	N/A	Sampled during ECOH 2016 Reassessment Survey
1-25	Lounge	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-25	Lounge	Wall	Drywall Joint Compound	Asbestos	Not Sampled	Visually Consistent with 15833-B077-ASB-01 16608-B077-ASB-13 (None Detected)	N/A	N/A	
1-25	Lounge	Ceiling	Ceiling Tile 3	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-10 (None Detected)	N/A	N/A	2'x4' long fissure
1-26	Kitchen	Floor	Vinyl Sheet Flooring 1	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-11 (None Detected)	N/A	N/A	Peach with black dots
1-26	Kitchen	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-26	Kitchen	Ceiling	Ceiling Tile 1	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-08 (None Detected)	N/A	N/A	2'x4' Pinprick with fissure
1-27	Office	Floor	Vinyl Floor Tile 5	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-05 (None Detected)	N/A	N/A	12"x12" Light Brown with Streaks
1-27	Office	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	

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Location Number	Location Name	System	Material Observed	Potential Hazardous Material	Sample ID	Asbestos Type/Content	Quantity	Condition	Notes/Required Action
1-27	Office	Ceiling	Ceiling Tile 3	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-10 (None Detected)	N/A	N/A	2'x4' long fissure
1-27	Office	Ceiling	Ceiling Tile 2	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-09 (None Detected)	N/A	N/A	1'x1' glue-on with small, medium holes Above Ceiling
1-28	Washroom	Floor	Vinyl Sheet Flooring 1	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-11 (None Detected)	N/A	N/A	Peach with black dots
1-28	Washroom	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-28	Washroom	Ceiling	Ceiling Tile 3	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-10 (None Detected)	N/A	N/A	2'x4' long fissure
1-28	Washroom	Ceiling	Ceiling Tile 3	Mould	Not Sampled	Visually Confirmed	1 ft²	N/A	1 SF Mould visually confirmed on water damaged Ceiling Tile (CT3)
1-29a	Photocopy Room	Floor	Vinyl Floor Tile 5	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-05 (None Detected)	N/A	N/A	12"x12" Light Brown with Streaks
1-29a	Photocopy Room	Wall	Drywall Joint Compound	Asbestos	Not Sampled	Visually Consistent with 15833-B077-ASB-01 16608-B077-ASB-13 (None Detected)	N/A	N/A	
1-29a	Photocopy Room	Ceiling	Ceiling Tile 3	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-10 (None Detected)	N/A	N/A	2'x4' long fissure
1-29b	Janitor's Closet	Floor	Vinyl Sheet Flooring 2	Asbestos	16608-B077-ASB-12A-C	None Detected	N/A	N/A	Black, Sparkly Sampled during ECOH 2016 Reassessment Survey
1-29b	Janitor's Closet	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-29b	Janitor's Closet	Wall	Drywall Joint Compound	Asbestos	Not Sampled	Visually Consistent with 15833-B077-ASB-01 16608-B077-ASB-13 (None Detected)	N/A	N/A	
1-29b	Janitor's Closet	Ceiling	Ceiling Tile 3	Asbestos	16608-B077-ASB-10A-C	None Detected	N/A	N/A	2'x4' long fissure Sampled during ECOH 2016 Reassessment Survey
1-29c	Storage	Floor	Vinyl Floor Tile 5	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-05 (None Detected)	N/A	N/A	12"x12" Light Brown with Streaks
1-29c	Storage	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-29c	Storage	Ceiling	Ceiling Tile 3	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-10 (None Detected)	N/A	N/A	2'x4' long fissure
1-30a	Office	Floor	Vinyl Floor Tile 7	Asbestos	16608-B077-ASB-07A-C	None Detected	N/A	N/A	12"x12" White with black marks Sampled during ECOH 2016 Reassessment Survey
1-30a	Office	Floor	Mastic - VFT7	Asbestos	16608-B077-ASB-07c	ACM Assumed	125 ft²	Good	Insufficient samples analyzed to meet regulatory requirements Sampled during ECOH 2016 Reassessment Survey
1-30a	Office	Floor	Leveler - VFT7	Asbestos	16608-B077-ASB-07a	ACM Assumed	125 ft²	Good	Insufficient samples analyzed to meet regulatory requirements Sampled during ECOH 2016 Reassessment Survey
1-30a	Office	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-30a	Office	Wall	Wood Panel	N/A	N/A	N/A	N/A	N/A	
1-30a	Office	Ceiling	Ceiling Tile 2	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-09 (None Detected)	N/A	N/A	1'x1' glue-on with small, medium holes
1-30b	Office	Floor	Vinyl Floor Tile 7	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-07 (None Detected)	N/A	N/A	12"x12" White with black marks

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Location Number	Location Name	System	Material Observed	Potential Hazardous Material	Sample ID	Asbestos Type/Content	Quantity	Condition	Notes/Required Action
1-30b	Office	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-30b	Office	Wall	Wood Panel	N/A	N/A	N/A	N/A	N/A	
1-30b	Office	Ceiling	Ceiling Tile 2	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-09 (None Detected)	N/A	N/A	1'x1' glue-on with small, medium holes
1-31	Office	Floor	Vinyl Floor Tile 7	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-07 (None Detected)	N/A	N/A	12"x12" White with black marks
1-31	Office	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-31	Office	Ceiling	Ceiling Tile 1	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-08 (None Detected)	N/A	N/A	2'x4' Pinprick with fissure
1-32	Office	Floor	Vinyl Floor Tile 7	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-07 (None Detected)	N/A	N/A	12"x12" White with black marks
1-32	Office	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-32	Office	Ceiling	Ceiling Tile 2	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-09 (None Detected)	N/A	N/A	1'x1' glue-on with small, medium holes
1-33	Men's Washroom	Floor	Vinyl Sheet Flooring 1	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-11 (None Detected)	N/A	N/A	Peach with black dots NOT OBSERVED 2018
1-33	Men's Washroom	Floor	Terrazzo	N/A	N/A	N/A	N/A	N/A	
1-33	Men's Washroom	Floor	Vinyl Floor Tile 6	Asbestos	Not Sampled	ACM Assumed	N/A	N/A	12"x12" black
1-33	Men's Washroom	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-33	Men's Washroom	Ceiling	Ceiling Tile 3	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-10 (None Detected)	N/A	N/A	2'x4' long fissure
1-33b	Electrical Room	Floor	Vinyl Floor Tile 5	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-05 (None Detected)	N/A	N/A	12"x12" Light Brown with Streaks
1-33b	Electrical Room	Wall	Drywall Joint Compound	Asbestos	Not Sampled	Visually Consistent with 15833-B077-ASB-01 16608-B077-ASB-13 (None Detected)	N/A	N/A	
1-33b	Electrical Room	Ceiling	Ceiling Tile 3	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-10 (None Detected)	N/A	N/A	2'x4' long fissure
1-34	Women's Washroom	Floor	Vinyl Sheet Flooring 1	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-11 (None Detected)	N/A	N/A	Peach with black dots NOT OBSERVED 2018
1-34	Women's Washroom	Floor	Vinyl Floor Tile 6	Asbestos	16608-B077-ASB-06A-C	None Detected	N/A	N/A	12"x12" black Sampled during ECOH 2016 Reassessment Survey
1-34	Women's Washroom	Floor	Mastic - VFT6	Asbestos	16608-B077-ASB-06a-c	None Detected	N/A	N/A	Sampled during ECOH 2016 Reassessment Survey
1-34	Women's Washroom	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-34	Women's Washroom	Ceiling	Ceiling Tile 3	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-10 (None Detected)	N/A	N/A	2'x4' long fissure
1-35	Corridor	Floor	Vinyl Floor Tile 1	Asbestos	16608-B077-ASB-01A-C	None Detected	N/A	N/A	12"x12" cream with brown specks Sampled during ECOH 2016 Reassessment Survey
1-35	Corridor	Floor	Mastic - VFT1	Asbestos	16608-B077-ASB-01b	ACM Assumed	200 ft²	Good	Insufficient samples analyzed to meet regulatory requirements Sampled during ECOH 2016 Reassessment Survey NOT OBSERVED 2018

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Location Number	Location Name	System	Material Observed	Potential Hazardous Material	Sample ID	Asbestos Type/Content	Quantity	Condition	Notes/Required Action
1-35	Corridor	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-35	Corridor	Ceiling	Ceiling Tile 1	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-08 (None Detected)	N/A	N/A	2'x4' Pinprick with fissure
1-36	Office	Floor	Vinyl Floor Tile 1	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-01 (None Detected)	N/A	N/A	12"x12" cream with brown specks
1-36	Office	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-36	Office	Ceiling	Ceiling Tile 1	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-08 (None Detected)	N/A	N/A	2'x4' Pinprick with fissure
1-37	Office	Floor	Vinyl Floor Tile 1	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-01 (None Detected)	N/A	N/A	12"x12" cream with brown specks
1-37	Office	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-37	Office	Wall	Drywall Joint Compound	Asbestos	Not Sampled	Visually Consistent with 15833-B077-ASB-01 16608-B077-ASB-13 (None Detected)	N/A	N/A	
1-37	Office	Ceiling	Ceiling Tile 1	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-08 (None Detected)	N/A	N/A	2'x4' Pinprick with fissure
1-38	Office	Floor	Vinyl Floor Tile 1	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-01 (None Detected)	N/A	N/A	12"x12" cream with brown specks
1-38	Office	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-38	Office	Wall	Drywall Joint Compound	Asbestos	Not Sampled	Visually Consistent with 15833-B077-ASB-01 16608-B077-ASB-13 (None Detected)	N/A	N/A	
1-38	Office	Ceiling	Ceiling Tile 1	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-08 (None Detected)	N/A	N/A	2'x4' Pinprick with fissure
1-39	Office	Floor	Vinyl Floor Tile 1	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-01 (None Detected)	N/A	N/A	12"x12" cream with brown specks
1-39	Office	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-39	Office	Ceiling	Ceiling Tile 1	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-08 (None Detected)	N/A	N/A	2'x4' Pinprick with fissure
1-40	Women's Washroom	Floor	Vinyl Sheet Flooring 1	Asbestos	16608-B077-ASB-11A-C	None Detected	N/A	N/A	Peach with black dots Sampled during ECOH 2016 Reassessment Survey
1-40	Women's Washroom	Floor	Mastic - VSF1	Asbestos	16608-B077-ASB-11a-c	None Detected	N/A	N/A	Sampled during ECOH 2016 Reassessment Survey
1-40	Women's Washroom	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-40	Women's Washroom	Ceiling	Ceiling Tile 1	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-08 (None Detected)	N/A	N/A	2'x4' Pinprick with fissure
1-41	Men's Washroom	Floor	Vinyl Sheet Flooring 1	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-11 (None Detected)	N/A	N/A	Peach with black dots
1-41	Men's Washroom	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-41	Men's Washroom	Ceiling	Ceiling Tile 1	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-08 (None Detected)	N/A	N/A	2'x4' Pinprick with fissure

APPENDIX I - HAZARDOUS MATERIALS INVENTORY SHEET

Location Number	Location Name	System	Material Observed	Potential Hazardous Material	Sample ID	Asbestos Type/Content	Quantity	Condition	Notes/Required Action
1-42	Computer Training Room	Floor	Vinyl Floor Tile 1	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-01 (None Detected)	N/A	N/A	12"x12" cream with brown specks
1-42	Computer Training Room	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-42	Computer Training Room	Wall	Wood Board	N/A	N/A	N/A	N/A	N/A	
1-42	Computer Training Room	Ceiling	Ceiling Tile 1	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-08 (None Detected)	N/A	N/A	2'x4' Pinprick with fissure
1-43	Office	Floor	Vinyl Floor Tile 1	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-01 (None Detected)	N/A	N/A	12"x12" cream with brown specks
1-43	Office	Wall	Drywall Joint Compound	Asbestos	Not Sampled	Visually Consistent with 15833-B077-ASB-01 16608-B077-ASB-13 (None Detected)	N/A	N/A	
1-43	Office	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-43	Office	Ceiling	Ceiling Tile 1	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-08 (None Detected)	N/A	N/A	2'x4' Pinprick with fissure
1-44	Office	Floor	Vinyl Floor Tile 1	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-01 (None Detected)	N/A	N/A	12"x12" cream with brown specks
1-44	Office	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-44	Office	Ceiling	Ceiling Tile 1	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-08 (None Detected)	N/A	N/A	2'x4' Pinprick with fissure
1-45	Arts and Crafts Rooms	Floor	Vinyl Floor Tile 1	Asbestos	Not Sampled	Visually consistent with 16608-B077-ASB-01 (None Detected)	N/A	N/A	12"x12" cream with brown specks
1-45	Arts and Crafts Rooms	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-45	Arts and Crafts Rooms	Ceiling	Ceiling Tile 1	Asbestos	16608-B077-ASB-08A-C	None Detected	N/A	N/A	2'x4' Pinprick with fissure Sampled during ECHO 2016 Reassessment Survey
1-46	Gym Balcony	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-46	Gym Balcony	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-46	Gym Balcony	Ceiling	N/A	N/A	N/A	N/A	N/A	N/A	No False Ceiling
1-46	Gym Balcony	Structure	Steel	N/A	N/A	N/A	N/A	N/A	
1-47	Pool Viewing Area	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-47	Pool Viewing Area	Wall	Concrete Block	N/A	N/A	N/A	N/A	N/A	
1-47	Pool Viewing Area	Ceiling	N/A	N/A	N/A	N/A	N/A	N/A	No False Ceiling
Surveyor's Field Notes									

APPENDIX II




RESULTS OF BULK SAMPLE ANALYSES

(NO INFORMATION TO REPORT)

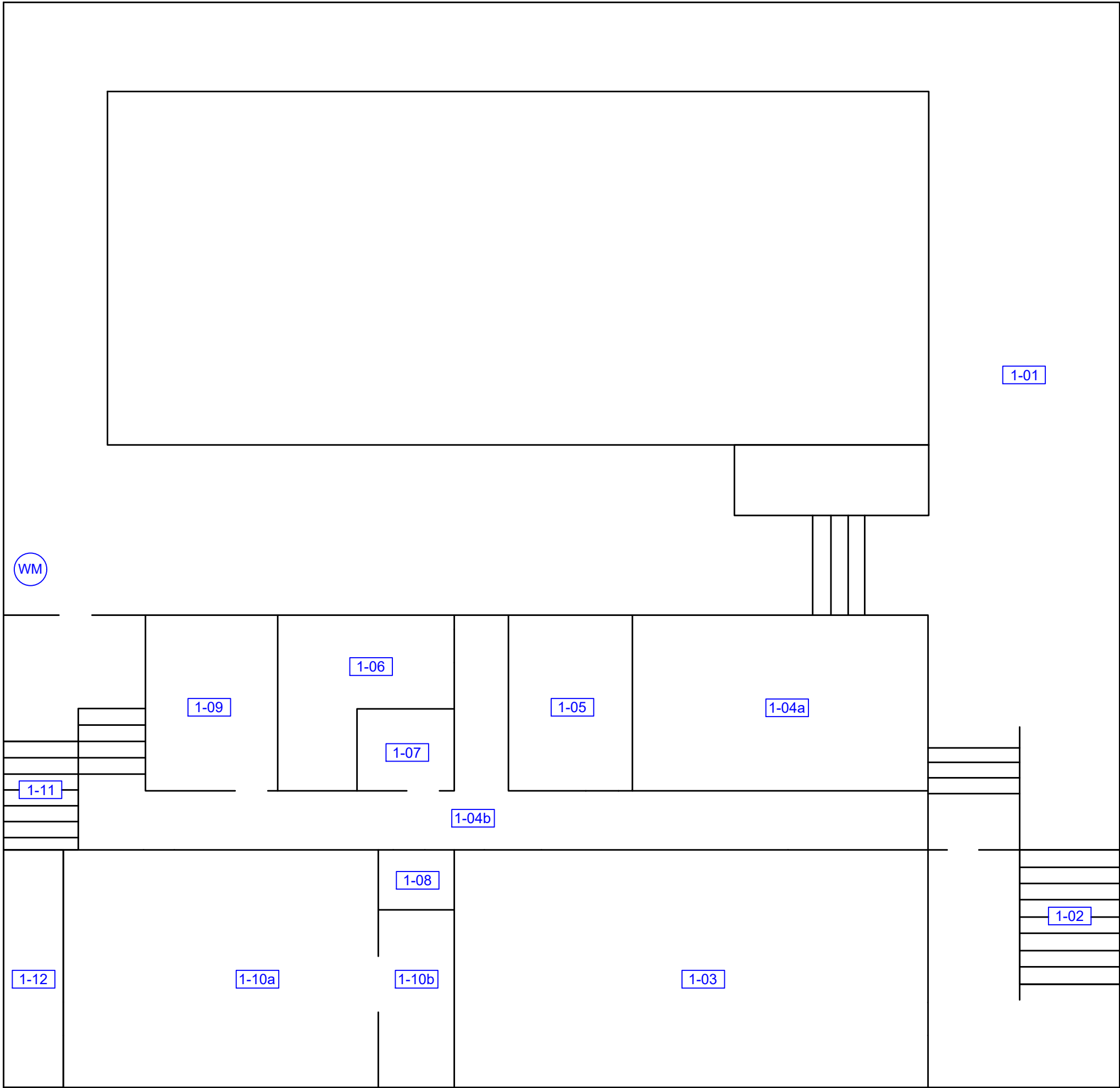
APPENDIX III

VISUALLY IDENTIFIABLE ASBESTOS-CONTAINING MATERIALS INFORMATION SHEET

APPENDIX III - VISUALLY IDENTIFIABLE ACM IDENTIFICATION SHEET

<i>MIN</i>	<i>Material</i>	<i>Photo</i>	<i>Material Description</i>	<i>Size (if applicable)</i>
VFT 1	Mastic		Cream with brown specks	12" x 12"
VFT 4	Mastic		Blue with white marks	12'x12'
VFT 6	Vinyl Floor Tile	Photo Not Available 2018	Black	12'x12'
VFT 7	Mastic & Leveller		White with black marks	12'x12'

APPENDIX IV
SURVEY DRAWINGS



Legend



Assumed or Confirmed Asbestos
Containing Material

1-01

Location Number

NAR

No Access to Room

The drawing does not illustrate locations of drywall joint compound, plaster, texture finish, window caulking or roofing materials, for reasons discussed in Section 6 of the Standard Operating Procedure for Asbestos Reassessment Surveys. Please refer to the Asbestos Reassessment Survey Form in Appendix I for information regarding the locations and asbestos-content of these materials.

Figure 1

LOCATION:
313 Pharmacy Avenue
Toronto, Ontario

BUILDING NAME:
West Scarborough Neighbourhood
Community Centre

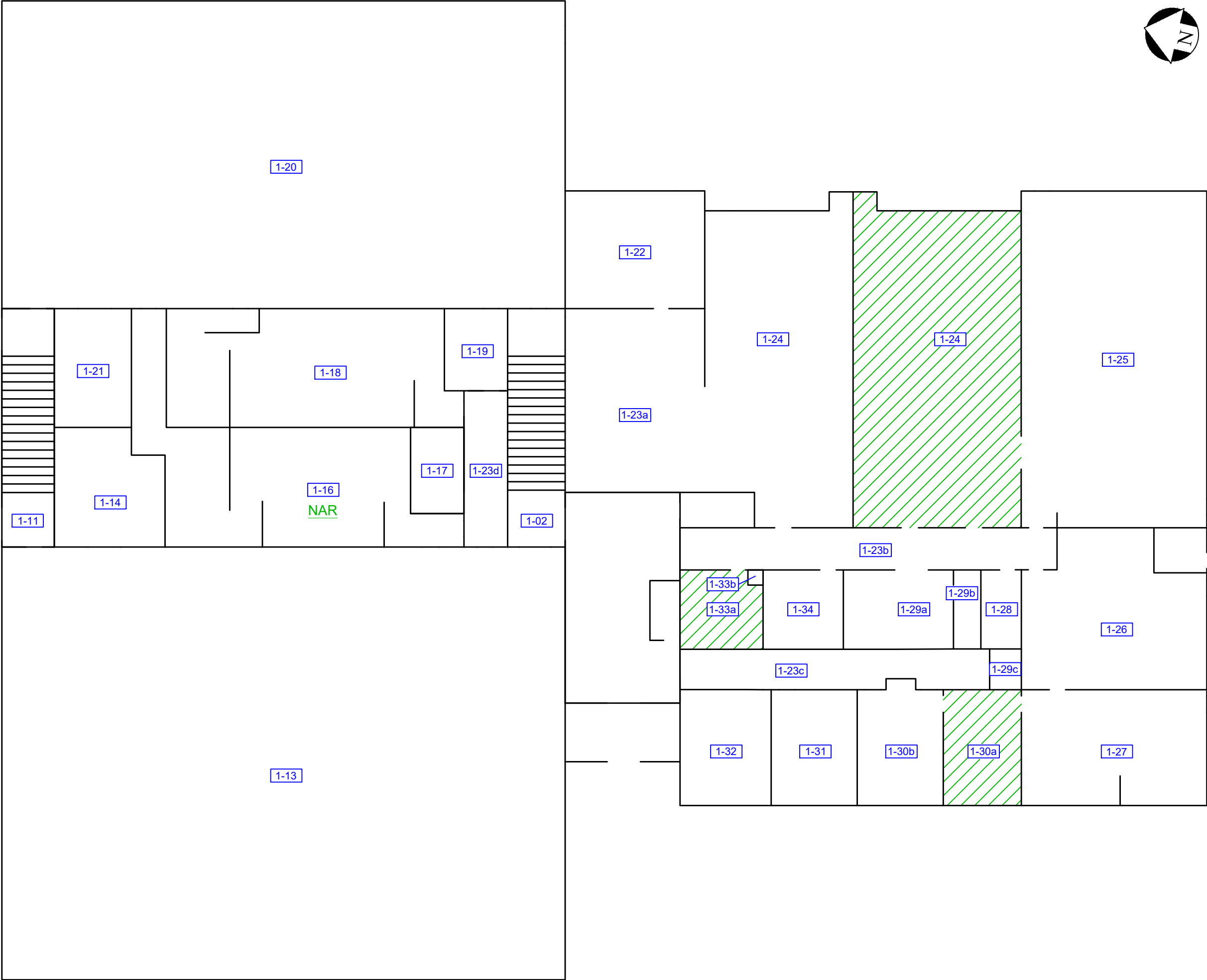
Lower Level Floor Plan
Locations of Designated Substances and
Hazardous Materials

CLIENT: City of Toronto

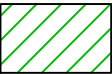
PROJECT NUMBER: 19181-B077 **DATE:** November 2018 **DRW BY:** PP

CAD FILE: Fig1-3 P19181-B077 ACM 313 Pharmacy Ave. **SCALE:** Not to Scale **CHK BY:** MM





Legend



Assumed or Confirmed Asbestos
Containing Material

1-01

Location Number

NAR

No Access to Room

The drawing does not illustrate locations of drywall joint compound, plaster, texture finish, window caulking or roofing materials, for reasons discussed in Section 6 of the Standard Operating Procedure for Asbestos Reassessment Surveys. Please refer to the Asbestos Reassessment Survey Form in Appendix I for information regarding the locations and asbestos-content of these materials.

Figure 2

LOCATION:
313 Pharmacy Avenue
Toronto, Ontario

BUILDING NAME:
West Scarborough Neighbourhood
Community Centre

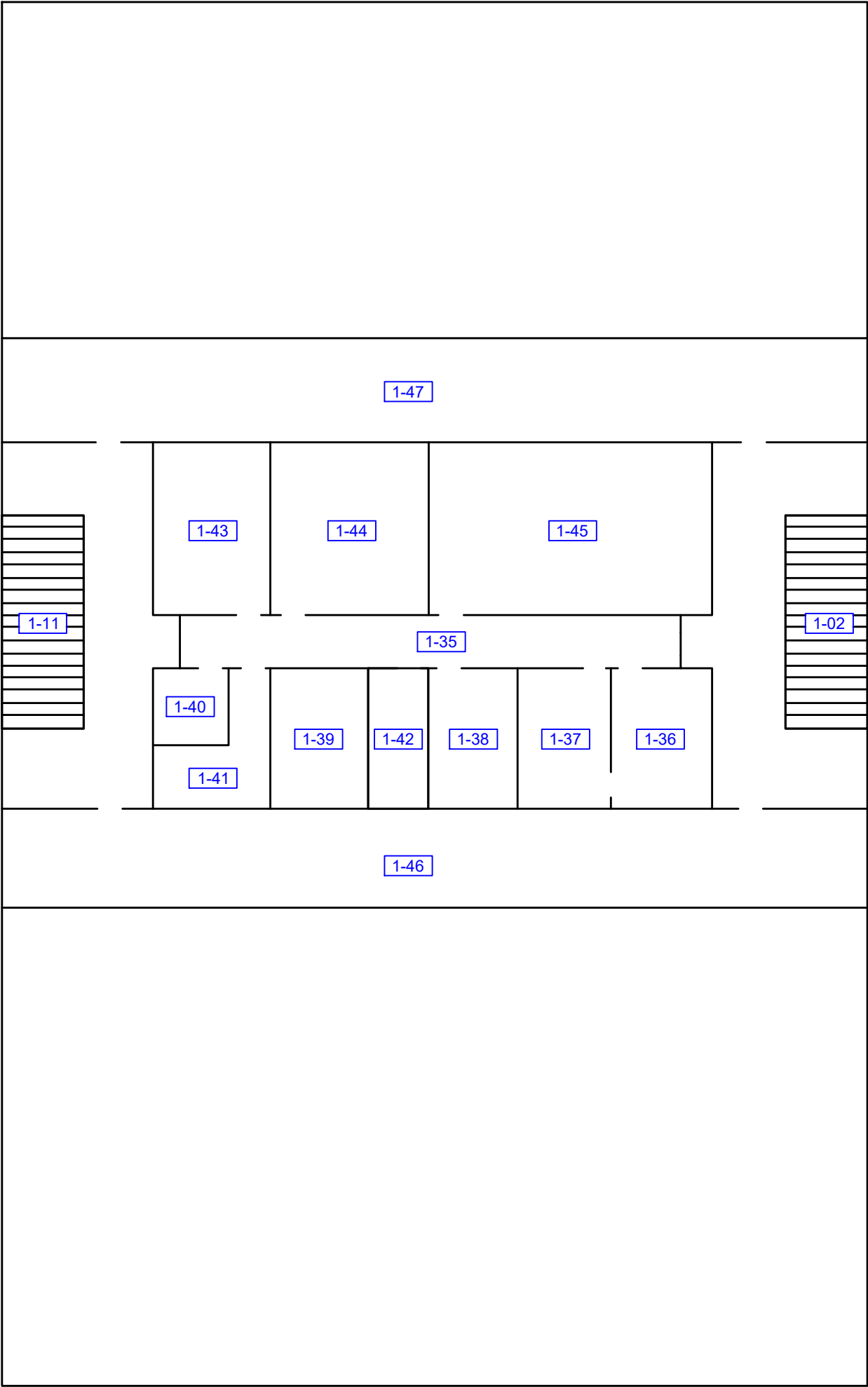
Main Floor Plan
Locations of Designated Substances and
Hazardous Materials

CLIENT: City of Toronto

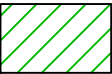
PROJECT NUMBER: 19181-B077 DATE: November 2018 DRW BY: PP

CAD FILE: Fig1-3 P19181-B077 ACM 313 Pharmacy Ave. SCALE: Not to Scale CHK BY: MM





Legend



Assumed or Confirmed Asbestos
Containing Material

1-01

Location Number

NAR

No Access to Room

The drawing does not illustrate locations of drywall joint compound, plaster, texture finish, window caulking or roofing materials, for reasons discussed in Section 6 of the Standard Operating Procedure for Asbestos Reassessment Surveys. Please refer to the Asbestos Reassessment Survey Form in Appendix I for information regarding the locations and asbestos-content of these materials.

Figure 3

LOCATION:
313 Pharmacy Avenue
Toronto, Ontario

BUILDING NAME:
West Scarborough Neighbourhood
Community Centre

Upper Level Floor Plan
Locations of Designated Substances and
Hazardous Materials

CLIENT: City of Toronto

PROJECT NUMBER: 19181-B077 DATE: November 2018 DRW BY: PP

CAD FILE: Fig1-3 P19181-B077 ACM 313 Pharmacy Ave. SCALE: Not to Scale CHK BY: MM



APPENDIX B3

Designated Substances Survey

351 Birchmount Road

Toronto Fire Museum and Fire Prevention

East District Office

Issued December 2021, by Fisher Environmental Ltd.



ENGINEERING



LABORATORY



DESIGNATED SUBSTANCES SURVEY FOR ACCESSIBILITY UPGRADES (IBI GROUP)

**TORONTO FIRE MUSEUM AND
FIRE PREVENTION EAST
DISTRICT OFFICE
351 BIRCHMOUNT ROAD
TORONTO, ONTARIO**

400 Esna Park Drive, Unit 15
Markham, ON
L3R 3K2

Tel: (905) 475-7755
Fax: (905) 475-7718
www.fisherenvironmental.com

Project No. FE-P 21-11706

December 15, 2021

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1.0. EXECUTIVE SUMMARY

Fisher Environmental Ltd. ('Fisher') was retained by IBI Group to carry out a survey for the Designated Substances and other potential hazardous materials within specified work areas for the Toronto Fire Museum and Fire Prevention East District Office building, located at 351 Birchmount Road, Toronto, Ontario, herein after referred to as the "Site". The site inspection and sampling works were conducted on November 10, 2021.

IBI Group has been commissioned by the City of Toronto to design and implement accessibility upgrades. The scope of the Designated Substances Survey (DSS) was to identify locations and types of designated substances within the building that may be impacted by the planned renovation work, and to provide recommendations for the safe handling or abatement of these materials, if any, prior to demolition.

The purpose of the project is to do the necessary construction and renovation at the locations are outlined on drawings provided by the IBI Group on October 27, 2021.

The survey was conducted in compliance with the Ontario Ministry of Labour (MOL) regulations for designated substances; O. Reg. 490/09 - *Designated Substances* and O. Reg. 278/05 - *Asbestos on Construction Projects and in Buildings and Repair Operations* made under the Occupational Health and Safety Act (OHSA), R.S.O. 1990.

Asbestos

Fisher was provided with the report of a previous DSS, which was conducted by Fisher Environmental Ltd. in June 2016. This report has indicated the following previously identified assumed and/or confirmed ACM within the specified work area(s):

- Caulking around doors and windows (assumed);
- Vinyl Floor Tiles 5 - 12"×12" White with Black Specks (confirmed); and
- Vinyl Floor Tiles 4 - 12"×12" Tan with Black and Green Specks (confirmed).

In the current survey, Vinyl Floor Tiles 4 was not observed within the specified work area(s) and no samples were collected for asbestos analysis.

Based on the observations of the current survey and the information provided in the previous report, Vinyl Floor Tile 5 (under the carpet) in the first-floor office was found to contain asbestos. However, this material is not expected to be disturbed by the planned project activities. Provide a copy of this report to contractors bidding on or performing work within the subject work areas.

Note: Fire doors, present within the specific work areas, may contain asbestos-containing thermal insulation inside the door panel. Removal of any asbestos containing fire doors, in intake condition, will require Type 1 to abatement procedures, as outlined in O. Reg. 278/05 and dispose of as asbestos waste.



Lead

Based on the age of the building, it is possible that lead-based paint and lead plumbing are present within the building. Lead can also be present in various ceramic tiles. During the current survey, three (3) bulk samples of paint were collected and submitted to Fisher Environmental Laboratories for lead analysis. The results of analysis revealed the following:

- Elevated concentrations of lead were identified in the red paint on handrails in the stairwell and door panels, and the light grey paint on the door frame within specified work areas.
- Measurable concentration of lead was identified in the light cream paint on the door hardware within the specified work areas, but below the action limit.

Fisher recommends that, prior to the planned renovation work, the removal of lead containing materials found within the specified work area(s), must be conducted using the appropriate lead abatement procedures. Lead abatement procedures to be used are determined by the method(s) of disturbance employed. Refer to *MOL Guideline: Lead on Construction Projects*, for details

Mercury

Mercury is presumed to be present in fluorescent light tubes and thermostatic controls. With the exception of fluorescent light bulbs and building thermostats, no other evidence of mercury was noted during the current survey. Prior to the planned renovation work, Fisher recommends that any presumed mercury-containing fluorescent light tubes and thermostats that will be impacted are to be removed and disposed of in accordance with O. Reg. 558/00.

Silica

No sampling for silica was conducted. However, as the building is constructed of concrete, brick and/or block walls with concrete floors, silica is expected to be found within these components of the buildings. If these materials will be disturbed during the planned renovation work, appropriate precautions should be taken to protect workers from inhaling silica dusts and debris. Refer to *MOL Guideline: Silica on Construction Projects* for details.

Other Designated Substances

The other Designated Substances would not be expected to be present at the Site. No immediate actions were recommended with regard to acrylonitrile, arsenic, benzene, coke oven emissions, ethylene oxide, isocyanates, and vinyl chloride.

Mould

During the current survey, no visible mould or favourable conditions for mould growth were observed in the specified work areas. No action is recommended with regard to mould.



2.0. INTRODUCTION

Fisher Environmental Ltd. ('Fisher') was retained by IBI Group to carry out a survey for the Designated Substances and other potential hazardous materials within specified work areas for the Toronto Fire Museum and Fire Prevention East District Office building, located at 351 Birchmount Road, Toronto, Ontario, herein after referred to as the "Site". The site inspection and sampling works were conducted on November 10, 2021.

IBI Group has been commissioned by the City of Toronto to design and implement accessibility upgrades. The scope of the Designated Substances Survey (DSS) was to identify locations and types of designated substances within the building that may be impacted by the planned renovation work, and to provide recommendations for the safe handling or abatement of these materials, if any, prior to demolition.

The purpose of the project is to do the necessary construction and renovation at the locations are outlined on drawings provided by the IBI Group on October 27, 2021.

3.0. REGULATIONS

The survey was conducted in compliance with the Ontario Ministry of Labour (MOL) regulations for designated substances; O. Reg. 490/09 - *Designated Substances* and O. Reg. 278/05 - *Asbestos on Construction Projects and in Buildings and Repair Operations* made under the Occupational Health and Safety Act (OHSA), R.S.O. 1990.

The OHSA, R.S.O. 1990, under the Ontario MOL, defines a toxic substance as a biological, chemical or physical agent (or a combination of such agents) whose presence in the workplace may endanger the health and safety of a worker. Sections of the Act that deals with toxic substances are intended to:

1. ensure that worker exposure to toxic substances is controlled;
2. ensure that toxic substances in the workplace are clearly identified and that workers are provided with enough information to be capable of handling them safely; and,
3. provide the general public with access to information about toxic substances used by industry in their communities.

The Act makes provision for a toxic substance to be "designated", where its use in the workplace is prohibited, regulated, restricted, limited or controlled. Designation is reserved for eleven substances that are particularly hazardous, covered under O. Reg 490/09 – *Designated Substances* that was implemented on July 1, 2010, and include Acrylonitrile, Arsenic, Asbestos, Benzene, Coke Oven Emissions, Ethylene Oxides, Isocyanates, Lead, Mercury, Silica, and Vinyl Chloride. Formerly, regulations for these substances were passed separately and each outlined exposure limits where workers were likely to inhale, ingest and / or absorb the substance.



O. Reg. 490/09 provides a consistent approach to dealing with existing requirements and provisions, and outlines steps required to control worker exposure to these substances, including by inhalation, ingestion, skin absorption or skin contact. Each designated substance has an allowable level of exposure based on a time-weighted average (TWA) limit, and may also have a short-term exposure limit (STEL) and / or ceiling limit (C) assigned to it. TWA refers to the time-weighted average airborne concentration of a biological or chemical agent to which a worker may be exposed in a work day or work week, STEL refers to the maximum airborne concentration of a biological or chemical agent to which a worker may be exposed in any 15 minute period, and C refers to the maximum airborne concentration of a biological or chemical agent to which a worker may be exposed at any time. Refer to O. Reg. 490/09 – *Designated Substances*.

A supplementary regulation regarding control of asbestos exposures in the construction industry has evolved into O. Reg. 278/05 – *Asbestos on Construction Projects and in Buildings and Repair Operations*. The regulation includes a definition of asbestos-containing materials (ACM), requirements for additional training and clearance air testing, procedures for determining materials that meet the definition of ACM and for the use of glove bags, and provisions for varying from measure and procedures set out in the regulation.

In addition to the OHSA and regulations regarding designated substances, the following regulations, guidelines and standards were also taken into account or referenced:

- O. Reg. 213/91 - *Construction Projects* regulated under the OHSA and last amended by O. Reg. 443/09;
- O. Reg. 558/00 made under the Ministry of Environment (MOE) Environmental Protection Act, amending O. Reg. 347 - *General Waste Management*;
- The Transport of Dangerous Goods Act (TDGA) provides regulations for the transport of asbestos-containing materials and wastes;
- MOL *Guideline: Lead on Construction Projects*, 2011; and,
- MOL *Guideline: Silica on Construction Projects*, 2011.

4.0. METHODOLOGY

Fisher followed the protocols outlined in O. Reg. 278/05 for collecting and analyzing bulk samples of materials suspected to contain asbestos. Visual assessment of the material was the primary method of identification with occasional physical contact for the purpose of collecting bulk samples or examining for underlying layers.

Where applicable, samples of suspect materials were collected in order to establish asbestos or lead content. Samples were grouped according to similarity of appearance (“homogeneous” materials). The frequency at which the samples were collected was sufficient to obtain a general representation of the presence of these materials at the Site. Samples collected are presumed to



be representative of respective building materials in-place at the Site. However, due to potential past renovations, alterations, repairs, or phases of construction, it is possible that individual materials may not be representative of samples collected.

Sampling of roofing materials was not part of the current scope of work. Further, sampling of materials found within operating equipment, portable building articles, or generally non-accessible components such as insulation within electrical switch gears, wiring, motors, light fixtures, elevator brakes, fire door cores, etc. was not performed as part of the current survey.

Samples collected during the survey were placed in plastic zip-lock bags which were labeled and submitted for laboratory analysis. Fisher Environmental Laboratories analysed bulk samples for asbestos type and approximate percent content by performing polarized light microscopy (PLM), as outlined in NIOSH Method 9002. Fisher Environmental Laboratories analysed samples for lead content in paint by performing acid digestion followed by Inductively Coupled Plasma (ICP) analysis.

Site Plans, indicating specific work areas, bulk sample locations and any area of asbestos, are included in Appendix A. The laboratory certificate of analysis is included in Appendix B. Representative photos of Site conditions encountered at the time of the current survey are included in Appendix C.

5.0. REVIEW OF PREVIOUS REPORTS

Fisher was provided with the report of a previous DSS, which was conducted by Fisher Environmental Ltd., in June 2016, attached in Appendix D. This report has indicated the following previously identified assumed and/or confirmed ACM within the specified work area(s):

- Caulking around doors and windows (assumed);
- Vinyl Floor Tiles 5 - 12"×12" White with Black Specks (confirmed); and
- Vinyl Floor Tiles 4 - 12"×12" Tan with Black and Green Specks (confirmed).

In the current survey, Vinyl Floor Tiles 4 was not observed within the specified work area(s).

Details are provided in the summaries found in the asbestos sections of this report.

6.0. FINDINGS AND RECOMMENDATIONS

6.1. Acrylonitrile

Acrylonitrile would not be expected to be present at the Site and was not observed during the current survey. No recommendations for Acrylonitrile are warranted at this time.



6.2. Arsenic

Arsenic would not be expected to be present at the Site and was not observed during the current survey. No recommendations for Arsenic are warranted at this time.

6.3. Asbestos

6.3.1. General Information

Asbestos is the name given to a group of six different fibrous minerals (amosite, chrysotile, crocidolite, and the fibrous varieties of tremolite, actinolite and anthophyllite) that occur naturally in the environment. Asbestos minerals have separable long fibres that are strong and flexible enough to be spun and woven and are heat resistant.

Because of these characteristics, asbestos has been used for a wide range of manufactured goods, mostly in building materials (roofing shingles, ceiling and floor tiles, paper products, and asbestos cement products), friction products (automobile clutch, brake, and transmission parts), heat-resistant fabrics, packaging, gaskets, and coatings. Some vermiculite or talc products may also contain asbestos.

Asbestos fibres may be released into the air by the disturbance of ACM during product use, renovation or demolition work, building or home maintenance, repair and remodeling. In general, exposure may occur only when the ACM is disturbed in some way to release particles and fibres into the air.

6.3.2. Friable vs. Non-Friable ACM

Based on the requirements of O. Reg. 278/05 and due diligence, an asbestos survey and report must be available at any workplace where asbestos exists identifying locations and types of ACM in the building. The survey must include both friable and non-friable materials confirmed to contain asbestos, as well as any other materials which were not sampled but are suspected (presumed) ACM. The term friable refers to material(s) that could be readily reduced to dust or powder when crushed by hand or moderate pressure. Friable materials have a much greater chance of releasing airborne asbestos fibres when disturbed.

In the past, the most commonly used friable asbestos-containing building materials were surfacing materials (e.g. sprayed on fireproofing, texture, decorative or acoustic plaster) as well as thermal insulation. Examples of manufactured asbestos-containing materials include vinyl floor tiles, ceiling tiles, gasket materials, asbestos cement (Transite) pipes or boards, and asbestos textiles. Depending on the above noted formulation, these materials range from non-friable to friable. Although some products are considered non-friable when in Good condition, severe damage or deterioration may cause non-friable materials to generate airborne dust more readily. Severely damaged non-friable materials, or those to be worked on with powered tools, may be considered as friable ACM for abatement purposes.



Examples of common types of ACM by friability include:

- Friable ACM
 - Sprayed Materials (or materials installed by roller or trowel), such as fireproofing, thermal insulation, texture finishes, etc.
 - Mechanical Insulation such as boiler and breeching, ductwork, piping, tanks and associated equipment.
 - Plaster
- Potentially Friable ACM
 - Acoustic Ceiling Tiles
 - Vinyl Sheet Flooring
- Non-Friable ACM
 - Vinyl Floor Tiles
 - Asbestos cement (“Transite”) piping or paneling
 - Window Caulking

6.3.3. Regulations

Exposure to asbestos is controlled by two Regulations passed under Ontario’s Occupational Health and Safety Act (OHSA), R.R.O. 1990.

- O. Reg. 490/09 – *Designated Substances* regarding asbestos applies to:
 - every employer operating a mine for the purpose of mining, crushing, grinding or sifting asbestos;
 - every employer processing, adapting or using asbestos in connection with manufacturing or assembling of goods or products;
 - every employer engaged in the repair, alteration or maintenance of machinery, equipment, aircraft, ships, locomotives, railway cars and vehicles;
 - every employer engaged in work on a building that is necessarily incidental to the repair, alteration or maintenance of machinery or equipment; and,
 - to those workers of such employers who are likely to be exposed to asbestos.

Exposure limits for this substance are set at 0.1 f/cc (TWA) for all types of asbestos.

- O. Reg. 278/05 - *Asbestos on Construction Projects and in Buildings and Repair Operations* applies to buildings that contain friable and non-friable ACM and to the repair, alteration and/or maintenance of these buildings.

In addition to regulations for controlling work around asbestos-containing building materials there are regulations for packaging, transportation and disposal of asbestos-containing waste:



- O. Reg. 558/00 made under the Ministry of Environment (MOE) Environmental Protection Act, amending O. Reg. 347 - *General Waste Management*; and,
- The Transport of Dangerous Goods Act (TDGA) provides regulations for the transport of asbestos-containing materials and wastes.

6.3.4. Findings

Samples of homogenous materials suspected to contain asbestos were collected and submitted for analysis. Fisher collected no bulk samples of building materials found within the specified work area(s) and that could potentially contain asbestos. Findings of all building materials identified within the specified work area(s) are outlined in further detail below.

6.3.4.1. Sprayed or Troweled Fireproofing and Thermal Insulation

No indication of sprayed or troweled fireproofing and / or thermal insulation was noted in any of the specified work areas during the current survey.

6.3.4.2. Texture Finish

No texture finish was noted in any of the specified work areas during the current survey.

6.3.4.3. Mechanical Insulation

The majority of mechanical insulation observed throughout the building are either not insulated or are insulated with fiberglass which is not suspected to contain asbestos.

6.3.4.4. Acoustic Ceiling Tile

No acoustic ceiling tiles was noted in any of the specified work areas during the current survey.

6.3.4.5. Plaster / Drywall Joint Compound

Plaster was not observed within the specific work areas at the Site. The previous report indicated that five (5) samples of the plaster were collected for analysis. The results of analysis revealed that the plaster does not contain asbestos.

Drywall Joint Compound (DJC) was observed within the specific work areas throughout the building. The previous report indicated that twelve (12) samples of the DJC were collected for analysis. The results of analysis revealed that the DJC does not contain asbestos.

6.3.4.6. Asbestos Cement Products

No asbestos cement products, such as Transite pipe or board, were noted in any of the specified work areas during the current survey.

6.3.4.7. Vinyl Sheet Flooring

No vinyl sheet flooring was noted in any of the specified work area(s) during the current survey.



6.3.4.8. Vinyl Floor Tile

During the current survey, two (2) varieties of vinyl floor tile were observed within the specified work areas.

- Vinyl Floor Tiles 1 – 12"×12" Dark Grey with Black/White Smears
- Vinyl Floor Tiles 5 – 12"×12" White with Black Specks

The previous report confirmed that Vinyl Floor Tiles 1 and Vinyl Floor Tiles 5 were sampled for analysis. The results of analysis revealed Vinyl Floor Tile 1 does not contain asbestos, however Vinyl Floor Tile 5 (under the carpet) in the first-floor office, contains 5-25% Chrysotile asbestos. However, this material is not expected to be disturbed by the planned project activities.

6.3.5. Recommendations

Prior to demolition or any renovation activities, all asbestos-containing materials must be removed from the specified work areas in accordance with O. Reg. 278/05 - *Asbestos on Construction Projects and in Buildings and Repair Operations*, and be disposed of at a MOE licensed landfill in accordance with O. Reg. 558/00 (amending O. Reg. 347, *General – Waste Management*).

Refer to attached Site Plans in Appendix A, which illustrate where the ACM is located within the specified work area(s).

Specifically, Fisher recommends the following:

- Provide a copy of this report to contractors bidding on or performing work within the subject work areas;
- If required, remove the asbestos-containing vinyl floor tile using Type 1 abatement procedures, as outlined in O. Reg. 278/05. Please note that if the vinyl floor tile will be disturbed by the use of power tools during removal, abatement must be performed using Type 3 abatement procedures as outlined in O. Reg. 278/05.

Note: Fire doors, present within the specific work areas, may contain asbestos-containing thermal insulation inside the door panel. Removal of any asbestos containing fire doors, in intake condition, will require Type 1 to abatement procedures, as outlined in O. Reg. 278/05 and dispose of as asbestos waste.

The presence of ACM should be presumed in locations not accessed during this survey. It is possible that ACM is present at the Site that is not identified in this report. Should additional suspected ACM be discovered, it should be presumed as ACM until sample analysis determines asbestos content.

Due to the limited nature of the current scope of work and the presence of solid building finishes (i.e., drywall walls and ceilings etc.) in many locations, the full extent of ACM may not be confirmed. Precautions should be taken when dismantling solid wall or ceiling finishes, or any



other building surfaces which may conceal potential ACM. Such precautions include, but are not limited to, isolation measures and appropriate personal protective equipment.

6.4. Benzene

Benzene would not be expected to be present at the Site and was not observed during the current survey. No recommendations for Benzene are warranted at this time.

6.5. Coke Oven Emissions

Coke oven emissions would not be expected to be present at the Site and were not observed during the current survey. No recommendations for coke oven emissions are warranted at this time.

6.6. Ethylene Oxides

Ethylene oxides would not be expected to be present at the Site and were not observed during the current survey. No recommendations for ethylene oxides are warranted at this time.

6.7. Isocyanates

Isocyanates would not be expected to be present at the Site and were not observed during the current survey. No recommendations for isocyanates are warranted at this time.

6.8. Lead

6.8.1. General Information

Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. Most lead in the environment comes from human activities such as burning fossil fuels, mining and manufacturing. Lead is used in the production of batteries, ammunition, metal products (solder and pipes) and X-ray devices.

Lead does not break down but lead compounds are changed by sunlight, air and water. Exposure occurs when eating food or drinking water that contains lead. Deteriorated lead paint can contribute to lead dust. The main target for lead toxicity is the nervous system.

6.8.2. Regulations and Guidelines

The Ontario MOL has not prescribed criteria defining an analyzed sample of bulk material as "lead-containing". Further, the MOL has not established a lower limit for concentrations of lead in paint, below which precautions do not need to be considered during construction projects. However, except for very aggressive disturbance of painted finishes, (e.g., abrasive blasting, torch cutting, or grinding), Fisher believes that a lead content below 0.1% by weight (1,000 ug/g or 1000 ppm) represents a concentration in which the lead content is not the limiting hazard for construction hygiene purposes. Regular construction dust suppression techniques and worker



hygiene practices are sufficient for disturbance of paint finishes determined to contain less than 0.1% lead by weight, provided that work is limited to non-aggressive operations.

The regulation for the designated substance lead applies to every employer and worker at a workplace where lead is present, produced, processed, used, handled or stored and at which a worker is likely to be exposed to lead. Exposure limits for this substance are set at 0.05 – 0.10 mg/m³ (TWA) depending on the type of lead, and for tetraethyl lead 0.30 mg/m³ (STEL).

Additionally, in 2011 the MOL revised *Guideline: Lead on Construction Projects* outlining practices that should be followed during construction projects to protect workers' from exposure to lead. This includes the methods and equipment employed in the removal of lead-containing coatings that reduce the creation of dust, providing appropriate facilities for workers to wash after each shift, and providing protective clothing and respirators where necessary.

6.8.3. Findings

Based on the age of the building, it is possible that lead-based paint and lead plumbing are present within the building. Lead can also be present in various ceramic tiles. During the current survey, three (3) bulk samples of paint were collected and submitted to Fisher Environmental Laboratories for lead analysis. The results of analysis revealed the following:

- Elevated concentrations of lead were identified in the red paint on handrails in the stairwell and door panels, and the light grey paint on the door frame within specified work areas.
- Measurable concentration of lead was identified in the light cream paint on the door hardware within the specified work areas, but below the action limit.

6.8.4. Recommendations

Where any lead-containing materials may be disturbed or removed, Fisher recommends that appropriate lead abatement procedures be used. The lead abatement procedures to be used are determined by the method(s) of disturbance employed. Regular construction dust suppression techniques and worker hygiene practices are sufficient for disturbance of paint finishes determined to contain less than 0.1% lead by weight, provided that work is limited to non-aggressive operations. The table below outlines lead abatement operations and associated respirator required, as outlined in Ontario MOL guidelines.

Classifications of Lead-Containing Operations and Required Respirator

Type 1 Operations (where concentrations of airborne lead would be expected to be < 0.05 mg/m ³)	
Activities that include; <ul style="list-style-type: none"> • Removal of lead containing coatings with chemical gel or paste and fibrous laminated cloth wrap • Removal of lead containing coatings / materials using power tool that has an effective dust collection system equipped with HEPA filter • Removal of lead containing coatings / materials using non-powered hand tools other than manual scraping or sanding 	Respirators should not be necessary if general procedures are followed and level of air is less than 0.05 mg/m ³ . However, if worker wishes to use a respirator, a half-mask particulate respirator with N-, R- or P-series filter, and 95, 99 or 100% efficiency should be provided.



Type 2a Operations (where concentrations of airborne lead would be expected to be > 0.05 to 0.50 mg/m ³)	
Activities that include; <ul style="list-style-type: none"> • Removal of lead containing coatings / materials by scraping or sanding using non-powered hand tools • Manual demolition of lead painted plaster walls / building components by striking with a sledgehammer or similar tool 	NIOSH APF = 10 Half-mask particulate respirator with N- , R- or P- series filter, and 95, 99 or 100% efficiency.
Type 2b Operations (where concentrations of airborne lead would be expected to be > 0.50 to 1.25 mg/m ³)	
Not applicable to potential renovation activities.	
Type 3a Operations (where concentrations of airborne lead would be expected to be > 1.25 to 2.50 mg/m ³)	
Activities that include; <ul style="list-style-type: none"> • Welding or high temperature cutting of lead-containing coatings or materials indoors or in a confined space. • Dry removal of lead-containing mortar using an electronic or pneumatic cutting device. • Burning of a surface containing lead • Removal of lead containing coatings / materials using power tools without an effective dust collection system equipped with HEPA filter 	NIOSH APF = 50 Full-face piece air-purifying respirator with N- , R- or P- series filter and 100% efficiency. Tight-fitting powered air-purifying respirator with high efficiency filter. Full-face piece supplied-air respirator operated in demand mode. Half-mask or full-face piece supplied air respirator operated in continuous-flow mode.
Type 3b Operations (where concentrations of airborne lead would be expected to be > 2.50 mg/m ³)	
Abrasive blasting of lead-containing coatings or materials.	NIOSH APF ≥ 1000 Type CE abrasive-blast supplied respirator operated in a positive pressure mode with a tight-fitting half-mask face piece.

Refer to MOL *Guideline: Lead on Construction Projects, 2011*, for details of the Ministry's health and safety guidelines regarding lead.

6.9. Mercury

6.9.1. General Information

Mercury is a naturally occurring metal. It is a shiny, silver-white and odourless liquid. It combines with other elements to form inorganic compounds or salts. Metallic mercury is used to produce chlorine gas and caustic soda, and is used in thermostats and thermometers, fluorescent light bulbs, dental fillings and batteries. Exposure occurs when eating fish or shellfish contaminated with methyl mercury, breathing vapors from spills, incinerators, etc.

The nervous system is very sensitive to all forms of mercury. Exposure to high levels of metallic inorganic or organic mercury can permanently damage the brain, kidneys and developing fetus. Short-term exposure may cause lung damage, nausea, vomiting and diarrhea as well as skin and eye irritation.

6.9.2. Regulations

The regulation for mercury applies to every employer and worker at a workplace where mercury is present, produced, processed, used, handled or stored and at which a worker is likely to be



exposed to mercury. Exposure limits for this substance are set at 0.025 – 0.01 mg/m³ (TWA) for all forms of mercury excluding alkyl, and for alkyl compounds of mercury 0.03 mg/m³ (STEL).

6.9.3. Findings

Mercury is presumed to be present in fluorescent light tubes and thermostatic controls. With the exception of fluorescent light bulbs and building thermostats, no other evidence of mercury was noted during the current survey.

6.9.4. Recommendations

Prior to the planned renovation work, Fisher recommends that any presumed mercury-containing fluorescent light tubes and thermostats that will be impacted are to be removed and disposed of in accordance with O. Reg. 558/00.

6.10. Silica

6.10.1. General Information

Silica is a crystalline compound occurring abundantly as quartz, sand, and many other minerals, and used to manufacture a variety of materials, especially glass and concrete. When mining this substance, silica can be deadly when it becomes airborne. If inhaled, silica dust can cause silicosis which can be fatal.

Some of the following industries have a high potential for risk to workers: construction (sandblasting, rock drilling, masonry work, jack hammering, tunneling), mining (cutting or drilling through sandstone or granite), foundry work (grinding, mouldings, shakeout, core room), stone cutting (sawing, abrasive blasting, chipping, grinding), manufacturing and use of abrasives, etc.

6.10.2. Regulations

The regulation for silica applies to every employer and worker at a workplace where silica is present, produced, processed, used, handled or stored and at which a worker is likely to be exposed to silica. Exposure limits for this substance are set at 0.05 - 0.10 mg/m³ (TWA), depending on the type of silica.

Additionally, in 2011 the MOL revised *Guideline: Silica on Construction Projects* outlining practices that should be followed during construction projects to protect workers' from exposure to silica. This includes the methods and equipment employed in the removal of silica-containing materials that reduce the creation of dust, providing appropriate facilities for workers to wash after each shift, and providing protective clothing and respirators where necessary.

6.10.3. Findings

No sampling for silica was conducted. However, as the building is constructed of concrete, brick and/or block walls with concrete floors, silica is expected to be found within these components of the buildings.



6.10.4. Recommendations

If these materials will be disturbed during the planned renovation work, appropriate precautions should be taken to protect workers from inhaling silica dusts and debris. Refer to MOL *Guideline: Silica on Construction Projects* for details.

6.11. Vinyl Chloride

Vinyl chloride would not be expected to be present at the Site and was not observed during the current survey. No recommendations for vinyl chloride are warranted at this time.

6.12. Mould

During the current survey, no visible mould or favourable conditions for mould growth were observed in the specified work areas. No action is recommended with regard to mould.



7.0. LIMITATIONS

Fisher Environmental Ltd. accepts responsibility for the competent performance of its duties in executing this assignment within the normal standards of the profession, but disclaims responsibility for consequential damages, if any.

The scope of the survey is based on prior agreement with the client, and the rationale given in this report. The survey findings rely on professional interpretation of selective sampling and analysis. Sample analysis results have been applied to homogenous materials in unsampled locations; it was not within the scope of work to carry out an exhaustive sampling and analysis program. For non-accessible building spaces, the likelihood of the presence or absence of asbestos and other designated substances has been described, but such assessment is not a definitive statement of presence or absence.

This report was prepared for the IBI Group. The scope of services performed may not be appropriate for the purposes of other users, and any use or reuse of this document or its findings or recommendations represented herein is at the sole risk of any other user.

We trust that the information provided in the report meets your current requirements. If you have any questions or concerns, please do not hesitate to contact the undersigned.

Respectfully submitted,



Iqbal Fattah, M.Sc.
Project Manager

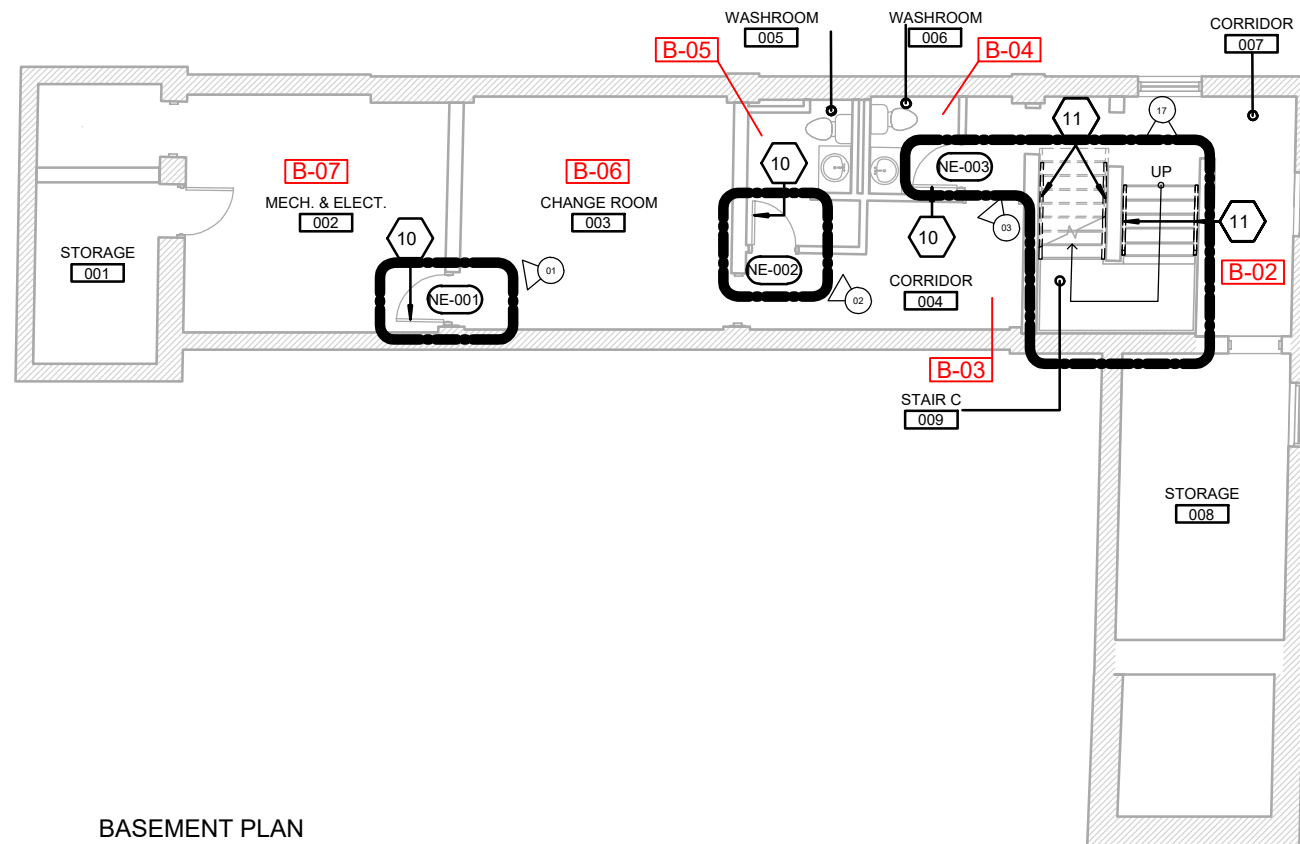


David Fisher, P. Eng., C. Chem.
Principal

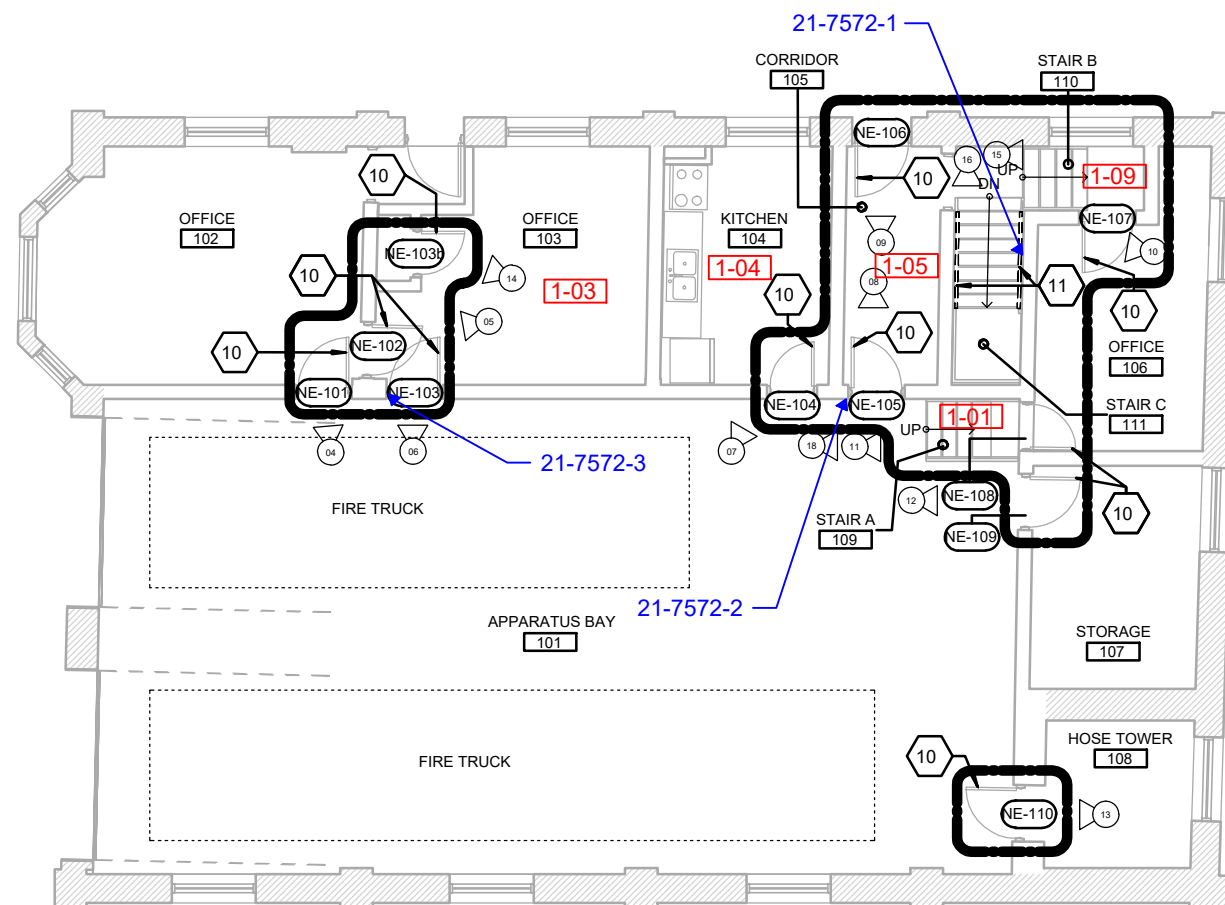


APPENDIX A – SITE PLANS





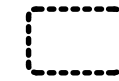
BASEMENT PLAN



FIRST FLOOR PLAN



Legend



Area of Work

1-01

Location Number



Lead Sample Location

Figure 1

LOCATION:

351 Birchmount Road
Toronto, Ontario

BUILDING NAME:

Fire Museum- Fire Prevention Office

Basement and First Floor Plan Lead Sample Locations

CLIENT:

IBI Group

PROJECT NUMBER: FE-P 21-11706

DATE: November 2021

DRW BY: ZA

CAD FILE: FIG1

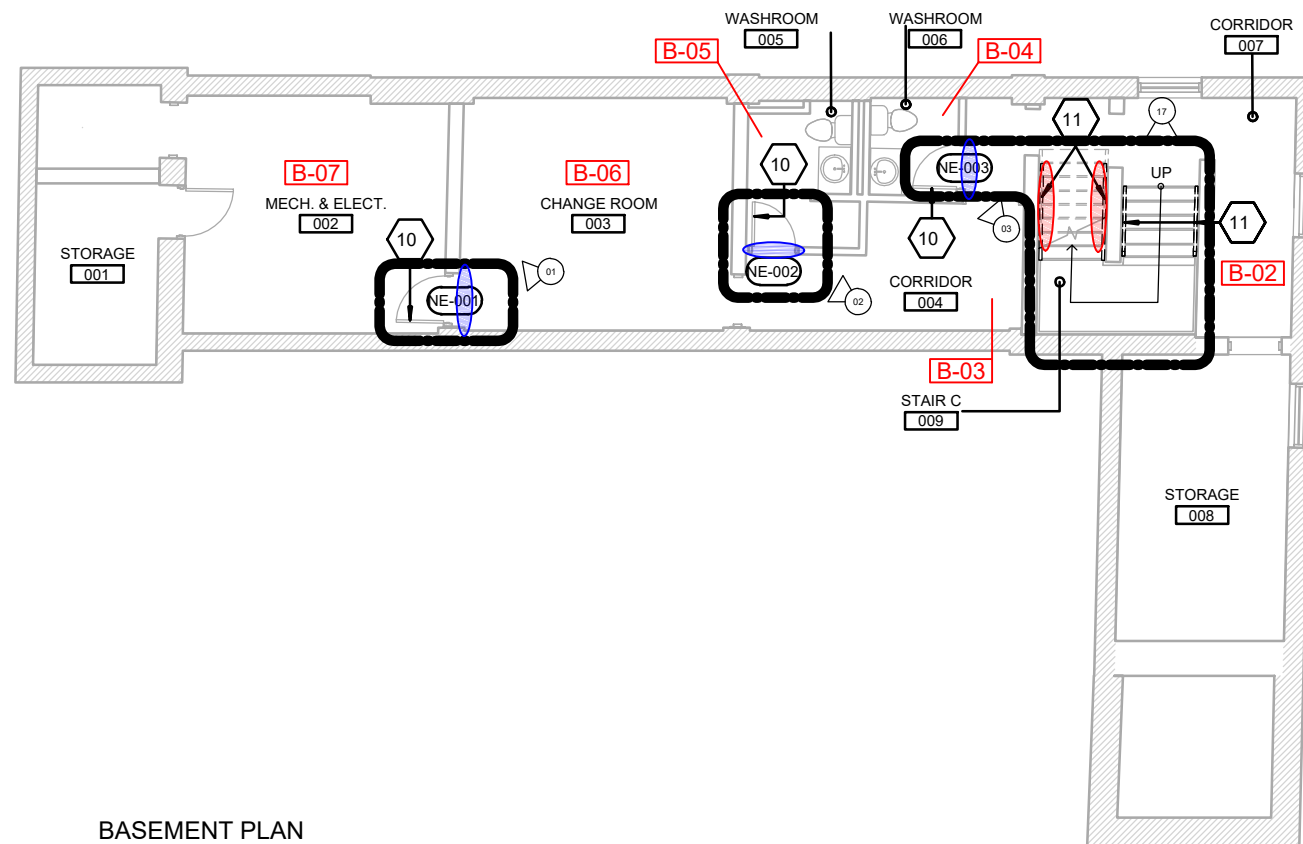
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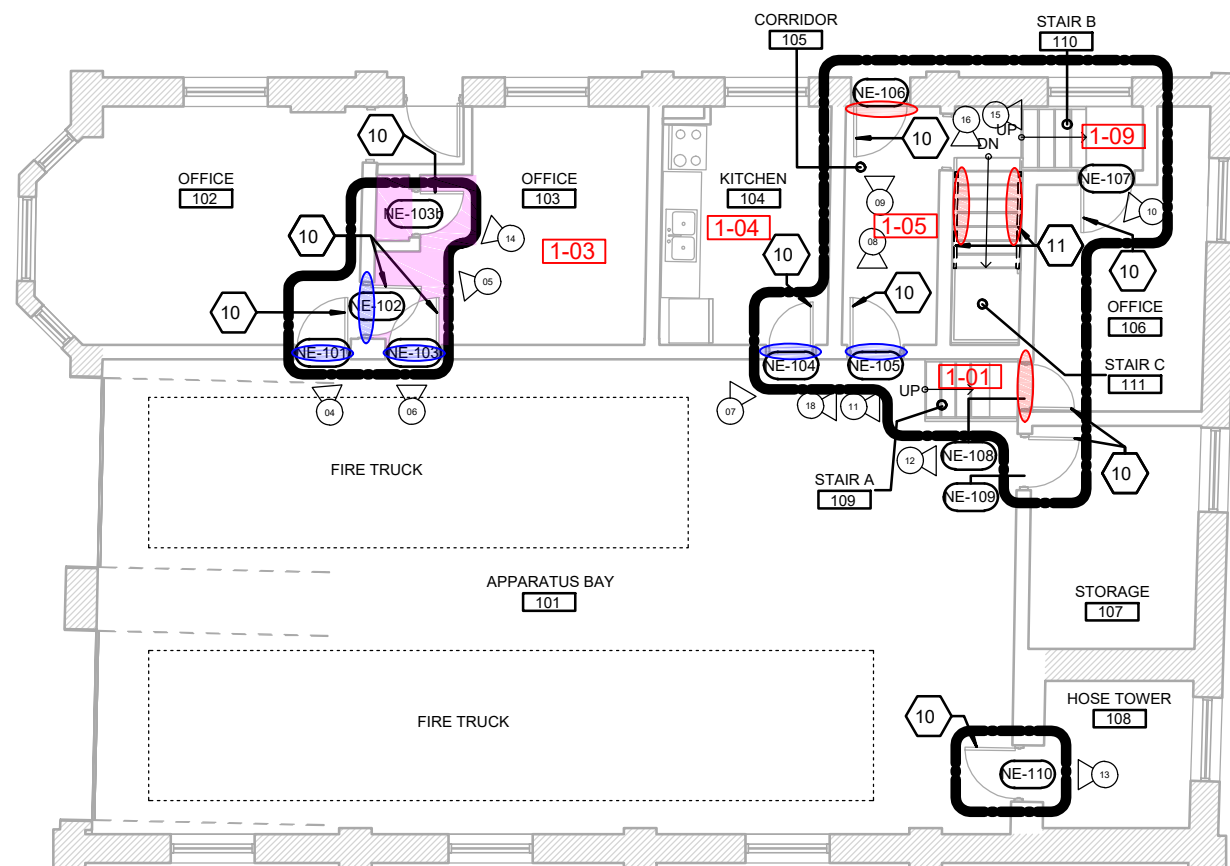


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L3R 3K2

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Fax: 905 475-7718



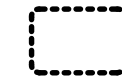
BASEMENT PLAN



FIRST FLOOR PLAN



Legend



Area of Work



Location Number



Asbestos-Containing VFT-5



Lead-Containing Light-Green Paint



Lead-Containing Red Paint

Figure 2

LOCATION:

351 Birchmount Road
Toronto, Ontario

BUILDING NAME:

Fire Museum- Fire Prevention Office

Basement and First Floor Plan Asbestos- Containing Material Locations and Lead- Containing Locations

CLIENT:

IBI Group

PROJECT NUMBER: FE-P 21-11706

DATE: November 2021

DRW BY: ZA

CAD FILE: FIG2

SCALE: Not to Scale

CHK BY: IF



400 Esna Park Dr., #15
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L3R 3K2

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Fax: 905 475-7718

APPENDIX B – CERTIFICATE OF ANALYSIS





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Toronto, ON
M9W 0C9
Tel.:
E-mail:
Attn: Luisa Sosa

F.E. Job #: 21-7572
Project Name: DSS
Project ID: FE-P 21-11706
Date Sampled: 10-Nov-2021
Date Received: 19-Nov-2021
Date Reported: 26-Nov-2021
Location: 351 Birchmount Road

Certificate of Analysis

Analysis Requested:	Lead
Sample Description:	3 Bulk Sample(s)

Sample Matrix and Client Sample Description	Client Sample Location	Lab Sample ID	Lead (ppm)
L1 - Red Paint	1-09, Stairwell, Handrailing	21-7572-1	2752
L2 - Light Grey Paint	1-05, Entrance Corridor, Door Frame	21-7572-2	1416
L3 - Light Cream Paint	1-03, Office, on the Hardware of the Door	21-7572-3	301.3

< result obtained was below RL (Reporting Limit).

QA/QC Report

Parameter	Blank (ppm)		LCS (%)		CRM/MS (%)	
	Result	RL	Recovery	AR	Recovery	AR
Lead	<10	10	89	80-120	114	70-130


Parameter	Duplicate (%)					
	RPD	AR				
Lead	6.5	0-30				

LEGEND:

RL - Reporting Limit
LCS - Laboratory Control Sample
MS - Matrix Spike
AR - Acceptable Range
RPD - Relative Percent Difference

ANALYTICAL METHODS:

Metals (Lead) - Method # F-1, Rev. 4.5, Standard Operation Procedure for determination of Metals by the Inductively Coupled Plasma- Optical. Method used by Fisher Environmental Lab complies with the Standard Methods for the Examination of Water and Wastewater, 20th Ed 3120-B.

Authorized by: 
Roger Lin, Ph. D., C. Chem.
Laboratory Manager



APPENDIX C – SITE PHOTOS





Photo 1: View of the asbestos-containing VFT-5 (12"x12" White with Black Specks) in the first floor office.



Photo 2: View of the elevated concentrations of lead-containing red paint on the handrail in the stairwell..

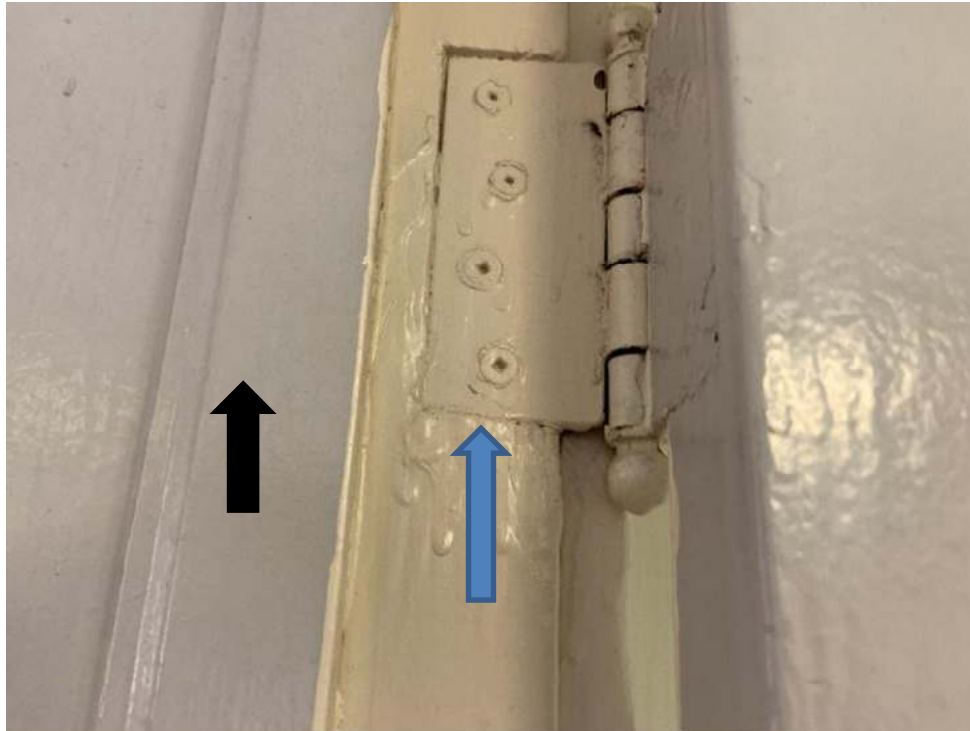


Photo 3: View of the elevated concentration of lead-containing light grey paint on the door frame (indicated with black arrow) and the light cream paint on the hardware and the door frame (indicated with blue arrow) within the specific work area.

APPENDIX D – PREVIOUS DSS REPORT





DESIGNATED SUBSTANCE SURVEY



TORONTO FIRE MUSEUM & FIRE PREVENTION EAST DISTRICT OFFICE 351 BIRCHMOUNT ROAD

Toronto, Ontario

Presented to:

Meaghan Aldcroft

City of Toronto
Facilities Management

Fisher Environmental Ltd.
Project Number: FE-P 16-7715

JUNE, 2016

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APPENDIX IV – SURVEY DRAWINGS

APPENDIX V – SITE PHOTOGRAPHS

1. INTRODUCTION AND REGULATORY REQUIREMENTS

1.1 Introduction and Scope

Fisher Environmental Ltd. was retained by the City of Toronto, Facilities Management to conduct a Designated Substance Survey of building materials in Toronto Fire Museum & Fire Prevention East District Office located at 351 Birchmount Road in Toronto, Ontario.

The objectives of the Designated Substance Survey (DSS) are to establish locations, conditions and types of designated substances contained within a building and, if necessary, provide recommendations to fulfill requirements set forth under the Ontario Occupational Health and Safety Act (OHSA) to achieve regulatory compliance. Preparation of the DSS report, which includes a brief description of the materials present, and the findings of the DSS, will fulfill the requirements of the Ontario Ministry of Labour (MOL) regulations for designated substances; O. Reg. 490/09 – Designated Substances and O. Reg. 278/05 – Asbestos on Construction Projects and in Buildings and Repair Operations.

The DSS should also include an examination for the presence of polychlorinated biphenyls (PCBs) and visible mould growth. This document should be filed as an addendum to the original survey, which was conducted by ECOH Management Inc. on August 9, 2007.

The *Designated Substance Survey* report is intended for management purposes only to demonstrate compliance with regulations. It is not to be used to establish the designated substance content within building materials before renovation or demolition activities. Prior to any work activities that may disturb building materials, a thorough Pre-Renovation or Pre-Demolition survey of the work area for designated substances and hazardous materials shall be conducted. Muhammad Junayed of Fisher Environmental Ltd. performed the fieldwork on June 7, 2016.

2. SURVEY METHODOLOGY

2.1 General Approach

To ensure familiarity with the building, the Surveyor made reference to the previous assessment and reassessment reports provided by the City of Toronto prior to commencing the survey. The Surveyor also made reference to facility floor plans included in the previous assessment reports, or provided independently by the City of Toronto. Facility drawings identifying locations of asbestos-containing materials, if present, are included in Appendix IV. Site photographs are included in Appendix V.

2.2 Survey Methodology

The City of Toronto provided the consultant with the previous DSS report and / or other survey reports of designated substances identified within the facility, if available. Prior to conducting the DSS, the reports were reviewed by Fisher Environmental Ltd. and updated with all available information regarding ACM, including that from past assessments and reassessments.

The survey was conducted in compliance with the Ontario Ministry of Labour (MOL) regulations for designated substances; O. Reg. 490/09 - *Designated Substances* and O. Reg. 278/05 - *Asbestos*

on Construction Projects and in Buildings and Repair Operations made under the Occupational Health and Safety Act (OHSA), R.S.O. 1990.

The Surveyor conducted a visual reassessment of all known and assumed asbestos-containing materials in all accessible areas of the building, as detailed in past survey reports and the Reassessment Survey Form, and recorded the condition (GOOD, FAIR or POOR) of each known or assumed ACM on the Asbestos Reassessment Survey Form. The Surveyor also recorded detailed descriptions of previously-unidentified potential ACM, if observed. Please refer to Appendix I for the updated Reassessment Survey Form.

Materials confirmed to be asbestos-containing during previous assessments were not sampled for this reassessment survey. Additionally, samples were not collected of materials that were previously confirmed to be non-asbestos by the requirements of Ontario Regulation 278/05.

Any other potential asbestos-containing materials noted during the reassessment survey that had not been identified in a previous survey, or were not sampled in accordance with the requirements of O. Reg. 278/05, were sampled as part of the reassessment.

The DSS is based on a walk-through inspection of the facility and shall be conducted room by room to establish locations, conditions and types of designated substances. The survey shall also include an examination for the presence of polychlorinated biphenyls (PCBs) and visible mould growth.

3. FINDINGS AND RECOMMENDATIONS

3.1 Asbestos

Asbestos fibres may be released into the air by the disturbance of asbestos containing material (ACM) during product use, demolition work, building or home maintenance, repair and remodeling. In general, exposure may occur only when the ACM is disturbed in some way to release particles and fibres into the air.

3.1.1 Findings

Previously identified assumed and/or confirmed ACM include the following:

- Roofing Materials,
- Window Caulking, and
- Vinyl Floor Tile – two (2) varieties.

All assumed and confirmed ACM were observed to be in GOOD condition at the time of the reassessment.

Unless previously determined to be non-asbestos, plaster, drywall joint compound, vinyl floor tiles, mastics and window caulking in other areas of the facility should continue to be assumed to be asbestos-containing, and should be sampled prior to renovation and/or demolition activities.

During this reassessment survey, samples of readily accessible materials (excluding roofing materials and window caulking) were collected to meet the bulk sampling requirements outlined in O. Reg. 278/05. Table 1 below summarizes the analytical results for the sampled assumed ACM.

TABLE 1 Summary of Analysis of Bulk Samples collected and analysed during this reassessment			
Sample Number	Sample Description	Sample Location	Analytical Results
16-4392-01	Vinyl Floor Tile 6 - 12" x 12" Brown	1-02, Office	None Detected
16-4392-02			
16-4392-03			

Laboratory analysis determined each material sampled to not contain asbestos. The laboratory analysis report is included with this report as Appendix II.

3.1.2 Recommendations

All assumed and confirmed ACM were observed in Good condition at the time of the reassessment. Therefore, no recommended corrective actions are made at this time.

Any other building materials suspected to contain asbestos which are not outlined in this report should be assumed to be asbestos-containing until sample analysis determines asbestos content.

Ontario Ministry of Labour Regulation 278/05 requires that an Asbestos Management Program (AMP) be implemented as long as asbestos-containing materials are present in a building. The AMP, original survey report and subsequent reassessment reports must be available at the work place, and must identify the type of asbestos, and where asbestos can be found on a room-by-room basis.

NOTE: Interpretation of all sources of asbestos-related information, including but not limited to the original asbestos survey report, asbestos reassessment reports, room-by-room survey data, survey drawings and reports from previous asbestos abatement projects, should be completed by a competent person trained in the historical application of asbestos in building materials, building design and preferably by a person with site-specific knowledge and/or experience.

Information contained within any of the above-noted sources may not relieve the Regulatory responsibility of building Owners, or project Employers/Constructors, to complete a detailed site inspection prior to commencement of a project.

This report should not be used as a substitute for a detailed site inspection to identify asbestos-containing building materials, which must be specifically tailored to the scope and nature of any given project, and completed prior to any maintenance, renovation or demolition work that may cause disturbance to building materials.

3.2 Lead

Most lead in the environment comes from human activities such as burning fossil fuels, mining and manufacturing. Lead is used in the production of batteries, ammunition, metal products such as solder and pipes, and x-ray devices. Exposure happens when eating food or drinking water that contains lead. Deteriorated lead paint can contribute to lead dust. The main target for lead toxicity is the nervous system.

The regulation for lead applies to every employer and worker at a workplace where lead is present, produced, processed, used, handled or stored and at which a worker is likely to be exposed to lead.

Additionally, in 2004 the MOL issued *Guideline: Lead on Construction Projects* outlining practices that should be followed during construction projects to protect workers' from exposure to lead. This includes the methods and equipment employed in the removal of lead containing coatings that reduce the creation of dust, providing appropriate facilities for workers to wash after each shift, and providing protective clothing and respirators where necessary.

3.2.1 Findings

Paint finishes were generally noted to be in Good condition throughout the Site. Based on the age of the building, it is possible that lead-based paint and lead plumbing are present within the building. During the current investigation, no samples were collected for lead analysis.

No other indication of lead containing materials was observed during the building audit, with the exception of that which may be contained within batteries.

3.2.2 Recommendations

During the disturbance of any painted surfaces that contain lead, it would be recommended that appropriate procedures and use of respirators be followed to protect workers.

No immediate corrective actions were recommended with regard to lead.

3.3 Acrylonitrile

Acrylonitrile is used to make other chemicals such as plastics, synthetic rubber and acrylic fibres. Breathing high concentrations of acrylonitrile will cause nose and throat irritation, tightness in chest, difficulty breathing, nausea, dizziness, weakness, headache, impaired judgment and convulsions. These symptoms usually disappear when exposure has stopped. If spilled on the skin, acrylonitrile will burn the skin and cause blisters and redness. Acrylonitrile is believed to be carcinogenic.

3.3.1 Findings

Acrylonitrile based polymers may have been utilized in the production of some of the building construction materials (e.g. paints, sealants, and adhesives). Although these polymers are generally volatile, they are expected to produce significant acrylonitrile exposure only during or shortly after application of the subject material. If present on site, acrylonitrile would not be expected to be a concern during future renovation or demolition works. Acrylonitrile was not evident in its pure form anywhere within the subject areas of the building.

3.3.2 Recommendations

No immediate corrective actions were recommended with regard to acrylonitrile.

3.4 Arsenic

Inorganic arsenic compounds are mainly used to preserve wood. Organic arsenic compounds are used as pesticides. Arsenic occurs naturally in soil and minerals and therefore may enter air and water. Breathing high levels of arsenic may cause sore throat and irritated lungs. Ingesting high levels of arsenic can result in death. Arsenic is a suspected carcinogenic substance.

3.4.1 Findings

Low levels of arsenic may be contained within paints or coatings utilized on building construction materials, however exposure levels resulting from personal contact are not expected to be significant. Arsenic or arsenic containing compounds were not encountered during the building survey works.

3.4.2 Recommendations

No immediate corrective actions were recommended with regard to arsenic.

3.5 Benzene

Benzene is colourless liquid with a sweet odour. Benzene utilization has historically been associated with solvents, paints, stains, adhesives, and in the manufacturing of various rubber products. While its current use in building materials has greatly decreased due to an increased awareness of associated health concerns, it may still be present in trace quantities in various industrial solvents. Gasoline sold in Canada contains approximately 4% benzene.

Breathing very high levels of benzene can result in death, while high levels may cause drowsiness, dizziness, rapid heart rate, headaches, and unconsciousness.

3.5.1 Findings

While it may be expected, given the age of the building, that the original construction materials utilized did contain some trace levels of benzene, it is likely that any has since volatilized and would not exceed the permissible exposure values. During future renovation or demolition works, it would not be expected to be a concern. No evidence of benzene was noted during the building survey, with the exception of that which may be contained in regular gasoline fuel burning equipment.

3.5.2 Recommendations

No immediate corrective actions were recommended with regard to benzene.

3.6 Coke Oven Emissions

Coke oven emissions are released during the carbonization of bituminous coal for the production of coke. Exposure routes include inhalation, skin and / or eye contact. Coke oven emissions are potential occupational carcinogens.

3.6.1 Findings

This substance would not be expected to be found in the building. No evidence of the burning of coke was found during the building survey.

3.6.2 Recommendations

No immediate corrective actions were recommended with regard to coke oven emissions.

3.7 Ethylene Oxides

Ethylene oxide is a man-made chemical used primarily to make ethylene glycol (antifreeze and polyester). Breathing low levels of ethylene oxides for a prolonged period of time causes eye, skin

and respiratory irritations, and can affect nervous system. Higher levels of exposure for shorter time produce symptoms that are similar but more severe.

3.7.1 Findings

This substance would not be expected to be found in the building. No evidence of ethylene oxides was found during the building survey.

3.7.2 Recommendations

No immediate corrective actions were recommended with regard to ethylene oxides.

3.8 Isocyanates

Isocyanates are a family of highly reactive, low molecular weight chemicals. They are widely used in the manufacture of flexible and rigid foams, fibres, and coatings such as paints and varnishes, and elastomers and various building materials (e.g. spray on polyurethane products).

Isocyanates are powerful irritants to the eyes, skin, and respiratory and gastrointestinal tracts.

3.8.1 Findings

Use of isocyanates or isocyanate compounds would not be expected in the building. No evidence of isocyanates was found during the building survey.

3.8.2 Recommendations

No immediate corrective actions were recommended with regard to isocyanates.

3.9 Mercury

Mercury is a naturally occurring metal. It is a shiny, silver-white and odourless liquid. It combines with other elements to form inorganic compounds or salts. Metallic mercury is used to produce chlorine gas and caustic soda, and is used in thermostats and thermometers, fluorescent light bulbs, dental fillings and batteries. Exposure occurs when breathing vapors from spills, incinerators, etc.

The nervous system is very sensitive to all forms of mercury. Exposure to high levels of metallic inorganic or organic mercury can permanently damage the brain, kidneys and developing fetus. Short-term exposure may cause lung damage, nausea, vomiting and diarrhea as well as skin and eye irritation.

3.9.1 Findings

Mercury can be found in fluorescent light bulbs and building thermostats. Prior to future renovation or demolition works, it would be recommended that these products be safely removed. The disposal of mercury containing items are regulated under the Environmental Protection Act, and it would be recommended that for disposal purposes any mercury containing thermostats and fluorescent light bulbs be disposed of at an MOE licensed receiver. With the exception of fluorescent light bulbs and building thermostats, no other evidence of mercury was noted during the building survey.

3.9.2 Recommendations

No immediate corrective actions were recommended with regard to mercury.

3.10 Silica

Silica is a crystalline compound occurring abundantly as quartz, sand, and many other minerals, and used to manufacture a variety of materials, especially glass and concrete. When mining this substance, silica can be deadly when it becomes airborne. If inhaled, silica dust can cause silicosis which can be fatal.

Additionally, in 2004 the MOL issued *Guideline: Silica on Construction Projects* outlining practices that should be followed during construction projects to protect workers' from exposure to silica. This includes the methods and equipment employed in the removal of silica containing materials that reduce the creation of dust, providing appropriate facilities for workers to wash after each shift, and providing protective clothing and respirators where necessary.

3.10.1 Findings

As the building is constructed of concrete block and brick, with concrete floors, silica is expected to be found within these components of the building. During any significant renovation or demolition works where concrete dust is generated, dust suppression techniques should be utilized to control worker exposure to silica. Silica is expected to be present in concrete and masonry products in the building.

3.10.2 Recommendations

No immediate corrective actions were recommended with regard to silica.

3.11 Vinyl Chloride

Vinyl chloride is used to make polyvinyl chloride (PVC) which is found in a variety of plastic products, including pipes, wires, cable coatings and packaging materials. Breathing high levels of vinyl chloride can cause dizziness, unconsciousness and death. Prolonged exposure causes changes in liver, nerve damage, immune reactions and changes in blood flow.

3.11.1 Findings

PVC pipe is generally stable and does not allow for the liberation of vinyl chloride, under normal conditions. During future renovation or demolition works, this substance would not be expected to be a concern. Vinyl chloride was not evident in its pure form, anywhere in the subject dwellings.

3.11.2 Recommendations

No immediate corrective actions were recommended with regard to vinyl chloride.

3.12 Polychlorinated Biphenyls (PCBs)

PCBs are mixtures of synthetic organic chemicals with the same basic chemical structure and similar physical properties ranging from oily liquids to waxy solids. Due to their non-flammability, chemical stability, high boiling point and electrical insulating properties, PCBs were used in hundreds of industrial and commercial applications including electrical, heat transfer, and hydraulic equipment; as plasticizers in paints, plastics and rubber products; in pigments, dyes and carbonless copy paper and many other applications.

PCBs have been demonstrated to cause a variety of adverse health effects. PCBs have been shown to cause cancer.

3.12.1 Findings

No PCB containing equipment with the potential exception of fluorescent lighting ballasts was observed on site. Fluorescent lighting was observed in use in several areas of the building and inspection of three random light ballasts revealed that they did not contain PCB's. The disposal of PCB containing equipment is regulated under MOE Reg. 558, and it would be recommended that during any ballast replacement works the generated ballasts be evaluated for PCB content, with any PCB ballasts being consolidated and sent for disposal to an MOE licensed PCB receiver under waste class 243D.

3.12.2 Recommendations

It would be recommended that during any ballast replacement works the generated ballasts be evaluated for PCB content. Any PCB ballasts identified should be consolidated and sent for disposal to an MOE licensed PCB receiver under waste class 243D.

3.13 Mould

Mould contamination inside buildings has become a concern to both building owners and occupants. Exposure to moulds is known to cause a variety of health effects in some people. Many fungal spores are considered to be allergenic to susceptible persons, though individual susceptibility varies greatly.

Elevated levels of indoor mould are usually attributed to the chronic moist conditions due to water leaks, floods or elevated humidity. Under these conditions, already low levels of fungal spores in air from plants and other sources may multiply on cellulose containing materials such as carpets, wallboards, and wood, and result in mould contamination and, if left untreated, can be destructive to certain building materials.

At present, no Federal or Provincial regulations are in effect with respect to reasonable levels of airborne mould spores and other contaminants inside buildings. Health Canada has provided strategies and guidelines related to some indoor contaminants to assist in conducting indoor air quality investigations in their publication *Indoor Air Quality in Office Buildings: A Technical Guide, 1995*. Health Canada recommends that indoor varieties of airborne mould spores should be qualitatively and quantitatively similar to those varieties found outdoors. The presence of one or more fungal species indoors that are not found outdoors suggests the presence of an amplifier in the building.

An additional resource that places numerical limits on acceptable indoor fungal spores is found in the Calgary Health Region's guidelines for *Fungal Air Testing, Investigation and Reporting* for remediated marihuana grow houses. These guidelines suggest that indoor fungal spores are acceptable if found to be elevated by as much as 2 or 3 times the outdoor measurement, depending on the type of mould spore. Refer to attached guidelines.

The Canadian Construction Association (CCA) has provided guidelines regarding investigation and remediation works in *CCA82 - 2004 Mould Guidelines for the Canadian Construction Industry* to protect the health and safety of workers who may be exposed to mould in the course of building renovations.

3.13.1 Findings

During the current investigation, no visible mould or favourable conditions for mould growth were observed in the surveyed areas.

3.13.2 Recommendations

No immediate corrective action is recommended with regard to mould contamination.

4. CORRECTIVE ACTIONS

No corrective actions for Designated Substances were recommended.

5. STATEMENT OF LIMITATIONS

Fisher Environmental Ltd. accepts responsibility for the competent performance of its duties in executing this assignment within the normal standards of the profession, but disclaims responsibility for consequential damages, if any.

The extent of the building survey of asbestos containing materials (ACM) and other designated substances is based on prior agreement of the scope of work with the client, and the rationale given in this report. The building survey findings rely on professional interpretation of selective sampling and analysis. Sample analysis results have been applied to homogenous materials in unsampled locations; it was not within the scope of work to carry out an exhaustive sampling and analysis program. For non-accessible building spaces, the likelihood of the presence or absence of asbestos and other designated substances has been described, but such assessment is not a definitive statement of presence or absence.

This report was prepared for the City of Toronto, Facilities Management. The scope of services performed may not be appropriate for the purposes of other users, and any use or reuse of this document or its findings or recommendations represented herein is at the sole risk of any other user.

We trust that the information provided in the report meets your current requirements. If you have any questions or concerns, please do not hesitate to contact the undersigned.

6. SIGN-OFF

We trust that this report meets with City of Toronto requirements and we thank you for the opportunity to be of service. Should you have any questions, please do not hesitate to contact us.

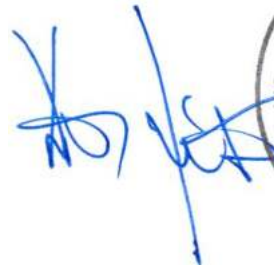
Fisher Environmental Ltd.

Prepared By:



Muhammad Junayed, B.Sc., EP
Project Manager

Reviewed By:




David Fisher, P. Eng., C. Chem.
Principal



APPENDIX I

REASSESSMENT SURVEY FORM

APPENDIX I - REASSESSMENT SURVEY FORM

Building Address:	351 Birchmount Road	Date(s) of Current Reassessment:	June 7, 2016
Building Name:	Toronto Fire Museum & Fire Prevention East District Office	Organization Completing Reassessment:	Fisher Environmental Ltd. / Project 16-7715
Original Survey Conducted By:	ECOH Management Inc.	Name of Surveyor:	Muhammad Junayed
Date(s) of Original Survey:	August 9, 2007	Signature of Surveyor:	

Summary of Findings

All Hazardous Materials observed in Good condition.

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 Material	Asbestos	Not Sampled	ACM Assumed	2500 SF	Good	
0-00	Exterior	Windows	Window Caulking	Asbestos	Not Sampled	ACM Assumed	All	Good	
0-00	Exterior	Walls	Drywall (DJC)	Asbestos	14-8924-01 to 03*	None Detected	N/A	N/A	*From Fisher Project No. 14-7006, dated July 2014
0-00	Exterior	Walls	Plaster	Asbestos	14-8924-04*	None Detected	N/A	N/A	*From Fisher Project No. 14-7006, dated July 2014
0-00	Exterior	Walls	Grey Paint	Lead	14-8924-05*	354 ppm	N/A	N/A	*From Fisher Project No. 14-7006, dated July 2014
B-01	Former Cell	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
B-01	Former Cell	Walls	Concrete	N/A	N/A	N/A	N/A	N/A	
B-01	Former Cell	Ceiling	Concrete	N/A	N/A	N/A	N/A	N/A	
B-02	Corridor	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
B-02	Corridor	Walls	Concrete	N/A	N/A	N/A	N/A	N/A	
B-02	Corridor	Ceiling	Not Found	N/A	N/A	N/A	N/A	N/A	Open to deck
B-02	Corridor	Pipe	White Paint	Lead	15-2124-01*	83 ppm	N/A	N/A	*From Fisher Project No. 15-7315, dated July 2015
B-03	Corridor	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
B-03	Corridor	Walls	Drywall (DJC)	Asbestos	14-9615-05 & 06*	None Detected	420 SF	Good	*From Fisher Project No. 14-6915, dated October 2014
B-03	Corridor	Ceiling	Drywall (DJC)	Asbestos	Homogeneous w. 14-9615-04 to 06 & 12-4440-1 to 3	None Detected	120 SF	Good	
B-04	Washroom	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	

APPENDIX I - REASSESSMENT SURVEY FORM

Location Number	Location Name	Building System	Material Observed	Potential Hazardous Material	Sample ID	Analytical Result	Quantity	Condition	Notes / Recommended Actions
B-04	Washroom	Walls	Drywall (DJC)	Asbestos	Homogeneous w. 14-9615-04 to 06 & 12-4440-1 to 3	None Detected	150 SF	Good	
B-04	Washroom	Walls	Concrete	N/A	N/A	N/A	N/A	N/A	
B-04	Washroom	Ceiling	Drywall (DJC)	Asbestos	Homogeneous w. 14-9615-04 to 06 & 12-4440-1 to 3	None Detected	20 SF	Good	
B-05	Washroom	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
B-05	Washroom	Walls	Drywall (DJC)	Asbestos	14-9615-04*	None Detected	200 SF	Good	*From Fisher Project No. 14-6915, dated October 2014
B-05	Washroom	Ceiling	Drywall (DJC)	Asbestos	Homogeneous w. 14-9615-04 to 06 & 12-4440-1 to 3	None Detected	40 SF	Good	
B-05	Washroom	Ceiling	Texture Coat	Asbestos	11850-B-10-04A* 11850-B-10-04B* 11850-B-10-04D*	None Detected	40 SF	Good	*From Survey Report 2007 NOT OBSERVED
B-06	Lockers	Floor	Vinyl Floor Tile 1	Asbestos	14-9615-01 to 03*	None Detected	225 SF	Good	12" x 12" Dark Grey with Black/White Smears *From Fisher Project No. 14-6915, dated October 2014
B-06	Lockers	Walls	Drywall (DJC)	Asbestos	12-4440-1* 12-4440-2* 12-4440-3*	None Detected	110 SF	Good	*From Survey Report 2012
B-06	Lockers	Walls	Plaster	Asbestos	12-4440-4* 12-4440-5*	None Detected	N/A	N/A	*From Survey Report 2012
B-06	Lockers	Walls	Concrete	N/A	N/A	N/A	N/A	N/A	
B-06	Lockers	Ceiling	Texture Coat	Asbestos	11850-B-10-04C* 11850-B-10-04E*	None Detected	225 SF	Good	*From Survey Report 2007 NOT OBSERVED
B-06	Lockers	Ceiling	Concrete	N/A	N/A	N/A	N/A	N/A	
B-07	Furnace	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
B-07	Furnace	Walls	Concrete	N/A	N/A	N/A	N/A	N/A	
B-07	Furnace	Ceiling	Texture Coat	Asbestos	11850-B-10-03a-e*	None Detected	40 SF	Good	*From Survey Report 2007 NOT OBSERVED
B-07	Furnace	Ceiling	Concrete	N/A	N/A	N/A	N/A	N/A	
B-08	Storage	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
B-08	Storage	Walls	Concrete	N/A	N/A	N/A	N/A	N/A	
B-08	Storage	Ceiling	Not Found	N/A	N/A	N/A	N/A	N/A	Open to deck

APPENDIX I - REASSESSMENT SURVEY FORM

Location Number	Location Name	Building System	Material Observed	Potential Hazardous Material	Sample ID	Analytical Result	Quantity	Condition	Notes / Recommended Actions
B-09	Storage	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
B-09	Storage	Walls	Concrete	N/A	N/A	N/A	N/A	N/A	
B-09	Storage	Ceiling	Not Found	N/A	N/A	N/A	N/A	N/A	Open to deck
1-01	Garage	Floor	Vinyl Floor Tile 2	Asbestos	Homogeneous w. 14-9615-18 to 20	None Detected	20 SF	Good	12" x 12" Beige with Black Specks NOT OBSERVED
1-01	Garage	Floor	Vinyl Floor Tile 3	Asbestos	Homogeneous w. 12-4440-7,9,11	None Detected	20 SF	Good	12" x 12" Brown with White Streaks On landing
1-01	Garage	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
1-01	Garage	Ceiling	Plaster	Asbestos	Not Sampled	ACM Assumed	1300 SF	Good	
1-01	Garage	Windows	Window Caulking	Asbestos	15-2124-03 to 05*	<0.5% Chrysotile	N/A	N/A	*From Fisher Project No. 15-7315, dated July 2015
1-02	Office	Floor	Vinyl Floor Tile 6	Asbestos	16-4392-01 to 03*	None Detected	220 SF	Good	12" x 12" Brown (Underneath carpet) *From Fisher Project No. 16-7715, dated June 2016
1-02	Office	Floor	Carpet	N/A	N/A	N/A	N/A	N/A	
1-02	Office	Walls	Plaster	Asbestos	14-9615-11*	None Detected	600 SF	Good	*From Fisher Project No. 14-6915, dated October 2014
1-02	Office	Ceiling	Plaster	Asbestos	Not Sampled	ACM Assumed	220 SF	Good	
1-03	Office	Floor	Vinyl Floor Tile 2	Asbestos	Homogeneous w. 14-9615-18 to 20	None Detected	10 SF	Good	12" x 12" Beige with Black Specks NOT OBSERVED
1-03	Office	Floor	Vinyl Floor Tile 5	Asbestos	14-9615-15 to 17*	5-25% Chrysotile	10 SF	Good	12" x 12" White with Black Steaks *From Fisher Project No. 14-6915, dated October 2014
1-03	Office	Floor	Carpet	N/A	N/A	N/A	N/A	N/A	
1-03	Office	Walls	Plaster	Asbestos	14-9615-12*	None Detected	420 SF	Good	*From Fisher Project No. 14-6915, dated October 2014
1-03	Office	Ceiling	Plaster	Asbestos	Not Sampled	ACM Assumed	110 SF	Good	
1-03	Office	Walls	Green/White Composite Paint	Lead	15-2124-02*	2,470 ppm	420 SF	Good	*From Fisher Project No. 15-7315, dated July 2015
1-04	Kitchen	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
1-04	Kitchen	Walls	Plaster	Asbestos	Not Sampled	ACM Assumed	420 SF	Good	
1-04	Kitchen	Walls	Block	N/A	N/A	N/A	N/A	N/A	
1-04	Kitchen	Ceiling	Plaster	Asbestos	Not Sampled	ACM Assumed	110 SF	Good	

APPENDIX I - REASSESSMENT SURVEY FORM

Location Number	Location Name	Building System	Material Observed	Potential Hazardous Material	Sample ID	Analytical Result	Quantity	Condition	Notes / Recommended Actions
1-05	Entrance Corridor	Floor	Vinyl Floor Tile 3	Asbestos	12-4440-7* 12-4440-9* 12-4440-11*	None Detected	120 SF	Good	12" x 12" Brown with White Streaks *From Survey Report 2012
1-05	Entrance Corridor	Floor	Mastic	Asbestos	12-4440-8* 12-4440-10* 12-4440-12*	None Detected	120 SF	Good	*From Survey Report 2012
1-05	Entrance Corridor	Walls	Plaster	Asbestos	14-9615-10*	None Detected	500 SF	Good	*From Fisher Project No. 14-6915, dated October 2014
1-05	Entrance Corridor	Ceiling	Plaster	Asbestos	Not Sampled	ACM Assumed	120 SF	Good	
1-06	Hose Hanger	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-06	Hose Hanger	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
1-06	Hose Hanger	Ceiling	Not Found	N/A	N/A	N/A	N/A	N/A	Open to deck
1-07	Copy Room	Floor	Vinyl Floor Tile 2	Asbestos	14-9615-18 to 20*	None Detected	110 SF	Good	12" x 12" Beige with Black Specks *From Fisher Project No. 14-6915, dated October 2014
1-07	Copy Room	Walls	Plaster	Asbestos	14-9615-13*	None Detected	420 SF	Good	*From Fisher Project No. 14-6915, dated October 2014
1-07	Copy Room	Ceiling	Plaster	Asbestos	Not Sampled	ACM Assumed	110 SF	Good	
1-08	Office	Floor	Carpet	N/A	N/A	N/A	N/A	N/A	
1-08	Office	Walls	Plaster	Asbestos	14-9615-14*	None Detected	500 SF	Good	*From Fisher Project No. 14-6915, dated October 2014
1-08	Office	Ceiling	Plaster	Asbestos	Not Sampled	ACM Assumed	220 SF	Good	
1-09	Stairwell	Floor	Vinyl Floor Tile 3	Asbestos	Homogeneous w. 12-4440-7,9,11	None Detected	36 SF	Good	12" x 12" Brown with White Streaks
1-09	Stairwell	Floor	Vinyl Floor Tile 4	Asbestos	14-9615-07 to 09*	5-25% Chrysotile	36 SF	Good	12" x 12" Tan with Black and Green Specks On the landing between floors *From Fisher Project No. 14-6915, dated October 2014
1-09	Stairwell	Walls	Plaster	Asbestos	12-4440-6*	None Detected	800 SF	Good	*From Survey Report 2012
1-09	Stairwell	Ceiling	Plaster	Asbestos	Not Sampled	ACM Assumed	100 SF	Good	

APPENDIX I - REASSESSMENT SURVEY FORM

Location Number	Location Name	Building System	Material Observed	Potential Hazardous Material	Sample ID	Analytical Result	Quantity	Condition	Notes / Recommended Actions
1-10	Garage Exterior	Roof	Roofing Material	Asbestos	Not Sampled	ACM Assumed	950 SF	Good	NO ACCESS
1-10	Garage Exterior	Windows	Window Caulking	Asbestos	Not Sampled	ACM Assumed	All	Good	
1-10	Garage Exterior	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
1-10	Garage	Floor	Asphalt	N/A	N/A	N/A	N/A	N/A	
1-10	Garage	Walls	Plaster	Asbestos	Not Sampled	ACM Assumed	950 SF	Good	
1-10	Garage	Ceiling	Ceiling Tile 1	Asbestos	11850-B-10-01A* 11850-B-10-01B* 11850-B-10-01C*	None Detected	865 SF	Good	2' x 2' Pinhole Fissure *From Survey report 2007
Surveyor's Field Notes									

APPENDIX II

RESULTS OF BULK SAMPLE ANALYSIS



FISHER ENVIRONMENTAL LABORATORIES

FULL RANGE ANALYTICAL SERVICES • SOIL/WATER/AIR TESTING • ENVIRONMENTAL
COMPLIANCE PACKAGES • 24 HOUR EMERGENCY RESPONSE • CALA ACCREDITED

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FAX: 905 475-7718
www.fisherenvironmental.com

Client: City of Toronto
Facilities Management
Address: 2nd Floor, Metro Hall
55 John Street, Toronto, ON
M5V 3C6
Tel.: 416-392-9024
E-mail: maldcro@toronto.ca
Attn: Meaghan Aldcroft

F.E. Job #: 16-4392
Project Name: Annual Reassessment
Project ID: FE-16-7715
Date Sampled: 7-Jun-16
Date Received: 18-Jul-16
Date Reported: 22-Jul-16
Location: 351 Birchmount Road
Toronto, ON

Certificate of Analysis

Analysis Requested:	Asbestos
Sample Description:	3 Bulk Samples

Client Sample ID	Lab Sample ID	Sample Matrix	Fibre Type	Asbestos Content
01A - VFT, Brown, 12"x12", Underneath the Carpet - Loc: 1-02, Office	16-4392-01	Vinyl Floor Tile		Not Detected
01B - VFT, Brown, 12"x12", Underneath the Carpet - Loc: 1-02, Office	16-4392-02	Vinyl Floor Tile		Not Detected
01C - VFT, Brown, 12"x12", Underneath the Carpet - Loc: 1-02, Office	16-4392-03	Vinyl Floor Tile		Not Detected

Fisher Environmental Laboratories (Lab ID #: 2745) is accredited by CALA (Canadian Association for Laboratory Accreditation Inc.) for asbestos analysis by PLM.

ANALYTICAL METHOD:

Asbestos has been done in accordance with normal professional standard using the following Fisher Environmental Lab Method: Asbestos by PLM (Polarized Light Microscope) F-26, Rev.2.2.

Authorized by:



Roger Lin, Ph. D., C. Chem.
Laboratory Manager

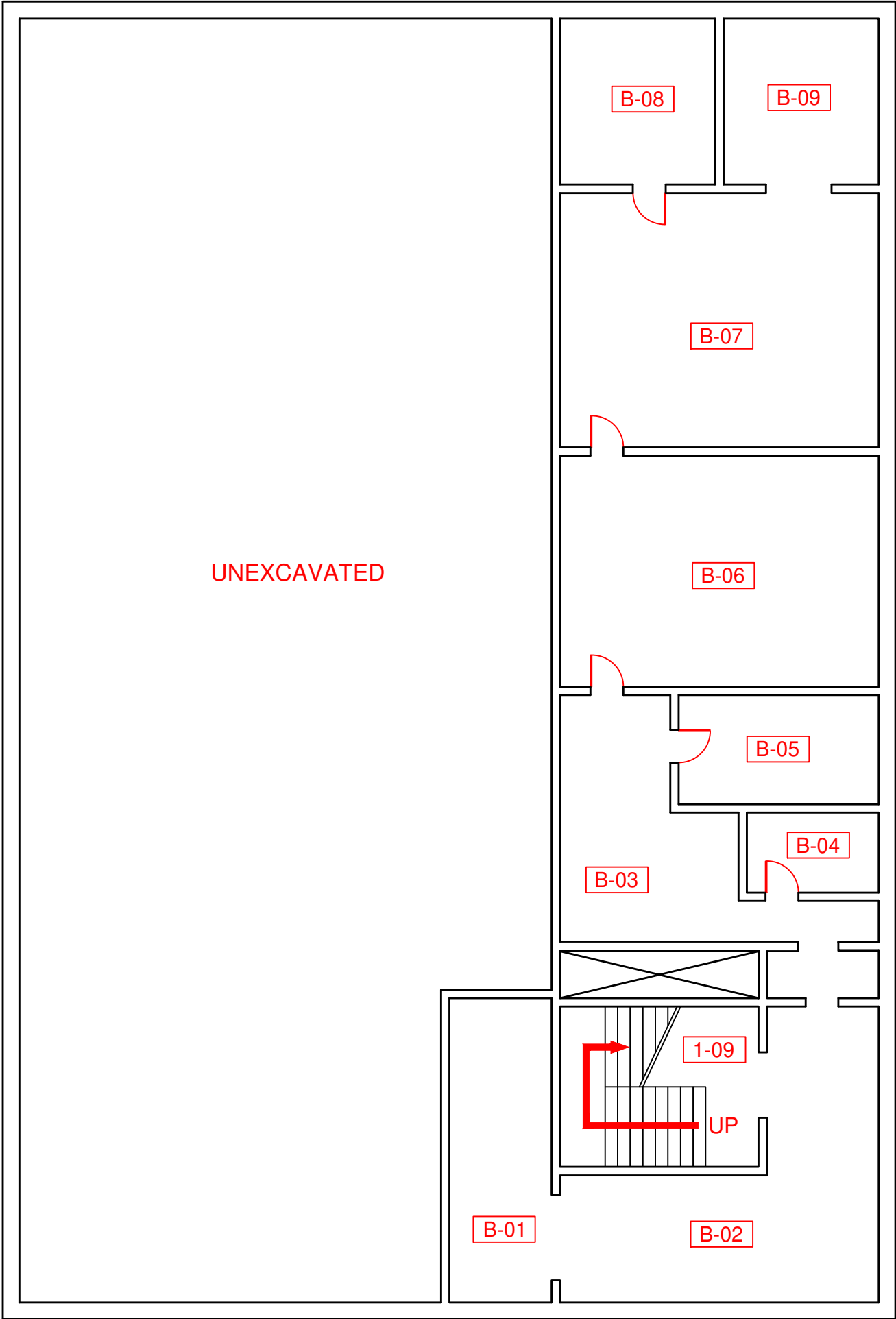


APPENDIX III

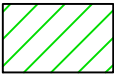
CORRECTIVE ACTIONS INSPECTION REPORT

(NO INFORMATION TO REPORT)

APPENDIX IV
SURVEY DRAWINGS



Legend



Asbestos-Containing Material

1-01

Location Number

NAR

No Access to Room



Asbestos Sample Location



Lead Sample Location

The drawing does not illustrate locations of drywall joint compound, plaster, window caulking or roofing materials, for reasons discussed in Section 6 of the Standard Operating Procedure for Designated Substance Surveys. Please refer to the Designated Substance Survey Form in Appendix I for information regarding the locations and asbestos or lead-content of these materials.

Figure 1

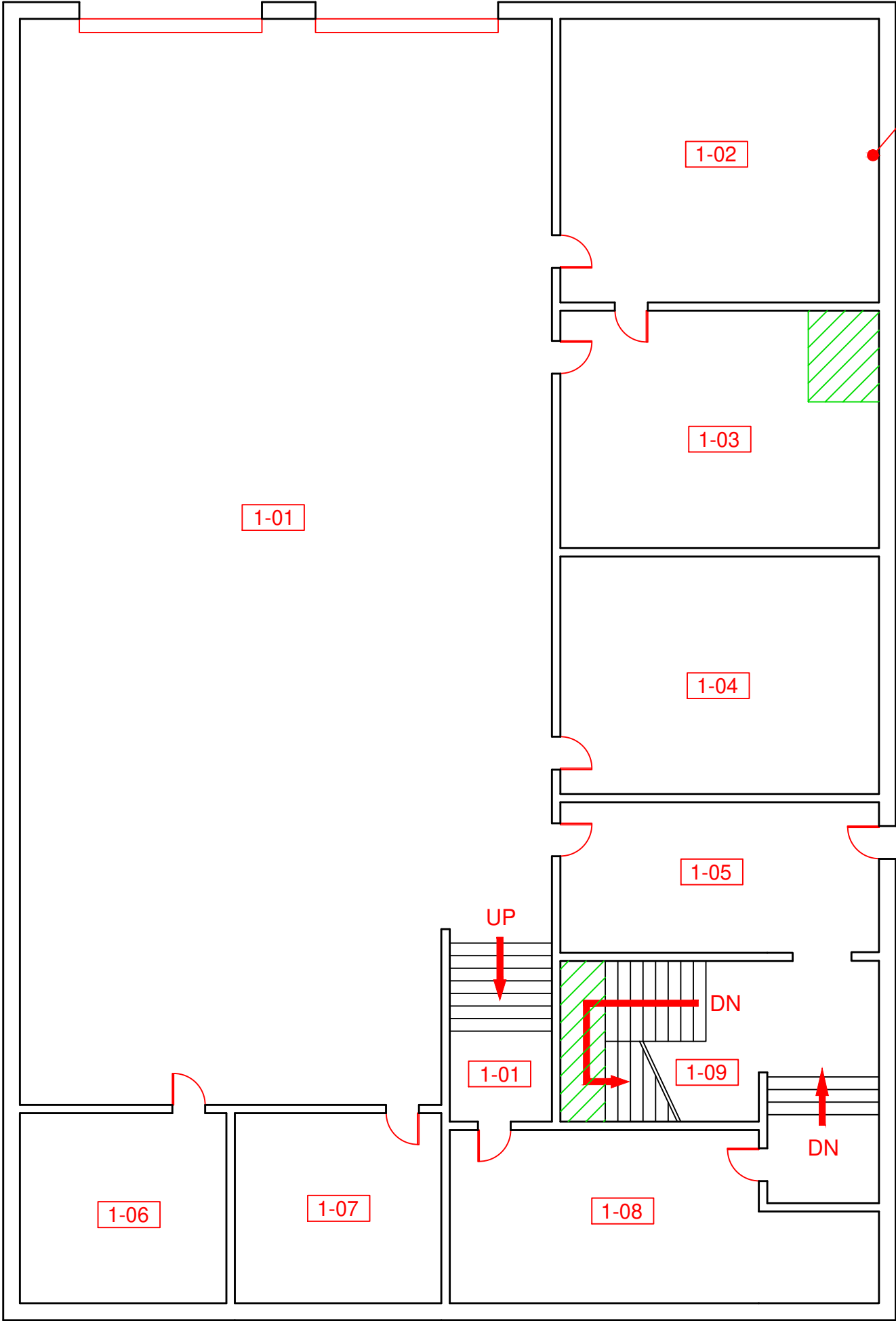
LOCATION: 351 Birchmount Road
Toronto, Ontario

BUILDING NAME: Toronto Fire Museum &
Fire Prevention East District Office

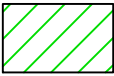
Basement Floor Plan
Asbestos-Containing Material Locations

CLIENT: City of Toronto		
PROJECT NUMBER: FE-P 16-7715	DATE: JUNE 2016	DRW BY: AH
CAD FILE: FIG1	SCALE: Not to Scale	CHK BY: MJ





Legend



Asbestos-Containing Material



Location Number

NAR

No Access to Room



Asbestos Sample Location



Lead Sample Location

The drawing does not illustrate locations of drywall joint compound, plaster, window caulking or roofing materials, for reasons discussed in Section 6 of the Standard Operating Procedure for Designated Substance Surveys. Please refer to the Designated Substance Survey Form in Appendix I for information regarding the locations and asbestos or lead-content of these materials.

Figure 2

LOCATION:
351 Birchmount Road
Toronto, Ontario

BUILDING NAME:
Toronto Fire Museum &
Fire Prevention East District Office

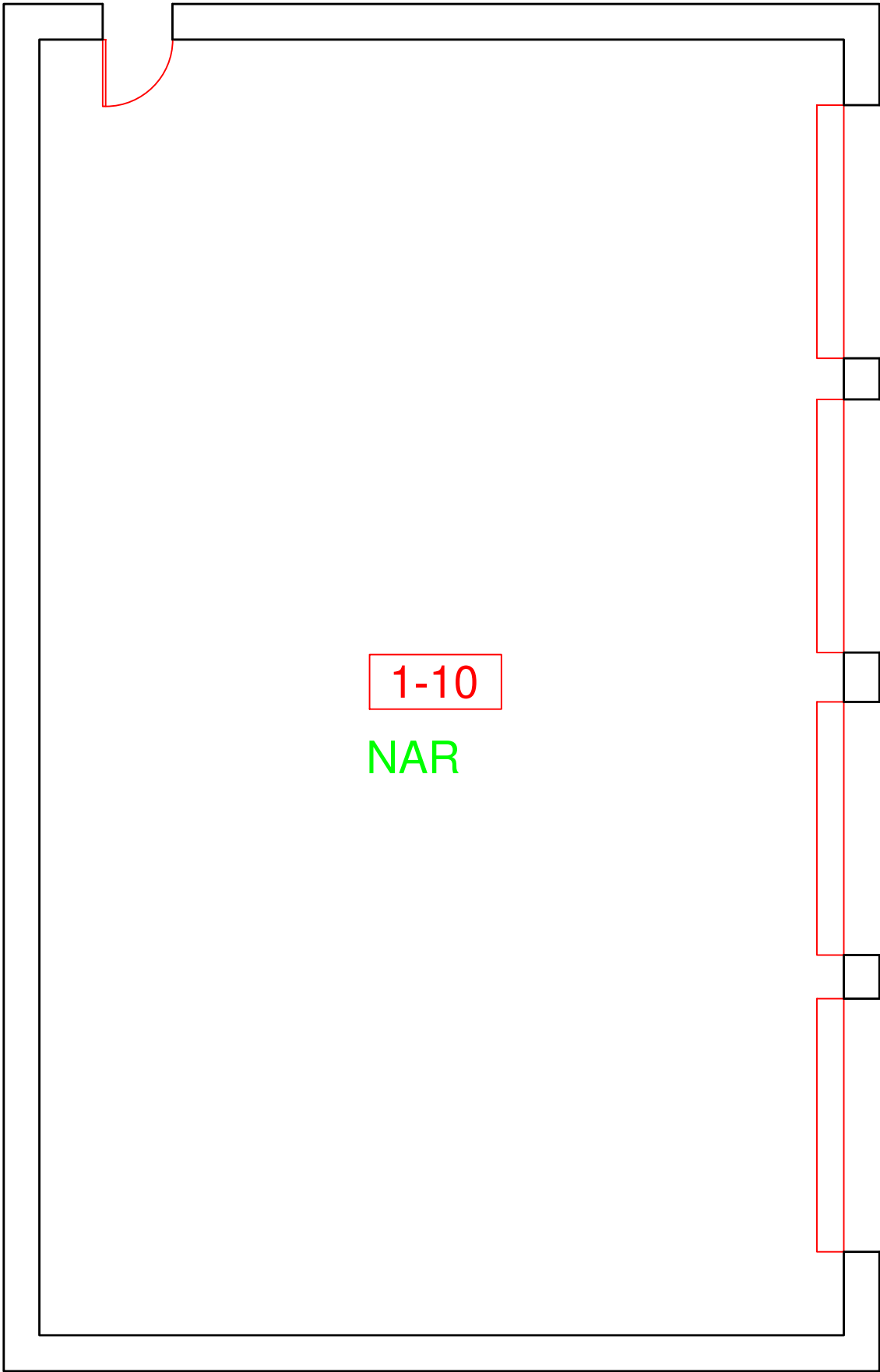
Main Floor Plan
Asbestos-Containing Material Locations

CLIENT: City of Toronto

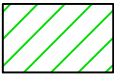
PROJECT NUMBER: FE-P 16-7715 DATE: JUNE 2016 DRW BY: AH

CAD FILE: FIG2 SCALE: Not to Scale CHK BY: MJ





Legend



Asbestos-Containing Material

1-01

Location Number

NAR

No Access to Room



Asbestos Sample Location



Lead Sample Location

The drawing does not illustrate locations of drywall joint compound, plaster, window caulking or roofing materials, for reasons discussed in Section 6 of the Standard Operating Procedure for Designated Substance Surveys. Please refer to the Designated Substance Survey Form in Appendix I for information regarding the locations and asbestos or lead-content of these materials.

Figure 3

LOCATION:
351 Birchmount Road
Toronto, Ontario

BUILDING NAME:
Toronto Fire Museum &
Fire Prevention East District Office

Garage Building Floor Plan
Asbestos-Containing Material Locations

CLIENT: City of Toronto

PROJECT NUMBER: FE-P 16-7715 DATE: JUNE 2016 DRW BY: AH

CAD FILE: FIG3 SCALE: Not to Scale CHK BY: MJ



APPENDIX V

SITE PHOTOGRAPHS

(NO INFORMATION TO REPORT)

APPENDIX B4

Designated Substances Survey

1313 Woodbine Avenue, Fire Hall No. 224
Issued December 2021, by Fisher Environmental Ltd.



ENGINEERING



LABORATORY



**DESIGNATED SUBSTANCES
SURVEY FOR ACCESSIBILITY
UPGRADES (IBI GROUP)**

**FIRE HALL No. 224
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Project No. FE-P 21-11706
December 15, 2021

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1.0. EXECUTIVE SUMMARY

Fisher Environmental Ltd. ('Fisher') was retained by IBI Group to carry out a survey for the Designated Substances and other potential hazardous materials within specified work areas for Fire Hall No. 224 building, located at 1313 Woodbine Avenue, Toronto, Ontario, herein after referred to as the "Site".

The site inspection and sampling works were conducted on November 18, 2021.

IBI Group has been commissioned by the City of Toronto to design and implement accessibility upgrades. The scope of the Designated Substances Survey (DSS) was to identify locations and types of designated substances within the building that may be impacted by the planned renovation work, and to provide recommendations for the safe handling or abatement of these materials, if any, prior to demolition.

The purpose of the project is to do the necessary construction and renovation at the locations are outlined on drawings provided by the IBI Group on October 27, 2021.

The survey was conducted in compliance with the Ontario Ministry of Labour (MOL) regulations for designated substances; O. Reg. 490/09 - *Designated Substances* and O. Reg. 278/05 - *Asbestos on Construction Projects and in Buildings and Repair Operations* made under the Occupational Health and Safety Act (OHSA), R.S.O. 1990.

Asbestos

Fisher was provided with the report of a previous DSS, which was conducted by Fisher Environmental Ltd. on July 23, 2014. This report has indicated no confirmed or assumed ACM within the specified work areas.

During the current survey, three (3) bulk samples of building materials found within the specified work area(s) and that could potentially contain asbestos, were collected and submitted to Fisher Environmental Laboratories for Polarised Light Microscopy (PLM) analysis, as outlined in NIOSH Method 9002. The results of analysis revealed that the material sampled does not contain asbestos. Provide a copy of this report to contractors bidding on or performing work within the subject work areas.

Note: Fire doors, present within the specific work areas, may contain asbestos-containing thermal insulation inside the door panel. Removal of any asbestos containing fire doors, in intake condition, will require Type 1 to abatement procedures, as outlined in O. Reg. 278/05 and dispose of as asbestos waste.



Lead

Based on the age of the building, it is possible that lead-based paint and lead plumbing are present within the building. Lead can also be present in various ceramic tiles. During the current survey, two (2) bulk samples of light grey wall paint, and grey floor paint were collected and submitted to Fisher Environmental Laboratories for lead analysis. The results of analysis revealed that light grey paint contains <10 ppm of lead, and grey floor paint contains 55 ppm of lead.

Fisher recommends that, prior to the planned renovation work, the removal of lead containing materials found within the specified work area(s), must be conducted using the appropriate lead abatement procedures. Lead abatement procedures to be used are determined by the method(s) of disturbance employed. Refer to *MOL Guideline: Lead on Construction Projects*, for details

Mercury

Mercury is presumed to be present in fluorescent light tubes and thermostatic controls. With the exception of fluorescent light bulbs and building thermostats, no other evidence of mercury was noted during the current survey. Prior to the planned renovation work, Fisher recommends that any presumed mercury-containing fluorescent light tubes and thermostats that will be impacted are to be removed and disposed of in accordance with O. Reg. 558/00.

Silica

No sampling for silica was conducted. However, as the building is constructed of concrete, brick and/or block walls with concrete floors, silica is expected to be found within these components of the buildings. If these materials will be disturbed during the planned renovation work, appropriate precautions should be taken to protect workers from inhaling silica dusts and debris. Refer to *MOL Guideline: Silica on Construction Projects* for details.

Other Designated Substances

The other Designated Substances would not be expected to be present at the Site. No immediate actions were recommended with regard to acrylonitrile, arsenic, benzene, coke oven emissions, ethylene oxide, isocyanates, and vinyl chloride.

Mould

During the current survey, no visible mould or favourable conditions for mould growth were observed in the specified work area(s). No action is recommended with regard to mould.



2.0. INTRODUCTION

Fisher Environmental Ltd. ('Fisher') was retained by IBI Group to carry out a survey for the Designated Substances and other potential hazardous materials within specified work areas for Fire Hall No. 224 building, located at 1313 Woodbine Avenue, Toronto, Ontario, herein after referred to as the "Site".

The site inspection and sampling works were conducted on November 18, 2021.

IBI Group has been commissioned by the City of Toronto to design and implement accessibility upgrades. The scope of the Designated Substances Survey (DSS) was to identify locations and types of designated substances within the building that may be impacted by the planned renovation work, and to provide recommendations for the safe handling or abatement of these materials, if any, prior to demolition.

The purpose of the project is to do the necessary construction and renovation at the locations are outlined on drawings provided by the IBI Group on October 27, 2021.

3.0. REGULATIONS

The survey was conducted in compliance with the Ontario Ministry of Labour (MOL) regulations for designated substances; O. Reg. 490/09 - *Designated Substances* and O. Reg. 278/05 - *Asbestos on Construction Projects and in Buildings and Repair Operations* made under the Occupational Health and Safety Act (OHSA), R.S.O. 1990.

The OHSA, R.S.O. 1990, under the Ontario MOL, defines a toxic substance as a biological, chemical or physical agent (or a combination of such agents) whose presence in the workplace may endanger the health and safety of a worker. Sections of the Act that deals with toxic substances are intended to:

1. ensure that worker exposure to toxic substances is controlled;
2. ensure that toxic substances in the workplace are clearly identified and that workers are provided with enough information to be capable of handling them safely; and,
3. provide the general public with access to information about toxic substances used by industry in their communities.

The Act makes provision for a toxic substance to be "designated", where its use in the workplace is prohibited, regulated, restricted, limited or controlled. Designation is reserved for eleven substances that are particularly hazardous, covered under O. Reg 490/09 – *Designated Substances* that was implemented on July 1, 2010, and include Acrylonitrile, Arsenic, Asbestos, Benzene, Coke Oven Emissions, Ethylene Oxides, Isocyanates, Lead, Mercury, Silica, and Vinyl



Chloride. Formerly, regulations for these substances were passed separately and each outlined exposure limits where workers were likely to inhale, ingest and / or absorb the substance.

O. Reg. 490/09 provides a consistent approach to dealing with existing requirements and provisions, and outlines steps required to control worker exposure to these substances, including by inhalation, ingestion, skin absorption or skin contact. Each designated substance has an allowable level of exposure based on a time-weighted average (TWA) limit, and may also have a short-term exposure limit (STEL) and / or ceiling limit (C) assigned to it. TWA refers to the time-weighted average airborne concentration of a biological or chemical agent to which a worker may be exposed in a work day or work week, STEL refers to the maximum airborne concentration of a biological or chemical agent to which a worker may be exposed in any 15-minute period, and C refers to the maximum airborne concentration of a biological or chemical agent to which a worker may be exposed at any time. Refer to O. Reg. 490/09 – *Designated Substances*.

A supplementary regulation regarding control of asbestos exposures in the construction industry has evolved into O. Reg. 278/05 – *Asbestos on Construction Projects and in Buildings and Repair Operations*. The regulation includes a definition of asbestos-containing materials (ACM), requirements for additional training and clearance air testing, procedures for determining materials that meet the definition of ACM and for the use of glove bags, and provisions for varying from measure and procedures set out in the regulation.

In addition to the OHSA and regulations regarding designated substances, the following regulations, guidelines and standards were also taken into account or referenced:

- O. Reg. 213/91 - *Construction Projects* regulated under the OHSA and last amended by O. Reg. 443/09;
- O. Reg. 558/00 made under the Ministry of Environment (MOE) Environmental Protection Act, amending O. Reg. 347 - *General Waste Management*;
- The Transport of Dangerous Goods Act (TDGA) provides regulations for the transport of asbestos-containing materials and wastes;
- MOL *Guideline: Lead on Construction Projects*, 2011; and,
- MOL *Guideline: Silica on Construction Projects*, 2011.

4.0. METHODOLOGY

Fisher followed the protocols outlined in O. Reg. 278/05 for collecting and analyzing bulk samples of materials suspected to contain asbestos. Visual assessment of the material was the primary method of identification with occasional physical contact for the purpose of collecting bulk samples or examining for underlying layers.

Where applicable, samples of suspect materials were collected in order to establish asbestos or lead content. Samples were grouped according to similarity of appearance (“homogeneous”



materials). The frequency at which the samples were collected was sufficient to obtain a general representation of the presence of these materials at the Site. Samples collected are presumed to be representative of respective building materials in-place at the Site. However, due to potential past renovations, alterations, repairs, or phases of construction, it is possible that individual materials may not be representative of samples collected.

Sampling of roofing materials was not part of the current scope of work. Further, sampling of materials found within operating equipment, portable building articles, or generally non-accessible components such as insulation within electrical switch gears, wiring, motors, light fixtures, elevator brakes, fire door cores, etc. was not performed as part of the current survey.

Samples collected during the survey were placed in plastic zip-lock bags which were labeled and submitted for laboratory analysis. Fisher Environmental Laboratories analysed bulk samples for asbestos type and approximate percent content by performing polarized light microscopy (PLM), as outlined in NIOSH Method 9002. Fisher Environmental Laboratories analysed samples for lead content in paint by performing acid digestion followed by Inductively Coupled Plasma (ICP) analysis.

Site Plans, indicating specific work areas, and bulk sample locations, are included in Appendix A. The laboratory certificate of analysis is included in Appendix B. Representative photos of Site conditions encountered at the time of the current survey are included in Appendix C.

5.0. REVIEW OF PREVIOUS REPORTS

Fisher was provided with the report of a previous DSS, which was conducted by Fisher Environmental Ltd. on July 23, 2014. This report has indicated no confirmed or assumed ACM within the specified work areas.

6.0. FINDINGS AND RECOMMENDATIONS

6.1. *Acrylonitrile*

Acrylonitrile would not be expected to be present at the Site and was not observed during the current survey. No recommendations for Acrylonitrile are warranted at this time.

6.2. *Arsenic*

Arsenic would not be expected to be present at the Site and was not observed during the current survey. No recommendations for Arsenic are warranted at this time.



6.3. Asbestos

6.3.1. General Information

Asbestos is the name given to a group of six different fibrous minerals (amosite, chrysotile, crocidolite, and the fibrous varieties of tremolite, actinolite and anthophyllite) that occur naturally in the environment. Asbestos minerals have separable long fibres that are strong and flexible enough to be spun and woven and are heat resistant.

Because of these characteristics, asbestos has been used for a wide range of manufactured goods, mostly in building materials (roofing shingles, ceiling and floor tiles, paper products, and asbestos cement products), friction products (automobile clutch, brake, and transmission parts), heat-resistant fabrics, packaging, gaskets, and coatings. Some vermiculite or talc products may also contain asbestos.

Asbestos fibres may be released into the air by the disturbance of ACM during product use, renovation or demolition work, building or home maintenance, repair and remodeling. In general, exposure may occur only when the ACM is disturbed in some way to release particles and fibres into the air.

6.3.2. Friable vs. Non-Friable ACM

Based on the requirements of O. Reg. 278/05 and due diligence, an asbestos survey and report must be available at any workplace where asbestos exists identifying locations and types of ACM in the building. The survey must include both friable and non-friable materials confirmed to contain asbestos, as well as any other materials which were not sampled but are suspected (presumed) ACM. The term friable refers to material(s) that could be readily reduced to dust or powder when crushed by hand or moderate pressure. Friable materials have a much greater chance of releasing airborne asbestos fibres when disturbed.

In the past, the most commonly used friable asbestos-containing building materials were surfacing materials (e.g. sprayed on fireproofing, texture, decorative or acoustic plaster) as well as thermal insulation. Examples of manufactured asbestos-containing materials include vinyl floor tiles, ceiling tiles, gasket materials, asbestos cement (transite) pipes or boards, and asbestos textiles. Depending on the above noted formulation, these materials range from non-friable to friable. Although some products are considered non-friable when in Good condition, severe damage or deterioration may cause non-friable materials to generate airborne dust more readily. Severely damaged non-friable materials, or those to be worked on with powered tools, may be considered as friable ACM for abatement purposes.

Examples of common types of ACM by friability include:

- Friable ACM



- Sprayed Materials (or materials installed by roller or trowel), such as fireproofing, thermal insulation, texture finishes, etc.
 - Mechanical Insulation such as boiler and breeching, ductwork, piping, tanks and associated equipment.
 - Plaster
- Potentially Friable ACM
 - Acoustic Ceiling Tiles
 - Vinyl Sheet Flooring
- Non-Friable ACM
 - Vinyl Floor Tiles
 - Asbestos cement (“transite”) piping or paneling
 - Window Caulking

6.3.3. Regulations

Exposure to asbestos is controlled by two Regulations passed under Ontario’s Occupational Health and Safety Act (OHSA), R.R.O. 1990.

- O. Reg. 490/09 – *Designated Substances* regarding asbestos applies to:
 - every employer operating a mine for the purpose of mining, crushing, grinding or sifting asbestos;
 - every employer processing, adapting or using asbestos in connection with manufacturing or assembling of goods or products;
 - every employer engaged in the repair, alteration or maintenance of machinery, equipment, aircraft, ships, locomotives, railway cars and vehicles;
 - every employer engaged in work on a building that is necessarily incidental to the repair, alteration or maintenance of machinery or equipment; and,
 - to those workers of such employers who are likely to be exposed to asbestos.

Exposure limits for this substance are set at 0.1 f/cc (TWA) for all types of asbestos.

- O. Reg. 278/05 - *Asbestos on Construction Projects and in Buildings and Repair Operations* applies to buildings that contain friable and non-friable ACM and to the repair, alteration and/or maintenance of these buildings.

In addition to regulations for controlling work around asbestos-containing building materials there are regulations for packaging, transportation and disposal of asbestos-containing waste:

- O. Reg. 558/00 made under the Ministry of Environment (MOE) Environmental Protection Act, amending O. Reg. 347 - *General Waste Management*; and,



- The Transport of Dangerous Goods Act (TDGA) provides regulations for the transport of asbestos-containing materials and wastes.

6.3.4. Findings

Samples of homogenous materials suspected to contain asbestos were collected and submitted for analysis. Fisher collected three (3) bulk samples of building materials found within the specified work areas and that could potentially contain asbestos. Findings of all building materials identified within the specified work area(s) are outlined in further detail below.

6.3.4.1. Sprayed or Troweled Fireproofing and Thermal Insulation

No indication of sprayed or troweled fireproofing and / or thermal insulation was noted in any of the specified work areas during the current survey.

6.3.4.2. Texture Finish

No indication of texture finish was noted in any of the specified work areas during the current survey.

6.3.4.3. Mechanical Insulation

The previous report assumed asbestos-containing mechanical insulation in the form of parging cement on pipe fittings, and air-cell on straight pipe are present at the Site, but not observed within the specified work areas.

6.3.4.4. Acoustic Ceiling Tile

No acoustic ceiling tile was noted in any of the specified work areas during the current survey.

6.3.4.5. Plaster / Drywall Joint Compound

Plaster was observed on the ceilings and walls in the building, but not observed within the specified work areas.

Drywall Joint Compound (DJC) was observed throughout the building. The previous report indicated DJC was sampled for analysis. The results of analysis revealed that the DJC does not contain asbestos

6.3.4.6. Asbestos Cement Products

No asbestos cement products, such as Transite pipe or board, were noted in any of the specified work areas during the current survey.

6.3.4.7. Vinyl Sheet Flooring

No vinyl sheet flooring was noted in any of the specified work area(s) during the current survey.

6.3.4.8. Vinyl Floor Tile

No vinyl floor tiles were noted in any of the specified work area(s) during the current survey.



6.3.4.9. Other ACM

Mortar

Mortar was observed on the brick wall within the specified work areas during the current survey. Three (3) samples of the mortar were collected for analysis. The results of analysis revealed that the mortar does not contain asbestos.

6.3.5. Recommendations

No asbestos-containing materials were identified in any of the specified work area(s). Therefore, no recommendations with regards to ACM are warranted at this time. Provide a copy of this report to contractors bidding on or performing work within the subject work areas.

Note: Fire doors, present within the specific work areas, may contain asbestos-containing thermal insulation inside the door panel. Removal of any asbestos containing fire doors, in intake condition, will require Type 1 to abatement procedures, as outlined in O. Reg. 278/05 and dispose of as asbestos waste.

The presence of ACM should be presumed in locations not accessed during this survey. It is possible that ACM is present at the Site that is not identified in this report. Should additional suspected ACM be discovered, it should be presumed as ACM until sample analysis determines asbestos content.

Due to the limited nature of the current scope of work and the presence of solid building finishes (i.e. plaster or drywall walls and ceilings etc.) in many locations, the full extent of ACM may not be confirmed. Precautions should be taken when dismantling solid wall or ceiling finishes, or any other building surfaces which may conceal potential ACM. Such precautions include, but are not limited to, isolation measures and appropriate personal protective equipment.

6.4. Benzene

Benzene would not be expected to be present at the Site and was not observed during the current survey. No recommendations for Benzene are warranted at this time.

6.5. Coke Oven Emissions

Coke oven emissions would not be expected to be present at the Site and were not observed during the current survey. No recommendations for coke oven emissions are warranted at this time.

6.6. Ethylene Oxides

Ethylene oxides would not be expected to be present at the Site and were not observed during the current survey. No recommendations for ethylene oxides are warranted at this time.



6.7. Isocyanates

Isocyanates would not be expected to be present at the Site and were not observed during the current survey. No recommendations for isocyanates are warranted at this time.

6.8. Lead

6.8.1. General Information

Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. Most lead in the environment comes from human activities such as burning fossil fuels, mining and manufacturing. Lead is used in the production of batteries, ammunition, metal products (solder and pipes) and X-ray devices.

Lead does not break down but lead compounds are changed by sunlight, air and water. Exposure occurs when eating food or drinking water that contains lead. Deteriorated lead paint can contribute to lead dust. The main target for lead toxicity is the nervous system.

6.8.2. Regulations and Guidelines

The Ontario MOL has not prescribed criteria defining an analyzed sample of bulk material as "lead-containing". Further, the MOL has not established a lower limit for concentrations of lead in paint, below which precautions do not need to be considered during construction projects. However, except for very aggressive disturbance of painted finishes, (e.g., abrasive blasting, torch cutting, or grinding), Fisher believes that a lead content below 0.1% by weight (1,000 ug/g or 1000 ppm) represents a concentration in which the lead content is not the limiting hazard for construction hygiene purposes. Regular construction dust suppression techniques and worker hygiene practices are sufficient for disturbance of paint finishes determined to contain less than 0.1% lead by weight, provided that work is limited to non-aggressive operations.

The regulation for the designated substance lead applies to every employer and worker at a workplace where lead is present, produced, processed, used, handled or stored and at which a worker is likely to be exposed to lead. Exposure limits for this substance are set at 0.05 – 0.10 mg/m³ (TWA) depending on the type of lead, and for tetraethyl lead 0.30 mg/m³ (STEL).

Additionally, in 2011 the MOL revised *Guideline: Lead on Construction Projects* outlining practices that should be followed during construction projects to protect workers' from exposure to lead. This includes the methods and equipment employed in the removal of lead-containing coatings that reduce the creation of dust, providing appropriate facilities for workers to wash after each shift, and providing protective clothing and respirators where necessary.

6.8.3. Findings

Based on the age of the building, it is possible that lead-based paint and lead plumbing are present within the building. Lead can also be present in various ceramic tiles. During the current



survey, two (2) bulk samples of light grey wall paint, and grey floor paint were collected and submitted to Fisher Environmental Laboratories for lead analysis. The results of analysis revealed that light grey paint contains <10 ppm of lead, and grey floor paint contains 55 ppm of lead.

6.8.4. Recommendations

Where any lead-containing materials may be disturbed or removed, Fisher recommends that appropriate lead abatement procedures be used. The lead abatement procedures to be used are determined by the method(s) of disturbance employed. Regular construction dust suppression techniques and worker hygiene practices are sufficient for disturbance of paint finishes determined to contain less than 0.1% lead by weight, provided that work is limited to non-aggressive operations. The table below outlines lead abatement operations and associated respirator required, as outlined in Ontario MOL guidelines.

Classifications of Lead-Containing Operations and Required Respirator

Type 1 Operations (where concentrations of airborne lead would be expected to be < 0.05 mg/m ³)	
Activities that include; <ul style="list-style-type: none"> • Removal of lead containing coatings with chemical gel or paste and fibrous laminated cloth wrap • Removal of lead containing coatings / materials using power tool that has an effective dust collection system equipped with HEPA filter • Removal of lead containing coatings / materials using non-powered hand tools other than manual scraping or sanding 	Respirators should not be necessary if general procedures are followed and level of air is less than 0.05 mg/m ³ . However, if worker wishes to use a respirator, a half-mask particulate respirator with N-, R- or P-series filter, and 95, 99 or 100% efficiency should be provided.
Type 2a Operations (where concentrations of airborne lead would be expected to be > 0.05 to 0.50 mg/m ³)	
Activities that include; <ul style="list-style-type: none"> • Removal of lead containing coatings / materials by scraping or sanding using non-powered hand tools • Manual demolition of lead painted plaster walls / building components by striking with a sledgehammer or similar tool 	NIOSH APF = 10 Half-mask particulate respirator with N-, R- or P- series filter, and 95, 99 or 100% efficiency.
Type 2b Operations (where concentrations of airborne lead would be expected to be > 0.50 to 1.25 mg/m ³)	
Not applicable to potential renovation activities.	
Type 3a Operations (where concentrations of airborne lead would be expected to be > 1.25 to 2.50 mg/m ³)	
Activities that include; <ul style="list-style-type: none"> • Welding or high temperature cutting of lead-containing coatings or materials indoors or in a confined space. • Dry removal of lead-containing mortar using an electronic or pneumatic cutting device. • Burning of a surface containing lead • Removal of lead containing coatings / materials using power tools without an effective dust collection system equipped with HEPA filter 	NIOSH APF = 50 Full-face piece air-purifying respirator with N-, R- or P- series filter and 100% efficiency. Tight-fitting powered air-purifying respirator with high efficiency filter. Full-face piece supplied-air respirator operated in demand mode. Half-mask or full-face piece supplied air respirator operated in continuous-flow mode.
Type 3b Operations (where concentrations of airborne lead would be expected to be > 2.50 mg/m ³)	
Abrasive blasting of lead-containing coatings or materials.	NIOSH APF ≥ 1000



	Type CE abrasive-blast supplied respirator operated in a positive pressure mode with a tight-fitting half-mask face piece.
--	--

Refer to MOL *Guideline: Lead on Construction Projects, 2011*, for details of the Ministry's health and safety guidelines regarding lead.

6.9. Mercury

6.9.1. General Information

Mercury is a naturally occurring metal. It is a shiny, silver-white and odourless liquid. It combines with other elements to form inorganic compounds or salts. Metallic mercury is used to produce chlorine gas and caustic soda, and is used in thermostats and thermometers, fluorescent light bulbs, dental fillings and batteries. Exposure occurs when eating fish or shellfish contaminated with methyl mercury, breathing vapors from spills, incinerators, etc.

The nervous system is very sensitive to all forms of mercury. Exposure to high levels of metallic inorganic or organic mercury can permanently damage the brain, kidneys and developing fetus. Short-term exposure may cause lung damage, nausea, vomiting and diarrhea as well as skin and eye irritation.

6.9.2. Regulations

The regulation for mercury applies to every employer and worker at a workplace where mercury is present, produced, processed, used, handled or stored and at which a worker is likely to be exposed to mercury. Exposure limits for this substance are set at 0.025 – 0.01 mg/m³ (TWA) for all forms of mercury excluding alkyl, and for alkyl compounds of mercury 0.03 mg/m³ (STEL).

6.9.3. Findings

Mercury is presumed to be present in fluorescent light tubes and thermostatic controls. With the exception of fluorescent light bulbs and building thermostats, no other evidence of mercury was noted during the current survey.

6.9.4. Recommendations

Prior to the planned renovation work, Fisher recommends that any presumed mercury-containing fluorescent light tubes and thermostats that will be impacted are to be removed and disposed of in accordance with O. Reg. 558/00.

6.10. Silica

6.10.1. General Information

Silica is a crystalline compound occurring abundantly as quartz, sand, and many other minerals, and used to manufacture a variety of materials, especially glass and concrete. When mining this



substance, silica can be deadly when it becomes airborne. If inhaled, silica dust can cause silicosis which can be fatal.

Some of the following industries have a high potential for risk to workers: construction (sandblasting, rock drilling, masonry work, jack hammering, tunneling), mining (cutting or drilling through sandstone or granite), foundry work (grinding, mouldings, shakeout, core room), stone cutting (sawing, abrasive blasting, chipping, grinding), manufacturing and use of abrasives, etc.

6.10.2. Regulations

The regulation for silica applies to every employer and worker at a workplace where silica is present, produced, processed, used, handled or stored and at which a worker is likely to be exposed to silica. Exposure limits for this substance are set at 0.05 - 0.10 mg/m³ (TWA), depending on the type of silica.

Additionally, in 2011 the MOL revised *Guideline: Silica on Construction Projects* outlining practices that should be followed during construction projects to protect workers' from exposure to silica. This includes the methods and equipment employed in the removal of silica-containing materials that reduce the creation of dust, providing appropriate facilities for workers to wash after each shift, and providing protective clothing and respirators where necessary.

6.10.3. Findings

No sampling for silica was conducted. However, as the building is constructed of concrete, brick and/or block walls with concrete floors, silica is expected to be found within these components of the buildings.

6.10.4. Recommendations

If these materials will be disturbed during the planned renovation work, appropriate precautions should be taken to protect workers from inhaling silica dusts and debris. Refer to MOL *Guideline: Silica on Construction Projects* for details.

6.11. Vinyl Chloride

Vinyl chloride would not be expected to be present at the Site and was not observed during the current survey. No recommendations for vinyl chloride are warranted at this time.

6.12. Mould

During the current survey, no visible mould or favourable conditions for mould growth were observed in the specified work area(s). No action is recommended with regard to mould.



7.0. LIMITATIONS

Fisher Environmental Ltd. accepts responsibility for the competent performance of its duties in executing this assignment within the normal standards of the profession, but disclaims responsibility for consequential damages, if any.

The scope of the survey is based on prior agreement with the client, and the rationale given in this report. The survey findings rely on professional interpretation of selective sampling and analysis. Sample analysis results have been applied to homogenous materials in unsampled locations; it was not within the scope of work to carry out an exhaustive sampling and analysis program. For non-accessible building spaces, the likelihood of the presence or absence of asbestos and other designated substances has been described, but such assessment is not a definitive statement of presence or absence.

This report was prepared for the IBI Group. The scope of services performed may not be appropriate for the purposes of other users, and any use or reuse of this document or its findings or recommendations represented herein is at the sole risk of any other user.

We trust that the information provided in the report meets your current requirements. If you have any questions or concerns, please do not hesitate to contact the undersigned.

Respectfully submitted,



Renata Stec, M.Sc.
Project Manager

David Fisher, P. Eng., C. Chem.
Principal



APPENDIX A – SITE PLAN(S)





Legend



Area of Work

1-01

Location Number



Asbestos Sample Location



Lead Sample Location

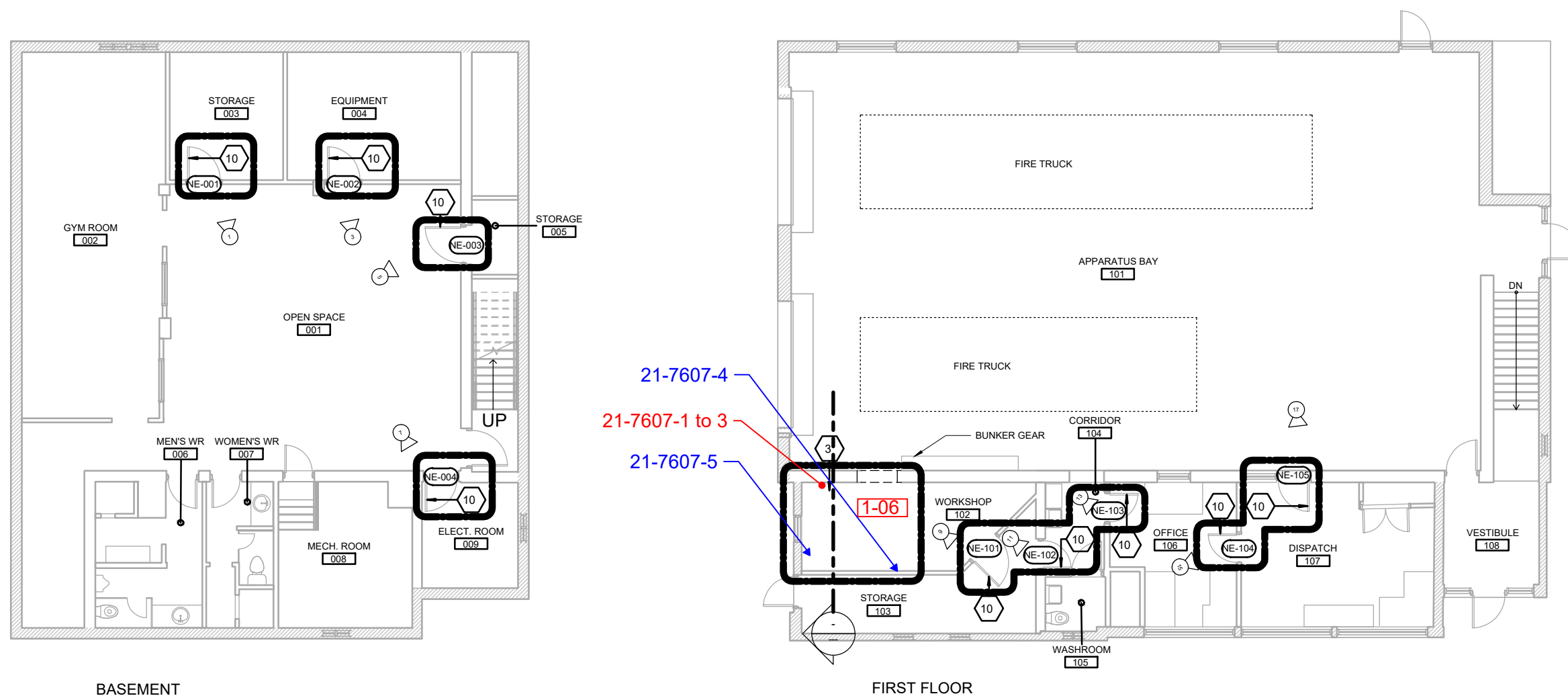


Figure 1

LOCATION: 1313 Woodbine Avenue
Toronto, Ontario

BUILDING NAME: Fire Hall NO. 224

Basement and First Floor Plan
Pre-Reno DSS
Asbestos and Lead Sample Locations

CLIENT: IBI Group

PROJECT NUMBER: FE-P 21-11706 DATE: November 2021 DRW BY: ZA

CAD FILE: FIG1 SCALE: Not to Scale CHK BY: RS



400 Esna Park Dr., #15
Markham, Ontario
L3R 3K2

Tel: 905 475-7755
Fax: 905 475-7718



Legend



Area of Work

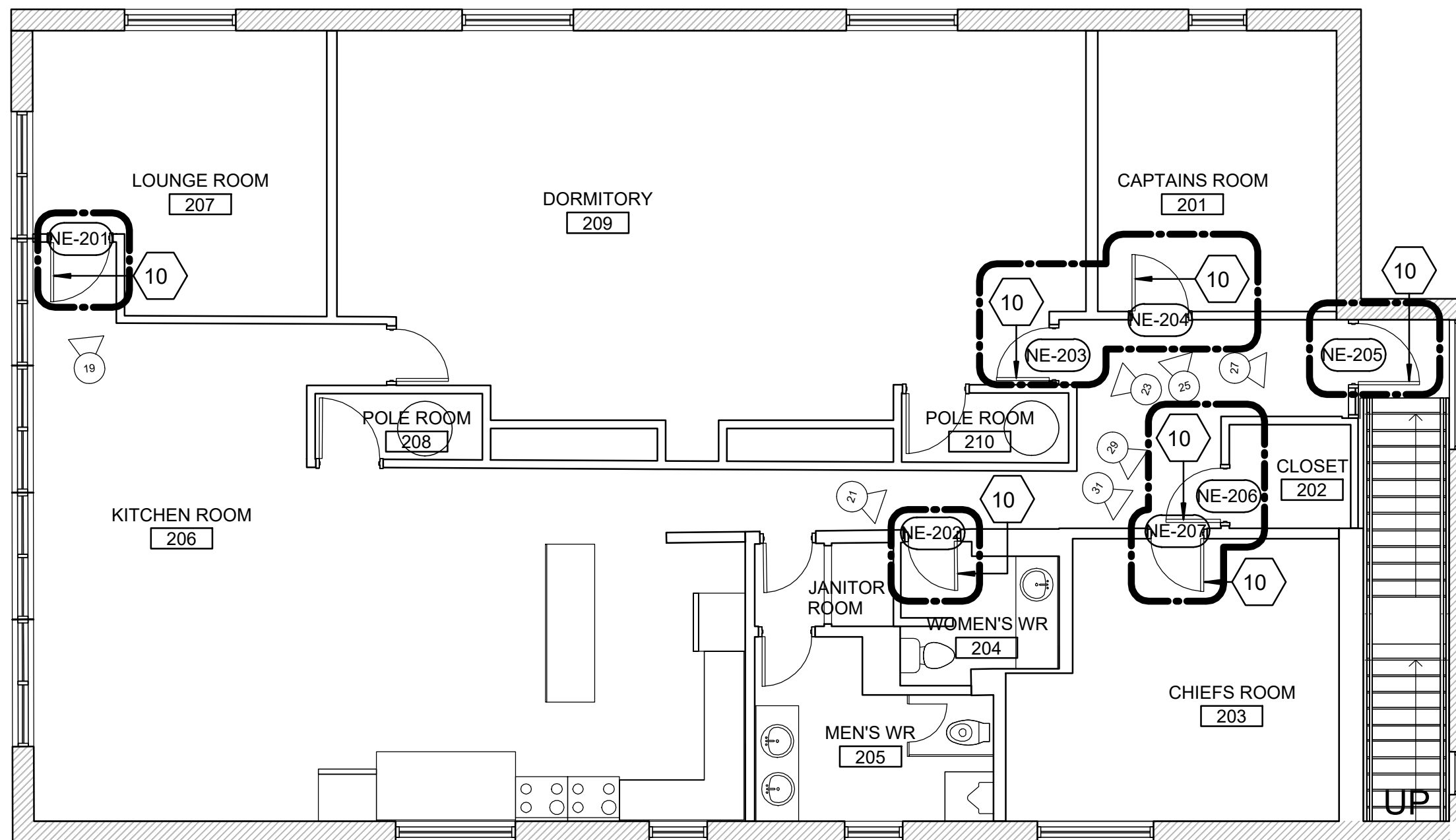


Figure 2

LOCATION:
1313 Woodbine Avenue
Toronto, Ontario

BUILDING NAME:
Fire Hall NO. 224

Second Floor Plan
Pre-Reno DSS

CLIENT:
IBI Group

PROJECT NUMBER: FE-P 21-11706 DATE: November 2021 DRW BY: ZA

CAD FILE: FIG2 SCALE: Not to Scale CHK BY: RS



400 Esna Park Dr., #15
Markham, Ontario
L3R 3K2

Tel: 905 475-7755
Fax: 905 475-7718

APPENDIX B – CERTIFICATE(S) OF ANALYSIS





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Client: IBI Group
Address: 100-175 Galaxy Blvd.
Toronto, ON
M9W 0C9
Tel.: 416-679-1930
E-mail:
Attn: Luisa Sosa

F.E. Job #: 21-7607
Project Name: Pre-Reno DSS
Project ID: FE-P 21-11706
Date Sampled: 18-Nov-2021
Date Received: 24-Nov-2021
Date Reported: 30-Nov-2021
Location: 1313 Woodbine Avenue
Toronto, ON

Certificate of Analysis

Analysis Requested:	Asbestos, Lead
Sample Description:	5 Bulk Sample(s)

Client Sample ID	Lab Sample ID	Sample Matrix	Fibre Type	Asbestos Content
01A - Mortar on Brick Wall, Workshop	21-7607-1	Mortar		Not Detected
01B - Mortar on Brick Wall, Workshop	21-7607-2	Mortar		Not Detected
01C - Mortar on Brick Wall, Workshop	21-7607-3	Mortar		Not Detected

Fisher Environmental Laboratories (Lab ID #: 2745) is accredited by CALA (Canadian Association for Laboratory Accreditation Inc.) for asbestos analysis by PLM.

ANALYTICAL METHOD:

Asbestos has been done in accordance with normal professional standard using the following Fisher Environmental Lab Method: Asbestos by PLM (Polarized Light Microscope) F-26, Rev.2.2.

Certificate of Analysis

Analysis Requested:	Asbestos, Lead
Sample Description:	5 Bulk Sample(s)

Client Sample ID	Lab Sample ID	Sample Matrix	Lead (ppm)	Comments
Pb1 - Light Grey Wall Paint, Workshop	21-7607-4	Paint	<10	
Pb2 - Grey Paint on the Floor, Workshop	21-7607-5	Paint	55	

< result obtained was below RL (Reporting Limit).

QA/QC Report

Parameter	Blank (ppm)		LCS (%)		CRM/MS (%)	
	Result	RL	Recovery	AR	Recovery	AR
Lead	<10	10	93	80-120	95	70-130

Parameter	Duplicate (%)					
	RPD	AR				
Lead	3.8	0-30				

LEGEND:

RL - Reporting Limit

LCS - Laboratory Control Sample

MS - Matrix Spike

AR - Acceptable Range

RPD - Relative Percent Difference

ANALYTICAL METHODS:

Metals (Lead) - Method # F-1, Rev. 4.5, Standard Operation Procedure for determination of Metals by the Inductively Coupled Plasma- Optical.

Method used by Fisher Environmental Lab complies with the Standard Methods for the Examination of Water and Wastewater, 20th Ed 3120-B.

Authorized by:

Roger Lin
 Roger Lin, Ph. D., C. Chem.
 Laboratory Manager



APPENDIX C – SITE PHOTOS





Photo 1 – View of non-lead containing grey paint on the floor in the Workshop.





Photos 2, 3 – View of a thermostat with the mercury vial at the entrance to the Workshop.

APPENDIX D – PREVIOUS DSS REPORT





DESIGNATED SUBSTANCE SURVEY



TORONTO FIRE STATION 224 1313 WOODBINE AVENUE

Toronto, Ontario

Presented to:

Meaghan Aldcroft

City of Toronto
Facilities Management

Fisher Environmental Ltd.
Project Number: FE-P 14-6915

JULY, 2014

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APPENDIX III – CORRECTIVE ACTIONS INSPECTION REPORTS

APPENDIX IV – SURVEY DRAWINGS

APPENDIX V – SITE PHOTOGRAPHS

1. INTRODUCTION AND REGULATORY REQUIREMENTS

1.1 Introduction and Scope

Fisher Environmental Ltd. was retained by the City of Toronto, Facilities Management to conduct a Designated Substance Survey of building in Toronto Fire Station 224 located at 1313 Woodbine Avenue in Toronto, Ontario.

The objectives of the Designated Substance Survey (DSS) are to establish locations, conditions and types of designated substances contained within a building and, if necessary, provide recommendations to fulfill requirements set forth under the Ontario Occupational Health and Safety Act (OHSA) to achieve regulatory compliance. Preparation of the DSS report, which includes a brief description of the materials present, and the findings of the DSS, will fulfill the requirements of the Ontario Ministry of Labour (MOL) regulations for designated substances; O. Reg 490/09 – Designated Substances and O. Reg 278/05 – Asbestos on Construction Projects and in Buildings and Repair Operations.

The DSS should also include an examination for the presence of polychlorinated biphenyls (PCBs) and visible mould growth. This document should be filed as an addendum to the original survey, which was conducted by APL Environmental Inc. on October 22, 2003.

The *Designated Substance Survey* report is intended for management purposes only to demonstrate compliance with regulations. It is not to be used to establish the designated substance content within building materials before renovation or demolition activities. Prior to any work activities that may disturb building materials, a thorough Pre-Renovation or Pre-Demolition survey of the work area for designated substances and hazardous materials shall be conducted.

Peter Milosh of Fisher Environmental Ltd. performed the fieldwork on July 23, 2014.

2. SURVEY METHODOLOGY

2.1 General Approach

To ensure familiarity with the building, the Surveyor made reference to the previous assessment and reassessment reports provided by the City of Toronto prior to commencing the asbestos reassessment survey. The Surveyor also made reference to facility floor plans included in the previous assessment reports, or provided independently by the City of Toronto. Facility drawings identifying locations of asbestos-containing materials, if present, are included in Appendix IV. Site photos are included in Appendix V.

2.2 Survey Methodology

The City of Toronto provided the consultant with the previous DSS report and / or other survey reports of designated substances identified within the facility, if available. Prior to conducting the DSS, the reports were reviewed by Fisher Environmental Ltd. and updated with all available information regarding ACM, including that from past assessments and reassessments.

The survey was conducted in compliance with the Ontario Ministry of Labour (MOL) regulations for designated substances; O. Reg. 490/09 - *Designated Substances* and O. Reg. 278/05 - *Asbestos*

on Construction Projects and in Buildings and Repair Operations made under the Occupational Health and Safety Act (OHSA), R.S.O. 1990.

The Surveyor conducted a visual reassessment of all known and assumed asbestos-containing materials in all accessible areas of the building, as detailed in past survey reports and the Reassessment Survey Form, and recorded the condition (GOOD, FAIR or POOR) of each known or assumed ACM on the Asbestos Reassessment Survey Form. The Surveyor also recorded detailed descriptions of previously-unidentified potential ACM, if observed. Please refer to Appendix I for the updated Reassessment Survey Form.

Materials confirmed to be asbestos-containing during previous assessments were not sampled for this reassessment survey. Additionally, samples were not collected of materials that were previously confirmed to be non-asbestos by the requirements of Ontario Regulation 278/05.

Non-friable materials (including plaster, drywall joint compound, vinyl floor tiles, mastics, window caulking) were not sampled unless damaged or otherwise deemed necessary by the surveyor(s) or the City of Toronto, and were assumed to be asbestos-containing.

Any other potential asbestos-containing materials noted during the reassessment survey that had not been identified in a previous survey, or were not sampled in accordance with the requirements of O. Reg. 278/05, were sampled as part of the reassessment.

The DSS is based on a walk-through inspection of the facility and shall be conducted room by room to establish locations, conditions and types of designated substances. The survey shall also include an examination for the presence of polychlorinated biphenyls (PCB) and visible mould growth.

3. FINDINGS AND RECOMMENDATIONS

3.1 Asbestos

Asbestos fibres may be released into the air by the disturbance of asbestos-containing material (ACM) during product use, demolition work, building or home maintenance, repair and remodelling. In general, exposure may occur only when the ACM is disturbed in some way to release particles and fibres into the air.

3.1.1 Findings

Previously identified assumed or confirmed ACM include the following:

- Parging Cement,
- Aircell Pipe Insulation,
- Vinyl Floor Tile – two (2) varieties,
- Sheet Flooring – one (1) variety,
- Plaster,
- Drywall Joint Compound,
- Window Caulking, and
- Roofing Materials

Asbestos-containing vinyl floor tiles 02 and 04 (12"x12" black with white flecks, and 12"x12" grey with random flecks, respectively), previously identified in Locations 1-03 (Lounge) and 1-04 (Office) was not observed during the audit.

All previously identified assumed ACM were observed to be in Good condition at the time of the reassessment. Although samples of these materials may have been collected during previous assessment surveys, samples were not necessarily collected with sufficient frequency to categorize the material as non-asbestos in accordance with O. Reg. 278/05.

During this reassessment survey, additional samples of readily accessible materials (excluding roofing materials and window caulking) were collected to meet the bulk sampling requirements outlined in O. Reg. 278/05. Table 1 below summarizes the bulk sample analysis results.

TABLE 1 Summary of Analysis of Bulk Samples collected and analysed during this reassessment			
Sample Number	Sample Description	Sample Location	Analytical Results
14-8977-01	Drywall Joint Compound	Location B-07, Locker Room	None Detected
14-8977-02	Drywall Joint Compound	Location B-08, Storage Room	None Detected
14-8977-03	Drywall Joint Compound	Location 1-03, Lounge	None Detected
14-8977-04	Drywall Joint Compound	Location 1-04, Office	None Detected
14-8977-05	Drywall Joint Compound	Location 1-07, Washroom	None Detected
14-8977-06	Drywall Joint Compound	Location 2-06, Dormitory	None Detected
14-8977-07	Drywall Joint Compound	Location 2-10, Men's Washroom	None Detected

Laboratory analysis determined each material sampled to not contain asbestos. The laboratory analysis report is included with this report as Appendix II.

3.1.2 Recommendations

All generally accessible building materials previously suspected to be ACM were determined to not contain asbestos and no immediate recommendations are made.

Any other building materials suspected to contain asbestos which are not outlined in this report should be assumed to be asbestos-containing until sample analysis determines asbestos content.

Ontario Ministry of Labour Regulation 278/05 requires that an Asbestos Management Program (AMP) be implemented as long as asbestos-containing materials are present in a building. The AMP, original survey report and subsequent reassessment reports must be available at the work place, and must identify the type of asbestos, and where asbestos can be found on a room-by-room basis.

NOTE: Interpretation of all sources of asbestos-related information, including but not limited to the original asbestos survey report, asbestos reassessment reports, room-by-room survey data, survey drawings and reports from previous asbestos abatement projects, should be completed by a

competent person trained in the historical application of asbestos in building materials, building design and preferably by a person with site-specific knowledge and/or experience.

Information contained within any of the above-noted sources may not relieve the Regulatory responsibility of building Owners, or project Employers/Constructors, to complete a detailed site inspection prior to commencement of a project.

This report should not be used as a substitute for a detailed site inspection to identify asbestos-containing building materials, which must be specifically tailored to the scope and nature of any given project, and completed prior to any maintenance, renovation or demolition work that may cause disturbance to building materials.

3.2 Lead

Most lead in the environment comes from human activities such as burning fossil fuels, mining and manufacturing. Lead is used in the production of batteries, ammunition, metal products such as solder and pipes, and x-ray devices. Exposure happens when eating food or drinking water that contains lead. Deteriorated lead paint can contribute to lead dust. The main target for lead toxicity is the nervous system.

The regulation for lead applies to every employer and worker at a workplace where lead is present, produced, processed, used, handled or stored and at which a worker is likely to be exposed to lead.

Additionally, in 2004 the MOL issued *Guideline: Lead on Construction Projects* outlining practices that should be followed during construction projects to protect workers' from exposure to lead. This includes the methods and equipment employed in the removal of lead containing coatings that reduce the creation of dust, providing appropriate facilities for workers to wash after each shift, and providing protective clothing and respirators where necessary.

3.2.1 Findings

Based on the age of the building, it is possible that lead-based paint and lead plumbing are present within the building. During the current investigation, no samples were collected for lead analysis.

No other indication of lead-containing materials was observed during the building audit, with the exception of that which may be contained within batteries.

3.2.2 Recommendations

During the disturbance of any painted surfaces that contain lead, it would be recommended that appropriate procedures and use of respirators be followed to protect workers.

No immediate corrective actions were recommended with regard to lead.

3.3 Acrylonitrile

Acrylonitrile is used to make other chemicals such as plastics, synthetic rubber and acrylic fibres. Breathing high concentrations of acrylonitrile will cause nose and throat irritation, tightness in chest, difficulty breathing, nausea, dizziness, weakness, headache, impaired judgment and convulsions. These symptoms usually disappear when exposure has stopped. If spilled on the skin, acrylonitrile will burn the skin and cause blisters and redness. Acrylonitrile is believed to be carcinogenic.

3.3.1 Findings

Acrylonitrile based polymers may have been utilized in the production of some of the building construction materials (e.g. paints, sealants, and adhesives). Although these polymers are generally volatile, they are expected to produce significant acrylonitrile exposure only during or shortly after application of the subject material. If present on site, acrylonitrile would not be expected to be a concern during future renovation or demolition works. Acrylonitrile was not evident in its pure form anywhere within the subject areas of the building.

3.3.2 Recommendations

No immediate corrective actions were recommended with regard to acrylonitrile.

3.4 Arsenic

Inorganic arsenic compounds are mainly used to preserve wood. Organic arsenic compounds are used as pesticides. Arsenic occurs naturally in soil and minerals and therefore may enter air and water. Breathing high levels of arsenic may cause sore throat and irritated lungs. Ingesting high levels of arsenic can result in death. Arsenic is a suspected carcinogenic substance.

3.4.1 Findings

Low levels of arsenic may be contained within paints or coatings utilized on building construction materials, however exposure levels resulting from personal contact are not expected to be significant. Arsenic or arsenic containing compounds were not encountered during the building survey works.

3.4.2 Recommendations

No immediate corrective actions were recommended with regard to arsenic.

3.5 Benzene

Benzene is colourless liquid with a sweet odour. Benzene utilization has historically been associated with solvents, paints, stains, adhesives, and in the manufacturing of various rubber products. While its current use in building materials has greatly decreased due to an increased awareness of associated health concerns, it may still be present in trace quantities in various industrial solvents. Gasoline sold in Canada contains approximately 4% benzene.

Breathing very high levels of benzene can result in death, while high levels may cause drowsiness, dizziness, rapid heart rate, headaches, and unconsciousness.

3.5.1 Findings

While it may be expected, given the age of the building, that the original construction materials utilized did contain some trace levels of benzene, it is likely that any has since volatilized and would not exceed the permissible exposure values. During future renovation or demolition works, it would not be expected to be a concern. No evidence of benzene was noted during the building survey, with the exception of that which may be contained in regular gasoline fuel burning equipment.

3.5.2 Recommendations

No immediate corrective actions were recommended with regard to benzene.

3.6 *Coke Oven Emissions*

Coke oven emissions are released during the carbonization of bituminous coal for the production of coke. Exposure routes include inhalation, skin and / or eye contact. Coke oven emissions are potential occupational carcinogens.

3.6.1 Findings

This substance would not be expected to be found in the building. No evidence of the burning of coke was found during the building survey.

3.6.2 Recommendations

No immediate corrective actions were recommended with regard to coke oven emissions.

3.7 *Ethylene Oxides*

Ethylene oxide is a man-made chemical used primarily to make ethylene glycol (antifreeze and polyester). Breathing low levels of ethylene oxides for a prolonged period of time causes eye, skin and respiratory irritations, and can affect nervous system. Higher levels of exposure for shorter time produce symptoms that are similar but more severe.

3.7.1 Findings

This substance would not be expected to be found in the building. No evidence of ethylene oxides was found during the building survey.

3.7.2 Recommendations

No immediate corrective actions were recommended with regard to ethylene oxides.

3.8 *Isocyanates*

Isocyanates are a family of highly reactive, low molecular weight chemicals. They are widely used in the manufacture of flexible and rigid foams, fibres, and coatings such as paints and varnishes, and elastomers and various building materials (e.g. spray on polyurethane products).

Isocyanates are powerful irritants to the eyes, skin, and respiratory and gastrointestinal tracts.

3.8.1 Findings

Use of isocyanates or isocyanate compounds would not be expected in the building. No evidence of isocyanates was found during the building survey.

3.8.2 Recommendations

No immediate corrective actions were recommended with regard to isocyanates.

3.9 Mercury

Mercury is a naturally occurring metal. It is a shiny, silver-white and odourless liquid. It combines with other elements to form inorganic compounds or salts. Metallic mercury is used to produce chlorine gas and caustic soda, and is used in thermostats and thermometers, fluorescent light bulbs, dental fillings and batteries. Exposure occurs when breathing vapors from spills, incinerators, etc.

The nervous system is very sensitive to all forms of mercury. Exposure to high levels of metallic inorganic or organic mercury can permanently damage the brain, kidneys and developing fetus. Short-term exposure may cause lung damage, nausea, vomiting and diarrhea as well as skin and eye irritation.

3.9.1 Findings

Mercury can be found in fluorescent light bulbs and building thermostats. Prior to future renovation or demolition works, it would be recommended that these products be safely removed. The disposal of mercury containing items are regulated under the Environmental Protection Act, and it would be recommended that for disposal purposes any mercury containing thermostats and fluorescent light bulbs be disposed of at an MOE licensed receiver. With the exception of fluorescent light bulbs and building thermostats, no other evidence of mercury was noted during the building survey.

3.9.2 Recommendations

No immediate corrective actions were recommended with regard to mercury.

3.10 Silica

Silica is a crystalline compound occurring abundantly as quartz, sand, and many other minerals, and used to manufacture a variety of materials, especially glass and concrete. When mining this substance, silica can be deadly when it becomes airborne. If inhaled, silica dust can cause silicosis which can be fatal.

Additionally, in 2004 the MOL issued *Guideline: Silica on Construction Projects* outlining practices that should be followed during construction projects to protect workers' from exposure to silica. This includes the methods and equipment employed in the removal of silica containing materials that reduce the creation of dust, providing appropriate facilities for workers to wash after each shift, and providing protective clothing and respirators where necessary.

3.10.1 Findings

As the building is constructed of concrete block and brick, with concrete floors, silica is expected to be found within these components of the building. During any significant renovation or demolition works where concrete dust is generated, dust suppression techniques should be utilized to control worker exposure to silica. Silica is expected to be present in concrete and masonry products in the building.

3.10.2 Recommendations

No immediate corrective actions were recommended with regard to silica.

3.11 Vinyl Chloride

Vinyl chloride is used to make polyvinyl chloride (PVC) which is found in a variety of plastic products, including pipes, wires, cable coatings and packaging materials. Breathing high levels of vinyl chloride can cause dizziness, unconsciousness and death. Prolonged exposure causes changes in liver, nerve damage, immune reactions and changes in blood flow.

3.11.1 Findings

PVC pipe is generally stable and does not allow for the liberation of vinyl chloride, under normal conditions. During future renovation or demolition works, this substance would not be expected to be a concern. Vinyl chloride was not evident in its pure form, anywhere in the subject building.

3.11.2 Recommendations

No immediate corrective actions were recommended with regard to vinyl chloride.

3.12 Polychlorinated Biphenyls (PCB)

PCBs are mixtures of synthetic organic chemicals with the same basic chemical structure and similar physical properties ranging from oily liquids to waxy solids. Due to their non-flammability, chemical stability, high boiling point and electrical insulating properties, PCBs were used in hundreds of industrial and commercial applications including electrical, heat transfer, and hydraulic equipment; as plasticizers in paints, plastics and rubber products; in pigments, dyes and carbonless copy paper and many other applications.

PCBs have been demonstrated to cause a variety of adverse health effects. PCBs have been shown to cause cancer.

3.12.1 Findings

No PCB containing equipment with the potential exception of fluorescent lighting ballasts was observed on site. Fluorescent lighting was observed in use in several areas of the building and inspection of three random light ballasts revealed that they did not contain PCBs. The disposal of PCB containing equipment is regulated under MOE Reg. 558, and it would be recommended that during any ballast replacement works the generated ballasts be evaluated for PCB content, with any PCB ballasts being consolidated and sent for disposal to an MOE licensed PCB receiver under waste class 243D.

3.12.2 Recommendations

It would be recommended that during any ballast replacement works the generated ballasts be evaluated for PCB content. Any PCB ballasts identified should be consolidated and sent for disposal to an MOE licensed PCB receiver under waste class 243D.

3.13 Mould

Mould contamination inside buildings has become a concern to both building owners and occupants. Exposure to moulds is known to cause a variety of health effects in some people. Many fungal spores are considered to be allergenic to susceptible persons, though individual susceptibility varies greatly.

Elevated levels of indoor mould are usually attributed to the chronic moist conditions due to water leaks, floods or elevated humidity. Under these conditions, already low levels of fungal spores in

air from plants and other sources may multiply on cellulose containing materials such as carpets, wallboards, and wood, and result in mould contamination and, if left untreated, can be destructive to certain building materials.

The Canadian Construction Association (CCA) has provided guidelines regarding investigation and remediation works in *CCA82 - 2004 Mould Guidelines for the Canadian Construction Industry* to protect the health and safety of workers who may be exposed to mould in the course of building renovations.

3.13.1 Findings

During the current investigation, no visible mould or favourable conditions for mould growth were observed in the surveyed areas.

3.13.2 Recommendations

No immediate corrective action is recommended with regard to mould contamination.

4. CORRECTIVE ACTIONS

No corrective actions were recommended.

5. STATEMENT OF LIMITATIONS

Fisher Environmental Ltd. accepts responsibility for the competent performance of its duties in executing this assignment within the normal standards of the profession, but disclaims responsibility for consequential damages, if any.

The extent of the building survey of asbestos containing materials (ACM) and other designated substances is based on prior agreement of the scope of work with the client, and the rationale given in this report. The building survey findings rely on professional interpretation of selective sampling and analysis. Sample analysis results have been applied to homogenous materials in unsampled locations; it was not within the scope of work to carry out an exhaustive sampling and analysis program. For non-accessible building spaces, the likelihood of the presence or absence of asbestos and other designated substances has been described, but such assessment is not a definitive statement of presence or absence.

This report was prepared for the City of Toronto, Facilities Management. The scope of services performed may not be appropriate for the purposes of other users, and any use or reuse of this document or its findings or recommendations represented herein is at the sole risk of any other user.

We trust that the information provided in the report meets your current requirements. If you have any questions or concerns, please do not hesitate to contact the undersigned.

6. SIGN-OFF

We trust that this report meets with City of Toronto requirements and we thank you for the opportunity to be of service. Should you have any questions, please do not hesitate to contact us.

Fisher Environmental Ltd.

Prepared By:



Peter Milosh, B.E.S.
Project Manager

Reviewed By:




David Fisher, P. Eng., C. Chem.
Principal

APPENDIX I

REASSESSMENT SURVEY FORM

APPENDIX I - REASSESSMENT SURVEY FORM

Building Address:	1313 Woodbine Avenue	Date(s) of Current Reassessment:	July 18, 2014
Building Name:	Toronto Fire Station 224	Organization Completing Reassessment:	Fisher Environmental Ltd. / Project FE-P 14-6915
Original Survey Conducted By:	APL Environmental Inc.	Name of Surveyor:	P. Milosh
Date(s) of Original Survey:	October 22, 2003	Signature of Surveyor:	

Summary of Findings

All hazardous materials observed in Good condition.

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	Not Sampled	ACM Assumed	4,350 SF	Good	
0-00	Exterior	Windows	Window Caulking	Asbestos	Not Sampled	ACM Assumed	All	Good	
0-00	Exterior	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
B-01	Basement Stairwell	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
B-01	Basement Stairwell	Walls	Plaster	Asbestos	12348-B-83-08a* 12348-B-83-08b* 12348-B-83-08c* 12348-B-83-08d* 12348-B-83-08e* 12348-B-83-08f* 12348-B-83-08g*	None Detected	180 SF	Good	* From Survey Report dated 2008
B-01	Basement Stairwell	Ceiling	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	80 SF	Good	
B-02	Electrical Room	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
B-02	Electrical Room	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
B-02	Electrical Room	Ceiling	Not Found	N/A	N/A	N/A	N/A	N/A	Open to deck

APPENDIX I - REASSESSMENT SURVEY FORM

Location Number	Location Name	Building System	Material Observed	Potential Hazardous Material	Sample ID	Analytical Result	Quantity	Condition	Notes / Recommended Actions
B-03	Hot Water Room	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
B-03	Hot Water Room	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
B-03	Hot Water Room	Ceiling	Not Found	N/A	N/A	N/A	N/A	N/A	Open to deck
B-04	Women's Washroom	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
B-04	Women's Washroom	Walls	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	300 SF	Good	
B-04	Women's Washroom	Ceiling	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	78 SF	Good	
B-04	Women's Washroom	Pipes	Parging Cement	Asbestos	11850-B-83-02a* 11850-B-83-02b* 11850-B-83-02c*	80% Chrysotile	1 Fitting	N/A	* From Survey Report dated 2007 NOT OBSERVED
B-05	Men's Washroom	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
B-05	Men's Washroom	Walls	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	370 SF	Good	
B-05	Men's Washroom	Ceiling	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	130 SF	Good	
B-06	Fitness Room	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
B-06	Fitness Room	Walls	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	300 SF	Good	
B-06	Fitness Room	Ceiling	Not Found	N/A	N/A	N/A	N/A	N/A	Open to deck
B-07	Locker Room	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
B-07	Locker Room	Walls	Drywall (DJC)	Asbestos	12348-B-83-05a* 12348-B-83-05b* 12348-B-83-05c* 12348-B-83-05d* 12348-B-83-05e* 14-8977-01*	None Detected	170 SF	Good	* From Survey Report dated 2008 *From Fisher Project No. 14-6915, dated July 2014
B-07	Locker Room	Ceiling	Not Found	N/A	N/A	N/A	N/A	N/A	Open to deck

APPENDIX I - REASSESSMENT SURVEY FORM

Location Number	Location Name	Building System	Material Observed	Potential Hazardous Material	Sample ID	Analytical Result	Quantity	Condition	Notes / Recommended Actions
B-08	Storage Room	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
B-08	Storage Room	Walls	Drywall (DJC)	Asbestos	14-8977-02*	None Detected	160 SF	Good	*From Fisher Project No.14-6915
B-08	Storage Room	Ceiling	Not Found	N/A	N/A	N/A	N/A	N/A	Open to deck
B-09	Equipment Storage	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
B-09	Equipment Storage	Walls	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	190 SF	Good	
B-09	Equipment Storage	Walls	Plaster	Asbestos	Not Sampled	None Detected	140 SF	Good	
B-09	Equipment Storage	Ceiling	Not Found	N/A	N/A	N/A	N/A	N/A	Open to deck
B-10	Storage Room	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
B-10	Storage Room	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
B-10	Storage Room	Ceiling	Not Found	N/A	N/A	N/A	N/A	N/A	Open to deck
B-11	Laundry Room	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
B-11	Laundry Room	Walls	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	160 SF	Good	
B-11	Laundry Room	Ceiling	Not Found	N/A	N/A	N/A	N/A	N/A	Open to deck
1-01	Apparatus Bay	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-01	Apparatus Bay	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
1-01	Apparatus Bay	Ceiling	Plaster	Asbestos	12320-01a* 12320-01b* 12320-01c* 12320-01d* 12320-01e*	None Detected	2,800 SF	Good	* From Analysis Report dated 2008
1-01	Apparatus Bay	Pipes	Aircell Pipe Insulation	Asbestos	Not Sampled	ACM Assumed	Unknown	Good	Above plaster ceiling
1-01	Apparatus Bay	Pipes	Parging Cement	Asbestos	Not Sampled	ACM Assumed	Unknown	Good	Above plaster ceiling

APPENDIX I - REASSESSMENT SURVEY FORM

Location Number	Location Name	Building System	Material Observed	Potential Hazardous Material	Sample ID	Analytical Result	Quantity	Condition	Notes / Recommended Actions
1-02	Vestibule	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
1-02	Vestibule	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
1-02	Vestibule	Ceiling	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	50 SF	Good	
1-03	Lounge	Floor	Vinyl Floor Tile 1	Asbestos	12348-B-83-01a*	None Detected	40 SF	Good	12" x 12" white with black flecks * From Survey Report dated 2008 NOT OBSERVED
1-03	Lounge	Floor	Vinyl Floor Tile 2	Asbestos	12348-B-83-02a*	20% Chrysotile	90 SF	Good	12" x 12" black with white flecks * From Survey Report dated 2008 NOT OBSERVED
1-03	Lounge	Floor	Vinyl Floor Tile 4	Asbestos	12348-B-83-04a* 12348-B-83-04b*	30% Chrysotile	210 SF	Good	12" x 12" grey with random flecks * From Survey Report dated 2008 NOT OBSERVED
1-03	Lounge	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
1-03	Lounge	Walls	Drywall (DJC)	Asbestos	12348-B-83-06a* 12348-B-83-06b* 12348-B-83-06c* 12348-B-83-06d* 12348-B-83-06e*	None Detected	500 SF	Good	* From Survey Report dated 2008
1-03	Lounge	Ceiling	Drywall (DJC)	Asbestos	14-8977-03*	None Detected	240 SF	Good	*From Fisher Project No.14-6915, dated July 2014
1-04	Office	Floor	Vinyl Floor Tile 1	Asbestos	12348-B-83-01b* 12348-B-83-01c*	None Detected	10 SF	Good	12" x 12" white with black flecks * From Survey Report dated 2008 NOT OBSERVED
1-04	Office	Floor	Vinyl Floor Tile 2	Asbestos	12348-B-83-02b* 12348-B-83-02c*	20% Chrysotile	20 SF	Good	12" x 12" black with white flecks * From Survey Report dated 2008 NOT OBSERVED
1-04	Office	Floor	Vinyl Floor Tile 4	Asbestos	12348-B-83-04c*	30% Chrysotile	150 SF	Good	12" x 12" grey with random flecks * From Survey Report dated 2008 NOT OBSERVED
1-04	Office	Floor	Sheet Flooring 1	Asbestos	12348-B-83-02b* 12348-B-83-02c*	20% Chrysotile	N/A	N/A	Tan / green * From Survey Report dated 2008 (underneath Floor Tile 2 and mastic) NOT OBSERVED
1-04	Office	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
1-04	Office	Walls	Drywall (DJC)	Asbestos	14-8977-04*	None Detected	400 SF	Good	*From Fisher Project No.14-6915, dated July 2014
1-04	Office	Ceiling	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	170 SF	Good	

APPENDIX I - REASSESSMENT SURVEY FORM

Location Number	Location Name	Building System	Material Observed	Potential Hazardous Material	Sample ID	Analytical Result	Quantity	Condition	Notes / Recommended Actions
1-05	Corridor	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
1-05	Corridor	Walls	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	160 SF	Good	
1-05	Corridor	Ceiling	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	100 SF	Good	
1-06	Workshop	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-06	Workshop	Walls	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	N/A	N/A	
1-06	Workshop	Ceiling	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	N/A	N/A	
1-07	Washroom	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
1-07	Washroom	Walls	Drywall (DJC)	Asbestos	14-8977-05*	None Detected	220 SF	Good	*From Fisher Project No.14-6915, dated July 2014
1-07	Washroom	Ceiling	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	25 SF	Good	
1-07	Washroom	Ceiling	Ceiling Tile 1	Asbestos	11430-B-04-01* 11430-B-04-02* 11430-B-04-03* 11850-B-83-03a+ 11850-B-83-03b+ 11850-B-83-03c+	None Detected	16 SF	Good	2' x 4' fissure * From Survey Report dated 2006 + From Survey Report dated 2007
1-08	Second Floor Stairwell	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
1-08	Second Floor Stairwell	Walls	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	120 SF	Good	
1-08	Second Floor Stairwell	Ceiling	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	80 SF	Good	
1-09	Janitor Closet	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-09	Janitor Closet	Walls	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	210 SF	Good	
1-09	Janitor Closet	Ceiling	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	35 SF	Good	
2-01	Bedroom	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
2-01	Bedroom	Walls	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	320 SF	Good	
2-01	Bedroom	Ceiling	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	100 SF	Good	

APPENDIX I - REASSESSMENT SURVEY FORM

Location Number	Location Name	Building System	Material Observed	Potential Hazardous Material	Sample ID	Analytical Result	Quantity	Condition	Notes / Recommended Actions
2-02	Housekeeping Closet	Floor	Vinyl Floor Tile 3	Asbestos	12348-B-83-03a*	None Detected	25 SF	Good	12" x 12" blue mosaic * From Survey Report dated 2008
2-02	Housekeeping Closet	Walls	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	160 SF	Good	
2-02	Housekeeping Closet	Ceiling	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	25 SF	Good	
2-03	Bedroom	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
2-03	Bedroom	Walls	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	430 SF	Good	
2-03	Bedroom	Ceiling	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	180 SF	Good	
2-04	Kitchen / Dining Area	Floor	Vinyl floor Tile 3	Asbestos	12348-B-83-03b*	None Detected	750 SF	Good	12" x 12" blue mosaic * From Survey Report dated 2008
2-04	Kitchen / Dining Area	Walls	Drywall (DJC)	Asbestos	12348-B-83-07a* 12348-B-83-07b* 12348-B-83-07c* 12348-B-83-07d* 12348-B-83-07e*	None Detected	880 SF	Good	* From Survey Report dated 2008
2-04	Kitchen / Dining Area	Ceiling	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	750 SF	Good	
2-04	Kitchen / Dining Area	Pipes	Thermal Pipe Insulation	Asbestos	11850-B-83-01a* 11850-B-83-01b* 11850-B-83-01c*	None Detected	N/A	N/A	* From Survey Report dated 2007
2-05	Lounge	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
2-05	Lounge	Walls	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	380 SF	Good	
2-05	Lounge	Ceiling	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	144 SF	Good	
2-06	Dormitory	Floor	Vinyl Floor Tile 3	Asbestos	Homogeneous w. 12348-B-83-03	None Detected	540 SF	Good	12" x 12" blue mosaic
2-06	Dormitory	Walls	Drywall (DJC)	Asbestos	14-8977-06*	None Detected	820 SF	Good	*From Fisher Project No.14-6915, dated July 2014
2-06	Dormitory	Ceiling	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	540 SF	Good	
2-07	East Pole Hole	Floor	Vinyl Floor Tile 3	Asbestos	12348-B-83-03c*	None Detected	20 SF	Good	12" x 12" blue mosaic * From Survey Report dated 2008
2-07	East Pole Hole	Walls	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	150 SF	Good	
2-07	East Pole Hole	Ceiling	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	20 SF	Good	

APPENDIX I - REASSESSMENT SURVEY FORM

<i>Location Number</i>	<i>Location Name</i>	<i>Building System</i>	<i>Material Observed</i>	<i>Potential Hazardous Material</i>	<i>Sample ID</i>	<i>Analytical Result</i>	<i>Quantity</i>	<i>Condition</i>	<i>Notes / Recommended Actions</i>
2-08	West Pole Hole	Floor	Vinyl Floor Tile 3	Asbestos	Homogeneous w. 12348-B-83-03	None Detected	20 SF	Good	12" x 12" blue mosaic
2-08	West Pole Hole	Walls	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	150 SF	Good	
2-08	West Pole Hole	Ceiling	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	20 SF	Good	
2-09	Women's Washroom	Floor	Vinyl Floor Tile 3	Asbestos	Homogeneous w. 12348-B-83-03	None Detected	42 SF	Good	12" x 12" blue mosaic
2-09	Women's Washroom	Walls	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	210 SF	Good	
2-09	Women's Washroom	Ceiling	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	50 SF	Good	
2-10	Men's Washroom	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
2-10	Men's Washroom	Walls	Drywall (DJC)	Asbestos	14-8977-07*	None Detected	340 SF	Good	*From Fisher Project No.14-6915, dated July 2014
2-10	Men's Washroom	Ceiling	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	130 SF	Good	
2-11	Corridor	Floor	Vinyl Floor Tile 3	Asbestos	Homogeneous w. 12348-B-83-03	None Detected	160 SF	Good	12" x 12" blue mosaic
2-11	Corridor	Walls	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	650 SF	Good	
2-11	Corridor	Ceiling	Drywall (DJC)	Asbestos	Homogeneous w. 14-8977-01 to 07	None Detected	160 SF	Good	
<i>Surveyor's Field Notes</i>									

APPENDIX II

RESULTS OF BULK SAMPLE ANALYSIS



FISHER ENVIRONMENTAL LABORATORIES

FULL RANGE ANALYTICAL SERVICES • SOIL/WATER/AIR TESTING • ENVIRONMENTAL
COMPLIANCE PACKAGES • 24 HOUR EMERGENCY RESPONSE • CALA ACCREDITED

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MARKHAM, ONT. L3R 3K2
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FAX: 905 475-7718
www.fisherenvironmental.com

Client: City of Toronto
Facilities Management
Address: 2nd Floor, Metro Hall
55 John Street, Toronto, ON
M5V 3C6
Tel.: 416-392-9024
E-mail: maldcro@toronto.ca
Attn: Meaghan Aldcroft

F.E. Job #: 14-8977
Project Name: 2014 ACM Reassessments
Project ID: FE-14-6915
Date Sampled: 18-Jul-14
Date Received: 22-Jul-14
Date Reported: 24-Jul-14
Location: 1313 Woodbine Ave
Toronto, ON

Certificate of Analysis

Analysis Requested:	Asbestos
Sample Description:	7 Bulk Samples

Client Sample ID	Lab Sample ID	Sample Matrix	Fibre Type	Asbestos Content
B-01A - Loc.B-07	14-8977-01	Drywall Joint Compound		Not Detected
B-01B - Loc.B-08	14-8977-02	Drywall Joint Compound		Not Detected
1-01C - Loc.1-03	14-8977-03	Drywall Joint Compound		Not Detected
1-01D - Loc.1-04	14-8977-04	Drywall Joint Compound		Not Detected
1-01E - Loc.1-07	14-8977-05	Drywall Joint Compound		Not Detected
2-01F - Loc.2-06	14-8977-06	Drywall Joint Compound		Not Detected
2-01G - Loc.2-10	14-8977-07	Drywall Joint Compound		Not Detected

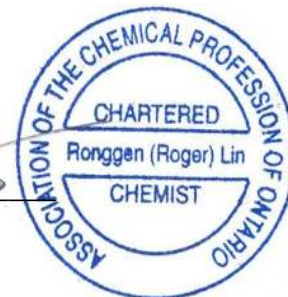
Fisher Environmental Laboratories (Lab ID #: 2745) is accredited by CALA (Canadian Association for Laboratory Accreditation Inc.) for asbestos analysis by PLM.

ANALYTICAL METHOD:

Asbestos has been done in accordance with normal professional standard using the following Fisher Environmental Lab Method: Asbestos by PLM (Polarized Light Microscope) F-26, Rev.2.2.

Authorized by:

Roger Lin, Ph. D., C. Chem.
Laboratory Manager

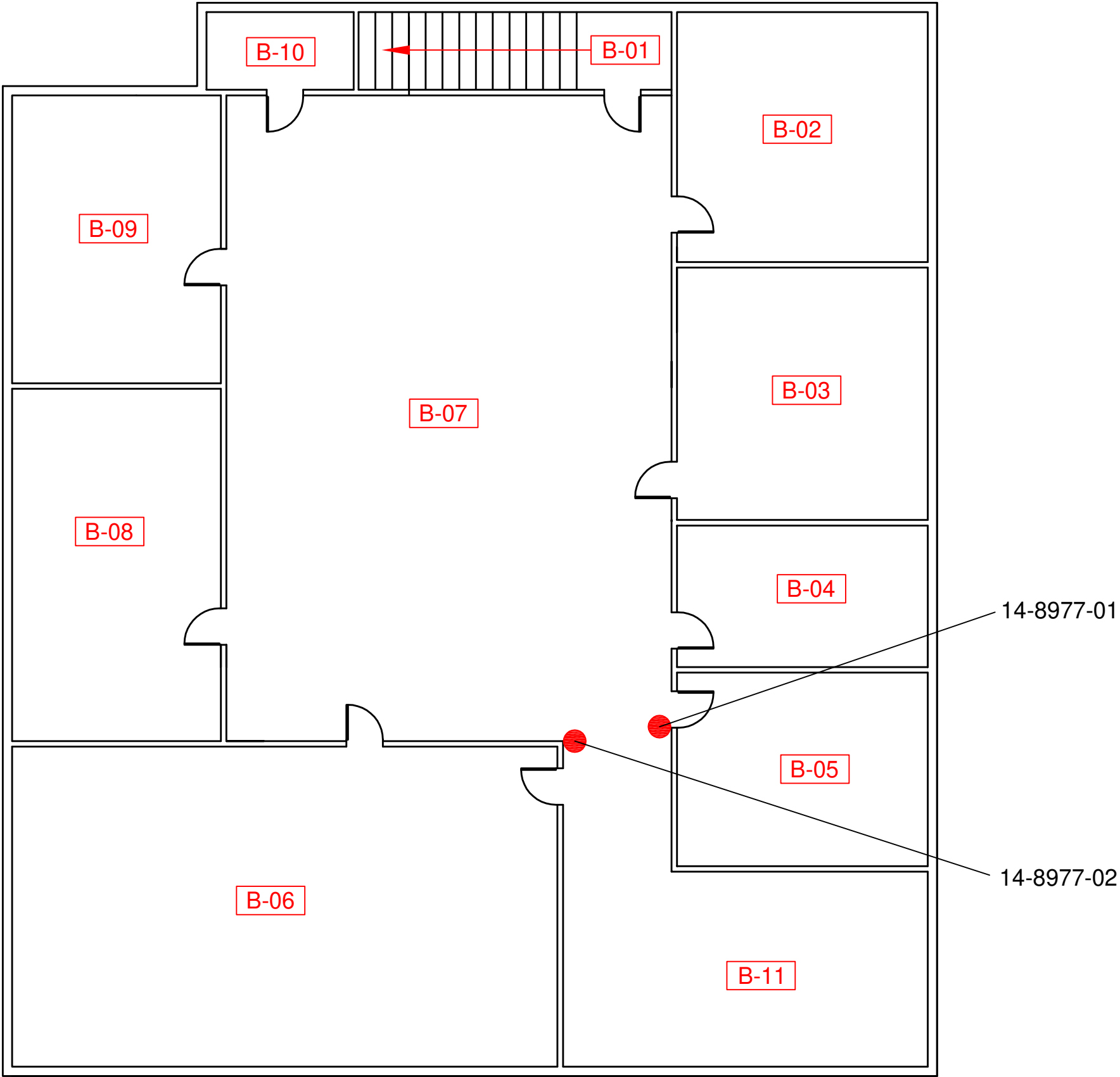


APPENDIX III

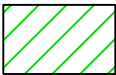




CORRECTIVE ACTIONS INSPECTION REPORT

(NO INFORMATION TO REPORT)

APPENDIX IV
SURVEY DRAWINGS



Legend

-  Asbestos-Containing Material
-  Location Number
-  No Access to Room
-  Asbestos Sample Location
-  Lead Sample Location

The drawing does not illustrate locations of drywall joint compound, plaster, window caulking or roofing materials, for reasons discussed in Section 6 of the Standard Operating Procedure for Designated Substance Surveys. Please refer to the Designated Substance Survey Form in Appendix I for information regarding the locations and asbestos or lead-content of these materials.

Figure 1

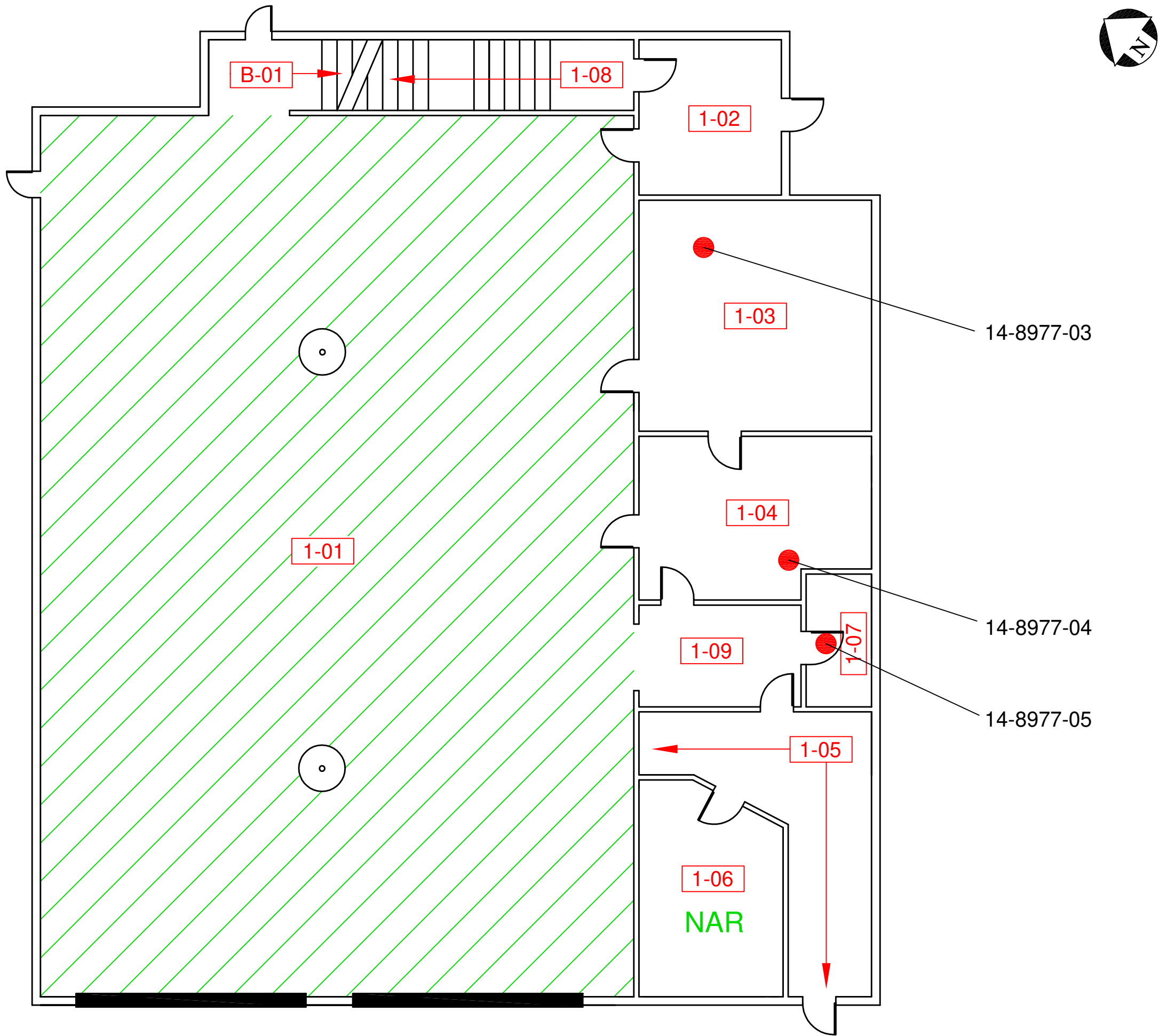
LOCATION:
1313 Woodbine Avenue
Toronto, Ontario

BUILDING NAME:
Toronto Fire Station 224

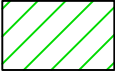
Basement Floor Plan
Asbestos-Containing Material Locations

CLIENT: City of Toronto		
PROJECT NUMBER: FE-P 14-6915	DATE: JULY 2014	DRW BY: AH
CAD FILE: FIG1	SCALE: Not to Scale	CHK BY: PM







Legend




Asbestos-Containing Material




Location Number



No Access to Room



Asbestos Sample Location



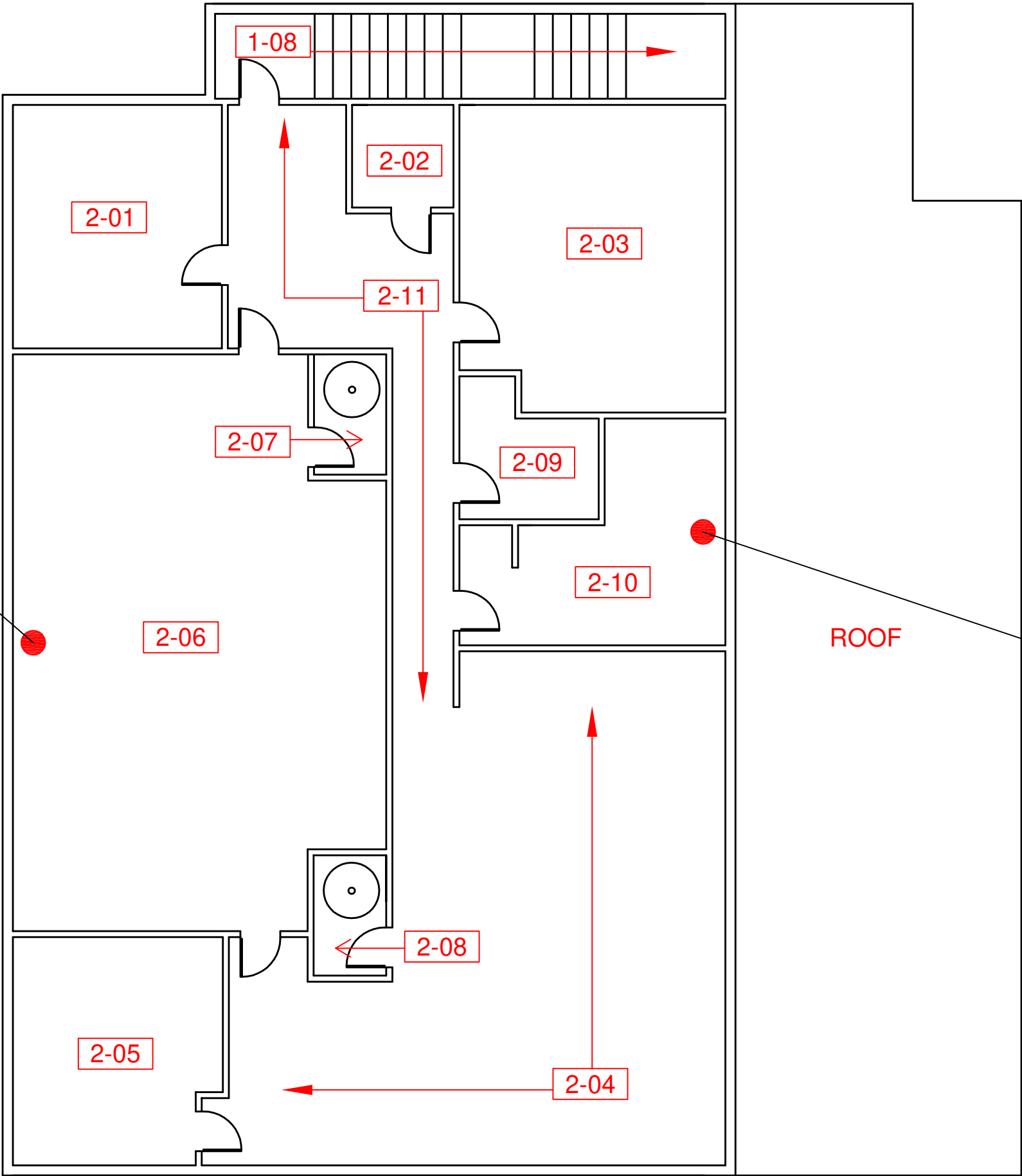
Lead Sample Location

The drawing does not illustrate locations of drywall joint compound, plaster, window caulking or roofing materials, for reasons discussed in Section 6 of the Standard Operating Procedure for Designated Substance Surveys. Please refer to the Designated Substance Survey Form in Appendix I for information regarding the locations and asbestos or lead-content of these materials.

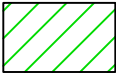
Figure 2		
LOCATION: 1313 Woodbine Avenue Toronto, Ontario		
BUILDING NAME: Toronto Fire Station 224		
Main Floor Plan Asbestos-Containing Material Locations		
CLIENT: City of Toronto		
PROJECT NUMBER: FE-P 14-6915	DATE: JULY 2014	DRW BY: AH
CAD FILE: FIG2	SCALE: Not to Scale	CHK BY: PM



14-8977-07



Legend



Asbestos-Containing Material

1-01

Location Number

NAR

No Access to Room



Asbestos Sample Location



Lead Sample Location

The drawing does not illustrate locations of drywall joint compound, plaster, window caulking or roofing materials, for reasons discussed in Section 6 of the Standard Operating Procedure for Designated Substance Surveys. Please refer to the Designated Substance Survey Form in Appendix I for information regarding the locations and asbestos or lead-content of these materials.

Figure 3

LOCATION:
1313 Woodbine Avenue
Toronto, Ontario

BUILDING NAME:
Toronto Fire Station 224

Second Floor Plan
Asbestos-Containing Material Locations

CLIENT: City of Toronto

PROJECT NUMBER: FE-P 14-6915 DATE: JULY 2014 DRW BY: AH

CAD FILE: FIG3 SCALE: Not to Scale CHK BY: PM



APPENDIX V

SITE PHOTOGRAPHS

(NO INFORMATION TO REPORT)

APPENDIX B5

Designated Substances Survey

1859 Kingston Road, Scarborough Arts Council
Issued December 2021, by Fisher Environmental Ltd.



ENGINEERING



LABORATORY



DESIGNATED SUBSTANCES SURVEY FOR ACCESSIBILITY UPGRADES (IBI GROUP)

**SCARBOROUGH ARTS COUNCIL
1859 KINGSTON ROAD
TORONTO, ONTARIO**

400 Esna Park Drive, Unit 15
Markham, ON
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Fax: (905) 475-7718
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Project No. FE-P 21-11706
December 15, 2021

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1.0. EXECUTIVE SUMMARY

Fisher Environmental Ltd. ('Fisher') was retained by IBI Group to carry out a survey for the Designated Substances and other potential hazardous materials within specified work area(s) for the Scarborough Arts Council building, located at 1859 Kingston Road, Toronto, Ontario, herein after referred to as the "Site". The site inspection and sampling works were conducted on November 8, 2021.

IBI Group has been commissioned by the City of Toronto to design and implement accessibility upgrades. The scope of the Designated Substances Survey (DSS) was to identify locations and types of designated substances within the building that may be impacted by the planned renovation work, and to provide recommendations for the safe handling or abatement of these materials, if any, prior to demolition.

The purpose of the project is to do the necessary construction and renovation at the locations are outlined on drawings provided by the IBI Group on October 27, 2021.

The survey was conducted in compliance with the Ontario Ministry of Labour (MOL) regulations for designated substances; O. Reg. 490/09 - *Designated Substances* and O. Reg. 278/05 - *Asbestos on Construction Projects and in Buildings and Repair Operations* made under the Occupational Health and Safety Act (OHSA), R.S.O. 1990.

Asbestos

Fisher was provided with the report of a previous DSS, which was conducted by ECOH Management Inc., on August 13, 2018. This report has indicated the following previously identified assumed and/or confirmed ACM within the specified work area(s):

- Caulking (windows/doors),
- Mastic under Vinyl Floor Tile 2 (12"×12" Grey, Dark Grey Beige Flecks and Mastic)
- Vinyl Sheet Flooring 2 (Red with square pattern and paper backing).

During the current survey, eighteen (18) bulk samples of building materials found within the specified work areas and that could potentially contain asbestos, were collected and submitted to Fisher Environmental Laboratories for Polarised Light Microscopy (PLM) analysis, as outlined in NIOSH Method 9002.

Based on the current results of laboratory analysis and information provided in the previous report, the mastic under Vinyl Floor Tile 2 was found to contain asbestos. However, this material is not expected to be disturbed by the planned project activities. The following materials are found to contain asbestos and will be impacted by the planned project activities;

- Vinyl Sheet Flooring 2 (Red with square pattern and paper backing) located in the main entrance vestibule;



- Brown caulking along the joint of the door frame and the brick wall on the exterior of the main entrance door on the ground floor;
- Tan caulking along the joint of the concrete pad and the foundation wall on the exterior of the main entrance door on the ground floor; and
- Dark brown caulking along the joint of the door frame and the brick wall on the exterior of the rear exit door in the basement.

Based on the findings of the survey, Fisher recommendations are as follows:

- Provide a copy of this report to contractors bidding on or performing work within the subject work areas;
- If required, remove the asbestos-containing mastic under VFT-2 in the basement washroom, using Type 1 abatement procedures, as outlined in O. Reg. 278/05.
- Remove asbestos-containing VSF-2 and paper backing in the main entrance vestibule, following Type 2 abatement procedures as outlined in O. Reg. 278/05.
- Remove asbestos-containing brown caulking along the joint of the door frame and the brick wall on the exterior of the main entrance door on the ground floor, following Type 1 abatement procedures as outline in O. Reg. 278/05.
- Remove asbestos-containing tan caulking along the joint of the concrete pad and the foundation wall on the exterior of the main entrance door on the ground floor, following Type 1 abatement procedures as outline in O. Reg. 278/05.
- Remove asbestos-containing dark brown caulking along the joint of the door frame and the brick wall on the exterior of the rear exit door in the basement, following Type 1 abatement procedures as outline in O. Reg. 278/05.

Note: Fire doors, present within the specific work areas, may contain asbestos-containing thermal insulation inside the door panel. Removal of any asbestos containing fire doors, in intake condition, will require Type 1 to abatement procedures, as outlined in O. Reg. 278/05 and dispose of as asbestos waste.

Lead

Based on the age of the building, it is possible that lead-based paint and lead plumbing are present within the building. Lead can also be present in various ceramic tiles. During the current survey, three (3) bulk samples of paint were collected and submitted to Fisher Environmental Laboratories for lead analysis.

The results of analysis revealed elevated concentration of lead in the red and black paint on the main entrance door and door frame.



Measurable quantities of lead concentrations in the brown/blue paint on the concrete slab at the exterior of main entrance door and in the blue paint on the concrete slab at the exterior of the rear exit door in the basement, however below the action limit.

The previous report also reported paint samples collected for lead analysis. The results of analysis revealed the following:

- Elevated concentration of lead in the white paint, green paint, and dark green paint on the walls in the basement; and in the purple paint on the wall of a 2nd floor office.
- Measurable concentration of lead was identified in the yellow and brown paint on the walls in the basement, within the specified work areas, however below the action limit.

Fisher recommends that, prior to the planned renovation work, the removal of lead containing materials found within the specified work area(s), must be conducted using the appropriate lead abatement procedures. Lead abatement procedures to be used are determined by the method(s) of disturbance employed. Refer to *MOL Guideline: Lead on Construction Projects*, for details

Mercury

Mercury is presumed to be present in fluorescent light tubes and thermostatic controls. With the exception of fluorescent light bulbs and building thermostats, no other evidence of mercury was noted during the current survey. Prior to the planned renovation work, Fisher recommends that any presumed mercury-containing fluorescent light tubes and thermostats that will be impacted are to be removed and disposed of in accordance with O. Reg. 558/00.

Silica

No sampling for silica was conducted. However, as the building is constructed of concrete, brick and/or block walls with concrete floors, silica is expected to be found within these components of the buildings. If these materials will be disturbed during the planned renovation work, appropriate precautions should be taken to protect workers from inhaling silica dusts and debris. Refer to *MOL Guideline: Silica on Construction Projects* for details.

Other Designated Substances

The other Designated Substances would not be expected to be present at the Site. No immediate actions were recommended with regard to acrylonitrile, arsenic, benzene, coke oven emissions, ethylene oxide, isocyanates, and vinyl chloride.

Mould

During the current survey, no visible mould or favourable conditions for mould growth were observed in the specified work areas. No action is recommended with regard to mould.



2.0. INTRODUCTION

Fisher Environmental Ltd. ('Fisher') was retained by IBI Group to carry out a survey for the Designated Substances and other potential hazardous materials within specified work area(s) for the Scarborough Arts Council building, located at 1859 Kingston Road, Toronto, Ontario, herein after referred to as the "Site". The site inspection and sampling works were conducted on November 8, 2021.

IBI Group has been commissioned by the City of Toronto to design and implement accessibility upgrades. The scope of the Designated Substances Survey (DSS) was to identify locations and types of designated substances within the building that may be impacted by the planned renovation work, and to provide recommendations for the safe handling or abatement of these materials, if any, prior to demolition.

The purpose of the project is to do the necessary construction and renovation at the locations are outlined on drawings provided by the IBI Group on October 27, 2021.

3.0. REGULATIONS

The survey was conducted in compliance with the Ontario Ministry of Labour (MOL) regulations for designated substances; O. Reg. 490/09 - *Designated Substances* and O. Reg. 278/05 - *Asbestos on Construction Projects and in Buildings and Repair Operations* made under the Occupational Health and Safety Act (OHSA), R.S.O. 1990.

The OHSA, R.S.O. 1990, under the Ontario MOL, defines a toxic substance as a biological, chemical or physical agent (or a combination of such agents) whose presence in the workplace may endanger the health and safety of a worker. Sections of the Act that deals with toxic substances are intended to:

1. ensure that worker exposure to toxic substances is controlled;
2. ensure that toxic substances in the workplace are clearly identified and that workers are provided with enough information to be capable of handling them safely; and,
3. provide the general public with access to information about toxic substances used by industry in their communities.

The Act makes provision for a toxic substance to be "designated", where its use in the workplace is prohibited, regulated, restricted, limited or controlled. Designation is reserved for eleven substances that are particularly hazardous, covered under O. Reg 490/09 – *Designated Substances* that was implemented on July 1, 2010, and include Acrylonitrile, Arsenic, Asbestos, Benzene, Coke Oven Emissions, Ethylene Oxides, Isocyanates, Lead, Mercury, Silica, and Vinyl Chloride. Formerly, regulations for these substances were passed separately and each outlined exposure limits where workers were likely to inhale, ingest and / or absorb the substance.



O. Reg. 490/09 provides a consistent approach to dealing with existing requirements and provisions, and outlines steps required to control worker exposure to these substances, including by inhalation, ingestion, skin absorption or skin contact. Each designated substance has an allowable level of exposure based on a time-weighted average (TWA) limit, and may also have a short-term exposure limit (STEL) and / or ceiling limit (C) assigned to it. TWA refers to the time-weighted average airborne concentration of a biological or chemical agent to which a worker may be exposed in a work day or work week, STEL refers to the maximum airborne concentration of a biological or chemical agent to which a worker may be exposed in any 15 minute period, and C refers to the maximum airborne concentration of a biological or chemical agent to which a worker may be exposed at any time. Refer to O. Reg. 490/09 – *Designated Substances*.

A supplementary regulation regarding control of asbestos exposures in the construction industry has evolved into O. Reg. 278/05 – *Asbestos on Construction Projects and in Buildings and Repair Operations*. The regulation includes a definition of asbestos-containing materials (ACM), requirements for additional training and clearance air testing, procedures for determining materials that meet the definition of ACM and for the use of glove bags, and provisions for varying from measure and procedures set out in the regulation.

In addition to the OHSA and regulations regarding designated substances, the following regulations, guidelines and standards were also taken into account or referenced:

- O. Reg. 213/91 - *Construction Projects* regulated under the OHSA and last amended by O. Reg. 443/09;
- O. Reg. 558/00 made under the Ministry of Environment (MOE) Environmental Protection Act, amending O. Reg. 347 - *General Waste Management*;
- The Transport of Dangerous Goods Act (TDGA) provides regulations for the transport of asbestos-containing materials and wastes;
- MOL *Guideline: Lead on Construction Projects*, 2011; and,
- MOL *Guideline: Silica on Construction Projects*, 2011.

4.0. METHODOLOGY

Fisher followed the protocols outlined in O. Reg. 278/05 for collecting and analyzing bulk samples of materials suspected to contain asbestos. Visual assessment of the material was the primary method of identification with occasional physical contact for the purpose of collecting bulk samples or examining for underlying layers.

Where applicable, samples of suspect materials were collected in order to establish asbestos or lead content. Samples were grouped according to similarity of appearance (“homogeneous” materials). The frequency at which the samples were collected was sufficient to obtain a general representation of the presence of these materials at the Site. Samples collected are presumed to



be representative of respective building materials in-place at the Site. However, due to potential past renovations, alterations, repairs, or phases of construction, it is possible that individual materials may not be representative of samples collected.

Sampling of roofing materials was not part of the current scope of work. Further, sampling of materials found within operating equipment, portable building articles, or generally non-accessible components such as insulation within electrical switch gears, wiring, motors, light fixtures, elevator brakes, fire door cores, etc. was not performed as part of the current survey.

Samples collected during the survey were placed in plastic zip-lock bags which were labeled and submitted for laboratory analysis. Fisher Environmental Laboratories analyzed bulk samples for asbestos type and approximate percent content by performing polarized light microscopy (PLM), as outlined in NIOSH Method 9002. Fisher Environmental Laboratories analyzed samples for lead content in paint by performing acid digestion followed by Inductively Coupled Plasma (ICP) analysis.

Site Plan(s), indicating specific work area(s), bulk sample locations and any area(s) of asbestos, are included in Appendix A. The laboratory certificate(s) of analysis are included in Appendix B. Representative photos of Site conditions encountered at the time of the current survey are included in Appendix C.

5.0. REVIEW OF PREVIOUS REPORTS

Fisher was provided with the report of a previous DSS, which was conducted by ECOH Management Inc., on August 13, 2018, attached in Appendix D. This report has indicated the following previously identified assumed and/or confirmed ACM within the specified work area(s):

- Caulking (windows/doors),
- Mastic under Vinyl Floor Tile 2 (12"×12" Grey, Dark Grey Beige Flecks and Mastic)
- Vinyl Sheet Flooring 2 (Red with square pattern and paper backing).

Details are provided in the summaries found in the asbestos sections of this report.

6.0. FINDINGS AND RECOMMENDATIONS

6.1. Acrylonitrile

Acrylonitrile would not be expected to be present at the Site and was not observed during the current survey. No recommendations for Acrylonitrile are warranted at this time.

6.2. Arsenic

Arsenic would not be expected to be present at the Site and was not observed during the current survey. No recommendations for Arsenic are warranted at this time.



6.3. Asbestos

6.3.1. General Information

Asbestos is the name given to a group of six different fibrous minerals (amosite, chrysotile, crocidolite, and the fibrous varieties of tremolite, actinolite and anthophyllite) that occur naturally in the environment. Asbestos minerals have separable long fibres that are strong and flexible enough to be spun and woven and are heat resistant.

Because of these characteristics, asbestos has been used for a wide range of manufactured goods, mostly in building materials (roofing shingles, ceiling and floor tiles, paper products, and asbestos cement products), friction products (automobile clutch, brake, and transmission parts), heat-resistant fabrics, packaging, gaskets, and coatings. Some vermiculite or talc products may also contain asbestos.

Asbestos fibres may be released into the air by the disturbance of ACM during product use, renovation or demolition work, building or home maintenance, repair and remodeling. In general, exposure may occur only when the ACM is disturbed in some way to release particles and fibres into the air.

6.3.2. Friable vs. Non-Friable ACM

Based on the requirements of O. Reg. 278/05 and due diligence, an asbestos survey and report must be available at any workplace where asbestos exists identifying locations and types of ACM in the building. The survey must include both friable and non-friable materials confirmed to contain asbestos, as well as any other materials which were not sampled but are suspected (presumed) ACM. The term friable refers to material(s) that could be readily reduced to dust or powder when crushed by hand or moderate pressure. Friable materials have a much greater chance of releasing airborne asbestos fibres when disturbed.

In the past, the most commonly used friable asbestos-containing building materials were surfacing materials (e.g. sprayed on fireproofing, texture, decorative or acoustic plaster) as well as thermal insulation. Examples of manufactured asbestos-containing materials include vinyl floor tiles, ceiling tiles, gasket materials, asbestos cement (Transite) pipes or boards, and asbestos textiles. Depending on the above noted formulation, these materials range from non-friable to friable. Although some products are considered non-friable when in Good condition, severe damage or deterioration may cause non-friable materials to generate airborne dust more readily. Severely damaged non-friable materials, or those to be worked on with powered tools, may be considered as friable ACM for abatement purposes.

Examples of common types of ACM by friability include:

- Friable ACM



- Sprayed Materials (or materials installed by roller or trowel), such as fireproofing, thermal insulation, texture finishes, etc.
 - Mechanical Insulation such as boiler and breeching, ductwork, piping, tanks and associated equipment.
 - Plaster
- Potentially Friable ACM
 - Acoustic Ceiling Tiles
 - Vinyl Sheet Flooring
- Non-Friable ACM
 - Vinyl Floor Tiles
 - Asbestos cement (“Transite”) piping or paneling
 - Window Caulking

6.3.3. Regulations

Exposure to asbestos is controlled by two Regulations passed under Ontario’s Occupational Health and Safety Act (OHSA), R.R.O. 1990.

- O. Reg. 490/09 – *Designated Substances* regarding asbestos applies to:
 - every employer operating a mine for the purpose of mining, crushing, grinding or sifting asbestos;
 - every employer processing, adapting or using asbestos in connection with manufacturing or assembling of goods or products;
 - every employer engaged in the repair, alteration or maintenance of machinery, equipment, aircraft, ships, locomotives, railway cars and vehicles;
 - every employer engaged in work on a building that is necessarily incidental to the repair, alteration or maintenance of machinery or equipment; and,
 - to those workers of such employers who are likely to be exposed to asbestos.

Exposure limits for this substance are set at 0.1 f/cc (TWA) for all types of asbestos.

- O. Reg. 278/05 - *Asbestos on Construction Projects and in Buildings and Repair Operations* applies to buildings that contain friable and non-friable ACM and to the repair, alteration and/or maintenance of these buildings.

In addition to regulations for controlling work around asbestos-containing building materials there are regulations for packaging, transportation and disposal of asbestos-containing waste:

- O. Reg. 558/00 made under the Ministry of Environment (MOE) Environmental Protection Act, amending O. Reg. 347 - *General Waste Management*; and,
- The Transport of Dangerous Goods Act (TDGA) provides regulations for the transport of asbestos-containing materials and wastes.



6.3.4. Findings

Samples of homogenous materials suspected to contain asbestos were collected and submitted for analysis. Fisher collected eighteen (18) bulk samples of building materials found within the specified work areas and that could potentially contain asbestos. Findings of all building materials identified within the specified work area(s) are outlined in further detail below.

6.3.4.1. Sprayed or Troweled Fireproofing and Thermal Insulation

No indication of sprayed or troweled fireproofing and / or thermal insulation was noted in any of the specified work areas during the current survey.

6.3.4.2. Texture Finish

Texture finish was observed on the walls and ceiling of the entrance vestibule during the current survey. The previous report confirmed that three (3) samples of the texture finish were collected for analysis. The result of analysis revealed that the texture finish does not contain asbestos.

6.3.4.3. Mechanical Insulation

The mechanical insulation on the pipes was observed in the form of horse hair in the basement. During the current survey, three (3) samples of the insulation were collected and submitted for analysis. The results of analysis revealed that the insulation does not contain asbestos.

6.3.4.4. Acoustic Ceiling Tile

No acoustic ceiling tile was noted in any of the specified work areas during the current survey.

6.3.4.5. Plaster / Drywall Joint Compound

Plaster was observed on the walls and ceilings throughout the building. The previous report indicated that seven (7) samples of the plaster was collected for analysis. The results of analysis revealed that the plaster does not contain asbestos.

Drywall Joint Compound (DJC) was observed in the basement and on the 2nd floor of the building. The previous report indicated that three (3) samples of the DJC was collected for analysis. The results of analysis revealed that the DJC does not contain asbestos.

6.3.4.6. Asbestos Cement Products

No asbestos cement products, such as Transite pipe or board, were noted in any of the specified work areas during the current survey.

6.3.4.7. Vinyl Sheet Flooring

During the current survey, three (3) distinct styles of vinyl sheet flooring were observed within the specified work areas.

- Vinyl Sheet Flooring 1 (Grey with Square Pattern)
- Vinyl Sheet Flooring 2 (Red with Square Pattern and Paper Backing)



The previous report confirmed that Vinyl Sheet Flooring 1 and 2 were sampled for analysis. The results of analysis revealed Vinyl Sheet Flooring 1 does not contain asbestos. **However, Vinyl Sheet Flooring 2, which was observed in the main entrance vestibule, contain 20% Chrysotile asbestos.**

6.3.4.8. Vinyl Floor Tile

During the current survey, three (3) distinct varieties of vinyl floor tile were observed within the specified work areas.

- Vinyl Floor Tile 1 – 12"×12", Blue, Green and Grey Flecks and mastic
- Vinyl Floor Tile 2 – 12"×12", Grey, Dark Grey and Beige Flecks and Mastic
- Vinyl Floor Tile 3 – 12"×12", Black with White Streaks and Mastic

The previous report confirmed that these varieties of Vinyl Floor Tile were sampled for analysis. The results of analysis revealed Vinyl Floor Tiles 1, 2 and 3 do not contain asbestos. The mastic under Vinyl Floor Tile 2, which was observed in the basement washroom, contains 3% Chrysotile asbestos. However, VFT2 is not expected to be disturbed by the planned project activities.

6.3.4.9. Other ACM

Mortar

Mortar was observed along the joints of the brick walls throughout the Site. Three (3) samples of the mortar were collected from the walls in the basement for analysis. The results of analysis revealed that the mortar does not contain asbestos.

Brown Caulking

Brown caulking was observed along the joints of the brick walls and the door frames on the exterior of the main entrance door. Three (3) samples of the brown caulking were collected for analysis. **The results of analysis revealed that the brown caulking contains 5-25% Chrysotile asbestos.**

Tan Caulking

Tan caulking was observed along the joint of the concrete pad and the foundation wall on the exterior of the main entrance door. Three (3) samples of the tan caulking were collected for analysis. **The results of analysis revealed that the tan caulking contains 5-25% Chrysotile asbestos.**

Dark Brown Caulking

Dark brown caulking was observed along the joints of the brick wall and the door frames on the exterior of the rear exit door in the basement. Three (3) samples of the dark brown caulking were collected for analysis. **The results of analysis revealed that the dark brown caulking contains 5-25% Chrysotile asbestos.**



White Caulking

White caulking was observed around the door frames in the basement. Three (3) samples of the white caulking were collected for analysis. The results of analysis revealed that the white caulking does not contain asbestos.

6.3.5. Recommendations

Prior to demolition or any renovation activities, all asbestos-containing materials must be removed from the specified work area(s) in accordance with O. Reg. 278/05 - *Asbestos on Construction Projects and in Buildings and Repair Operations*, and be disposed of at a MOE licensed landfill in accordance with O. Reg. 558/00 (amending O. Reg. 347, *General – Waste Management*).

Refer to attached Site Plans in Appendix A, which illustrate where the ACM is located within the specified work areas.

Specifically, Fisher recommends the following:

- Provide a copy of this report to contractors bidding on or performing work within the subject work areas;
- if required, remove the asbestos-containing mastic under VFT-2 in the basement washroom using Type 1 abatement procedures, as outlined in O. Reg. 278/05.
- Remove asbestos-containing VSF-2 in the main entrance vestibule following Type 2 abatement procedures as outlined in O. Reg. 278/05.
- Remove asbestos-containing brown caulking along the joint of the door frame and the brick wall on the exterior of the main entrance door on the ground floor, following Type 1 abatement procedures as outline in O. Reg. 278/05.
- Remove asbestos-containing tan caulking along the joint of the concrete pad and the foundation wall on the exterior of the main entrance door on the ground floor, following Type 1 abatement procedures as outline in O. Reg. 278/05.
- Remove asbestos-containing dark brown caulking along the joint of the door frame and the brick wall on the exterior of the rare exit door in the basement, following Type 1 abatement procedures as outline in O. Reg. 278/05.

Note: Fire doors, present within the specific work areas, may contain asbestos-containing thermal insulation inside the door panel. Removal of any asbestos containing fire doors, in intake condition, will require Type 1 to abatement procedures, as outlined in O. Reg. 278/05 and dispose of as asbestos waste.

The presence of ACM should be presumed in locations not accessed during this survey. It is possible that ACM is present at the Site that is not identified in this report. Should additional suspected ACM be discovered, it should be presumed as ACM until sample analysis determines asbestos content.



Due to the limited nature of the current scope of work and the presence of solid building finishes (i.e. plaster or drywall walls and ceilings etc.) in many locations, the full extent of ACM may not be confirmed. Precautions should be taken when dismantling solid wall or ceiling finishes, or any other building surfaces which may conceal potential ACM. Such precautions include, but are not limited to, isolation measures and appropriate personal protective equipment.

6.4. Benzene

Benzene would not be expected to be present at the Site and was not observed during the current survey. No recommendations for Benzene are warranted at this time.

6.5. Coke Oven Emissions

Coke oven emissions would not be expected to be present at the Site and were not observed during the current survey. No recommendations for coke oven emissions are warranted at this time.

6.6. Ethylene Oxides

Ethylene oxides would not be expected to be present at the Site and were not observed during the current survey. No recommendations for ethylene oxides are warranted at this time.

6.7. Isocyanates

Isocyanates would not be expected to be present at the Site and were not observed during the current survey. No recommendations for isocyanates are warranted at this time.

6.8. Lead

6.8.1. General Information

Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. Most lead in the environment comes from human activities such as burning fossil fuels, mining and manufacturing. Lead is used in the production of batteries, ammunition, metal products (solder and pipes) and X-ray devices.

Lead does not break down but lead compounds are changed by sunlight, air and water. Exposure occurs when eating food or drinking water that contains lead. Deteriorated lead paint can contribute to lead dust. The main target for lead toxicity is the nervous system.

6.8.2. Regulations and Guidelines

The Ontario MOL has not prescribed criteria defining an analyzed sample of bulk material as "lead-containing". Further, the MOL has not established a lower limit for concentrations of lead in paint, below which precautions do not need to be considered during construction projects. However, except for very aggressive disturbance of painted finishes, (e.g., abrasive blasting, torch cutting, or grinding), Fisher believes that a lead content below 0.1% by weight (1,000 ug/g or 1000



ppm) represents a concentration in which the lead content is not the limiting hazard for construction hygiene purposes. Regular construction dust suppression techniques and worker hygiene practices are sufficient for disturbance of paint finishes determined to contain less than 0.1% lead by weight, provided that work is limited to non-aggressive operations.

The regulation for the designated substance lead applies to every employer and worker at a workplace where lead is present, produced, processed, used, handled or stored and at which a worker is likely to be exposed to lead. Exposure limits for this substance are set at 0.05 – 0.10 mg/m³ (TWA) depending on the type of lead, and for tetraethyl lead 0.30 mg/m³ (STEL).

Additionally, in 2011 the MOL revised *Guideline: Lead on Construction Projects* outlining practices that should be followed during construction projects to protect workers' from exposure to lead. This includes the methods and equipment employed in the removal of lead-containing coatings that reduce the creation of dust, providing appropriate facilities for workers to wash after each shift, and providing protective clothing and respirators where necessary.

6.8.3. Findings

Based on the age of the building, it is possible that lead-based paint and lead plumbing are present within the building. Lead can also be present in various ceramic tiles. During the current survey, three (3) bulk samples of paint were collected and submitted to Fisher Environmental Laboratories for lead analysis.

The results of analysis revealed elevated concentration of lead in the red and black paint on the main entrance door and door frame.

Measurable quantities of lead concentrations in the brown/blue paint on the concrete slab at the exterior of main entrance door and in the blue paint on the concrete slab at the exterior of the rear exit door in the basement, however below the action limit.

The previous report also reported paint samples collected for lead analysis. The results of analysis revealed the following:

- Elevated concentration of lead in the white paint, green paint, and dark green paint on the walls in the basement; and in the purple paint on the wall of a 2nd floor office.
- Measurable concentration of lead was identified in the yellow and brown paint on the walls in the basement, within the specified work areas, however below the action limit.

6.8.4. Recommendations

Where any lead-containing materials may be disturbed or removed, Fisher recommends that appropriate lead abatement procedures be used. The lead abatement procedures to be used are determined by the method(s) of disturbance employed. Regular construction dust suppression techniques and worker hygiene practices are sufficient for disturbance of paint finishes determined to contain less than 0.1% lead by weight, provided that work is limited to non-



aggressive operations. The table below outlines lead abatement operations and associated respirator required, as outlined in Ontario MOL guidelines.

Classifications of Lead-Containing Operations and Required Respirator

Type 1 Operations (where concentrations of airborne lead would be expected to be < 0.05 mg/m ³)	
Activities that include; <ul style="list-style-type: none"> Removal of lead containing coatings with chemical gel or paste and fibrous laminated cloth wrap Removal of lead containing coatings / materials using power tool that has an effective dust collection system equipped with HEPA filter Removal of lead containing coatings / materials using non-powered hand tools other than manual scraping or sanding 	Respirators should not be necessary if general procedures are followed and level of air is less than 0.05 mg/m ³ . However, if worker wishes to use a respirator, a half-mask particulate respirator with N-, R- or P-series filter, and 95, 99 or 100% efficiency should be provided.
Type 2a Operations (where concentrations of airborne lead would be expected to be > 0.05 to 0.50 mg/m ³)	
Activities that include; <ul style="list-style-type: none"> Removal of lead containing coatings / materials by scraping or sanding using non-powered hand tools Manual demolition of lead painted plaster walls / building components by striking with a sledgehammer or similar tool 	NIOSH APF = 10 Half-mask particulate respirator with N-, R- or P- series filter, and 95, 99 or 100% efficiency.
Type 2b Operations (where concentrations of airborne lead would be expected to be > 0.50 to 1.25 mg/m ³)	
Not applicable to potential renovation activities.	
Type 3a Operations (where concentrations of airborne lead would be expected to be > 1.25 to 2.50 mg/m ³)	
Activities that include; <ul style="list-style-type: none"> Welding or high temperature cutting of lead-containing coatings or materials indoors or in a confined space. Dry removal of lead-containing mortar using an electronic or pneumatic cutting device. Burning of a surface containing lead Removal of lead containing coatings / materials using power tools without an effective dust collection system equipped with HEPA filter 	NIOSH APF = 50 Full-face piece air-purifying respirator with N-, R- or P- series filter and 100% efficiency. Tight-fitting powered air-purifying respirator with high efficiency filter. Full-face piece supplied-air respirator operated in demand mode. Half-mask or full-face piece supplied air respirator operated in continuous-flow mode.
Type 3b Operations (where concentrations of airborne lead would be expected to be > 2.50 mg/m ³)	
Abrasive blasting of lead-containing coatings or materials.	NIOSH APF ≥ 1000 Type CE abrasive-blast supplied respirator operated in a positive pressure mode with a tight-fitting half-mask face piece.

Refer to MOL *Guideline: Lead on Construction Projects, 2011*, for details of the Ministry's health and safety guidelines regarding lead.

6.9. Mercury

6.9.1. General Information

Mercury is a naturally occurring metal. It is a shiny, silver-white and odourless liquid. It combines with other elements to form inorganic compounds or salts. Metallic mercury is used to produce chlorine gas and caustic soda, and is used in thermostats and thermometers, fluorescent light



bulbs, dental fillings and batteries. Exposure occurs when eating fish or shellfish contaminated with methyl mercury, breathing vapors from spills, incinerators, etc.

The nervous system is very sensitive to all forms of mercury. Exposure to high levels of metallic inorganic or organic mercury can permanently damage the brain, kidneys and developing fetus. Short-term exposure may cause lung damage, nausea, vomiting and diarrhea as well as skin and eye irritation.

6.9.2. Regulations

The regulation for mercury applies to every employer and worker at a workplace where mercury is present, produced, processed, used, handled or stored and at which a worker is likely to be exposed to mercury. Exposure limits for this substance are set at 0.025 – 0.01 mg/m³ (TWA) for all forms of mercury excluding alkyl, and for alkyl compounds of mercury 0.03 mg/m³ (STEL).

6.9.3. Findings

Mercury is presumed to be present in fluorescent light tubes and thermostatic controls. With the exception of fluorescent light bulbs and building thermostats, no other evidence of mercury was noted during the current survey.

6.9.4. Recommendations

Prior to the planned renovation work, Fisher recommends that any presumed mercury-containing fluorescent light tubes and thermostats that will be impacted are to be removed and disposed of in accordance with O. Reg. 558/00.

6.10. Silica

6.10.1. General Information

Silica is a crystalline compound occurring abundantly as quartz, sand, and many other minerals, and used to manufacture a variety of materials, especially glass and concrete. When mining this substance, silica can be deadly when it becomes airborne. If inhaled, silica dust can cause silicosis which can be fatal.

Some of the following industries have a high potential for risk to workers: construction (sandblasting, rock drilling, masonry work, jack hammering, tunneling), mining (cutting or drilling through sandstone or granite), foundry work (grinding, mouldings, shakeout, core room), stone cutting (sawing, abrasive blasting, chipping, grinding), manufacturing and use of abrasives, etc.

6.10.2. Regulations

The regulation for silica applies to every employer and worker at a workplace where silica is present, produced, processed, used, handled or stored and at which a worker is likely to be exposed to silica. Exposure limits for this substance are set at 0.05 - 0.10 mg/m³ (TWA), depending on the type of silica.



Additionally, in 2011 the MOL revised *Guideline: Silica on Construction Projects* outlining practices that should be followed during construction projects to protect workers' from exposure to silica. This includes the methods and equipment employed in the removal of silica-containing materials that reduce the creation of dust, providing appropriate facilities for workers to wash after each shift, and providing protective clothing and respirators where necessary.

6.10.3. Findings

No sampling for silica was conducted. However, as the building is constructed of concrete, brick and/or block walls with concrete floors, silica is expected to be found within these components of the buildings.

6.10.4. Recommendations

If these materials will be disturbed during the planned renovation work, appropriate precautions should be taken to protect workers from inhaling silica dusts and debris. Refer to MOL *Guideline: Silica on Construction Projects* for details.

6.11. Vinyl Chloride

Vinyl chloride would not be expected to be present at the Site and was not observed during the current survey. No recommendations for vinyl chloride are warranted at this time.

6.12. Mould

During the current survey, no visible mould or favourable conditions for mould growth were observed in the specified work areas. No action is recommended with regard to mould.



7.0. LIMITATIONS

Fisher Environmental Ltd. accepts responsibility for the competent performance of its duties in executing this assignment within the normal standards of the profession, but disclaims responsibility for consequential damages, if any.

The scope of the survey is based on prior agreement with the client, and the rationale given in this report. The survey findings rely on professional interpretation of selective sampling and analysis. Sample analysis results have been applied to homogenous materials in unsampled locations; it was not within the scope of work to carry out an exhaustive sampling and analysis program. For non-accessible building spaces, the likelihood of the presence or absence of asbestos and other designated substances has been described, but such assessment is not a definitive statement of presence or absence.

This report was prepared for the IBI Group. The scope of services performed may not be appropriate for the purposes of other users, and any use or reuse of this document or its findings or recommendations represented herein is at the sole risk of any other user.

We trust that the information provided in the report meets your current requirements. If you have any questions or concerns, please do not hesitate to contact the undersigned.

Respectfully submitted,



Iqbal Fattah, M.Sc.
Project Manager



David Fisher, P. Eng., C. Chem.
Principal



APPENDIX A – SITE PLANS





Legend



Area of Work

1-01

Location Number



Asbestos Sample Location



Lead Sample Location

Figure 1

LOCATION:
1859 Kingston Road
Toronto, Ontario

BUILDING NAME:
Scarborough Arts Council

Basement Floor Plan Asbestos and Lead Sample Locations

CLIENT: IBI Group

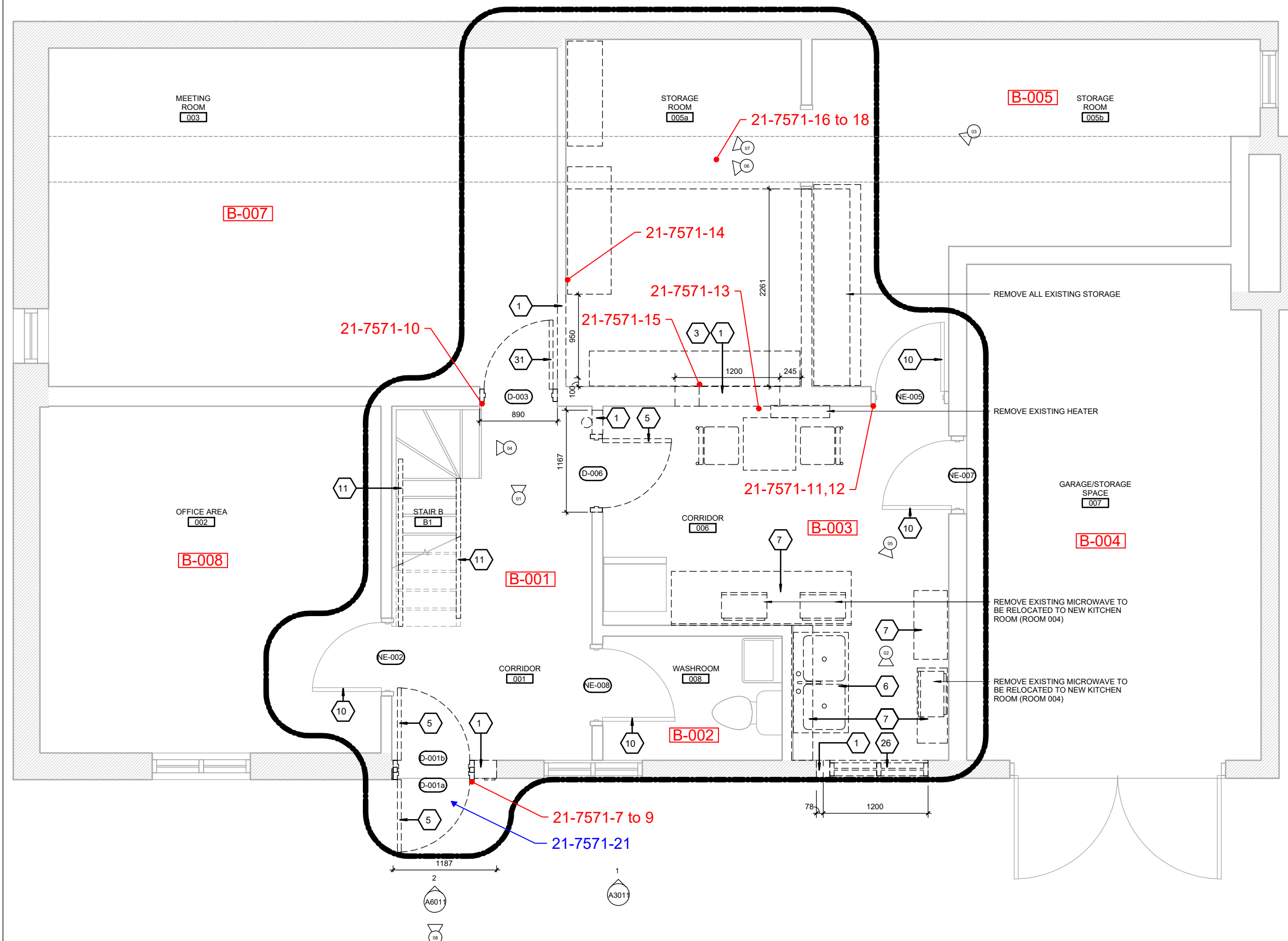
PROJECT NUMBER: FE-P 21-11706 DATE: November 2021 DRW BY: ZA

CAD FILE: FIG1 SCALE: Not to Scale CHK BY: IF



400 Esna Park Dr., #15
Markham, Ontario
L3R 3K2

Tel: 905 475-7755
Fax: 905 475-7718





Legend



Area of Work

1-01

Location Number



Asbestos Sample Location



Lead Sample Location

Figure 2

LOCATION:
1859 Kingston Road
Toronto, Ontario

BUILDING NAME:
Scarborough Arts Council

Basement Floor Plan Asbestos and Lead Sample Locations

CLIENT: IBI Group

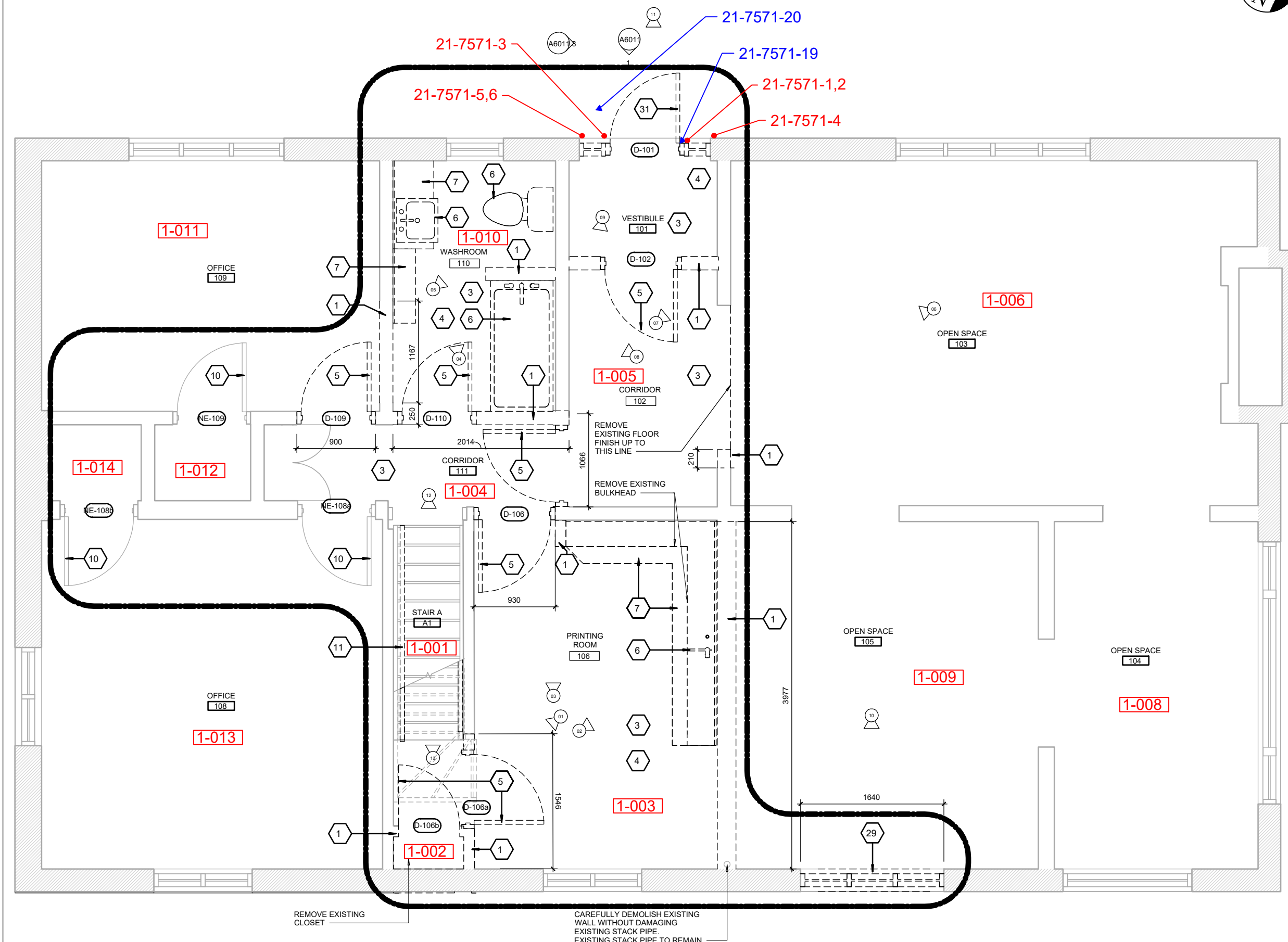
PROJECT NUMBER: FE-P 21-11706 **DATE:** November 2021 **DRW BY:** ZA

CAD FILE: FIG2 **SCALE:** Not to Scale **CHK BY:** IF



400 Esna Park Dr., #15
Markham, Ontario
L3R 3K2

Tel: 905 475-7755
Fax: 905 475-7718





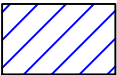
Legend



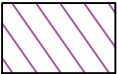
Area of Work

1-01

Location Number



Asbestos-Containing Mastic Under VFT-2



Asbestos-Containing Dark Brown Caulking

Figure 3

LOCATION: 1859 Kingston Road
Toronto, Ontario

BUILDING NAME:
Scarborough Arts Council

Basement Floor Plan
Asbestos- Containing Material Locations

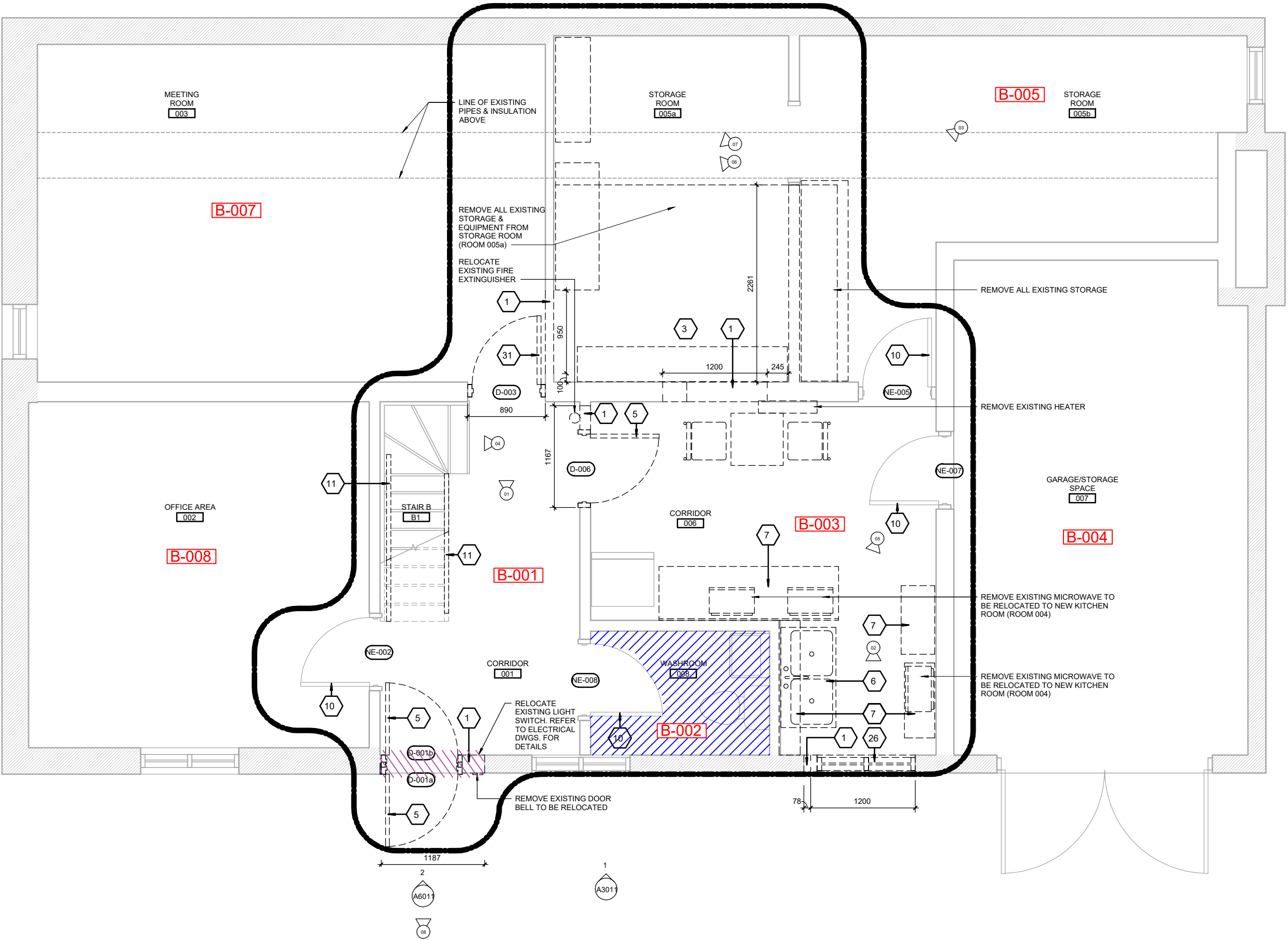
CLIENT: IBI Group

PROJECT NUMBER:	FE-P 21-11706	DATE:	November 2021	DRW BY:	ZA
CAD FILE:	FIG3	SCALE:	Not to Scale	CHK BY:	IF



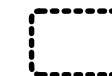
400 Esna Park Dr., #15
Markham, Ontario
L3R 3K2

Tel: 905 475-7755
Fax: 905 475-7718





Legend



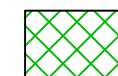
Area of Work

1-01

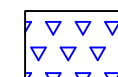
Location Number



Asbestos-Containing Mastic Under VFT-2



Asbestos-Containing Brown Caulking



Asbestos-Containing Tan Caulking

Figure 4

LOCATION:
1859 Kingston Road
Toronto, Ontario

BUILDING NAME:
Scarborough Arts Council

First Floor Plan
Asbestos- Containing Material Locations

CLIENT: IBI Group

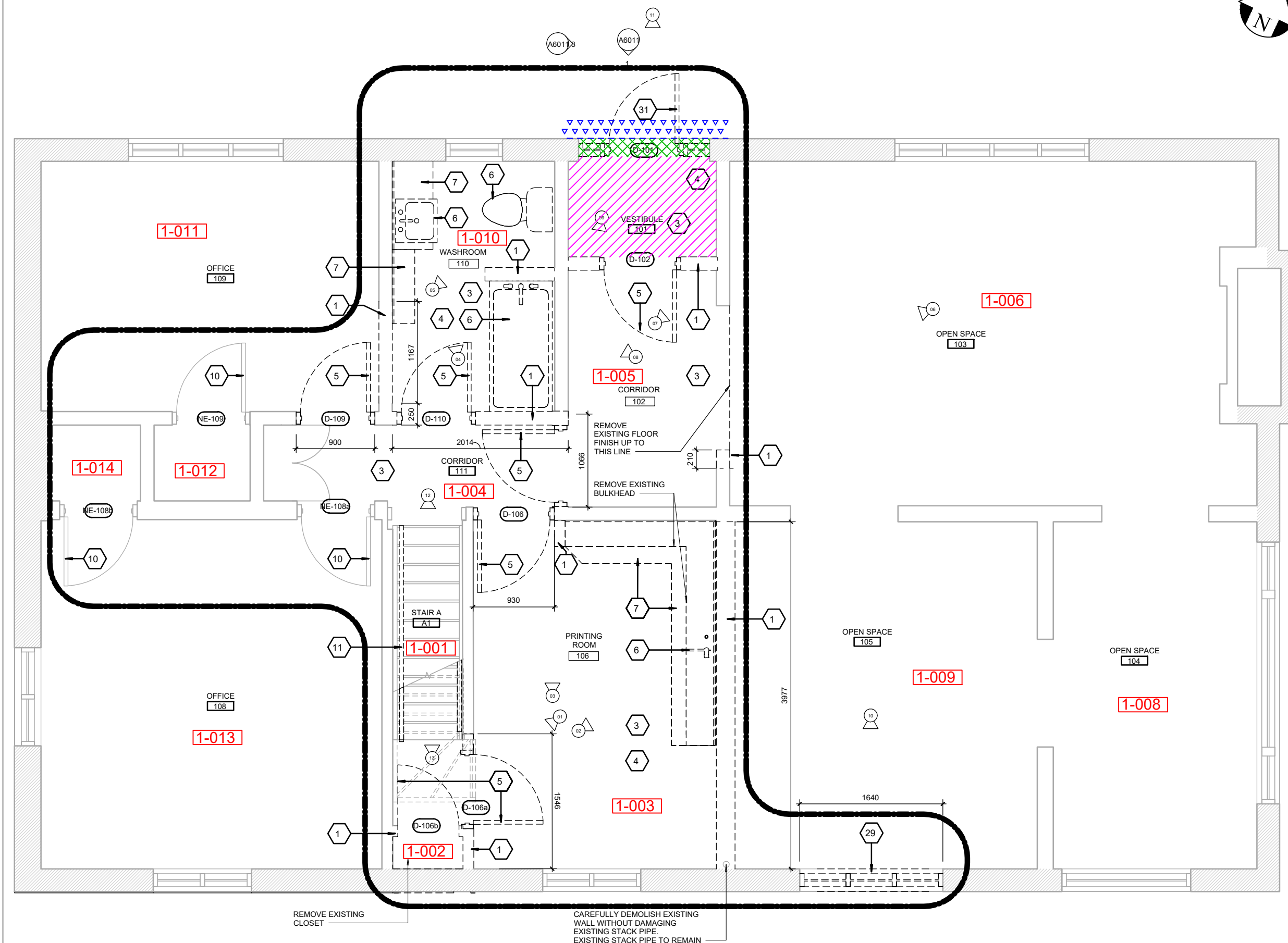
PROJECT NUMBER: FE-P 21-11706 **DATE:** November 2021 **DRW BY:** ZA

CAD FILE: FIG4 **SCALE:** Not to Scale **CHK BY:** IF



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APPENDIX B – CERTIFICATE OF ANALYSIS





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Address: 100-175 Galaxy Blvd.
Toronto, ON
M9W 0C9
Tel.:
E-mail:
Attn: Luisa Sosa

F.E. Job #: 21-7571
Project Name: DSS
Project ID: FE-P 21-11706
Date Sampled: 8-Nov-2021
Date Received: 19-Nov-2021
Date Reported: 29-Nov-2021
Location: 1859 Kingston Road

Certificate of Analysis

Analysis Requested:	Asbestos, Lead		
Sample Description:	21 Bulk Sample(s)		
Sample Matrix and Client Sample Description	Client Sample Location	Lab Sample ID	Asbestos Content and Fibre Type
1A - Brown Caulking	Main Entrance Door, Exterior, around the Door Frame	21-7571-1	0.5-5%, Chrysotile
1B - Brown Caulking	Main Entrance Door, Exterior, around the Door Frame	21-7571-2	0.5-5%, Chrysotile
1C - Brown Caulking	Main Entrance Door, Exterior, around the Door Frame	21-7571-3	0.5-5%, Chrysotile
2A - Tan Caulking	Main Entrance, Exterior, along the Joint of the Concrete Pad and the Wall	21-7571-4	5-25%, Chrysotile
2B - Tan Caulking	Main Entrance, Exterior, along the Joint of the Concrete Pad and the Wall	21-7571-5	5-25%, Chrysotile
2C - Tan Caulking	Main Entrance, Exterior, along the Joint of the Concrete Pad and the Wall	21-7571-6	5-25%, Chrysotile
3A- Dark Brown Caulking	Rare Exit Door, Exterior, around the Door Frame	21-7571-7	5-25%, Chrysotile
3B- Dark Brown Caulking	Rare Exit Door, Exterior, around the Door Frame	21-7571-8	5-25%, Chrysotile
3C- Dark Brown Caulking	Rare Exit Door, Exterior, around the Door Frame	21-7571-9	5-25%, Chrysotile

Certificate of Analysis

Analysis Requested:	Asbestos, Lead
Sample Description:	20 Bulk Sample(s)

Sample Matrix and Client Sample Description	Client Sample Location	Lab Sample ID	Asbestos Content and Fibre Type
4A - White Caulking	Loc. B-001, Entrance, around the Door Frame	21-7571-10	Not Detected
4B - White Caulking	Loc. B-003, Kitchen, around the Door Frame	21-7571-11	Not Detected
4C - White Caulking	Loc. B-003, Kitchen, around the Door Frame	21-7571-12	Not Detected
5A - Mortar	Loc. B-003, Kitchen, North Wall, along the Joint of the Brick Wall	21-7571-13	Not Detected
5B - Mortar	Loc. B-006, Storage Room, West Wall, along the Joint of the Brick Wall	21-7571-14	Not Detected
5C - Mortar	Loc. B-006, Storage Room, West Wall, along the Joint of the Brick Wall	21-7571-15	Not Detected
6A - Horse Hair	Loc. B-006, Storage Room, around the Pipes	21-7571-16	Not Detected
6B - Horse Hair	Loc. B-006, Storage Room, around the Pipes	21-7571-17	Not Detected
6C - Horse Hair	Loc. B-006, Storage Room, around the Pipes	21-7571-18	Not Detected

Fisher Environmental Laboratories (Lab ID #: 2745) is accredited by CALA (Canadian Association for Laboratory Accreditation Inc.) for asbestos analysis by PLM.

ANALYTICAL METHOD:

Asbestos has been done in accordance with normal professional standard using the following Fisher Environmental Lab Method: Asbestos by PLM (Polarized Light Microscope) F-26, Rev.2.2.

Certificate of Analysis

Analysis Requested:	Asbestos, Lead
Sample Description:	21 Bulk Sample(s)

Sample Matrix and Client Sample Description	Client Sample Location	Lab Sample ID	Lead (ppm)
L1 - Red/Black Paint	Main Entrance Door Frame	21-7571-19	1579
L2 - Brown/Blue Paint	Main Entrance, Concrete Slab	21-7571-20	162
L3 - Blue Paint	Rare Entrance, Concrete Slab	21-7571-21	46

< result obtained was below RL (Reporting Limit).

QA/QC Report

Parameter	Blank (ppm)		LCS (%)		CRM/MS (%)	
	Result	RL	Recovery	AR	Recovery	AR
Lead	<10	10	93	80-120	95	70-130

Parameter	Duplicate (%)					
	RPD	AR				
Lead	3.8	0-30				

LEGEND:

RL - Reporting Limit

LCS - Laboratory Control Sample

MS - Matrix Spike

AR - Acceptable Range

RPD - Relative Percent Difference

ANALYTICAL METHODS:

Metals (Lead) - Method # F-1, Rev. 4.5, Standard Operation Procedure for determination of Metals by the Inductively Coupled Plasma- Optical. Method used by Fisher Environmental Lab complies with the Standard Methods for the Examination of Water and Wastewater, 20th Ed 3120-B.

Authorized by:

Roger Lin
 Roger Lin, Ph. D., C. Chem.
 Laboratory Manager



APPENDIX C – SITE PHOTOS





Photo 1: View of the asbestos-containing Vinyl Sheet Flooring in the main entrance vestibule.



Photo 2: View of the VFT-2 in the basement washroom, the mastic under VFT-2 is confirmed as asbestos-containing.



Photo 3: View of the asbestos-containing brown caulking around the main entrance door on the ground floor.



Photo 4: View of the asbestos-containing tan caulking along the joint of the concrete pad and the wall by the main entrance door on the ground floor.



Photo 5: View of the asbestos-containing dark brown caulking around the door frame of the rear exit door in the basement.



Photo 6: View of the elevated concentration of lead-containing white paint on the brick wall within the specified area in the basement.



Photo 7: View of the elevated concentration of lead-containing green paint on the wall within the specified area in the basement.



Photo 8: View of the elevated concentration of lead-containing dark green paint on the wall within the specified area in the basement.



Photo 9: View of the elevated concentration of lead-containing red/black on the main entrance door and door frame on the ground floor.

APPENDIX D - PREVIOUS DSS REPORT



ANNUAL SURVEY FOR DESIGNATED SUBSTANCES AND HAZARDOUS MATERIALS



**Scarborough Arts Centre
1859 Kingston Road
Toronto, Ontario**

Presented to:

Sara Reid

City of Toronto
Corporate Services
Facilities Management

Presented By:

ECOH
Project: 19181-CUL19

November 2018

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1. INTRODUCTION AND REGULATORY REQUIREMENTS

1.1 Introduction and Scope

ECOH Management Inc. (ECOH) was retained by The City of Toronto to conduct a reassessment survey for designated substances and hazardous materials at the Scarborough Arts Centre, located at 1859 Kingston Road in Toronto, Ontario (hereafter referred to as the “facility” or the “project area”).

The objective of the survey was to determine the condition of previously identified asbestos-containing materials (ACM), identify and assess the condition of previously-identified designated substances and other hazardous materials, and, if necessary, provide recommendations to assist the City of Toronto in fulfilling requirements to achieve regulatory compliance, as set forth under the Ontario Occupational Health and Safety Act, and enforced by the Ontario Ministry of Labour. This document should be filed as an addendum to the original survey report.

This designated substances survey report is for management purposes only. It is not intended to be used to establish the presence of designated substances or hazardous materials in building materials prior to demolition or renovation activities. **A pre-renovation/pre-demolition audit of the work area for designated substances and hazardous materials should be conducted prior to any work activities that may disturb building materials potentially containing designated materials or hazardous substances.**

Ms. Marlene Lopes Jongsma of ECOH performed the fieldwork on August 13, 2018.

The following designated substances and hazardous materials were included in the re-assessment, if previously identified in the facility:

- | | |
|------------------------|---|
| → <i>Asbestos</i> | → <i>Benzene</i> |
| → <i>Lead</i> | → <i>Coke Oven Emissions</i> |
| → <i>Mercury</i> | → <i>Ethylene Oxide</i> |
| → <i>Silica</i> | → <i>Isocyanates</i> |
| → <i>Acrylonitrile</i> | → <i>Vinyl Chloride Monomer</i> |
| → <i>Arsenic</i> | → <i>Polychlorinated Biphenyls (PCB)s</i> |
| → <i>Mould</i> | |

The following report details the project regulatory requirements, survey and analytical methodologies, findings and recommendations, and survey statement of limitations.

1.2 Regulatory Requirements

Regulatory requirements and guidelines applicable to the designated substances and hazardous materials noted above include, but are not limited to, the following:

- Ontario Occupational Health and Safety Act and applicable Regulations made under the Act including;
 - Designated Substances – Ontario Regulation 490/09, and
 - Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations – Ontario Regulation 278/05.
- Ontario Environmental Protection Act, and applicable regulations made under the Act.
 - General – Waste Management – Ontario Regulation 347
 - Waste Management – PCB’s – Ontario Regulation 362.

- Canadian Environmental Protection Act, 1999 and applicable Regulations made under the Act, including:
 - PCB Regulations (SOR/2008-273), amended Dec 8, 2011.
- Ministry of Labour Guideline, “*Lead on Construction Projects*”, dated April 2011,
- Ministry of Labour Guideline, “*Silica on Construction Projects*”, dated April 2011.
- Canadian Construction Association, Standard Construction Document CCA 82, 2004; “*Mould Guidelines for the Canadian Construction Industry*”,
- Environmental Abatement Council of Ontario (EACO) *Mould Abatement Guidelines*, Ed. 3, 2015.
- Environment Canada Document, “*PCB Identification of Lamp Ballasts Containing PCBs*”, EPS 2/CC/2, dated August 1991.
- Environment Canada Document, “*Handbook on PCBs in Electrical Equipment*” EN 47-310/1988E, dated April 1988.

2. SURVEY METHODOLOGY

2.1 General Approach

To ensure familiarity with the building, and prior to commencing the survey, the surveyor made reference to previous surveys, facility floor plans, and other available documentation. The surveyor looked for the most common applications of building materials made with Designated Substances based on historical applications. The investigation performed was non-intrusive in nature (i.e. did not include demolition of building systems to verify concealed conditions).

Any rooms that could not be accessed during the survey are noted in the Hazardous Materials Inventory Sheet in Appendix I and on project drawings in Appendix IV.

2.2 Asbestos Survey Methodology

2.2.1 Asbestos Sampling Strategy and Analytical Methods

Where sampling was required, bulk samples of potentially asbestos-containing materials were collected for analysis. As per the requirements of Ontario Regulation 278/05, multiple samples (ranging from 3 to 7 depending on quantity and type of material) are required to confirm that asbestos is not present in that given material. Only one positive result (i.e. confirmation of the presence of asbestos) is required to classify a material as asbestos-containing. Therefore, ECOH’s sampling strategy involves the collection of sufficient numbers of samples to meet regulatory requirements, followed by instructions to the laboratory to cease analysis of all remaining samples within a series when a sample within that series is determined to be asbestos-containing.

Sampling requires a small volume of material to either be removed from a damaged section of suspect material or cut from intact material, which is then repaired by sealing with tape to prevent fibre release. The collected samples are placed in plastic bags, sealed, and shipped to an independent laboratory. A formal chain of custody procedure is maintained between ECOH and the sub-contracted laboratory during sample transport. Samples are analysed following the analytical procedure prescribed by O. Reg. 278/05 U.S. Environmental Protection Agency Test Method EPA/600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials. June 1993. Although not required by provincial regulation, all laboratories used by ECOH are accredited under the U.S. National Voluntary Laboratory Accreditation Program (NVLAP) to ensure consistent, accurate and defensible results.

Materials confirmed to be asbestos-containing during any previous assessments of the facility (if applicable) were not re-sampled for this survey. Additionally, samples were not collected of materials that were previously confirmed to be non-asbestos per the requirements of Ontario Regulation 278/05.

With the exception of window caulking and roofing materials, all other potentially asbestos-containing materials (currently recorded as “assumed to contain asbestos”) were sampled, unless materials were located at heights exceeding the reach of a surveyor using a 6’ step ladder, or were otherwise inaccessible.

Materials assumed or confirmed to contain asbestos in previous years, but not observed during the current survey, are retained in the Hazardous Materials Inventory Sheet in Appendix I with a notation that the material was not observed.

2.3 Lead Methodology

Where sampling was required (i.e. where damaged materials were observed), bulk samples of potentially lead-containing materials were collected for analysis by flame atomic absorption spectroscopy. The collected samples were placed in plastic bags, sealed, and shipped to an independent laboratory. A formal chain of custody procedure is maintained between ECOH and the sub-contracted laboratory during sample transport. All laboratories used by ECOH are accredited under the U.S. EPA National Environmental Lead Laboratory Accreditation Program (NLLAP) and/or American Industrial Hygiene Association (AIHA) Environmental Lead Laboratory Accreditation Program (ELLAP) to ensure consistent, accurate and defensible results.

Lead concentrations exceeding 1000ppm (0.1%) are considered to indicate the material is “lead-containing” per City of Toronto policy and applicable guidelines.

2.4 Mould Assessment

The mould assessment of the project area was conducted in accordance with the Canadian Construction Association, Standard Construction Document CCA 82, 2004; “*Mould Guidelines for the Canadian Construction Industry*”. Although there are no regulatory requirements or guidelines in Ontario for such an assessment, the preceding protocol has become accepted as the industry standard by most experts, consultants, and the Ontario Ministry of Labour.

2.5 Assessment for PCBs

PCBs in commercial facilities can be present in high concentrations in fluorescent or HID light fixtures, and electrical transformers.

Neither dismantling the lights to investigate the ballasts, nor dismantling the transformers to investigate their interiors, was part of the scope of this survey. Without disassembly, determination of whether light ballasts are PCB-containing is often very difficult. If no labels are present, all such light fixtures are assumed to contain PCB ballasts.

Electrical transformers are not disassembled for safety reasons. Determination of PCB content relies on the comparison of information on labels and nameplates located on the exterior of the transformer with standard PCB Identifier Code literature. Transformers must be assumed to contain PCBs if the results of that comparison do not clearly and specifically indicate the transformer does not contain PCBs.

2.6 Hazardous Materials Survey Inventory

ECOH’s surveyor completed a mould, lead and asbestos field data sheet for each room entered. The data sheet contains the room name, a unique room number assigned by the surveyor, the quantity,

type and condition of potentially hazardous materials present in the room, and sampling information. The inventory sheet is included as Appendix I.

2.7 Survey of Other Hazardous Materials

Materials or equipment suspected of containing other Designated Substances and/or PCBs are identified by appearance, age and knowledge of historic applications.

3. FINDINGS AND RECOMMENDATIONS

3.1 Asbestos

Confirmed ACM identified within the facility includes the following:

- Vinyl Floor Tile (Non-friable), and
- Vinyl Sheet Flooring (Friable).

Assumed ACM identified within the facility includes the following:

- Window Caulking (Non-friable), and
- Roofing Material (Non-friable).

The locations and quantities of materials assumed or confirmed to be asbestos-containing can be found in the hazardous materials inventory sheet, which is included as Appendix I.

Table 1, below, identifies any assumed and/or confirmed ACM observed to be in damaged condition at the time of the reassessment.

TABLE 1 Identified Damaged Asbestos Materials			
Location Number	Location Name	Quantity, Type and Condition of Material	Analytical Result
N/A - All Assumed and/or Confirmed ACM Observed to be in Good Condition at the Time of the Reassessment Survey			

No samples were collected for analysis of asbestos type and content during the current survey.

For the purposes of future renovation and/or demolition activities in specific locations within the facility, any building materials not specifically sampled within the renovation project area should be treated as if their asbestos content is not known. Such materials should, therefore, be sampled prior the occurrence of renovation or demolition work.

Additional asbestos-containing materials may be present in areas of the building which were inaccessible at the time of the survey (i.e. above fixed ceilings, behind walls, under flooring, etc.).

3.2 Lead

Confirmed lead-containing materials identified within the facility includes the following:

- Dark Green Paint (41000 ppm),
- Green Paint (4400 ppm),
- Purple Paint (5800 ppm), and
- White Paint (1800 ppm).

No potentially lead-containing materials were observed to be damaged during the survey, and, therefore, no lead bulk samples were collected.

However, lead may be present in:

- Ceramic tile glazing
- Internal batteries associated with emergency lighting systems,
- Wiring connectors and electric cable sheathing,
- Piping and solder joints on piping, and
- Cast iron pipe joint packing.

3.3 Mould

No mould-affected building materials were observed during the survey.

3.4 Mercury

Mercury is present in minor quantities within the project area in the following forms:

- As a vapour within fluorescent light tubes that are present in the project area,
- As a possible constituent of thermostats, and
- As a possible constituent of paints and adhesives.

3.5 Silica

Free crystalline silica, in the form of common construction sand, is present in all concrete and masonry products within the building.

3.6 Polychlorinated Biphenyls (PCBs)

The following potential sources of Polychlorinated Biphenyls (PCBs) were identified within the facility. Dismantling lights to investigate ballasts, and/or dismantling transformers to investigate their contents, was not part of the scope of this survey. Therefore, the items listed below must be assumed to contain PCBs, unless specifically stated otherwise:

- Fluorescent light ballasts:
 - Approximately 25 fluorescent light fixtures are present throughout the facility. Ballasts within these fixtures are assumed to contain PCBs.

Additional mechanical equipment or components of mechanical equipment throughout the facility may contain PCBs. These may include, but are not limited to, electrical capacitors and electrical equipment containing capacitors, voltage regulators, switches, re-closers, bushings or electromagnets, cable insulation, heat transfer equipment, hydraulic equipment, vapour diffusion pumps, bridge bearings, and caulking and motor/hydraulic oils. A specific assessment prior to the removal of any mechanical equipment within the facility should be conducted to confirm if PCBs are present within the equipment.

3.7 Other Environmental Considerations

The environmental audit also included an investigation for the following compounds, none of which were found to be present:

- Acrylonitrile
- Ethylene Oxides

- Arsenic
- Benzene
- Coke Oven Emissions
- Isocyanates
- Vinyl Chloride Monomer

Please note: paint, adhesives and plastics present throughout the project area may contain trace amounts of Acrylonitrile, Arsenic, Benzene, Ethylene Oxides, Isocyanates, Lead, Mercury and Vinyl Chloride Monomer. However, none of these materials were observed in a hazardous or unsafe condition, unless noted previously in Section 3.

4. RECOMMENDATIONS

4.1 Asbestos

All assumed and/or confirmed ACM were observed to be in GOOD condition at the time of the reassessment. As such, no corrective actions are recommended at this time.

Ontario Ministry of Labour Regulation 278/05 requires that an Asbestos Management Program (AMP) be implemented as long as asbestos-containing materials are present (or assumed to be present) in a building. The AMP, original survey report and subsequent reassessment reports must be available at the work place, and must identify the type of asbestos, and where asbestos can be found on a room-by-room basis.

NOTE: Interpretation of all sources of asbestos-related information, including but not limited to the original asbestos survey report, asbestos reassessment reports, room-by-room survey data, survey drawings and reports from previous asbestos abatement projects, should be completed by a competent person trained in the historical application of asbestos in building materials, building design and preferably by a person with site-specific knowledge and/or experience.

Information contained within any of the above-noted sources may not relieve the Regulatory responsibility of building Owners, or project Employers/Constructors, to complete a detailed site inspection prior to commencement of a project.

This report should not be used as a substitute for a detailed site inspection to identify asbestos-containing building materials, which must be specifically tailored to the scope and nature of any given project, and completed prior to any maintenance, renovation or demolition work that may cause disturbance to building materials.

4.2 Lead

Renovation, demolition or general construction work involving the removal of materials containing only trace concentrations of lead (i.e. Concentrations below 0.1% (1000ppm) by dry weight) can be completed without lead specific safety precautions provided that:

- a) work does not include 'fume generating activities' (heat producing) such as welding, torching, burning, high temperature cutting, etc.,
- b) work does not include dust-generating activities such as grinding, cutting or chemical stripping,
- c) dust levels are maintained below 3mg/m³, and
- d) general health and safety construction procedures are implemented, which would include dust suppression methods, proper respiratory protection (minimum of a 1/2-face respirator) and protective clothing, as is appropriate for the work being completed.

Any work involving the disturbance of building materials assumed to contain lead (e.g. wiring connectors or electric cable sheathing) should be conducted following recommendations detailed within the Ministry of Labour document *Guideline - Lead on Construction Projects*, dated April 2011.

All lead-containing waste materials must be disposed of following requirements set forth in applicable federal and/or provincial regulations, including Ontario Regulation 347: *General – Waste Management*.

4.3 Mould

No mould growth was observed at the time of the reassessment. As such, no corrective actions are recommended at this time.”

4.4 Mercury

The presence of mercury within assembled units (e.g. fluorescent light bulbs and thermostat bulbs) should not be considered a hazard provided that the assembled units remain sealed and intact. Avoid direct skin contact with mercury and avoid inhalation of mercury vapour. If required, dispose of mercury following applicable legislative requirements.

4.5 Silica

Silica-containing building materials are present throughout the facility (e.g. concrete, brick, cement block, etc.). Any work involving the disturbance of materials that may contain silica should be conducted following recommendations detailed in the Ministry of Labour document “*Guideline - Silica on Construction Projects*”, dated April 2011.

4.6 Polychlorinated Biphenyls (PCBs)

Fluorescent light ballasts and other mechanical equipment throughout the facility are assumed to contain PCBs, as neither dismantling the lights to investigate the ballasts, nor dismantling the transformers to investigate their contents, was within the scope of this survey.

PCB-containing light ballasts may legally remain in use until December 31, 2025, if they were already in use in the facility on September 5, 2008. However, it is ECOH’s general recommendation that PCB ballasts are proactively removed to eliminate the possibility of ballasts rupturing, which can cause the release of high concentrations of PCBs into indoor air for extended periods, and/or result in costly remediation. To determine whether light ballasts contain PCBs, they should be disassembled to observe serial codes and then compared to standard PCB Identifier Code literature. Ballasts with unidentifiable serial codes, or from manufacturers who are not included in the standard PCB Identifier Code literature, or which are not clearly labelled as “PCB Free”, or for which no date is clearly visible (ballasts dated 1981 or later do not contain PCBs), must be assumed to contain PCBs.

Disposal of fluorescent light ballasts that contain PCBs must follow Ontario Regulation 347, General –Waste Management, Ontario Regulation 362, Waste Management – PCB’s, and the amended PCB Regulations, 2008 established under the Canadian Environmental Protection Act, 1999.

Removal of any other PCB-containing substances or equipment in the facility should follow the amended *PCB Regulations*, 2008, made under the *Canadian Environmental Protection Act*, 1999 (CEPA).

4.7 Other Substances

Dust suppression and personal protection procedures should be implemented during the demolition of materials that may contain Acrylonitrile, Arsenic, Benzene, Ethylene Oxides, Isocyanates, and Vinyl Chloride.

5. CORRECTIVE ACTIONS

Corrective actions are not required.

6. STATEMENT OF LIMITATIONS

Due to the nature of building construction, some limitations exist as to the possible thoroughness of the designated substance and hazardous materials survey. The field observations, measurements and analysis are considered sufficient in detail and scope to form a reasonable basis for the findings and conclusions presented in this report. The findings and conclusions drawn by ECOH, concerning the designated substance and hazardous materials survey, are limited to the specific scope of work for which ECOH was retained and are based solely on information generated as a result of the specific scope of work authorized by The City of Toronto. The results of the designated substance and hazardous materials survey are limited to visual inspection of areas made accessible to ECOH personnel and information obtained from facility personnel, when obtained.

ECOH warrants that the findings and conclusions contained herein have been made in accordance with generally accepted evaluation methods in the industry and applicable regulations at the time of the performance of the designated substance survey. However, there is no warranty, expressed or implied, that this building survey has uncovered all environmental considerations on the subject site. In addition, ECOH cannot guarantee the completeness or accuracy of information supplied by a third party.

This report was prepared by ECOH for The City of Toronto. The material in it reflects ECOH's professional interpretation of information available at the time of report preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

ECOH

Environmental Consulting
Occupational Health

Prepared by:



Marlene Lopes Jongsma
Senior Environmental Scientist

Reviewed by:



Steve Bizi
Project Manager

APPENDIX I

HAZARDOUS MATERIALS INVENTORY SHEET

APPENDIX I - HAZARDOUS MATERIALS INVENTORY SHEET

Building Address 1859 Kingston Road, Scarborough, Ontario					Date(s) of Current Reassessment: August 13, 2018				
Building Name Scarborough Arts Centre					Organization completing Reassessment: ECOH				
Summary of Findings All ACM observed in GOOD condition. Mastic is assumed to be present underneath existing Vinyl Floor Tiles and Vinyl Sheet Flooring throughout the facility. Complete sampling of mastic is recommended prior to any flooring renovations.									
Location Number	Location Name	Building System	Material Observed	Potential Hazardous Material	Sample ID	Asbestos Type/Content	Quantity	Condition	Notes/Required Action
0-00	Exterior	Roof	Roofing Material	Asbestos	Not Sampled	ACM Assumed	N/A	N/A	
0-00	Exterior	Windows	Window Caulking	Asbestos	Not Sampled	ACM Assumed	N/A	N/A	
B-001	Entrance	Floor	Vinyl Floor Tiles 1	Asbestos	2014-A0001A,B	None Detected	N/A	N/A	VFT01, 12" x 12" blue, green and grey flecks and mastic 2014 Pinchin Reassessment Survey
B-001	Entrance	Wall	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	
B-001	Entrance	Wall	Drywall Joint Compound (DJC)	Asbestos	2014-A0002A-C	None Detected	N/A	N/A	
B-001	Entrance	Ceiling	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	*No Access above Ceiling
B-001	Entrance	Wall	Paint - White	Lead	L004	1800 ppm POSITIVE	300 sf	Good	White paint on plaster
B-001	Entrance	Wall	Paint - Yellow	Lead	L005	310 ppm (NEGATIVE - Trace Concentrations Only)	N/A	N/A	Yellow paint on brick
B-001	Entrance	Wall	Paint - Brown	Lead	L007	555 ppm (NEGATIVE - Trace Concentrations Only)	N/A	N/A	Brown paint on brick
B-002	Washroom	Floor	Vinyl Floor Tiles 2	Asbestos	2014-A0004A-C	3% Chrysotile (Mastic only)	50 sf	Unknown	VFT02, 12" x 12" grey, dark grey and beige flecks and mastic 2014 Pinchin Reassessment Survey
B-002	Washroom	Wall	Drywall Joint Compound (DJC)	Asbestos	2014-A0002A-C	None Detected	N/A	N/A	
B-002	Washroom	Wall	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	
B-002	Washroom	Ceiling	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	*No Access above Ceiling
B-002	Washroom	Pipe	Uninsulated	N/A	N/A	N/A	N/A	N/A	
B-003	Kitchen	Floor	Vinyl Floor Tiles 1	Asbestos	2014-A0001C	None Detected	N/A	N/A	VFT01, 12" x 12" blue, green and grey flecks and mastic 2014 Pinchin Reassessment Survey
B-003	Kitchen	Wall	Drywall Joint Compound (DJC)	Asbestos	2014-A0002A	None Detected	N/A	N/A	
B-003	Kitchen	Wall	Brick	N/A	N/A	N/A	N/A	N/A	
B-003	Kitchen	Ceiling	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	*No Access above Ceiling
B-003	Kitchen	Wall	Paint - Beige	Lead	L006	130 ppm (NEGATIVE - Trace Concentrations Only)	N/A	N/A	Beige paint on brick
B-004	Garage	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	

APPENDIX I - HAZARDOUS MATERIALS INVENTORY SHEET

<i>Location Number</i>	<i>Location Name</i>	<i>Building System</i>	<i>Material Observed</i>	<i>Potential Hazardous Material</i>	<i>Sample ID</i>	<i>Asbestos Type/Content</i>	<i>Quantity</i>	<i>Condition</i>	<i>Notes/Required Action</i>
B-004	Garage	Wall	Brick	N/A	N/A	N/A	N/A	N/A	
B-004	Garage	Ceiling	Concrete	N/A	N/A	N/A	N/A	N/A	
B-004	Garage	Pipe	Horsehair	N/A	N/A	N/A	N/A	N/A	
B-004	Garage	Wall	Paint - Green	Lead	L001	4400 ppm POSITIVE	120 sf	Good	Green paint on brick
B-004	Garage	Door	Paint - White	Lead	L002	180 ppm (NEGATIVE - Trace Concentrations Only)	N/A	N/A	White paint on door frame
B-004	Garage	Wall	Paint - Dark Green	Lead	L003	41000 ppm POSITIVE	180 sf	Good	Dark green paint on wood
B-005	Boiler Room	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
B-005	Boiler Room	Wall	Brick	N/A	N/A	N/A	N/A	N/A	
B-005	Boiler Room	Ceiling	Drywall Joint Compound (DJC)	Asbestos	2014-A0003AB	None Detected	N/A	N/A	*No Access above Ceiling
B-005	Boiler Room	Pipe	Horsehair	N/A	N/A	N/A	N/A	N/A	
B-005	Boiler Room	Mechanical	Fibreglass	N/A	N/A	N/A	N/A	N/A	Gas-Fired Hot Water Boiler
B-006	Storage Room	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
B-006	Storage Room	Wall	Brick	N/A	N/A	N/A	N/A	N/A	
B-006	Storage Room	Ceiling	Drywall Joint Compound (DJC)	Asbestos	2014-A0003C	None Detected	N/A	N/A	*No Access above Ceiling
B-006	Storage Room	Pipe	Horsehair	N/A	N/A	N/A	N/A	N/A	
B-007	Meeting Room	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
B-007	Meeting Room	Wall	Drywall Joint Compound (DJC)	Asbestos	2014-A0002BC	None Detected	N/A	N/A	
B-007	Meeting Room	Wall	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	
B-007	Meeting Room	Ceiling	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	*No Access above Ceiling
B-007	Meeting Room	Pipe	Uninsulated	N/A	N/A	N/A	N/A	N/A	
B-007	Meeting Room	Mechanical	Fibreglass	N/A	N/A	N/A	N/A	N/A	Domestic hot water tank
B-008	Office	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
B-008	Office	Wall	Drywall Joint Compound (DJC)	Asbestos	2014-A0002A-C	None Detected	N/A	N/A	
B-008	Office	Ceiling	Drywall Joint Compound (DJC)	Asbestos	2014-A0003A-C	None Detected	N/A	N/A	*No Access above Ceiling
1-001	Stairs	Floor	Vinyl Sheet Flooring 1	Asbestos	1429-02-01A-C	None Detected	N/A	N/A	VSF01, Grey with square pattern 2012 ECHO Assessment (File 14291-02)

APPENDIX I - HAZARDOUS MATERIALS INVENTORY SHEET

Location Number	Location Name	Building System	Material Observed	Potential Hazardous Material	Sample ID	Asbestos Type/Content	Quantity	Condition	Notes/Required Action
1-001	Stairs	Wall	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	
1-001	Stairs	Ceiling	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	*No Access above Ceiling
1-002	Closet	Floor	Wood	N/A	N/A	N/A	N/A	N/A	
1-002	Closet	Wall	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	
1-002	Closet	Ceiling	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	*No Access above Ceiling
1-003	Copy Room	Floor	Vinyl Sheet Flooring 1	Asbestos	1429-02-01A-C	None Detected	N/A	N/A	VSF01, Grey with square pattern 2012 ECHO Assessment (File 14291-02)
1-003	Copy Room	Wall	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	
1-003	Copy Room	Ceiling	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	*No Access above Ceiling
1-004	Corridor	Floor	Wood	N/A	N/A	N/A	N/A	N/A	
1-004	Corridor	Wall	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	
1-004	Corridor	Ceiling	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	*No Access above Ceiling
1-005	Corridor	Floor	Wood	N/A	N/A	N/A	N/A	N/A	
1-005	Corridor	Wall	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	
1-005	Corridor	Ceiling	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	*No Access above Ceiling
1-006	Art Gallery	Floor	Wood	N/A	N/A	N/A	N/A	N/A	
1-006	Art Gallery	Floor	Ceramic	Lead	N/A	Lead Assumed	N/A	N/A	
1-006	Art Gallery	Wall	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	
1-006	Art Gallery	Ceiling	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	*No Access above Ceiling
1-006	Art Gallery	Other	Mercury	N/A	N/A	N/A	1 EA	N/A	Mercury-containing thermostat
1-007	Entrance Vestibule	Floor	Vinyl Sheet Flooring 2	Asbestos	2014-A0005A-C	20% Chrysotile	30 sf	Good	VSF02, Red with square pattern and paper backing 2014 Pinchin Reassessment Survey
1-007	Entrance Vestibule	Wall	Textured Finish	Asbestos	A002A-C	None Detected	N/A	N/A	
1-007	Entrance Vestibule	Ceiling	Textured Finish	Asbestos	A002A-C	None Detected	N/A	N/A	*No Access above Ceiling
1-008	Office	Floor	Ceramic	Lead	N/A	Lead Assumed	N/A	N/A	
1-008	Office	Wall	Textured Finish	Asbestos	A002A-C	None Detected	N/A	N/A	
1-008	Office	Wall	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	
1-008	Office	Ceiling	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	*No Access above Ceiling

APPENDIX I - HAZARDOUS MATERIALS INVENTORY SHEET

<i>Location Number</i>	<i>Location Name</i>	<i>Building System</i>	<i>Material Observed</i>	<i>Potential Hazardous Material</i>	<i>Sample ID</i>	<i>Asbestos Type/Content</i>	<i>Quantity</i>	<i>Condition</i>	<i>Notes/Required Action</i>
1-009	Art Gallery	Floor	Wood	N/A	N/A	N/A	N/A	N/A	
1-009	Art Gallery	Wall	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	
1-009	Art Gallery	Ceiling	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	*No Access above Ceiling
1-010	Washroom	Floor	Ceramic	Lead	N/A	Lead Assumed	N/A	N/A	
1-010	Washroom	Wall	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	
1-010	Washroom	Ceiling	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	*No Access above Ceiling
1-011	Office	Floor	Wood	N/A	N/A	N/A	N/A	N/A	
1-011	Office	Wall	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	
1-011	Office	Ceiling	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	*No Access above Ceiling
1-012	Closet	Floor	Wood	N/A	N/A	N/A	N/A	N/A	
1-012	Closet	Wall	Wood	N/A	N/A	N/A	N/A	N/A	
1-012	Closet	Ceiling	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	*No Access above Ceiling
1-013	Office	Floor	Wood	N/A	N/A	N/A	N/A	N/A	
1-013	Office	Wall	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	
1-013	Office	Ceiling	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	*No Access above Ceiling
1-014	Closet	Floor	Wood	N/A	N/A	N/A	N/A	N/A	
1-014	Closet	Wall	Wood	N/A	N/A	N/A	N/A	N/A	
1-014	Closet	Ceiling	Wood	N/A	N/A	N/A	N/A	N/A	*No Access above Ceiling
2-001	Stairs	Floor	Wood	N/A	N/A	N/A	N/A	N/A	
2-001	Stairs	Wall	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	
2-001	Stairs	Ceiling	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	*No Access above Ceiling
2-002	Closet	Floor	Wood	N/A	N/A	N/A	N/A	N/A	
2-002	Closet	Wall	Wood	N/A	N/A	N/A	N/A	N/A	
2-002	Closet	Ceiling	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	*No Access above Ceiling
2-003	Washroom	Floor	Vinyl Floor Tiles 3	Asbestos	2014-A0006A-C	None Detected	N/A	N/A	VFT03, 12" x 12", Black with white streaks and mastic 2014 Pinchin Reassessment Survey

APPENDIX I - HAZARDOUS MATERIALS INVENTORY SHEET

Location Number	Location Name	Building System	Material Observed	Potential Hazardous Material	Sample ID	Asbestos Type/Content	Quantity	Condition	Notes/Required Action
2-003	Washroom	Wall	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	
2-003	Washroom	Ceiling	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	*No Access above Ceiling
2-004	Office	Floor	Wood	N/A	N/A	N/A	N/A	N/A	
2-004	Office	Wall	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	
2-004	Office	Ceiling	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	*No Access above Ceiling
2-004	Office	Wall	Paint - Purple	Lead	L008	5800 ppm POSITIVE	450 sf	Good	Purple paint on plaster
2-005	Closet	Floor	Wood	N/A	N/A	N/A	N/A	N/A	
2-005	Closet	Wall	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	
2-005	Closet	Ceiling	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	*No Access above Ceiling
2-006	Attic	Floor	Wood	N/A	N/A	N/A	N/A	N/A	
2-006	Attic	Wall	Drywall Joint Compound (DJC)	Asbestos	2014-A0002A-C	None Detected	N/A	N/A	No joint compound observed
2-006	Attic	Ceiling	Drywall Joint Compound (DJC)	Asbestos	2014-A0003A-C	None Detected	N/A	N/A	No joint compound observed
2-006	Attic	Pipe	Uninsulated	N/A	N/A	N/A	N/A	N/A	
2-007	Office	Floor	Wood	N/A	N/A	N/A	N/A	N/A	
2-007	Office	Wall	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	
2-007	Office	Ceiling	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	*No Access above Ceiling
2-008	Closet	Floor	Wood	N/A	N/A	N/A	N/A	N/A	
2-008	Closet	Wall	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	
2-008	Closet	Ceiling	Plaster	Asbestos	A001A-G	None Detected	N/A	N/A	*No Access above Ceiling
2-009	Attic	Floor	Wood	N/A	N/A	N/A	N/A	N/A	
2-009	Attic	Wall	Drywall Joint Compound (DJC)	Asbestos	2014-A0002A-C	None Detected	N/A	N/A	No joint compound observed
2-009	Attic	Ceiling	Drywall Joint Compound (DJC)	Asbestos	2014-A0003A-C	None Detected	N/A	N/A	No joint compound observed
2-010	Hallway	Floor	Wood	N/A	N/A	N/A	N/A	N/A	
2-010	Hallway	Wall	Plaster	Asbestos	A001A-G	N/A	N/A	N/A	2011 Assessment Survey
2-010	Hallway	Ceiling	Plaster	Asbestos	A001A-G	N/A	N/A	N/A	
Surveyor's Field Notes									

APPENDIX I - HAZARDOUS MATERIALS INVENTORY SHEET

Location Number	Location Name	Building System	Material Observed	Potential Hazardous Material	Sample ID	Asbestos Type/Content	Quantity	Condition	Notes/Required Action

APPENDIX II

RESULTS OF BULK SAMPLE ANALYSES

(NO INFORMATION TO REPORT)

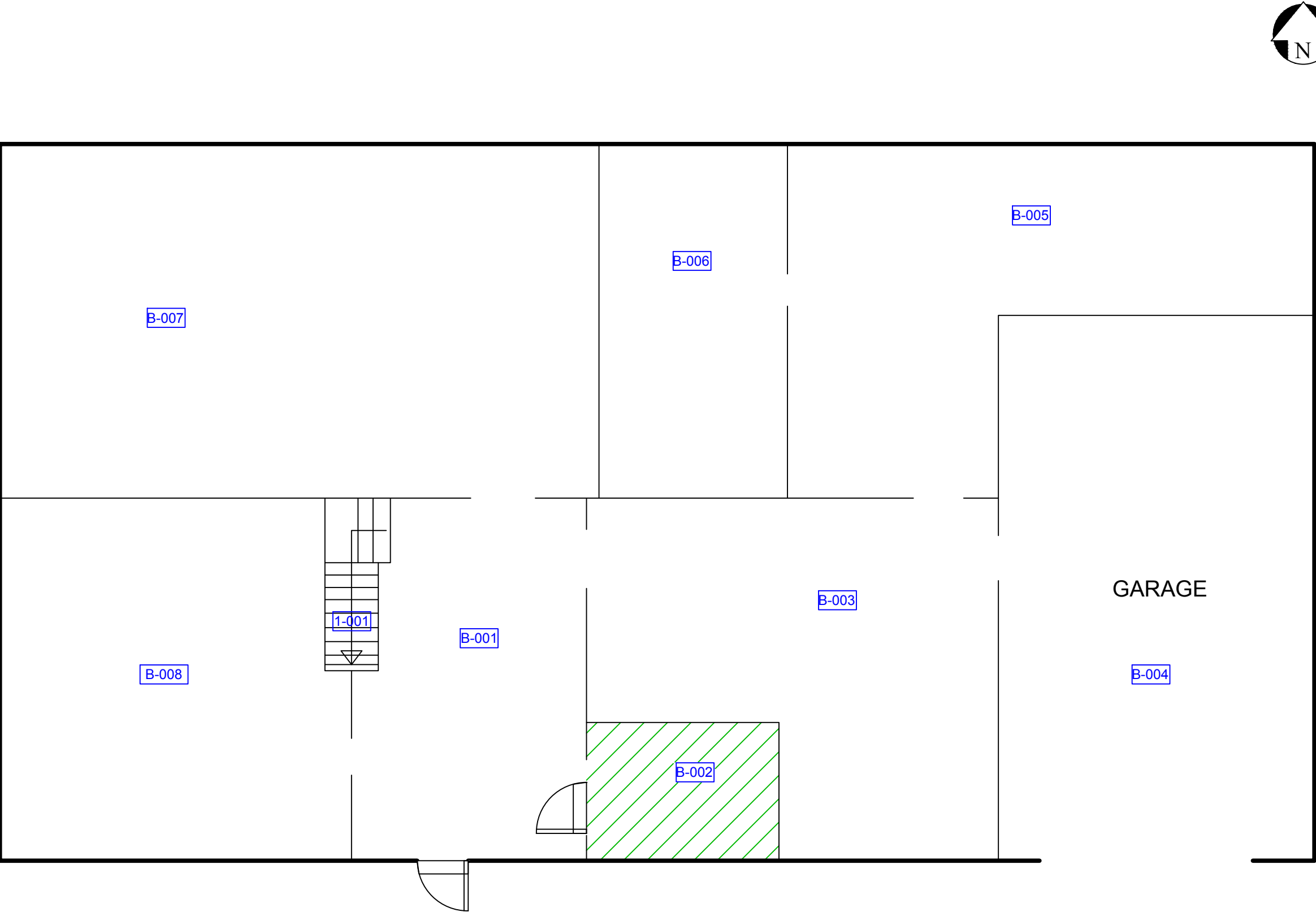
APPENDIX III

VISUALLY IDENTIFIABLE ASBESTOS-CONTAINING MATERIALS INFORMATION SHEET

APPENDIX III - VISUALLY IDENTIFIABLE ACM IDENTIFICATION SHEET

<i>MIN</i>	<i>Material</i>	<i>Photo</i>	<i>Material Description</i>	<i>Size (if applicable)</i>
VSF2	Vinyl Sheet Flooring		Red with square pattern and paper backing	N/A
VFT2	Vinyl Floor Tiles		Grey, dark grey and beige flecks (MASTIC ONLY)	12" x 12"

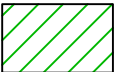
APPENDIX IV
SURVEY DRAWINGS



Legend

1-01

Location Number



Assumed or Confirmed Asbestos
Containing Material

The drawing does not illustrate locations of drywall joint compound, plaster, window caulking or roofing materials, for reasons discussed in Section 6 of the Standard Operating Procedure for Asbestos Reassessment Surveys. Please refer to the Asbestos Reassessment Survey Form in Appendix I for information regarding the locations and asbestos-content of these materials.

Figure 1

LOCATION: 1859 Kingston Road,
Toronto, Ontario

BUILDING NAME: Scarborough Arts Centre

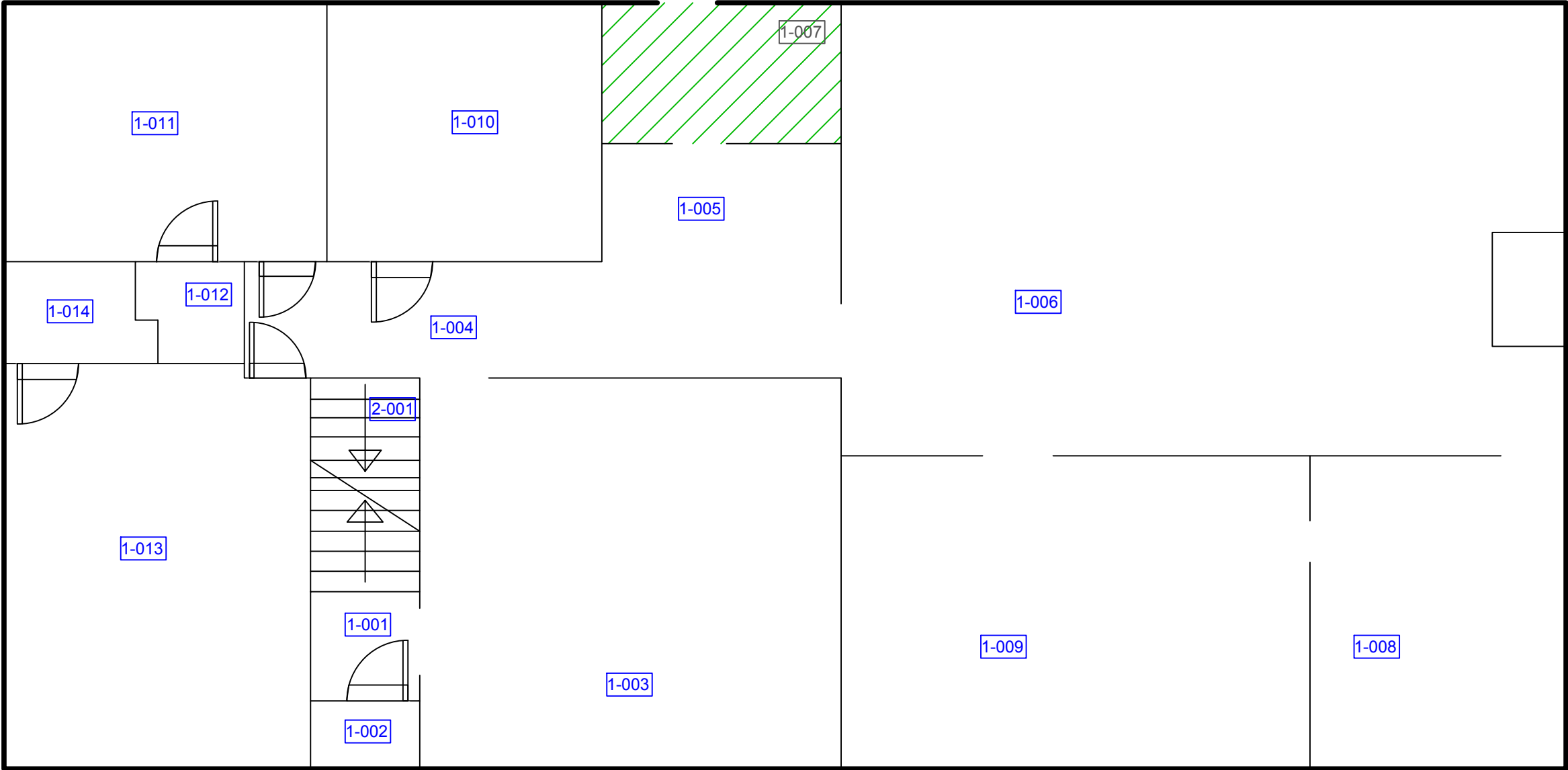
Basement Floor Plan
Locations of Designated Substances and
Hazardous Materials

CLIENT: City of Toronto

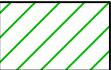
PROJECT NUMBER: 19181-CUL19 DATE: October 2018 DRW BY: PP

CAD FILE: FIG1-3 P19181-CUL19 ACM SCALE: Not to Scale CHK BY: MLJ





Legend

- 1-01 Location Number
-  Assumed or Confirmed Asbestos Containing Material

The drawing does not illustrate locations of drywall joint compound, plaster, window caulking or roofing materials, for reasons discussed in Section 6 of the Standard Operating Procedure for Asbestos Reassessment Surveys. Please refer to the Asbestos Reassessment Survey Form in Appendix I for information regarding the locations and asbestos-content of these materials.

Figure 2

LOCATION:
1859 Kingston Road,
Toronto, Ontario

BUILDING NAME:
Scarborough Arts Centre

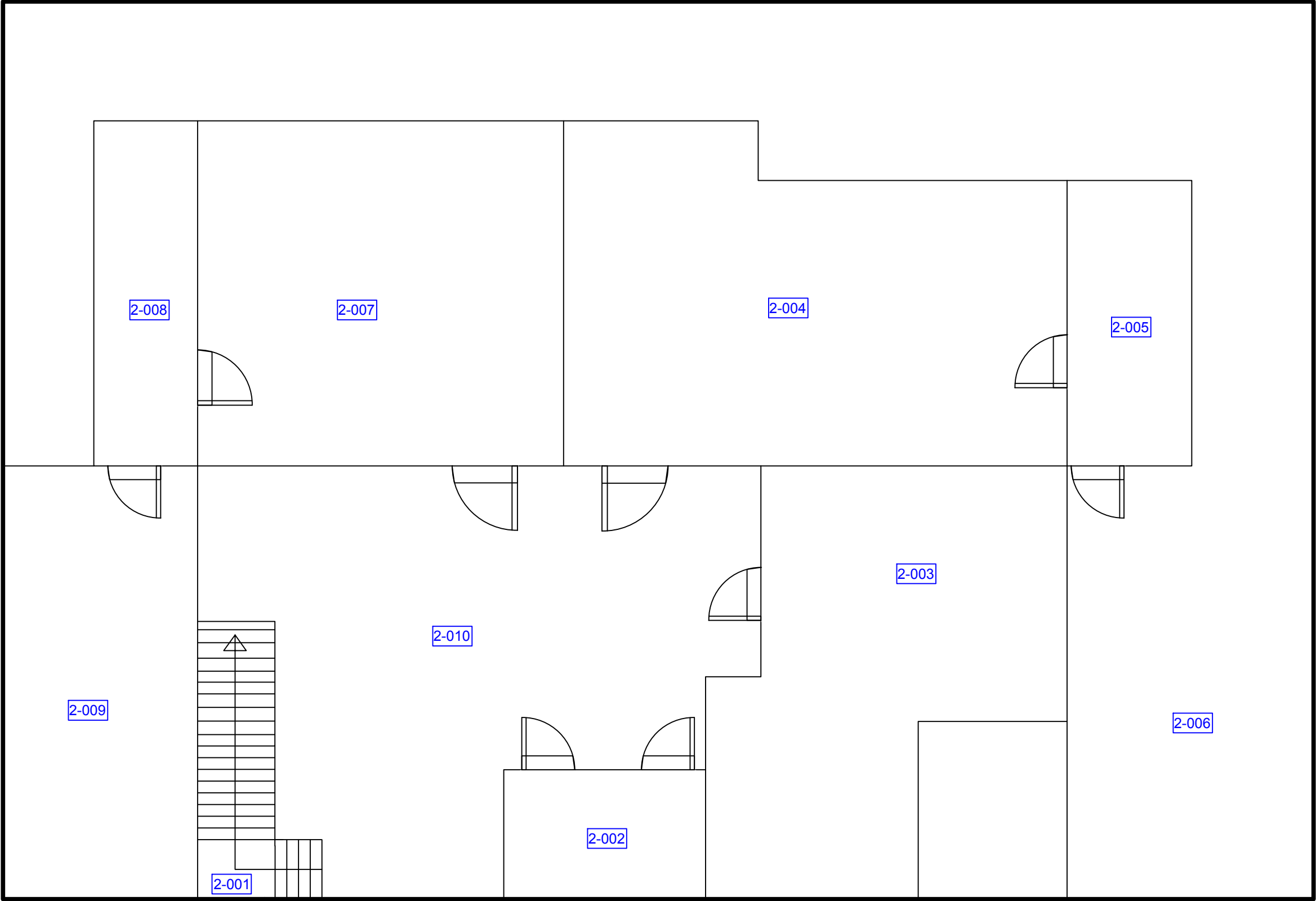
Ground Floor Plan
Locations of Designated Substances and
Hazardous Materials

CLIENT: City of Toronto

PROJECT NUMBER: 19181-CUL19 DATE: October 2018 DRW BY: PP

CAD FILE: FIG1-3 P19181-CUL19 ACM SCALE: Not to Scale CHK BY: MLJ





Legend

1-01

Location Number



Assumed or Confirmed Asbestos
Containing Material

The drawing does not illustrate locations of drywall joint compound, plaster, window caulking or roofing materials, for reasons discussed in Section 6 of the Standard Operating Procedure for Asbestos Reassessment Surveys. Please refer to the Asbestos Reassessment Survey Form in Appendix I for information regarding the locations and asbestos-content of these materials.

Figure 3

LOCATION:
1859 Kingston Road,
Toronto, Ontario

BUILDING NAME:
Scarborough Arts Centre

Second Floor Plan
Locations of Designated Substances and
Hazardous Materials

CLIENT: City of Toronto

PROJECT NUMBER: 19181-CUL19 DATE: October 2018 DRW BY: PP

CAD FILE: FIG1-3 P19181-CUL19 ACM SCALE: Not to Scale CHK BY: MLJ



APPENDIX B6

Designated Substances Survey

1904 Queen Street East, Fire Hall No. 227

Issued December 2021, by Fisher Environmental Ltd.



ENGINEERING



LABORATORY



**DESIGNATED SUBSTANCES
SURVEY FOR ACCESSIBILITY
UPGRADES (IBI GROUP)**

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Project No. FE-P 21-11706
December 15, 2021

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1.0. EXECUTIVE SUMMARY

Fisher Environmental Ltd. ('Fisher') was retained by IBI Group to carry out a survey for the Designated Substances and other potential hazardous materials within specified work areas for Fire Hall No. 227 building, located at 1904 Queen Street East, Toronto, Ontario, herein after referred to as the "Site".

The site inspection and sampling works were conducted on November 18, 2021.

IBI Group has been commissioned by the City of Toronto to design and implement accessibility upgrades. The scope of the Designated Substances Survey (DSS) was to identify locations and types of designated substances within the building that may be impacted by the planned renovation work, and to provide recommendations for the safe handling or abatement of these materials, if any, prior to demolition.

The purpose of the project is to do the necessary construction and renovation at the locations are outlined on drawings provided by the IBI Group on October 27, 2021.

The survey was conducted in compliance with the Ontario Ministry of Labour (MOL) regulations for designated substances; O. Reg. 490/09 - *Designated Substances* and O. Reg. 278/05 - *Asbestos on Construction Projects and in Buildings and Repair Operations* made under the Occupational Health and Safety Act (OHSA), R.S.O. 1990.

Asbestos

Fisher was provided with the report of a previous DSS, which was conducted by Pinchin Environmental Ltd. on September 20, 2017. This report has indicated no confirmed or assumed ACM within the specified work areas.

During the current survey, three (3) bulk samples of building materials found within the specified work area(s) and that could potentially contain asbestos, were collected and submitted to Fisher Environmental Laboratories for Polarised Light Microscopy (PLM) analysis, as outlined in NIOSH Method 9002.

The results of analysis revealed that the material sampled does not contain asbestos. Provide a copy of this report to contractors bidding on or performing work within the subject work areas.

Note: Fire doors, present within the specific work areas, may contain asbestos-containing thermal insulation inside the door panel. Removal of any asbestos containing fire doors, in intake condition, will require Type 1 to abatement procedures, as outlined in O. Reg. 278/05 and dispose of as asbestos waste.



Lead

Based on the age of the building, it is possible that lead-based paint and lead plumbing are present within the building. Lead can also be present in various ceramic tiles. During the current investigation, no samples were collected for lead analysis.

Fisher recommends that, prior to the planned renovation work, the removal of lead containing materials found within the specified work area(s), must be conducted using the appropriate lead abatement procedures. Lead abatement procedures to be used are determined by the method(s) of disturbance employed. Refer to *MOL Guideline: Lead on Construction Projects*, for details

Mercury

Mercury is presumed to be present in fluorescent light tubes and thermostatic controls. With the exception of fluorescent light bulbs and building thermostats, no other evidence of mercury was noted during the current survey. Prior to the planned renovation work, Fisher recommends that any presumed mercury-containing fluorescent light tubes and thermostats that will be impacted are to be removed and disposed of in accordance with O. Reg. 558/00.

Silica

No sampling for silica was conducted. However, as the building is constructed of concrete, brick and/or block walls with concrete floors, silica is expected to be found within these components of the buildings. If these materials will be disturbed during the planned renovation work, appropriate precautions should be taken to protect workers from inhaling silica dusts and debris. Refer to *MOL Guideline: Silica on Construction Projects* for details.

Other Designated Substances

The other Designated Substances would not be expected to be present at the Site. No immediate actions were recommended with regard to acrylonitrile, arsenic, benzene, coke oven emissions, ethylene oxide, isocyanates, and vinyl chloride.

Mould

During the current survey, no visible mould or favourable conditions for mould growth were observed in the specified work area(s). No action is recommended with regard to mould.



2.0. INTRODUCTION

Fisher Environmental Ltd. ('Fisher') was retained by IBI Group to carry out a survey for the Designated Substances and other potential hazardous materials within specified work areas for Fire Hall No. 227 building, located at 1904 Queen Street East, Toronto, Ontario, herein after referred to as the "Site".

The site inspection and sampling works were conducted on November 18, 2021.

IBI Group has been commissioned by the City of Toronto to design and implement accessibility upgrades. The scope of the Designated Substances Survey (DSS) was to identify locations and types of designated substances within the building that may be impacted by the planned renovation work, and to provide recommendations for the safe handling or abatement of these materials, if any, prior to demolition.

The purpose of the project is to do the necessary construction and renovation at the locations are outlined on drawings provided by the IBI Group on October 27, 2021.

3.0. REGULATIONS

The survey was conducted in compliance with the Ontario Ministry of Labour (MOL) regulations for designated substances; O. Reg. 490/09 - *Designated Substances* and O. Reg. 278/05 - *Asbestos on Construction Projects and in Buildings and Repair Operations* made under the Occupational Health and Safety Act (OHSA), R.S.O. 1990.

The OHSA, R.S.O. 1990, under the Ontario MOL, defines a toxic substance as a biological, chemical or physical agent (or a combination of such agents) whose presence in the workplace may endanger the health and safety of a worker. Sections of the Act that deals with toxic substances are intended to:

1. ensure that worker exposure to toxic substances is controlled;
2. ensure that toxic substances in the workplace are clearly identified and that workers are provided with enough information to be capable of handling them safely; and,
3. provide the general public with access to information about toxic substances used by industry in their communities.

The Act makes provision for a toxic substance to be "designated", where its use in the workplace is prohibited, regulated, restricted, limited or controlled. Designation is reserved for eleven substances that are particularly hazardous, covered under O. Reg 490/09 – *Designated Substances* that was implemented on July 1, 2010, and include Acrylonitrile, Arsenic, Asbestos, Benzene, Coke Oven Emissions, Ethylene Oxides, Isocyanates, Lead, Mercury, Silica, and Vinyl



Chloride. Formerly, regulations for these substances were passed separately and each outlined exposure limits where workers were likely to inhale, ingest and / or absorb the substance.

O. Reg. 490/09 provides a consistent approach to dealing with existing requirements and provisions, and outlines steps required to control worker exposure to these substances, including by inhalation, ingestion, skin absorption or skin contact. Each designated substance has an allowable level of exposure based on a time-weighted average (TWA) limit, and may also have a short-term exposure limit (STEL) and / or ceiling limit (C) assigned to it. TWA refers to the time-weighted average airborne concentration of a biological or chemical agent to which a worker may be exposed in a work day or work week, STEL refers to the maximum airborne concentration of a biological or chemical agent to which a worker may be exposed in any 15-minute period, and C refers to the maximum airborne concentration of a biological or chemical agent to which a worker may be exposed at any time. Refer to O. Reg. 490/09 – *Designated Substances*.

A supplementary regulation regarding control of asbestos exposures in the construction industry has evolved into O. Reg. 278/05 – *Asbestos on Construction Projects and in Buildings and Repair Operations*. The regulation includes a definition of asbestos-containing materials (ACM), requirements for additional training and clearance air testing, procedures for determining materials that meet the definition of ACM and for the use of glove bags, and provisions for varying from measure and procedures set out in the regulation.

In addition to the OHSA and regulations regarding designated substances, the following regulations, guidelines and standards were also taken into account or referenced:

- O. Reg. 213/91 - *Construction Projects* regulated under the OHSA and last amended by O. Reg. 443/09;
- O. Reg. 558/00 made under the Ministry of Environment (MOE) Environmental Protection Act, amending O. Reg. 347 - *General Waste Management*;
- The Transport of Dangerous Goods Act (TDGA) provides regulations for the transport of asbestos-containing materials and wastes;
- MOL *Guideline: Lead on Construction Projects*, 2011; and,
- MOL *Guideline: Silica on Construction Projects*, 2011.

4.0. METHODOLOGY

Fisher followed the protocols outlined in O. Reg. 278/05 for collecting and analyzing bulk samples of materials suspected to contain asbestos. Visual assessment of the material was the primary method of identification with occasional physical contact for the purpose of collecting bulk samples or examining for underlying layers.

Where applicable, samples of suspect materials were collected in order to establish asbestos or lead content. Samples were grouped according to similarity of appearance (“homogeneous”



materials). The frequency at which the samples were collected was sufficient to obtain a general representation of the presence of these materials at the Site. Samples collected are presumed to be representative of respective building materials in-place at the Site. However, due to potential past renovations, alterations, repairs, or phases of construction, it is possible that individual materials may not be representative of samples collected.

Sampling of roofing materials was not part of the current scope of work. Further, sampling of materials found within operating equipment, portable building articles, or generally non-accessible components such as insulation within electrical switch gears, wiring, motors, light fixtures, elevator brakes, fire door cores, etc. was not performed as part of the current survey.

Samples collected during the survey were placed in plastic zip-lock bags which were labeled and submitted for laboratory analysis. Fisher Environmental Laboratories analysed bulk samples for asbestos type and approximate percent content by performing polarized light microscopy (PLM), as outlined in NIOSH Method 9002. Fisher Environmental Laboratories analysed samples for lead content in paint by performing acid digestion followed by Inductively Coupled Plasma (ICP) analysis.

Site Plans, indicating specific work areas, and bulk sample locations, are included in Appendix A. The laboratory certificate of analysis is included in Appendix B.

5.0. REVIEW OF PREVIOUS REPORTS

Fisher was provided with the report of a previous DSS, which was conducted by Pinchin Environmental Ltd. on September 20, 2017, attached in Appendix D. This report has indicated no confirmed or assumed ACM within the specified work areas.

6.0. FINDINGS AND RECOMMENDATIONS

6.1. *Acrylonitrile*

Acrylonitrile would not be expected to be present at the Site and was not observed during the current survey. No recommendations for Acrylonitrile are warranted at this time.

6.2. *Arsenic*

Arsenic would not be expected to be present at the Site and was not observed during the current survey. No recommendations for Arsenic are warranted at this time.

6.3. *Asbestos*

6.3.1. General Information

Asbestos is the name given to a group of six different fibrous minerals (amosite, chrysotile, crocidolite, and the fibrous varieties of tremolite, actinolite and anthophyllite) that occur naturally



in the environment. Asbestos minerals have separable long fibres that are strong and flexible enough to be spun and woven and are heat resistant.

Because of these characteristics, asbestos has been used for a wide range of manufactured goods, mostly in building materials (roofing shingles, ceiling and floor tiles, paper products, and asbestos cement products), friction products (automobile clutch, brake, and transmission parts), heat-resistant fabrics, packaging, gaskets, and coatings. Some vermiculite or talc products may also contain asbestos.

Asbestos fibres may be released into the air by the disturbance of ACM during product use, renovation or demolition work, building or home maintenance, repair and remodeling. In general, exposure may occur only when the ACM is disturbed in some way to release particles and fibres into the air.

6.3.2. Friable vs. Non-Friable ACM

Based on the requirements of O. Reg. 278/05 and due diligence, an asbestos survey and report must be available at any workplace where asbestos exists identifying locations and types of ACM in the building. The survey must include both friable and non-friable materials confirmed to contain asbestos, as well as any other materials which were not sampled but are suspected (presumed) ACM. The term friable refers to material(s) that could be readily reduced to dust or powder when crushed by hand or moderate pressure. Friable materials have a much greater chance of releasing airborne asbestos fibres when disturbed.

In the past, the most commonly used friable asbestos-containing building materials were surfacing materials (e.g., sprayed on fireproofing, texture, decorative or acoustic plaster) as well as thermal insulation. Examples of manufactured asbestos-containing materials include vinyl floor tiles, ceiling tiles, gasket materials, asbestos cement (transite) pipes or boards, and asbestos textiles. Depending on the above noted formulation, these materials range from non-friable to friable. Although some products are considered non-friable when in Good condition, severe damage or deterioration may cause non-friable materials to generate airborne dust more readily. Severely damaged non-friable materials, or those to be worked on with powered tools, may be considered as friable ACM for abatement purposes.

Examples of common types of ACM by friability include:

- Friable ACM
 - Sprayed Materials (or materials installed by roller or trowel), such as fireproofing, thermal insulation, texture finishes, etc.
 - Mechanical Insulation such as boiler and breeching, ductwork, piping, tanks and associated equipment.
 - Plaster



- Potentially Friable ACM
 - Acoustic Ceiling Tiles
 - Vinyl Sheet Flooring
- Non-Friable ACM
 - Vinyl Floor Tiles
 - Asbestos cement (“transite”) piping or paneling
 - Window Caulking

6.3.3. Regulations

Exposure to asbestos is controlled by two Regulations passed under Ontario’s Occupational Health and Safety Act (OHSA), R.R.O. 1990.

- O. Reg. 490/09 – *Designated Substances* regarding asbestos applies to:
 - every employer operating a mine for the purpose of mining, crushing, grinding or sifting asbestos;
 - every employer processing, adapting or using asbestos in connection with manufacturing or assembling of goods or products;
 - every employer engaged in the repair, alteration or maintenance of machinery, equipment, aircraft, ships, locomotives, railway cars and vehicles;
 - every employer engaged in work on a building that is necessarily incidental to the repair, alteration or maintenance of machinery or equipment; and,
 - to those workers of such employers who are likely to be exposed to asbestos.

Exposure limits for this substance are set at 0.1 f/cc (TWA) for all types of asbestos.

- O. Reg. 278/05 - *Asbestos on Construction Projects and in Buildings and Repair Operations* applies to buildings that contain friable and non-friable ACM and to the repair, alteration and/or maintenance of these buildings.

In addition to regulations for controlling work around asbestos-containing building materials there are regulations for packaging, transportation and disposal of asbestos-containing waste:

- O. Reg. 558/00 made under the Ministry of Environment (MOE) Environmental Protection Act, amending O. Reg. 347 - *General Waste Management*; and,
- The Transport of Dangerous Goods Act (TDGA) provides regulations for the transport of asbestos-containing materials and wastes.

6.3.4. Findings

Samples of homogenous materials suspected to contain asbestos were collected and submitted for analysis. Fisher collected three (3) bulk samples of building materials found within the specified work areas and that could potentially contain asbestos.



Findings of all building materials identified within the specified work area(s) are outlined in further detail below.

6.3.4.1. Sprayed or Troweled Fireproofing and Thermal Insulation

Presence of non-asbestos containing sprayed fireproofing insulation was noted in the previous report, however, not within specified work areas.

6.3.4.2. Texture Finish

No indication of texture finish was noted in any of the specified work areas during the current survey.

6.3.4.3. Mechanical Insulation

The majority of mechanical insulation observed throughout the building are either not insulated or are insulated with fiberglass which is not suspected to contain asbestos.

6.3.4.4. Acoustic Ceiling Tile

During the current survey, one (1) visually distinct style of ceiling tile, Ceiling Tile 3 (2'x4' Pinhole Fissures), were observed within the specified work areas. The previous report confirmed that Ceiling Tile 3 was sampled for analysis. The results of analysis revealed this style of ceiling tile does not contain asbestos.

6.3.4.5. Plaster / Drywall Joint Compound

Plaster was observed on the ceilings and walls in the building. The previous report indicated that plaster samples were sampled for analysis. The results of analysis revealed that the plaster does not contain asbestos

Drywall Joint Compound (DJC) was observed throughout the building. The previous report indicated DJC was sampled for analysis. The results of analysis revealed that the DJC does not contain asbestos

6.3.4.6. Asbestos Cement Products

No asbestos cement products, such as Transite pipe or board, were noted in any of the specified work areas during the current survey.

6.3.4.7. Vinyl Sheet Flooring

No vinyl sheet flooring was noted in any of the specified work area(s) during the current survey.

6.3.4.8. Vinyl Floor Tile

During the current survey, one (1) type of vinyl floor tile, Vinyl Floor Tile 6 – 12" x 12", Mauve with White & Purple, was observed within the specified work area(s). The previous report confirmed that Vinyl Floor Tile 6 was sampled for analysis. The results of analysis revealed this type of vinyl floor tile does not contain asbestos.



6.3.4.9. Other ACM

Mortar

Mortar was observed on the brick wall within the specified work areas during the current survey. Three (3) samples of the mortar were collected for analysis. The results of analysis revealed that the mortar does not contain asbestos.

6.3.5. Recommendations

No asbestos-containing materials were identified in any of the specified work area(s). Therefore, no recommendations with regards to ACM are warranted at this time.

Note: Fire doors, present within the specific work areas, may contain asbestos-containing thermal insulation inside the door panel. Removal of any asbestos containing fire doors, in intake condition, will require Type 1 to abatement procedures, as outlined in O. Reg. 278/05 and dispose of as asbestos waste.

The presence of ACM should be presumed in locations not accessed during this survey. It is possible that ACM is present at the Site that is not identified in this report. Should additional suspected ACM be discovered, it should be presumed as ACM until sample analysis determines asbestos content.

Due to the limited nature of the current scope of work and the presence of solid building finishes (i.e., plaster or drywall walls and ceilings etc.) in many locations, the full extent of ACM may not be confirmed. Precautions should be taken when dismantling solid wall or ceiling finishes, or any other building surfaces which may conceal potential ACM. Such precautions include, but are not limited to, isolation measures and appropriate personal protective equipment.

6.4. Benzene

Benzene would not be expected to be present at the Site and was not observed during the current survey. No recommendations for Benzene are warranted at this time.

6.5. Coke Oven Emissions

Coke oven emissions would not be expected to be present at the Site and were not observed during the survey. No recommendations for coke oven emissions are warranted at this time.

6.6. Ethylene Oxides

Ethylene oxides would not be expected to be present at the Site and were not observed during the current survey. No recommendations for ethylene oxides are warranted at this time.

6.7. Isocyanates

Isocyanates would not be expected to be present at the Site and were not observed during the current survey. No recommendations for isocyanates are warranted at this time.



6.8. Lead

6.8.1. General Information

Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. Most lead in the environment comes from human activities such as burning fossil fuels, mining and manufacturing. Lead is used in the production of batteries, ammunition, metal products (solder and pipes) and X-ray devices.

Lead does not break down but lead compounds are changed by sunlight, air and water. Exposure occurs when eating food or drinking water that contains lead. Deteriorated lead paint can contribute to lead dust. The main target for lead toxicity is the nervous system.

6.8.2. Regulations and Guidelines

The Ontario MOL has not prescribed criteria defining an analyzed sample of bulk material as "lead-containing". Further, the MOL has not established a lower limit for concentrations of lead in paint, below which precautions do not need to be considered during construction projects. However, except for very aggressive disturbance of painted finishes, (e.g., abrasive blasting, torch cutting, or grinding), Fisher believes that a lead content below 0.1% by weight (1,000 ug/g or 1000 ppm) represents a concentration in which the lead content is not the limiting hazard for construction hygiene purposes. Regular construction dust suppression techniques and worker hygiene practices are sufficient for disturbance of paint finishes determined to contain less than 0.1% lead by weight, provided that work is limited to non-aggressive operations.

The regulation for the designated substance lead applies to every employer and worker at a workplace where lead is present, produced, processed, used, handled or stored and at which a worker is likely to be exposed to lead. Exposure limits for this substance are set at 0.05 – 0.10 mg/m³ (TWA) depending on the type of lead, and for tetraethyl lead 0.30 mg/m³ (STEL).

Additionally, in 2011 the MOL revised *Guideline: Lead on Construction Projects* outlining practices that should be followed during construction projects to protect workers from exposure to lead. This includes the methods and equipment employed in the removal of lead-containing coatings that reduce the creation of dust, providing appropriate facilities for workers to wash after each shift, and providing protective clothing and respirators where necessary.

6.8.3. Findings

Based on the age of the building, it is possible that lead-based paint and lead plumbing are present within the building. Lead can also be present in various ceramic tiles. During the current investigation, no samples were collected for lead analysis.



6.8.4. Recommendations

Where any lead-containing materials may be disturbed or removed, Fisher recommends that appropriate lead abatement procedures be used. The lead abatement procedures to be used are determined by the method(s) of disturbance employed. Regular construction dust suppression techniques and worker hygiene practices are sufficient for disturbance of paint finishes determined to contain less than 0.1% lead by weight, provided that work is limited to non-aggressive operations. The table below outlines lead abatement operations and associated respirator required, as outlined in Ontario MOL guidelines.

Classifications of Lead-Containing Operations and Required Respirator

Type 1 Operations (where concentrations of airborne lead would be expected to be < 0.05 mg/m ³)	
Activities that include; <ul style="list-style-type: none"> Removal of lead containing coatings with chemical gel or paste and fibrous laminated cloth wrap Removal of lead containing coatings / materials using power tool that has an effective dust collection system equipped with HEPA filter Removal of lead containing coatings / materials using non-powered hand tools other than manual scraping or sanding 	Respirators should not be necessary if general procedures are followed and level of air is less than 0.05 mg/m ³ . However, if worker wishes to use a respirator, a half-mask particulate respirator with N-, R- or P- series filter, and 95, 99 or 100% efficiency should be provided.
Type 2a Operations (where concentrations of airborne lead would be expected to be > 0.05 to 0.50 mg/m ³)	
Activities that include; <ul style="list-style-type: none"> Removal of lead containing coatings / materials by scraping or sanding using non-powered hand tools Manual demolition of lead painted plaster walls / building components by striking with a sledgehammer or similar tool 	NIOSH APF = 10 Half-mask particulate respirator with N-, R- or P- series filter, and 95, 99 or 100% efficiency.
Type 2b Operations (where concentrations of airborne lead would be expected to be > 0.50 to 1.25 mg/m ³)	
Not applicable to potential renovation activities.	
Type 3a Operations (where concentrations of airborne lead would be expected to be > 1.25 to 2.50 mg/m ³)	
Activities that include; <ul style="list-style-type: none"> Welding or high temperature cutting of lead-containing coatings or materials indoors or in a confined space. Dry removal of lead-containing mortar using an electronic or pneumatic cutting device. Burning of a surface containing lead Removal of lead containing coatings / materials using power tools without an effective dust collection system equipped with HEPA filter 	NIOSH APF = 50 Full-face piece air-purifying respirator with N-, R- or P- series filter and 100% efficiency. Tight-fitting powered air-purifying respirator with high efficiency filter. Full-face piece supplied-air respirator operated in demand mode. Half-mask or full-face piece supplied air respirator operated in continuous-flow mode.
Type 3b Operations (where concentrations of airborne lead would be expected to be > 2.50 mg/m ³)	
Abrasive blasting of lead-containing coatings or materials.	NIOSH APF >=1000 Type CE abrasive-blast supplied respirator operated in a positive pressure mode with a tight-fitting half-mask face piece.

Refer to MOL *Guideline: Lead on Construction Projects, 2011*, for details of the Ministry's health and safety guidelines regarding lead.



6.9. Mercury

6.9.1. General Information

Mercury is a naturally occurring metal. It is a shiny, silver-white and odourless liquid. It combines with other elements to form inorganic compounds or salts. Metallic mercury is used to produce chlorine gas and caustic soda, and is used in thermostats and thermometers, fluorescent light bulbs, dental fillings and batteries. Exposure occurs when eating fish or shellfish contaminated with methyl mercury, breathing vapors from spills, incinerators, etc.

The nervous system is very sensitive to all forms of mercury. Exposure to high levels of metallic inorganic or organic mercury can permanently damage the brain, kidneys and developing fetus. Short-term exposure may cause lung damage, nausea, vomiting and diarrhea as well as skin and eye irritation.

6.9.2. Regulations

The regulation for mercury applies to every employer and worker at a workplace where mercury is present, produced, processed, used, handled or stored and at which a worker is likely to be exposed to mercury. Exposure limits for this substance are set at 0.025 – 0.01 mg/m³ (TWA) for all forms of mercury excluding alkyl, and for alkyl compounds of mercury 0.03 mg/m³ (STEL).

6.9.3. Findings

Mercury is presumed to be present in fluorescent light tubes and thermostatic controls. With the exception of fluorescent light bulbs and building thermostats, no other evidence of mercury was noted during the current survey.

6.9.4. Recommendations

Prior to the planned renovation work, Fisher recommends that any presumed mercury-containing fluorescent light tubes and thermostats that will be impacted are to be removed and disposed of in accordance with O. Reg. 558/00.

6.10. Silica

6.10.1. General Information

Silica is a crystalline compound occurring abundantly as quartz, sand, and many other minerals, and used to manufacture a variety of materials, especially glass and concrete. When mining this substance, silica can be deadly when it becomes airborne. If inhaled, silica dust can cause silicosis which can be fatal.

Some of the following industries have a high potential for risk to workers: construction (sandblasting, rock drilling, masonry work, jack hammering, tunneling), mining (cutting or drilling through sandstone or granite), foundry work (grinding, mouldings, shakeout, core room), stone cutting (sawing, abrasive blasting, chipping, grinding), manufacturing and use of abrasives, etc.



6.10.2. Regulations

The regulation for silica applies to every employer and worker at a workplace where silica is present, produced, processed, used, handled or stored and at which a worker is likely to be exposed to silica. Exposure limits for this substance are set at 0.05 - 0.10 mg/m³ (TWA), depending on the type of silica.

Additionally, in 2011 the MOL revised *Guideline: Silica on Construction Projects* outlining practices that should be followed during construction projects to protect workers' from exposure to silica. This includes the methods and equipment employed in the removal of silica-containing materials that reduce the creation of dust, providing appropriate facilities for workers to wash after each shift, and providing protective clothing and respirators where necessary.

6.10.3. Findings

No sampling for silica was conducted. However, as the building is constructed of concrete, brick and/or block walls with concrete floors, silica is expected to be found within these components of the buildings.

6.10.4. Recommendations

If these materials will be disturbed during the planned renovation work, appropriate precautions should be taken to protect workers from inhaling silica dusts and debris. Refer to MOL *Guideline: Silica on Construction Projects* for details.

6.11. Vinyl Chloride

Vinyl chloride would not be expected to be present at the Site and was not observed during the current survey. No recommendations for vinyl chloride are warranted at this time.

6.12. Mould

During the current survey, no visible mould or favourable conditions for mould growth were observed in the specified work area(s). No action is recommended with regard to mould.



7.0. LIMITATIONS

Fisher Environmental Ltd. accepts responsibility for the competent performance of its duties in executing this assignment within the normal standards of the profession, but disclaims responsibility for consequential damages, if any.

The scope of the survey is based on prior agreement with the client, and the rationale given in this report. The survey findings rely on professional interpretation of selective sampling and analysis. Sample analysis results have been applied to homogenous materials in unsampled locations; it was not within the scope of work to carry out an exhaustive sampling and analysis program. For non-accessible building spaces, the likelihood of the presence or absence of asbestos and other designated substances has been described, but such assessment is not a definitive statement of presence or absence.

This report was prepared for the IBI Group. The scope of services performed may not be appropriate for the purposes of other users, and any use or reuse of this document or its findings or recommendations represented herein is at the sole risk of any other user.

We trust that the information provided in the report meets your current requirements. If you have any questions or concerns, please do not hesitate to contact the undersigned.

Respectfully submitted,



A circular professional engineer stamp from the Province of Ontario. The outer ring contains the text "LICENSED PROFESSIONAL ENGINEER" at the top and "PROVINCE OF ONTARIO" at the bottom. The center of the stamp contains the name "D. A. FISHER". A handwritten signature in blue ink is written over the stamp.

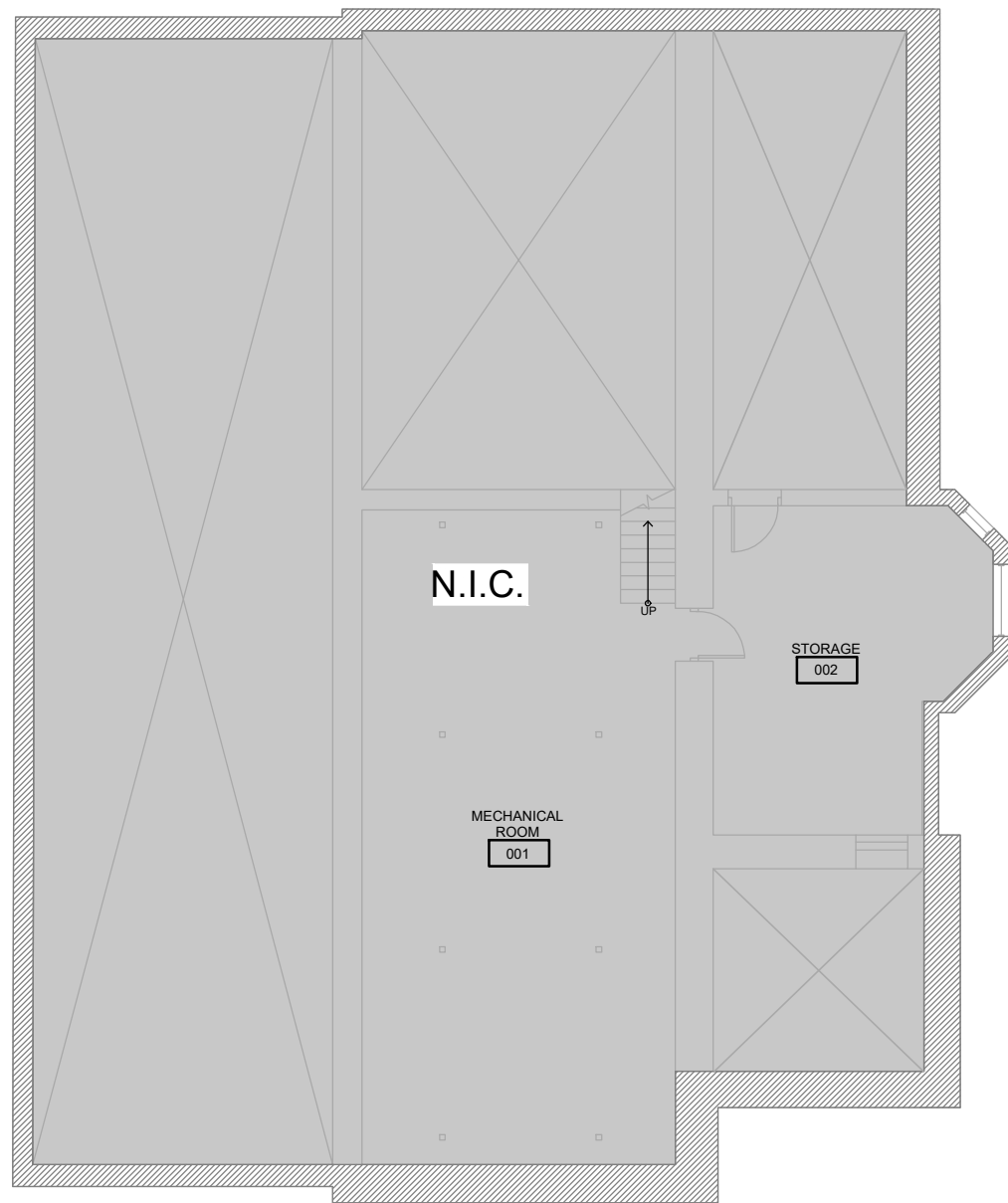
Renata Stec, M.Sc.
Project Manager

David Fisher, P. Eng., C. Chem.
Principal

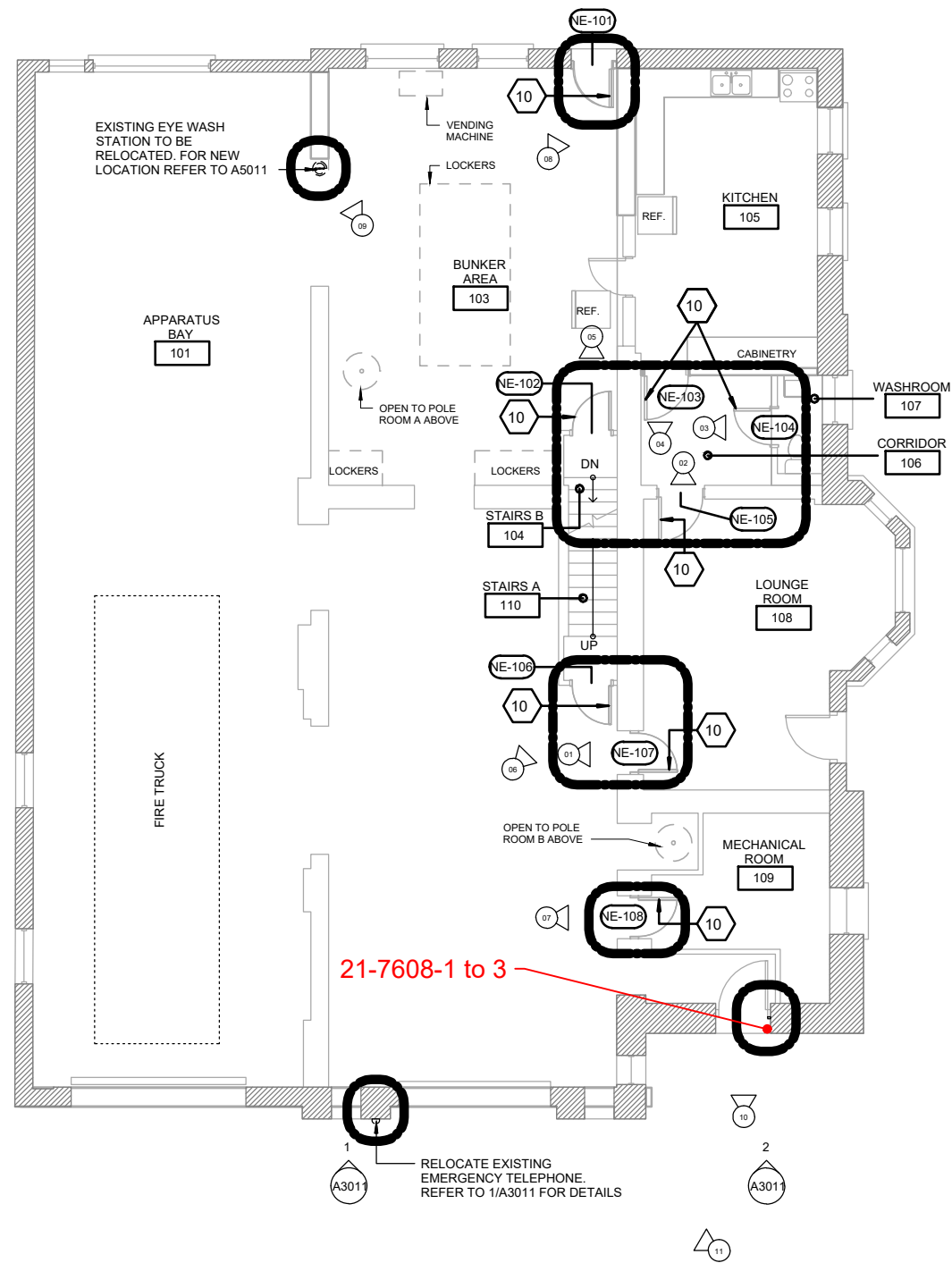


APPENDIX A – SITE PLAN(S)





BASEMENT PLAN



FIRST FLOOR PLAN



Legend



Area of Work



Asbestos Sample Location

Figure 1

LOCATION:

1904 Queen Street East
Toronto, Ontario

BUILDING NAME:

Fire Hall NO. 227

Basement and First Floor Plan
Pre-Reno DSS
Asbestos Sample Locations

CLIENT:

IBI Group

PROJECT NUMBER: FE-P 21-11706

DATE: November 2021

DRW BY: ZA

CAD FILE: FIG1

SCALE: Not to Scale

CHK BY: RS



400 Esna Park Dr., #15
Markham, Ontario
L3R 3K2

Tel: 905 475-7755
Fax: 905 475-7718



Legend



Area of Work

Figure 2

LOCATION:
1904 Queen Street East
Toronto, Ontario

BUILDING NAME:
Fire Hall NO. 227

Second and Third Floor Plan
Pre-Reno DSS

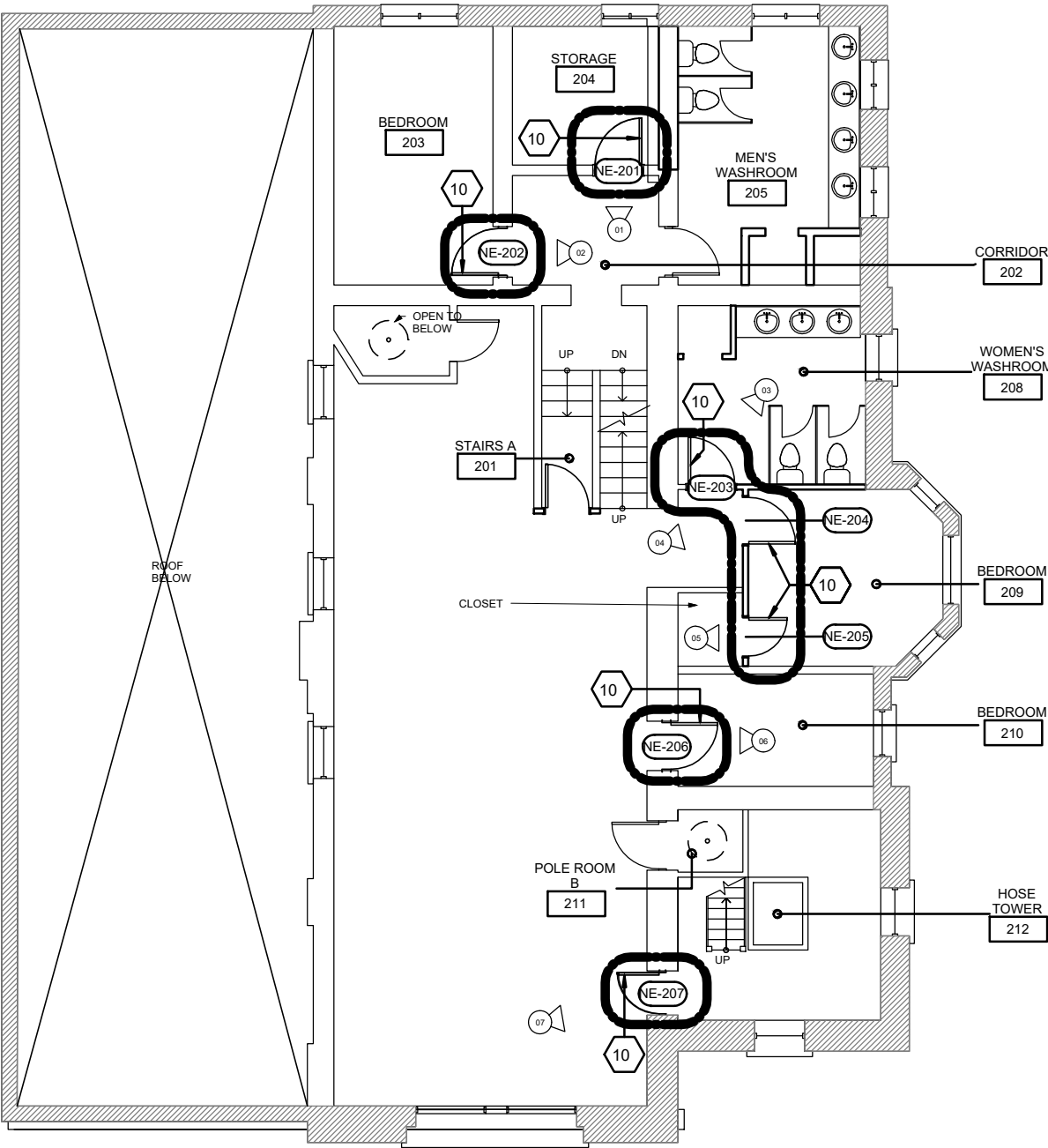
CLIENT:
IBI Group

PROJECT NUMBER:	FE-P 21-11706	DATE:	November 2021	DRW BY:	ZA
CAD FILE:	FIG2	SCALE:	Not to Scale	CHK BY:	RS

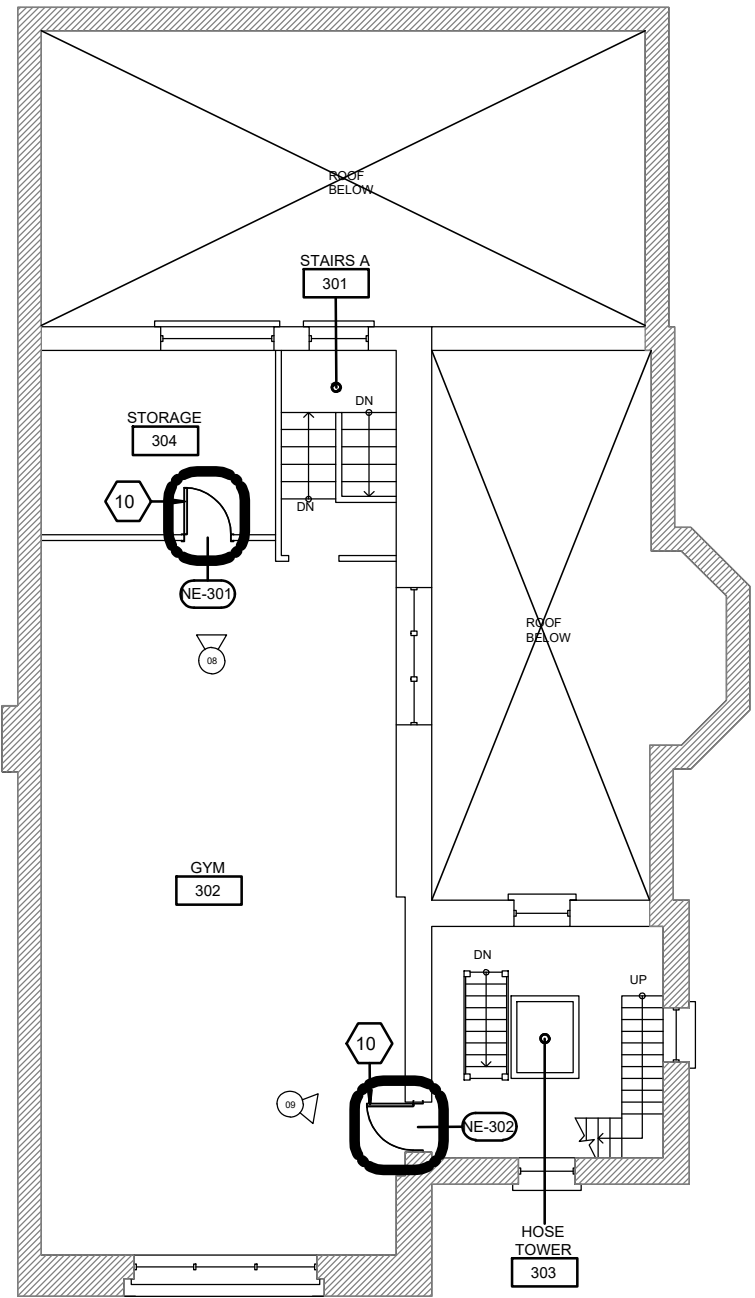


400 Esna Park Dr., #15
Markham, Ontario
L3R 3K2

Tel: 905 475-7755
Fax: 905 475-7718



SECOND FLOOR PLAN



THIRD FLOOR PLAN

APPENDIX B – CERTIFICATE(S) OF ANALYSIS





FISHER ENVIRONMENTAL LABORATORIES

FULL RANGE ANALYTICAL SERVICES • SOIL/WATER/AIR TESTING • ENVIRONMENTAL
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MARKHAM, ONT. L3R 3K2
TEL: 905 475-7755
FAX: 905 475-7718
www.fisherenvironmental.com

Client: IBI Group
Address: 100-175 Galaxy Blvd.
Toronto, ON
M9W 0C9
Tel.: 416-679-1930
E-mail:
Attn: Luisa Sosa

F.E. Job #: 21-7608
Project Name: Pre-Reno DSS
Project ID: FE-P 21-11706
Date Sampled: 18-Nov-2021
Date Received: 24-Nov-2021
Date Reported: 30-Nov-2021
Location: 1904 Queen Street East
Toronto, ON

Certificate of Analysis

Analysis Requested:	Asbestos, Lead
Sample Description:	3 Bulk Sample(s)

Client Sample ID	Lab Sample ID	Sample Matrix	Fibre Type	Asbestos Content
01A - Mortar on Brick, Exterior	21-7608-1	Mortar		Not Detected
01B - Mortar on Brick, Exterior	21-7608-2	Mortar		Not Detected
01C - Mortar on Brick, Exterior	21-7608-3	Mortar		Not Detected

Fisher Environmental Laboratories (Lab ID #: 2745) is accredited by CALA (Canadian Association for Laboratory Accreditation Inc.) for asbestos analysis by PLM.

ANALYTICAL METHOD:

Asbestos has been done in accordance with normal professional standard using the following Fisher Environmental Lab Method: Asbestos by PLM (Polarized Light Microscope) F-26, Rev.2.2.

Authorized by:



Roger Lin, Ph. D., C. Chem.
Laboratory Manager



APPENDIX C – PREVIOUS DSS REPORT





FINAL **Designated Substances** **Survey Report**

Toronto Fire Services Station 227
1904 Queen Street East, Toronto,
Ontario

Prepared for:

The City of Toronto
Facilities Management
55 John Street, 2nd Floor
Toronto, Ontario, M5V 3C6

Attention: Sara Reid
Environmental Project Manager

December 29, 2017

Pinchin File: 202781



Issued to: The City of Toronto
Contact: Sara Reid
Environmental Project Manager
Issued on: December 29, 2017
Pinchin file: 202781
Issuing Office: 50 Wellington Street East, Suite 200,
Toronto, ON M5E 1C8
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EXECUTIVE SUMMARY

The City of Toronto (Client) retained Pinchin Ltd. (Pinchin) to conduct a Designated Substance survey of Toronto Fire Services Station 227, located at 1904 Queen Street East, Toronto, Ontario. The survey was performed on September 20, 2017.

The objective of the survey was to document any changes in condition and quantity of specified Designated Substances, polychlorinated biphenyls (PCBs) and mould identified in the previous Designated Substances Survey (Fisher Environmental Ltd., Project Number FE-P 16-7715), and develop corrective action plans as required. The results of this survey are not intended for construction, renovation, demolition or project tendering purposes.

The assessed area consisted of the entire building. The building was occupied at the time of the survey.

SUMMARY OF FINDINGS

Asbestos: Asbestos-containing materials (ACM) were assumed to be present as follows:

- Roofing materials.

Lead: Lead was confirmed present in select paints. Lead may be present in emergency lighting.

Silica: Crystalline silica is present in concrete, mortar, brick and ceramics.

Mercury: Mercury vapour is present in fluorescent lamps.

Polychlorinated Biphenyls (PCBs): PCB-containing materials were not confirmed.

Mould: Mould-impacted materials were not observed.

SUMMARY OF RECOMMENDATIONS

The following is a summary of significant recommendations; refer to the body of the report for detailed recommendations.

1. Perform a pre-construction survey and remove all ACM prior to alteration or maintenance work or if ACM may be disturbed by the work.
2. Remove and dispose of mercury-containing items when taken out of service.
3. Follow appropriate safe work procedures when handling or disturbing asbestos, lead, mercury and silica.

Please refer to Section 4.0 of this report for detailed recommendations regarding administrative actions.

This Executive Summary is subject to the same standard limitations as contained in the report and must be read in conjunction with the entire report.



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APPENDIX I	Drawings
APPENDIX II-A	Asbestos Analytical Certificates
APPENDIX II-B	Lead Analytical Certificates (No Information to Report)
APPENDIX II-C	PCB Analytical Certificates (No Information to Report)
APPENDIX III	Methodology
APPENDIX IV	Survey Form



1.0 INTRODUCTION AND SCOPE

The City of Toronto (Client) retained Pinchin Ltd. (Pinchin) to conduct a Designated Substances Survey of Toronto Fire Services Station 227, located at 1904 Queen Street East, Toronto, Ontario.

The survey was performed by Charlotte Spelt, B.A., on September 20, 2017. The surveyor was unaccompanied during the survey. The building was occupied at the time.

The objective of the survey was to document any changes in condition and quantity of specified Designated Substances, polychlorinated biphenyls (PCBs) and mould identified in the previous Designated Substances Survey (Fisher Environmental Ltd., Project Number FE-P 16-7715), and develop corrective action plans as required. This survey is only to be used for the purposes of long term management and routine maintenance. The results of this survey are not to be used for construction, renovation, demolition or project tendering purposes.

1.1 Scope of Survey

For the purpose of the survey and this report, hazardous building materials include the following Designated Substances:

- Asbestos
- Lead
- Silica
- Mercury

The survey also included:

- Polychlorinated Biphenyls (PCBs)
- Mould

The following Ontario Designated Substances are not typically found in building materials in a composition/state that is hazardous and were not included in this survey:

- Arsenic
- Acrylonitrile
- Benzene
- Coke oven emissions
- Ethylene oxide
- Isocyanates
- Vinyl chloride monomer



2.0 BACKGROUND INFORMATION

2.1 Building Description

Item	Details
Building Use	Toronto Fire Services station
Number of Floors/Levels	3 stories plus 1 below grade
Total Size of Building	Approximately 10,500 square feet
Year of Construction	1905
Structure	Concrete, brick, wood
Exterior Cladding	Brick
HVAC	Basement boiler and forced air
Flooring	Vinyl floor tile, ceramic, concrete, rubber, wood
Interior Walls	Drywall, plaster, brick, concrete, ceramic, wood
Ceilings	Plaster, wood, drywall, acoustic ceiling tile

2.2 Inaccessible Locations

The following rooms or areas of the building were not accessible to the surveyor and are therefore not included in the report:

Area or Room	Reason
Basement Crawlspace (Location B-03)	No access, unexcavated
Basement Crawlspace (Location B-04)	No access, unexcavated
Basement Crawlspace (Location B-05)	No access, unexcavated
Basement Crawlspace (Location B-06)	No access, unexcavated
Second Floor Storage (Location 2-08)	No access, blocked by tenant articles
Second Floor Storage (Location 2-10)	No access, blocked by tenant articles

3.0 FINDINGS

3.1 Asbestos

3.1.1 *Suspect Building Materials Not Found*

The following types of building materials may historically contain asbestos but were not observed in the building and are not discussed in the report findings:

- Texture finishes (acoustic/decorative)
- Asbestos cement products
- Vinyl sheet flooring

3.1.2 *Spray-Applied Fireproofing and Thermal Insulation*

Non-asbestos fireproofing is present on the structure throughout the Basement Mechanical Room (previous samples 11-31751, 11-31752 and 11-31753).



Photo 1: Non-asbestos fireproofing present on deck of Basement Mechanical Room (Location B-01).

3.1.3 *Thermal Systems Insulation (TSI)*

3.1.3.1 *Pipe Insulation*

All pipes observed are either uninsulated or insulated with fibreglass.

As per the previous report, asbestos-containing insulations were abated from pipes (straights and fittings) in 2010. Therefore, pipes insulated with friable asbestos insulations may be present in inaccessible spaces such as above solid ceilings, in chases, in column enclosures and within shafts.



Photo 2: Pipes insulated with fiberglass and jacketed in canvas in Basement Mechanical Room (Location B-01).

3.1.3.2 *Duct Insulation*

Ducts are either uninsulated or insulated with fiberglass and jacketed with foil.



Photo 3: Uninsulated duct in Ground Floor Bunker Room (Location 1-03).



Photo 4: Duct insulated with fiberglass and jacketed in foil in Ground Floor Apparatus Bay (Location 1-01).

3.1.3.3 *Mechanical Equipment Insulation*

Mechanical equipment is either uninsulated or insulated with fiberglass.



Photo 4: Boilers in Basement Mechanical Room (Location B-01).



Photo 5: Hot water tank in Basement Storage (Location B-02).

3.1.4 Acoustic Ceiling Tiles

One type of acoustic ceiling tile is present in the Ground Floor Lounge (Location 1-07) and the Second Floor Dormitory (Location 2-05). The white, 24" x 48", lay-in, tile with pinhole and fissure pattern (ACT03) does not contain asbestos (sample 2017-A0001A-C).



Photo 6: Non-asbestos ACT03.

3.1.5 Plaster

Plaster is present as a wall and ceiling finish at various locations in the building. Plaster was previously sampled and determined not to contain asbestos (samples 14-9572-01, 14-9572-02, 14-9572-03, 1238-B-65-08A-E, 12348-B-65-01A-C and 12348-B-65-09A-E).

3.1.6 Drywall Joint Compound

Drywall (gypsum board) and drywall joint compound is present as a wall and ceiling finish at various locations in the building. Ten samples of drywall joint compound were previously collected (samples 12348-B-65-06A-E and 12348-B-65-07A-E) and determined not to contain asbestos.

3.1.7 Vinyl Floor Tile

One type of vinyl floor tile is present in various locations throughout the Second Floor. The mauve, 12" x 12" tile with white and purple streaks (VFT06) was previously sampled and does not contain asbestos (samples 14-9572-04, 14-9572-05 and 14-9572-06).



Photo 7: Non-asbestos VFT06.

3.1.8 Sealants, Caulking, and Putty

Grey caulking at exterior windows was previously sampled and determined not to contain asbestos (samples 12666-01A-C). White caulking at exterior windows was previously sampled and determined not to contain asbestos (samples 12666-02A-C).

3.1.9 Assumed Asbestos Materials

A number of materials which might contain asbestos were not sampled during our survey due to limitations in scope and methodology. Where present, these materials must be assumed to be an asbestos material and are best sampled during project planning and preparation of contract documents for their removal. Materials assumed to contain asbestos include:

- Roofing, felts and tar
- Concrete floor levelling compound
- Electrical components or wiring within control centers, breakers, motors or lights, insulation on wiring
- Vermiculite in concrete block wall cavities
- Adhesives and duct mastics
- Fire resistant doors

3.2 Lead

3.2.1 Paints

No paint samples were collected from the assessed area during this survey to avoid causing visible damage to painted finishes.

Three paint chip samples were previously collected from interior painted finishes. The following table summarizes the sample analytical results and the sampling locations.

Sample Number	Colour, Substrate Description	Locations	Lead (%)
16-4103-01	Off-white	Basement Mechanical Room (Location B-01)	0.477
16-4103-02	Cream	Basement Mechanical Room (Location B-01)	<0.001
14-9572-07	White	Basement Storage (Location B-02)	0.0564

All paints containing levels of lead above the City of Toronto action limit of 0.1% were found to be in good condition and not flaking, peeling or delaminating.

3.2.2 Lead Products and Applications

Lead-containing batteries may present in emergency lighting.

3.3 Silica

Crystalline silica is assumed component of the following building materials where present in the building:

- Poured or pre-cast concrete
- Masonry and mortar
- Ceramic tiles, grout
- Plaster

3.4 Mercury

3.4.1 Lamps

Mercury vapour is present in fluorescent lamps.

3.4.2 Mercury-Containing Devices

Mercury-containing devices were not found during the survey.

3.5 Polychlorinated Biphenyls

3.5.1 Lighting Ballasts

Based on visual observations (evidence of T-8 fixtures) the building has been comprehensively re-lamped and will not contain PCB ballasts.

3.5.2 Transformers

Transformers were not found during the survey.

3.6 Mould

Visible mould growth was not found in the assessed area.



4.0 RECOMMENDATIONS

4.1 General

Perform a detailed intrusive survey prior to building renovation or demolition operations. The survey should include; destructive testing (i.e. coring and/or removal of building finishes and components), and sampling of materials not previously tested (i.e. roofing materials, caulking, mastics).

4.2 On-going Management and Maintenance

The following recommendations are made regarding on-going management and maintenance work involving the hazardous materials identified.

4.2.1 Asbestos

Perform an assessment of asbestos materials on an annual basis. The next assessment of ACM should be performed prior to December 2018 to remain in compliance.

Remove all asbestos-containing materials (ACM) prior to alteration or maintenance work or if ACM may be disturbed by the work. Follow appropriate asbestos precautions for the classification of work being performed.

Update the asbestos inventory report upon completion of any abatement and removal of asbestos-containing materials.

4.2.2 Lead

Disturbance of lead in paint and coatings (or other materials) during maintenance activities may result in over-exposure to lead dust or fumes. The need for work procedures, engineering controls and personal protective equipment will need to be assessed on a project-by-project basis and must comply with provincial standards or guidelines. Performing an exposure assessment during work that disturbs lead in paints and coatings may be able to alleviate the use of some of the precautions specified by these standards or guidelines.

Lead-containing items should be recycled when taken out of service.

4.2.3 Silica

Disturbance of silica-containing products during maintenance activities may result in excessive exposures to airborne silica, especially if performed indoors and dry. Cutting, grinding, drilling or demolition of materials containing silica should be completed only with proper respiratory protection and other worker safety precautions that comply with provincial standards or guidelines.



4.2.4 Mercury

Recycle and reclaim mercury from fluorescent light tubes when taken out of service. Do not break lamps. Light tubes are accepted free of charge at many local recycling depots.

5.0 LIMITATIONS

The work performed by Pinchin was conducted in accordance with the City of Toronto, Blanket Contract #47020968.

6.0 REFERENCES

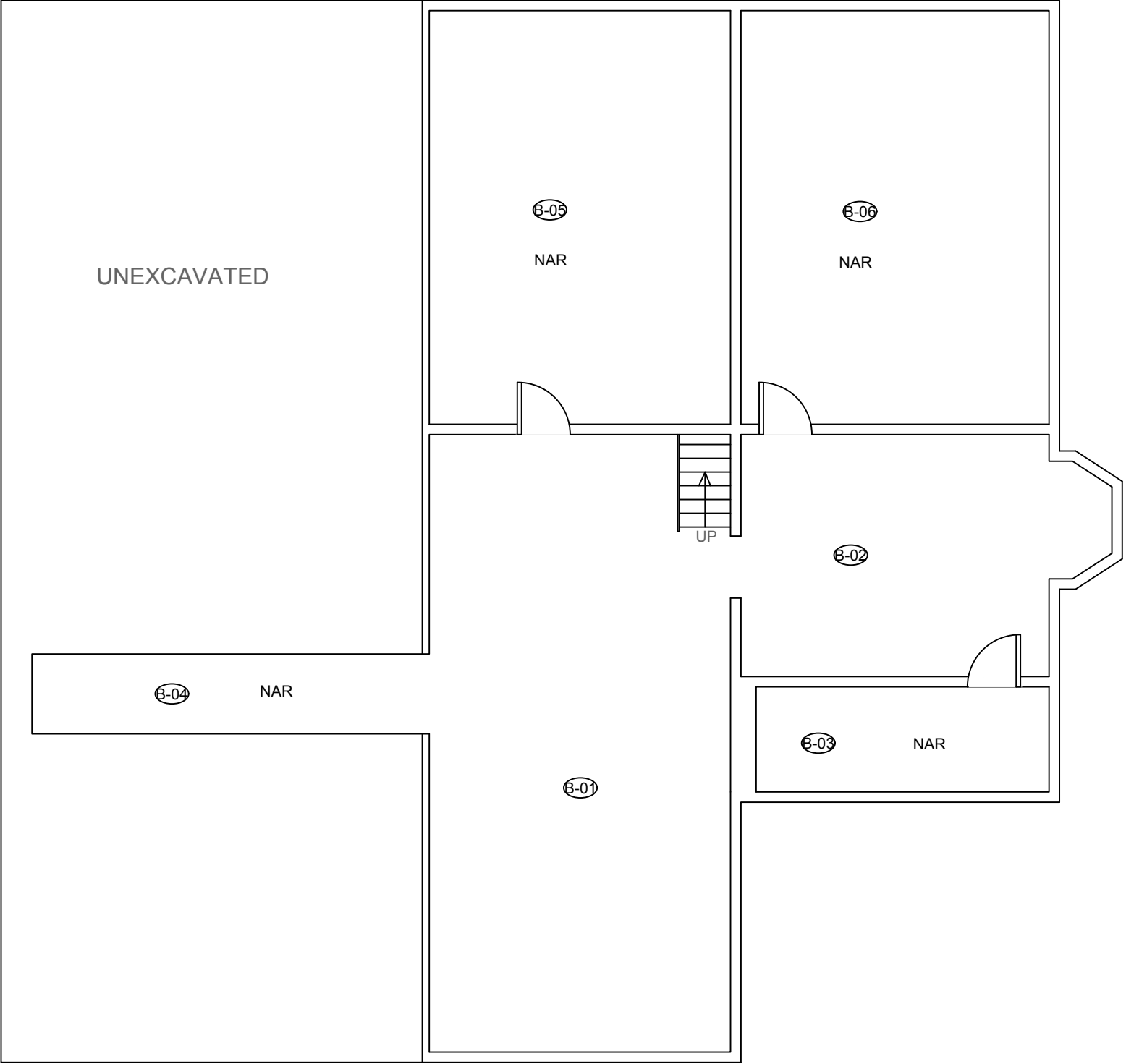
The following legislation and documents were referenced in completing the survey and this report:

1. Asbestos on Construction Projects and in Buildings and Repair Operations, Ontario Regulation 278/05.
2. Designated Substances, Ontario Regulation 490/09.
3. Lead on Construction Projects, Ministry of Labour Guidance Document.
4. Ministry of the Environment Regulation, R.R.O. 1990 Reg. 347 as amended.
5. Surface Coating Materials Regulations, SOR/2005-109, Hazardous Products Act.
6. Silica on Construction Projects, Ministry of Labour Guidance Document.
7. Alert – Mould in Workplace Buildings, Ontario Ministry of Labour.
8. Standard Operating Procedures for Designated Substance Surveys, dated April, 2014, City of Toronto, Facilities Management.

\\pinchin.com\miss\Job\202000s\0202781.000 CITYOFTORONTO\Fire_DSUB_ASSMT\Deliverables\Locations\1904 Queen St E\Deliverables\Final\202781_FINAL DSS_1904 Queen St E, Toronto_2017.docx

Template: Master Report City of Toronto, 2016 Designated Substance Survey, Haz, April 21, 2016

APPENDIX I
Drawings



LEGEND:

(X) PINCHIN LOCATION NUMBER

NAR NO ACCESS TO ROOM/AREA

◎ ASBESTOS BULK SAMPLE

NOT ALL KNOWN OR ASSUMED DESIGNATED SUBSTANCES ARE IDENTIFIED ON THE DRAWING. REFER TO THE DESIGNATED SUBSTANCE SURVEY REPORT FOR A COMPLETE LIST OF KNOWN AND SUSPECTED DESIGNATED SUBSTANCES.

LEGEND IS COLOUR DEPENDENT. NON-COLOUR COPIES MAY ALTER INTERPRETATION.

CLIENT:	
CITY OF TORONTO	
LOCATION:	
TORONTO FIRE STATION 227 1904 QUEEN STREET EAST TORONTO, ONTARIO	
TITLE:	
DESIGNATED SUBSTANCE SURVEY BASEMENT	
DATE:	PROJECT # :
2017/09/29	202781
DRAWN BY:	DRAWING:
VB	
CHECKED BY:	
CS	
SCALE:	
NTS	



LEGEND:

- (X) PINCHIN LOCATION NUMBER
- NAR NO ACCESS TO ROOM/AREA
- ◎ ASBESTOS BULK SAMPLE

NOT ALL KNOWN OR ASSUMED DESIGNATED SUBSTANCES ARE IDENTIFIED ON THE DRAWING. REFER TO THE DESIGNATED SUBSTANCE SURVEY REPORT FOR A COMPLETE LIST OF KNOWN AND SUSPECTED DESIGNATED SUBSTANCES.

LEGEND IS COLOUR DEPENDENT.
NON-COLOUR COPIES MAY ALTER INTERPRETATION.

CLIENT:

CITY OF TORONTO

LOCATION:

TORONTO FIRE STATION 227
1904 QUEEN STREET EAST
TORONTO, ONTARIO

TITLE:

DESIGNATED SUBSTANCE
SURVEY
GROUND FLOOR

DATE:

2017/09/29

PROJECT # :

202781

DRAWN BY:

VB

DRAWING:

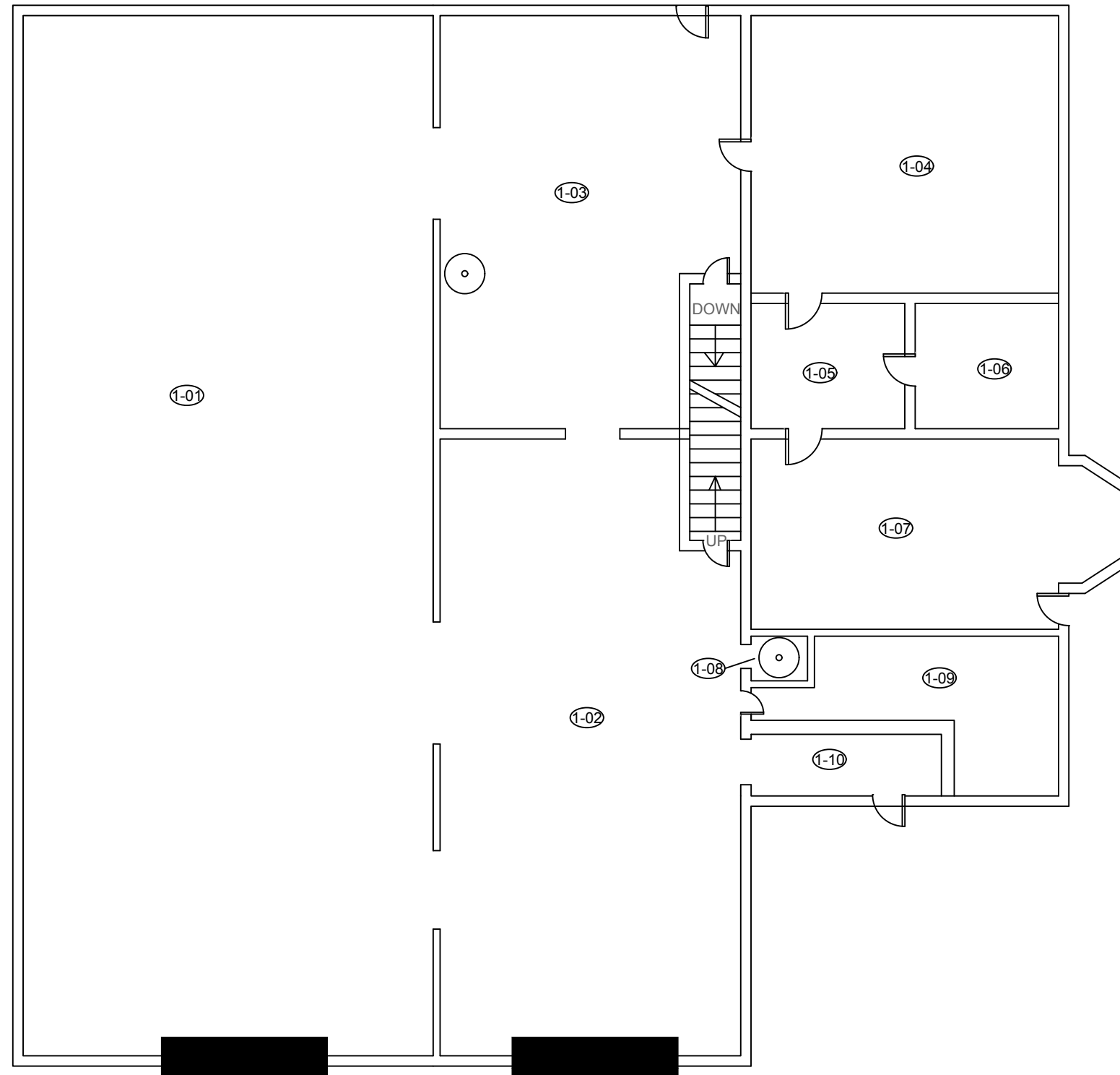
CHECKED BY:

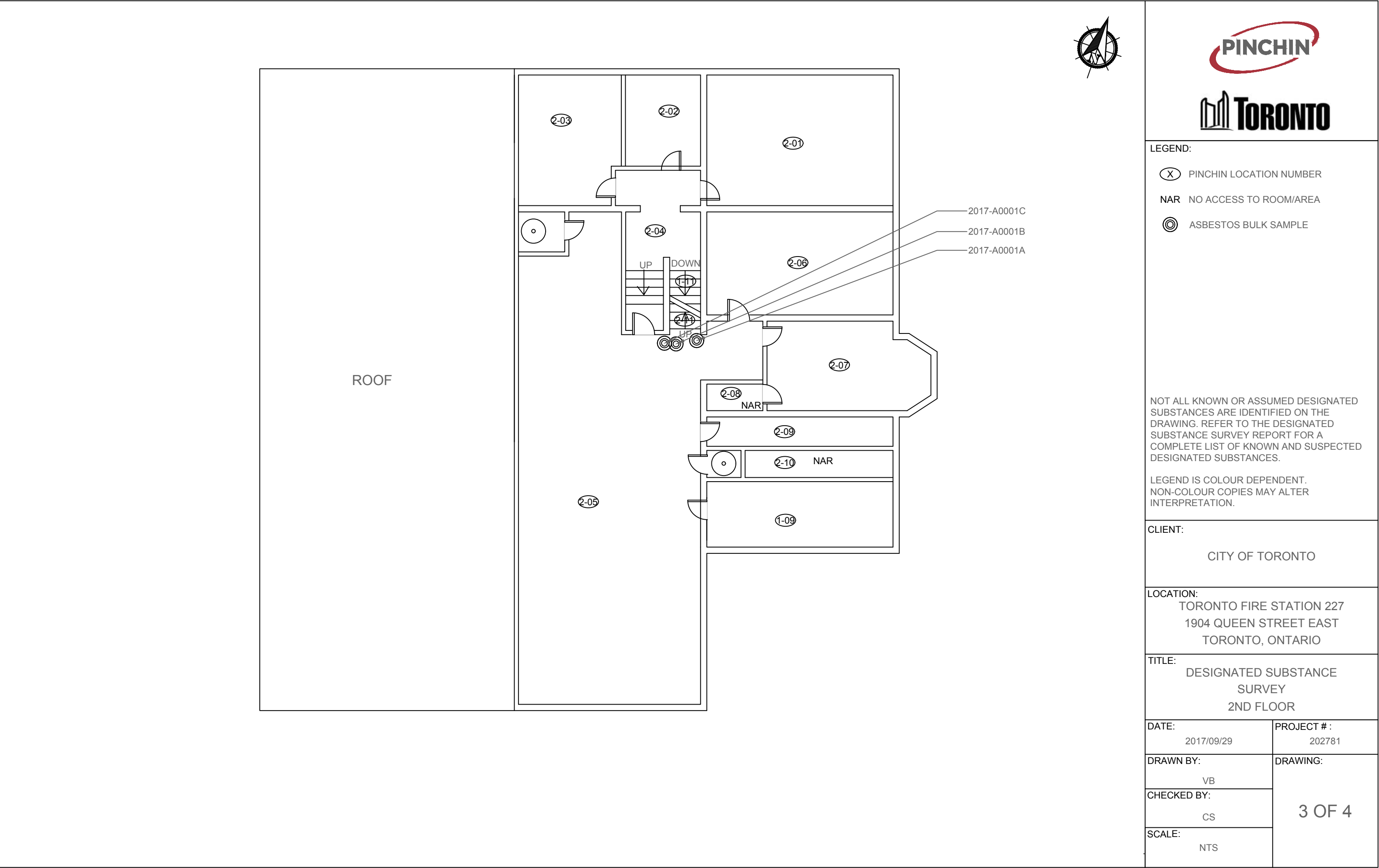
CS

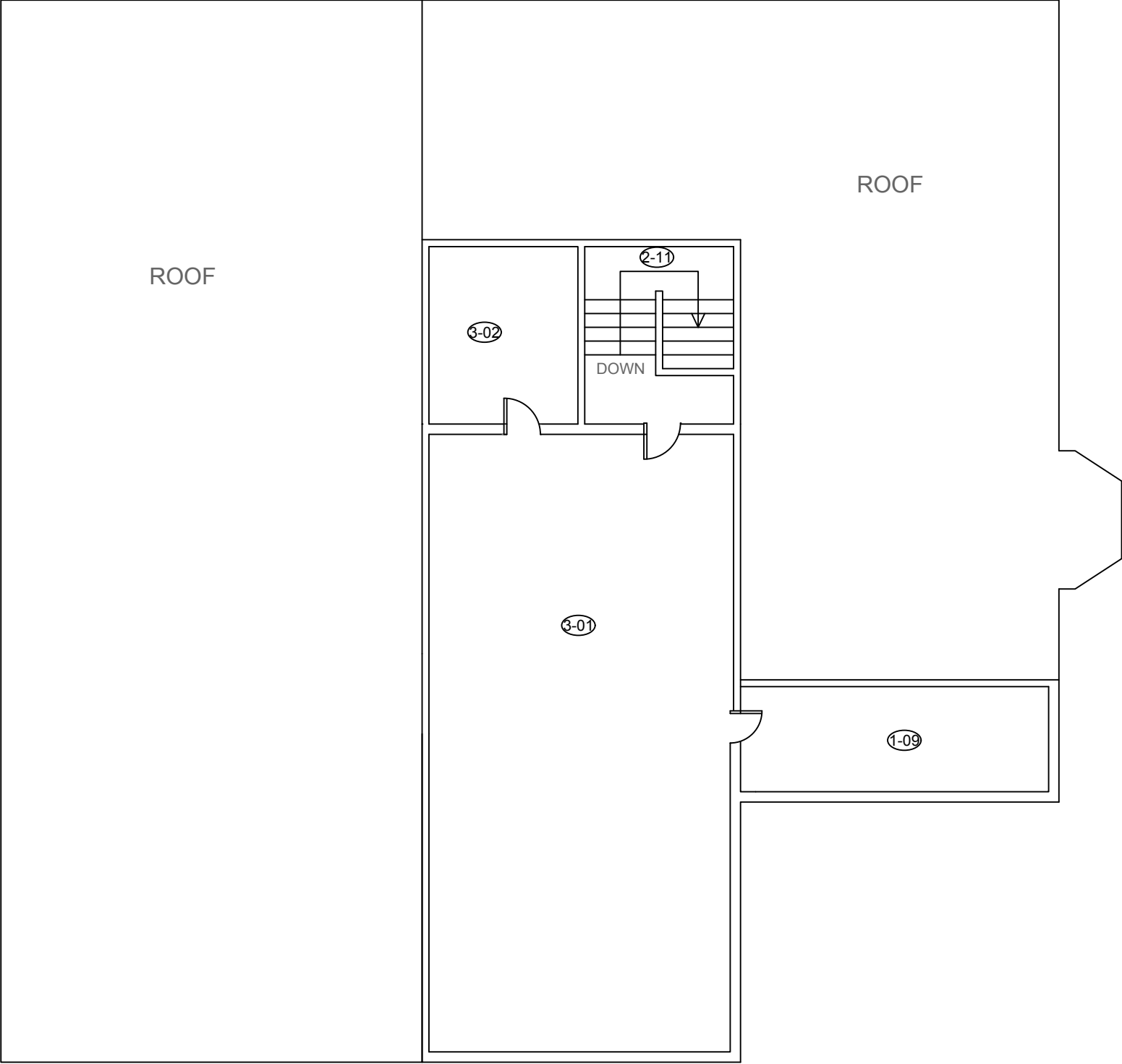
SCALE:

NTS

2 OF 4







LEGEND:

(X) PINCHIN LOCATION NUMBER

NAR NO ACCESS TO ROOM/AREA

(C) ASBESTOS BULK SAMPLE

NOT ALL KNOWN OR ASSUMED DESIGNATED SUBSTANCES ARE IDENTIFIED ON THE DRAWING. REFER TO THE DESIGNATED SUBSTANCE SURVEY REPORT FOR A COMPLETE LIST OF KNOWN AND SUSPECTED DESIGNATED SUBSTANCES.

LEGEND IS COLOUR DEPENDENT. NON-COLOUR COPIES MAY ALTER INTERPRETATION.

CLIENT:	
CITY OF TORONTO	
LOCATION:	
TORONTO FIRE STATION 227 1904 QUEEN STREET EAST TORONTO, ONTARIO	
TITLE:	
DESIGNATED SUBSTANCE SURVEY 3RD FLOOR	
DATE:	PROJECT # :
2017/09/29	202781
DRAWN BY:	DRAWING:
VB	
CHECKED BY:	
CS	4 OF 4
SCALE:	
NTS	

APPENDIX II-A
Asbestos Analytical Certificates



Pinchin Ltd. Asbestos Laboratory Certificate of Analysis

Project Name:	City of Toronto, 1904 Queen Street East, Toronto, Ontario		
Project No.:	0202781.000		
Prepared For:	C. Spelt / A. Quinn	Date Received:	October 27, 2017
Lab Reference No.:	b179389	Date Analyzed:	November 1, 2017
Analyst(s):	T. Ly	# Samples submitted:	3
		# Phases analyzed:	3

Method of Analysis:

EPA 600/R-93/116 - Method for the Determination of Asbestos in Bulk Building Materials dated July, 1993

Bulk samples are checked visually and scanned under a stereomicroscope. Slides are prepared and observed under a Polarized Light Microscope (PLM) at magnifications of 40X, 100X or 400X as appropriate. Asbestos fibres are identified by a combination of morphology, colour, refractive index, extinction, sign of elongation, birefringence and dispersion staining colours. A visual estimate is made of the percentage of asbestos present. A reported concentration of less than (<) the regulatory threshold (see chart below) indicates the presence of confirmed asbestos in trace quantities, limited to only a few fibres or fibre bundles in an entire sample. This method complies with provincial regulatory requirements where applicable. Multiple phases within a sample are analyzed and reported separately.

Provincial Jurisdiction	Regulatory Threshold	Provincial Jurisdiction	Regulatory Threshold
Ontario, British Columbia, Nova Scotia	0.5%	Manitoba	0.1% friable 1% non-friable
Quebec	0.1%	Saskatchewan	0.5% friable 1% non-friable
Alberta, NWT, Yukon, Nunavut	1%	Newfoundland and Labrador, PEI and New Brunswick	1%

All bulk samples submitted to this laboratory for asbestos analysis are retained for a minimum of three months. Samples may be retrieved, upon request, for re-examination at any time during that period.

Pinchin Ltd. is accredited by the National Institute of Standards and Technology, National Voluntary Laboratory Accreditation Program (NVLAP Lab Code 101270-0) for the 'EPA-600/M4-82-020: Interim Method for the Determination of Asbestos in Bulk Insulation Samples,' and the 'EPA 600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials'; and meets all requirements of ISO/IEC 17025:2005.

This report relates only to the items tested.

NOTE: This test report may not be reproduced, except in full, without the written approval of the laboratory. The client may not use this report to claim product endorsement by NVLAP or any agency of the U.S. Government. This report is valid only when signed in blue ink by the analyst. Vinyl asbestos floor tiles contain very fine fibres of asbestos and may be missed by some laboratories using the PLM method. Internal verification studies performed by Pinchin indicate that the chance of missing asbestos in floor tiles is no higher than about 2%. The vinyl tile study and laboratory documentation on measurement uncertainty is available upon request. The analysis of dust samples by PLM cannot be used as an indicator of past or present airborne asbestos fibre levels.



Pinchin Ltd. Asbestos Laboratory
Certificate of Analysis

Project Name: City of Toronto, 1904 Queen Street East, Toronto, Ontario
Project No.: 0202781.000
Prepared For: C. Spelt / A. Quinn


Lab Reference No.: b179389
Date Analyzed: November 1, 2017

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
2017-A0001A Acoustic ceiling tile (ACT03), lay-in, 24" x 48", Pinhole fissure, Second Floor Dormitory (Location 2-05)	Homogeneous, beige, compressed, acoustic ceiling tile.	None Detected	Cellulose > 75% Man-made Vitreous 5-10% Fibres Perlite 5-10% Other Non-Fibrous 0.5-5%
2017-A0001B Acoustic ceiling tile (ACT03), lay-in, 24" x 48", Pinhole fissure, Second Floor Dormitory (Location 2-05)	Homogeneous, beige, compressed, acoustic ceiling tile.	None Detected	Cellulose > 75% Man-made Vitreous 5-10% Fibres Perlite 5-10% Other Non-Fibrous 0.5-5%
2017-A0001C Acoustic ceiling tile (ACT03), lay-in, 24" x 48", Pinhole fissure, Second Floor Dormitory (Location 2-05)	Homogeneous, beige, compressed, acoustic ceiling tile.	None Detected	Cellulose > 75% Man-made Vitreous 5-10% Fibres Perlite 5-10% Other Non-Fibrous 0.5-5%

Reviewed by:

Reporting Analyst:


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by Julieth Oran
Date:
2017.11.02
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by Julieth Oran
Date:
2017.11.02
11:42:47 -04'00'

Analyzed by: RLReviewed by: KCReport Sent By: EL**Special Instructions:****Pinchin Ltd. - Asbestos Laboratory
Internal Asbestos Bulk Sample Chain of Custody**

Client Name:	City of Toronto	Project Address:	1904 Queen Street East, Toronto, Ontario
Portfolio/Building No:	N/A	Pinchin File:	202781
Submitted by:	Charlotte Spelt	Email:	cspelt@pinchin.com
CC Results to:	Andrew Quinn	CC Email:	aquinn@pinchin.com
Invoice to:	Andrew Quinn	Invoice Email:	aquinn@pinchin.com
Date Submitted:	November 26 2017	Required by:	November 2 2017
# of Samples:	3	Priority:	5 Day Turnaround
Year of Building Construction (Mandatory Field):	1905		
Do NOT Stop on Positive (Sample Numbers):			
Pinchin Group Company (Mandatory Field):	Pinchin		

To be Completed by Lab Personnel Only:

Lab Reference #:	b779389		Time:	24 hour clock		
Received by:	OCT 27 2017		Date:	Month	Day	Year
Name(s) of Analyst(s):	RL			11	01	17
Sample Prefix	Sample No.	Sample Suffix	Sample Description/Location (Mandatory)			
2017-A	0001	A	Acoustic ceiling tile (ACT03), lay-in, 24" x 48", Pinhole fissure, Second Floor Dormitory (Location 2-05) ND			
2017-A	0001	B	Acoustic ceiling tile (ACT03), lay-in, 24" x 48", Pinhole fissure, Second Floor Dormitory (Location 2-05) ND			
2017-A	0001	C	Acoustic ceiling tile (ACT03), lay-in, 24" x 48", Pinhole fissure, Second Floor Dormitory (Location 2-05) ND			

APPENDIX II-B
Lead Analytical Certificates
(No Information to Report)

APPENDIX II-C
PCB Analytical Certificates
(No Information to Report)

APPENDIX III
Methodology

1.0 GENERAL

The following survey methodology is based on the requirements of the *Standard Operation Procedure for Designated Substance Surveys*, dated April, 2014, provided by the City of Toronto (the “SOP”).

Pinchin conducted a room-by-room survey (rooms, corridors, service areas, exterior, etc.) to identify the hazardous building materials as defined in Section 1.1. Information regarding the approximate quantity, location, and condition of hazardous building materials encountered and visually estimated quantities were recorded on the *Survey Form*, provided by the City of Toronto, found in Appendix V. The locations of any samples collected were recorded on small-scale plans, found in Appendix I.

Drawings (i.e., floor plans), previous reports, and Survey Forms, were referenced where provided.

1.1 Limitations on Scope

The survey excludes the following:

- Owner or occupant articles (e.g. stored items, furniture, appliances, etc.);
- Underground materials or equipment (e.g. vessels, drums, underground storage tanks, pipes, etc.);
- Building envelope, structural components, inaccessible or concealed materials or other items where sampling may cause consequential damage to the property.
- Energized systems (e.g. internal boiler components, elevators, mechanical or electrical components);
- Controlled products (e.g. stored chemicals, operational or process-related substances); and
- Materials not typically associated with construction (e.g. settled dust, spills, residual contamination from prior spills, etc.).

The survey was limited to non-intrusive testing. Concealed spaces such as those above solid ceilings and within shafts and pipe chases were accessed via existing access panels only. Pinchin did not conduct demolition of walls, solid ceilings, structural items, interior finishes or exterior building finishes, to determine the presence of concealed materials.

1.2 Asbestos

Pinchin conducted an inspection for the presence of friable and non-friable asbestos-containing materials (ACM). A friable material is a material that when dry can be crumbled, pulverized or powdered by hand pressure.

Pinchin collected samples at a rate that is in compliance with Table 1 of O.Reg. 278/05. A separate set of samples was collected of each of homogenous material sampled. A homogenous material is defined by the US EPA¹ as material that is uniform in texture and appearance, was installed at one time, and is unlikely to consist of more than one type or formulation of material. The homogeneous materials are determined by visual examination, available information on the phases of the construction and prior renovations.

The following materials were sampled:

- All friable materials historically known to contain asbestos, regardless of year of installation, not identified in previous reports;
- Friable materials previously sampled in insufficient quantity to conclude the materials are non-asbestos, in accordance with the requirements of O.Reg. 278/05;
- Friable materials previously reported to contain less than 1% asbestos, if sampled prior to the Ministry of Labour defining an asbestos-containing material as a material containing contains 0.5 percent or more asbestos by weight;
- Non-friable acoustic ceiling tiles;
- Non-friable vinyl floor tiles and mastic.

The following materials were **not** sampled:

- Materials previously identified in previous reports provided as asbestos-containing;
- Materials previously confirmed to be non-asbestos in accordance with O.Reg. 278/05;
- Unless damaged the following materials were not sampled: plaster, drywall joint compound, mastic, window caulking, roofing materials, vinyl sheet flooring. Materials not sampled are assumed to contain asbestos.
- Materials where sampling poses an inherent, imminent danger to the Assessor such as high voltage wiring, materials present at heights greater than 12 feet, or those in confined spaces. These materials are assumed to be asbestos-containing.

In some cases, manufactured products such as asbestos cement pipe are visually identified without sample confirmation.

¹ Environmental Protection Agency

Pinchin submits the bulk samples to a NVLAP² accredited laboratory for analysis. The analysis is performed in accordance with Test Method EPA/600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials, July 1993.

The asbestos analysis is completed using a stop positive approach. Only one result of greater than the regulated criteria (0.5%) is required to determine that a material is asbestos-containing, but all samples must be analyzed to conclusively determine that a material is non-asbestos. The laboratory stops analyzing samples from a homogeneous material once a result greater than the regulated criteria is detected in any of the samples of that material. All samples of a homogeneous material are analyzed if no asbestos is detected. In some cases, all samples are analyzed in the sample set regardless of result. Where building materials are described in the report as non-asbestos, or described as containing no asbestos, this is subject to the limitations of the analytical method used, and should be understood to mean no asbestos was detected.

Asbestos materials are evaluated in order to make recommendations regarding remedial work. The priority for remedial action is based on several factors:

- Friability (friable or non-friable).
- Condition (good, fair, poor, debris, based on definitions in the SOP).
- Accessibility (ranking from accessible to all building users to inaccessible).
- Visibility (whether the material is obscured by other building components).
- Efficiency of the work (for example, if damaged ACM is being removed in an area, it may be most practical to remove all ACM in the area even if it is in good condition).

This includes friability, condition and efficiency and practicality of the work.

1.3 Lead

Pinchin collected samples of damaged paint not identified in a previous report. Drawings included show sample locations.

Analysis for lead in paints or surface coatings is performed in accordance with EPA Method No. 3050B/Method No. 7420; flame atomic absorption at an accredited laboratory.

For this report, all paints containing lead at a concentration 0.1% or greater are discussed. Paint was evaluated for condition.

Lead building products (e.g. batteries, lead sheeting, flashing) are identified by visual observation only.

² National Voluntary Laboratory Accreditation Program

1.4 Silica

Pinchin identifies building materials suspected of containing crystalline silica (e.g. concrete, cement, tile, brick, masonry, mortar) by knowledge of current and historic applications and visual inspection only.

Pinchin does not perform sampling of these materials for laboratory analysis of crystalline silica content.

1.5 Mercury

Building materials/products/equipment (e.g. thermostats, barometers, pressure gauges, light tubes), suspected to contain mercury were identified by visual inspection only. Dismantling of equipment suspected of containing mercury was not performed. Sampling of these materials for laboratory analysis of mercury content was not performed.

Mercury spills or damaged mercury-containing equipment was recorded where observed.

1.6 Polychlorinated Biphenyls

Pinchin determines the potential for light ballast and wet transformers to contain PCBs based on the age of the building, a review of maintenance records and examination of labels or nameplates on equipment, where present and accessible. The information is compared to known ban dates of PCBs and Environment Canada publications.

Dry type transformers are assumed to be free of dielectric fluids and hence non-PCB.

Pinchin records spills or leakage of suspect PCB-containing fluids where observed.

Fluids (mineral oil, hydraulic or Askaral) in transformers or other equipment are not sampled for PCB content.

Non-liquid forms of PCBs (i.e. sealants or caulking) are not sampled for PCB content.

1.7 Visible Mould

Pinchin identifies the presence of mould if visibly present in a significant quantity on exposed building surfaces. If any mould growth is concealed within wall cavities it is not addressed in this survey.

APPENDIX IV
Survey Form

APPENDIX IV - SURVEY FORM

Building Address:	1904 Queen Street East	Date(s) of Current Reassessment:	September 20, 2017
Building Name:	Toronto Fire Station 227	Organization Completing Reassessment:	Pinchin Ltd.
Original Survey Conducted By:	ECOH Management Inc.	Name of Surveyor:	C.Spelt
Date(s) of Original Survey:	August 20, 2007		

NOTES:

Asbestos was abated from some roofing materials in 2009 (per inspection report dated 2009);
 Asbestos containing parging cement pipe insulation was abated from the Basement Mechanical Room (Location B-01) & Storage room (Location B-02) (per inspection report dated 2010);
 Asbestos containing Aircell pipe insulation was abated from the Basement Mechanical Room (Location B-01) & Storage room (Location B-02) (per inspection report dated 2010);
 Asbestos containing VFT02 was not observed in the Ground Floor Stairwell (Location 1-11) & Second Floor Bedroom (Location 2-03) during the 2016 or 2017 survey;
 Asbestos containing VFT03 (Non-ACM mastic) was not observed in the Ground Floor Pole Hole (Location 1-08), Second Floor Housekeeping (Location 2-02) & Dormitory (Location 2-05) during the 2016 or 2017 survey;
 Asbestos containing VFT04 (ACM mastic) was not observed in the Second Floor Bedrooms (Location 2-07 & 2-08) during the 2016 or 2017 survey;
 Asbestos containing VFT05 (Non-ACM mastic) was not observed in the Second Stairwell (Location 2-11) during the 2016 or 2017 survey.

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 Material	Asbestos	Not Sampled	ACM Assumed	4600 SF	Good	
0-00	Exterior	Windows	Window Caulking**	Asbestos	12666-01a* 12666-01b* 12666-01c*	None Detected	N/A	N/A	**Grey *From Asbestos & Lead Sampling Analysis Report, dated 2009
0-00	Exterior	Windows	Window Caulking**	Asbestos	12666-02a* 12666-02b* 12666-02c*	None Detected	N/A	N/A	**White *From Asbestos & Lead Sampling Analysis Report, dated 2009
0-00	Exterior	Walls	Brick	N/A	N/A	N/A	N/A	N/A	
B-01	Mechanical Room	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
B-01	Mechanical Room	Walls	Brick	N/A	N/A	N/A	N/A	N/A	
B-01	Mechanical Room	Walls	Paint	Lead	16-4103-01*	0.477%	500 SF	Good	Off-white paint *From Fisher Project No. 16-7706, dated June 2016.
B-01	Mechanical Room	Ceiling	Sprayed Fireproofing	Asbestos	11-3175-1* 11-3175-2* 11-3175-3*	None Detected	N/A	N/A	*Sampled during 2011 Survey
B-01	Mechanical Room	Ceiling	Paint	Lead	16-4103-02*	<0.001%	N/A	N/A	Cream paint *From Fisher Project No. 16-7706, dated June 2016.
B-01	Mechanical Room	Pipes	Uninsulated	N/A	N/A	N/A	N/A	N/A	
B-01	Mechanical Room	Pipes	Fibreglass	N/A	N/A	N/A	N/A	N/A	

APPENDIX IV - SURVEY FORM

<i>Location Number</i>	<i>Location Name</i>	<i>Building System</i>	<i>Material Observed</i>	<i>Potential Hazardous Material</i>	<i>Sample ID</i>	<i>Analytical Result</i>	<i>Quantity</i>	<i>Condition</i>	<i>Notes / Recommended Actions</i>
B-01	Mechanical Room	Duct	Uninsulated	N/A	N/A	N/A	N/A	N/A	
B-01	Mechanical Room	Mechanical	Uninsulated	N/A	N/A	N/A	N/A	N/A	Two boilers
B-02	Storage	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
B-02	Storage	Walls	Brick	N/A	N/A	N/A	N/A	N/A	
B-02	Storage	Ceiling	Plaster	Asbestos	14-9572-01,02,03*	None Detected	N/A	N/A	* From Survey Report 2014
B-02	Storage	Ceiling	Paint	Lead	14-9572-07*	0.0564%	N/A	N/A	White paint * From Survey Report 2014
B-02	Storage	Pipes	Uninsulated	N/A	N/A	N/A	N/A	N/A	
B-02	Storage	Pipes	Fibreglass	N/A	N/A	N/A	N/A	N/A	
B-02	Storage	Duct	Uninsulated	N/A	N/A	N/A	N/A	N/A	
B-02	Storage	Mechanical	Fibreglass	N/A	N/A	N/A	N/A	N/A	
B-03	Crawlspace	Floor	Soil	N/A	N/A	N/A	N/A	N/A	*NO ACCESS TO ROOM*
B-03	Crawlspace	Walls	Brick	N/A	N/A	N/A	N/A	N/A	*NO ACCESS TO ROOM*
B-03	Crawlspace	Ceiling	Wood	N/A	N/A	N/A	N/A	N/A	*NO ACCESS TO ROOM*
B-04	Crawlspace	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	*NO ACCESS TO ROOM*
B-04	Crawlspace	Walls	Concrete	N/A	N/A	N/A	N/A	N/A	*NO ACCESS TO ROOM*
B-04	Crawlspace	Ceiling	Concrete	N/A	N/A	N/A	N/A	N/A	*NO ACCESS TO ROOM*
B-05	Crawlspace	Floor	Soil	N/A	N/A	N/A	N/A	N/A	*NO ACCESS TO ROOM*
B-05	Crawlspace	Walls	Brick	N/A	N/A	N/A	N/A	N/A	*NO ACCESS TO ROOM*
B-05	Crawlspace	Ceiling	Wood	N/A	N/A	N/A	N/A	N/A	*NO ACCESS TO ROOM*
B-06	Crawlspace	Floor	Soil	N/A	N/A	N/A	N/A	N/A	*NO ACCESS TO ROOM*
B-06	Crawlspace	Walls	Brick	N/A	N/A	N/A	N/A	N/A	*NO ACCESS TO ROOM*

APPENDIX IV - SURVEY FORM

<i>Location Number</i>	<i>Location Name</i>	<i>Building System</i>	<i>Material Observed</i>	<i>Potential Hazardous Material</i>	<i>Sample ID</i>	<i>Analytical Result</i>	<i>Quantity</i>	<i>Condition</i>	<i>Notes / Recommended Actions</i>
B-06	Crawlspace	Ceiling	Wood	N/A	N/A	N/A	N/A	N/A	*NO ACCESS TO ROOM*
1-01	Apparatus Bay	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-01	Apparatus Bay	Walls	Ceramic	N/A	N/A	N/A	N/A	N/A	
1-01	Apparatus Bay	Walls	Plaster	Asbestos	12348-B-65-08	None Detected	N/A	N/A	
1-01	Apparatus Bay	Ceiling	Plaster	Asbestos	12348-B-65-08	None Detected	N/A	N/A	
1-01	Apparatus Bay	Pipes	Uninsulated	N/A	N/A	N/A	N/A	N/A	
1-01	Apparatus Bay	Duct	Fibreglass	N/A	N/A	N/A	N/A	N/A	
1-02	Apparatus Bay	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-02	Apparatus Bay	Walls	Ceramic	N/A	N/A	N/A	N/A	N/A	
1-02	Apparatus Bay	Walls	Plaster	Asbestos	12348-B-65-08	None Detected	N/A	N/A	
1-02	Apparatus Bay	Ceiling	Plaster	Asbestos	12348-B-65-08	None Detected	N/A	N/A	
1-02	Apparatus Bay	Pipes	Uninsulated	N/A	N/A	N/A	N/A	N/A	
1-02	Apparatus Bay	Pipes	Fibreglass	N/A	N/A	N/A	N/A	N/A	
1-02	Apparatus Bay	Duct	Uninsulated	N/A	N/A	N/A	N/A	N/A	
1-03	Bunker Room	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-03	Bunker Room	Walls	Brick	N/A	N/A	N/A	N/A	N/A	
1-03	Bunker Room	Walls	Plaster	Asbestos	12348-B-65-08	None Detected	N/A	N/A	
1-03	Bunker Room	Ceiling	Plaster	Asbestos	12348-B-65-08	None Detected	N/A	N/A	
1-03	Bunker Room	Pipes	Uninsulated	N/A	N/A	N/A	N/A	N/A	
1-03	Bunker Room	Duct	Uninsulated	N/A	N/A	N/A	N/A	N/A	
1-03	Bunker Room	Duct	Fibreglass	N/A	N/A	N/A	N/A	N/A	
1-04	Kitchen	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	

APPENDIX IV - SURVEY FORM

Location Number	Location Name	Building System	Material Observed	Potential Hazardous Material	Sample ID	Analytical Result	Quantity	Condition	Notes / Recommended Actions
1-04	Kitchen	Walls	Drywall (DJC)	Asbestos	12348-B-65-06a* 12348-B-65-06b* 12348-B-65-06c* 12348-B-65-06d* 12348-B-65-06e*	None Detected	N/A	N/A	*From Re-assessment of Asbestos-Containing Building Materials & Wall Paint Analysis, dated 2008
1-04	Kitchen	Ceiling	Plaster	Asbestos	12348-B-65-08a* 12348-B-65-08b* 12348-B-65-08c* 12348-B-65-08d* 12348-B-65-08e*	None Detected	N/A	N/A	*From Re-assessment of Asbestos-Containing Building Materials & Wall Paint Analysis, dated 2008
1-04	Kitchen	Pipes	Uninsulated	N/A	N/A	N/A	N/A	N/A	
1-05	Telephone Room	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
1-05	Telephone Room	Walls	Plaster	Asbestos	12348-B-65-08	None Detected	N/A	N/A	
1-05	Telephone Room	Ceiling	Plaster	Asbestos	12386-B65-01A* 12386-B65-01B* 12386-B65-01C*	None Detected	N/A	N/A	*From Asbestos Sampling Analysis Report #01, dated Aug. 2008
1-05	Telephone Room	Pipes	Uninsulated	N/A	N/A	N/A	N/A	N/A	
1-06	Washroom	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
1-06	Washroom	Walls	Plaster	Asbestos	12348-B-65-08	None Detected	N/A	N/A	
1-06	Washroom	Ceiling	Plaster	Asbestos	12348-B-65-08	None Detected	N/A	N/A	
1-06	Washroom	Pipes	Uninsulated	N/A	N/A	N/A	N/A	N/A	
1-07	Lounge	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
1-07	Lounge	Walls	Plaster	Asbestos	12348-B-65-08	None Detected	N/A	N/A	
1-07	Lounge	Ceiling	Acoustic Ceiling Tile (ACT)	Asbestos	2017-A0001A-C	None Detected	N/A	N/A	ACT03, 24" x 48" Pinhole Fissure *From Pinchin 2017 Survey
1-08	Pole Hole	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-08	Pole Hole	Walls	Ceramic	N/A	N/A	N/A	N/A	N/A	
1-08	Pole Hole	Walls	Plaster	Asbestos	12348-B-65-08	None Detected	N/A	N/A	
1-08	Pole Hole	Ceiling	Plaster	Asbestos	12348-B-65-08	None Detected	N/A	N/A	
1-09	Hose Tower	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	

APPENDIX IV - SURVEY FORM

<i>Location Number</i>	<i>Location Name</i>	<i>Building System</i>	<i>Material Observed</i>	<i>Potential Hazardous Material</i>	<i>Sample ID</i>	<i>Analytical Result</i>	<i>Quantity</i>	<i>Condition</i>	<i>Notes / Recommended Actions</i>
1-09	Hose Tower	Walls	Brick	N/A	N/A	N/A	N/A	N/A	
1-09	Hose Tower	Walls	Wood	N/A	N/A	N/A	N/A	N/A	
1-09	Hose Tower	Walls	Plaster	Asbestos	12348-B-65-08	None Detected	N/A	N/A	
1-09	Hose Tower	Ceiling	Plaster	Asbestos	12348-B-65-08	None Detected	N/A	N/A	
1-09	Hose Tower	Pipes	Fibreglass	N/A	N/A	N/A	N/A	N/A	
1-10	Corridor	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-10	Corridor	Walls	Plaster	Asbestos	12348-B-65-08	None Detected	N/A	N/A	
1-10	Corridor	Ceiling	Plaster	Asbestos	12348-B-65-08	None Detected	N/A	N/A	
1-11	Stairwell	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-11	Stairwell	Floor	Rubber	N/A	N/A	N/A	N/A	N/A	
1-11	Stairwell	Walls	Plaster	Asbestos	12348-B-65-08	None Detected	N/A	N/A	
1-11	Stairwell	Ceiling	Plaster	Asbestos	12348-B-65-08	None Detected	N/A	N/A	
2-01	Men's Washroom	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
2-01	Men's Washroom	Walls	Drywall (DJC)	Asbestos	12348-B-65-07	None Detected	N/A	N/A	
2-01	Men's Washroom	Ceiling	Drywall (DJC)	Asbestos	12348-B-65-07	None Detected	N/A	N/A	
2-02	Housekeeping	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
2-02	Housekeeping	Walls	Drywall (DJC)	Asbestos	12348-B-65-07	None Detected	N/A	N/A	
2-02	Housekeeping	Ceiling	Drywall (DJC)	Asbestos	12348-B-65-07	None Detected	N/A	N/A	
2-03	Bedroom	Floor	Vinyl Floor Tile (VFT)	Asbestos	14-9572-04,05,06	None Detected	N/A	N/A	VFT06, 12" x 12" - Mauve with White and Purple Sampled during 2014 survey
2-03	Bedroom	Walls	Drywall (DJC)	Asbestos	12348-B-65-07	None Detected	N/A	N/A	
2-03	Bedroom	Ceiling	Drywall (DJC)	Asbestos	12348-B-65-07	None Detected	N/A	N/A	
2-04	Corridor	Floor	Vinyl Floor Tile (VFT)	Asbestos	14-9572-04,05,06	None Detected	N/A	N/A	VFT06, 12" x 12" - Mauve with White and Purple Sampled during 2014 survey

APPENDIX IV - SURVEY FORM

Location Number	Location Name	Building System	Material Observed	Potential Hazardous Material	Sample ID	Analytical Result	Quantity	Condition	Notes / Recommended Actions
2-04	Corridor	Walls	Drywall (DJC)	Asbestos	12348-B-65-07a* 12348-B-65-07b* 12348-B-65-07c* 12348-B-65-07d* 12348-B-65-07e*	None Detected	N/A	N/A	*From Re-assessment of Asbestos-Containing Building Materials & Wall Paint Analysis, dated 2008
2-04	Corridor	Walls	Plaster	Asbestos	12348-B-65-09a* 12348-B-65-09b* 12348-B-65-09c* 12348-B-65-09d* 12348-B-65-09e*	None Detected	N/A	N/A	*From Re-assessment of Asbestos-Containing Building Materials & Wall Paint Analysis, dated 2008
2-04	Corridor	Ceiling	Plaster	Asbestos	12348-B-65-09	None Detected	N/A	N/A	
2-05	Dormitory	Floor	Vinyl Floor Tile (VFT)	Asbestos	14-9572-04	None Detected	N/A	N/A	VFT06, 12" x 12" - Mauve with White and Purple Sampled during 2014 survey
2-05	Dormitory	Walls	Drywall (DJC)	Asbestos	12348-B-65-07	None Detected	N/A	N/A	
2-05	Dormitory	Walls	Plaster	Asbestos	12348-B-65-09	None Detected	N/A	N/A	
2-05	Dormitory	Ceiling	Acoustic Ceiling Tile (ACT)	Asbestos	2017-A0001A-C	None Detected	N/A	N/A	ACT03, 24" x 48" Pinhole Fissure *From Pinchin 2017 Survey
2-05	Dormitory	Pipes	Uninsulated	N/A	N/A	N/A	N/A	N/A	
2-06	Washroom	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
2-06	Washroom	Walls	Ceramic	N/A	N/A	N/A	N/A	N/A	
2-06	Washroom	Walls	Drywall (DJC)	Asbestos	12348-B-65-07	None Detected	N/A	N/A	
2-06	Washroom	Ceiling	Plaster	Asbestos	12348-B-65-09	None Detected	N/A	N/A	
2-07	Bedroom	Floor	Vinyl Floor Tile (VFT)	Asbestos	14-9572-04,05,06	None Detected	N/A	N/A	VFT06, 12" x 12" - Mauve with White and Purple Sampled during 2014 survey
2-07	Bedroom	Walls	Drywall (DJC)	Asbestos	12348-B-65-07	None Detected	N/A	N/A	
2-07	Bedroom	Ceiling	Plaster	Asbestos	12348-B-65-09	None Detected	N/A	N/A	
2-08	Storage	Floor	Vinyl Floor Tile (VFT)	Asbestos	14-9572-04,05,06	None Detected	N/A	N/A	*NO ACCESS TO ROOM* VFT06, 12" x 12" - Mauve with White and Purple Sampled during 2014 survey
2-08	Storage	Walls	Plaster	Asbestos	12348-B-65-09	None Detected	N/A	N/A	*NO ACCESS TO ROOM*

APPENDIX IV - SURVEY FORM

<i>Location Number</i>	<i>Location Name</i>	<i>Building System</i>	<i>Material Observed</i>	<i>Potential Hazardous Material</i>	<i>Sample ID</i>	<i>Analytical Result</i>	<i>Quantity</i>	<i>Condition</i>	<i>Notes / Recommended Actions</i>
2-08	Storage	Ceiling	Plaster	Asbestos	12348-B-65-09	None Detected	N/A	N/A	*NO ACCESS TO ROOM*
2-09	Bedroom	Floor	Vinyl Floor Tile (VFT)	Asbestos	14-9572-04,05,06	None Detected	N/A	N/A	VFT06, 12" x 12" - Mauve with White and Purple Sampled during 2014 survey
2-09	Bedroom	Walls	Plaster	Asbestos	12348-B-65-09	None Detected	N/A	N/A	
2-09	Bedroom	Ceiling	Plaster	Asbestos	12348-B-65-09	None Detected	N/A	N/A	
2-10	Storage	Floor	Vinyl Floor Tile (VFT)	Asbestos	14-9572-04,05,06	None Detected	N/A	N/A	*NO ACCESS TO ROOM* VFT06, 12" x 12" - Mauve with White and Purple Sampled during 2014 survey
2-10	Storage	Walls	Plaster	Asbestos	12348-B-65-09	None Detected	N/A	N/A	*NO ACCESS TO ROOM*
2-10	Storage	Ceiling	Plaster	Asbestos	12348-B-65-09	None Detected	N/A	N/A	*NO ACCESS TO ROOM*
2-11	Stairwell	Floor	Rubber	N/A	N/A	N/A	N/A	N/A	*on stairs
2-11	Stairwell	Floor	Vinyl Floor Tile (VFT)	Asbestos	14-9572-05,06	None Detected	N/A	N/A	VFT06, 12" x 12" - Mauve with White and Purple Sampled during 2014 survey
2-11	Stairwell	Walls	Plaster	Asbestos	12348-B-65-09	None Detected	N/A	N/A	
2-11	Stairwell	Ceiling	Plaster	Asbestos	12348-B-65-09	None Detected	N/A	N/A	
3-01	Fitness Room	Floor	Wood	N/A	N/A	N/A	N/A	N/A	
3-01	Fitness Room	Walls	Brick	N/A	N/A	N/A	N/A	N/A	
3-01	Fitness Room	Ceiling	Wood	N/A	N/A	N/A	N/A	N/A	
3-01	Fitness Room	Pipes	Uninsulated	N/A	N/A	N/A	N/A	N/A	
3-02	Storage	Floor	Wood	N/A	N/A	N/A	N/A	N/A	
3-02	Storage	Walls	Wood	N/A	N/A	N/A	N/A	N/A	
3-02	Storage	Walls	Brick	N/A	N/A	N/A	N/A	N/A	
3-02	Storage	Ceiling	Wood	N/A	N/A	N/A	N/A	N/A	
3-02	Storage	Pipes	Uninsulated	N/A	N/A	N/A	N/A	N/A	

APPENDIX B7

Designated Substances Survey

3600 Danforth Avenue, Fire Hall No. 225

Issued December 2021, by Fisher Environmental Ltd.



ENGINEERING



LABORATORY



**DESIGNATED SUBSTANCES
SURVEY FOR ACCESSIBILITY
UPGRADES (IBI GROUP)**

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Project No. FE-P 21-11706

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1.0. EXECUTIVE SUMMARY

Fisher Environmental Ltd. ('Fisher') was retained by IBI Group to carry out a survey for the Designated Substances and other potential hazardous materials within specified work areas for Fire Hall No. 225 building, located at 3600 Danforth Avenue, Toronto, Ontario, herein after referred to as the "Site".

The site inspection and sampling works were conducted on November 9, 2021.

IBI Group has been commissioned by the City of Toronto to design and implement accessibility upgrades. The scope of the Designated Substances Survey (DSS) was to identify locations and types of designated substances within the building that may be impacted by the planned renovation work, and to provide recommendations for the safe handling or abatement of these materials, if any, prior to demolition.

The purpose of the project is to do the necessary construction and renovation at the locations are outlined on drawings provided by the IBI Group on October 27, 2021.

The survey was conducted in compliance with the Ontario Ministry of Labour (MOL) regulations for designated substances; O. Reg. 490/09 - *Designated Substances* and O. Reg. 278/05 - *Asbestos on Construction Projects and in Buildings and Repair Operations* made under the Occupational Health and Safety Act (OHSA), R.S.O. 1990.

Asbestos

Fisher was provided with the report of a previous DSS, which was conducted by Fisher Environmental Ltd. on October 24, 2014. This report has indicated no confirmed or assumed ACM within the specified work areas.

During the current surveys, six (6) bulk samples of building materials found within the specified work area(s) and that could potentially contain asbestos, were collected and submitted to Fisher Environmental Laboratories for Polarised Light Microscopy (PLM) analysis, as outlined in NIOSH Method 9002.

The results of analysis revealed that each material sampled does not contain asbestos. Provide a copy of this report to contractors bidding on or performing work within the subject work areas.

Note: Fire doors, present within the specific work areas, may contain asbestos-containing thermal insulation inside the door panel. Removal of any asbestos containing fire doors, in intake condition, will require Type 1 to abatement procedures, as outlined in O. Reg. 278/05 and dispose of as asbestos waste.



Lead

Based on the age of the building, it is possible that lead-based paint and lead plumbing are present within the building. Lead can also be present in various ceramic tiles. During the current survey, one (1) bulk sample of grey wall paint was collected and submitted to Fisher Environmental Laboratories for lead analysis. The results of analysis revealed that grey paint contains <10 ppm of lead.

Measurable quantities of lead concentration were detected in some of the previously collected paint samples, however below the action limit. Based on the observations and findings outlined above, Fisher recommends that the planned construction activities do not require lead abatement procedures.

Mercury

Mercury is presumed to be present in fluorescent light tubes and thermostatic controls. With the exception of fluorescent light bulbs and building thermostats, no other evidence of mercury was noted during the current survey. Prior to the planned renovation work, Fisher recommends that any presumed mercury-containing fluorescent light tubes and thermostats that will be impacted are to be removed and disposed of in accordance with O. Reg. 558/00.

Silica

No sampling for silica was conducted. However, as the building is constructed of concrete, brick and/or block walls with concrete floors, silica is expected to be found within these components of the buildings. If these materials will be disturbed during the planned renovation work, appropriate precautions should be taken to protect workers from inhaling silica dusts and debris. Refer to MOL *Guideline: Silica on Construction Projects* for details.

Other Designated Substances

The other Designated Substances would not be expected to be present at the Site. No immediate actions were recommended with regard to acrylonitrile, arsenic, benzene, coke oven emissions, ethylene oxide, isocyanates, and vinyl chloride.

Mould

During the current survey, no visible mould or favourable conditions for mould growth were observed in the specified work area(s). No action is recommended with regard to mould.



2.0. INTRODUCTION

Fisher Environmental Ltd. ('Fisher') was retained by IBI Group to carry out a survey for the Designated Substances and other potential hazardous materials within specified work areas for Fire Hall No. 225 building, located at 3600 Danforth Avenue, Toronto, Ontario, herein after referred to as the "Site".

The site inspection and sampling works were conducted on November 9, 2021.

IBI Group has been commissioned by the City of Toronto to design and implement accessibility upgrades. The scope of the Designated Substances Survey (DSS) was to identify locations and types of designated substances within the building that may be impacted by the planned renovation work, and to provide recommendations for the safe handling or abatement of these materials, if any, prior to demolition.

The purpose of the project is to do the necessary construction and renovation at the locations are outlined on drawings provided by the IBI Group on October 27, 2021.

3.0. REGULATIONS

The survey was conducted in compliance with the Ontario Ministry of Labour (MOL) regulations for designated substances; O. Reg. 490/09 - *Designated Substances* and O. Reg. 278/05 - *Asbestos on Construction Projects and in Buildings and Repair Operations* made under the Occupational Health and Safety Act (OHSA), R.S.O. 1990.

The OHSA, R.S.O. 1990, under the Ontario MOL, defines a toxic substance as a biological, chemical or physical agent (or a combination of such agents) whose presence in the workplace may endanger the health and safety of a worker. Sections of the Act that deals with toxic substances are intended to:

1. ensure that worker exposure to toxic substances is controlled;
2. ensure that toxic substances in the workplace are clearly identified and that workers are provided with enough information to be capable of handling them safely; and,
3. provide the general public with access to information about toxic substances used by industry in their communities.

The Act makes provision for a toxic substance to be "designated", where its use in the workplace is prohibited, regulated, restricted, limited or controlled. Designation is reserved for eleven substances that are particularly hazardous, covered under O. Reg 490/09 – *Designated Substances* that was implemented on July 1, 2010, and include Acrylonitrile, Arsenic, Asbestos, Benzene, Coke Oven Emissions, Ethylene Oxides, Isocyanates, Lead, Mercury, Silica, and Vinyl Chloride. Formerly, regulations for these substances were passed separately and each



outlined exposure limits where workers were likely to inhale, ingest and / or absorb the substance.

O. Reg. 490/09 provides a consistent approach to dealing with existing requirements and provisions, and outlines steps required to control worker exposure to these substances, including by inhalation, ingestion, skin absorption or skin contact. Each designated substance has an allowable level of exposure based on a time-weighted average (TWA) limit, and may also have a short-term exposure limit (STEL) and / or ceiling limit (C) assigned to it. TWA refers to the time-weighted average airborne concentration of a biological or chemical agent to which a worker may be exposed in a work day or work week, STEL refers to the maximum airborne concentration of a biological or chemical agent to which a worker may be exposed in any 15-minute period, and C refers to the maximum airborne concentration of a biological or chemical agent to which a worker may be exposed at any time. Refer to O. Reg. 490/09 – *Designated Substances*.

A supplementary regulation regarding control of asbestos exposures in the construction industry has evolved into O. Reg. 278/05 – *Asbestos on Construction Projects and in Buildings and Repair Operations*. The regulation includes a definition of asbestos-containing materials (ACM), requirements for additional training and clearance air testing, procedures for determining materials that meet the definition of ACM and for the use of glove bags, and provisions for varying from measure and procedures set out in the regulation.

In addition to the OHSA and regulations regarding designated substances, the following regulations, guidelines and standards were also taken into account or referenced:

- O. Reg. 213/91 - *Construction Projects* regulated under the OHSA and last amended by O. Reg. 443/09;
- O. Reg. 558/00 made under the Ministry of Environment (MOE) Environmental Protection Act, amending O. Reg. 347 - *General Waste Management*;
- The Transport of Dangerous Goods Act (TDGA) provides regulations for the transport of asbestos-containing materials and wastes;
- MOL *Guideline: Lead on Construction Projects*, 2011; and,
- MOL *Guideline: Silica on Construction Projects*, 2011.

4.0. METHODOLOGY

Fisher followed the protocols outlined in O. Reg. 278/05 for collecting and analyzing bulk samples of materials suspected to contain asbestos. Visual assessment of the material was the primary method of identification with occasional physical contact for the purpose of collecting bulk samples or examining for underlying layers.



Where applicable, samples of suspect materials were collected in order to establish asbestos or lead content. Samples were grouped according to similarity of appearance (“homogeneous” materials). The frequency at which the samples were collected was sufficient to obtain a general representation of the presence of these materials at the Site. Samples collected are presumed to be representative of respective building materials in-place at the Site. However, due to potential past renovations, alterations, repairs, or phases of construction, it is possible that individual materials may not be representative of samples collected.

Sampling of roofing materials was not part of the current scope of work. Further, sampling of materials found within operating equipment, portable building articles, or generally non-accessible components such as insulation within electrical switch gears, wiring, motors, light fixtures, elevator brakes, fire door cores, etc. was not performed as part of the current survey.

Samples collected during the survey were placed in plastic zip-lock bags which were labeled and submitted for laboratory analysis. Fisher Environmental Laboratories analysed bulk samples for asbestos type and approximate percent content by performing polarized light microscopy (PLM), as outlined in NIOSH Method 9002. Fisher Environmental Laboratories analysed samples for lead content in paint by performing acid digestion followed by Inductively Coupled Plasma (ICP) analysis.

Site Plans, indicating specific work areas, and bulk sample locations, are included in Appendix A. The laboratory certificate of analysis is included in Appendix B.

5.0. REVIEW OF PREVIOUS REPORTS

Fisher was provided with the report of a previous DSS, which was conducted by Fisher Environmental Ltd. on October 24, 2014, attached in Appendix C. This report has indicated no confirmed or assumed ACM within the specified work areas.

6.0. FINDINGS AND RECOMMENDATIONS

6.1. *Acrylonitrile*

Acrylonitrile would not be expected to be present at the Site and was not observed during the current survey. No recommendations for Acrylonitrile are warranted at this time.

6.2. *Arsenic*

Arsenic would not be expected to be present at the Site and was not observed during the current survey. No recommendations for Arsenic are warranted at this time.



6.3. Asbestos

6.3.1. General Information

Asbestos is the name given to a group of six different fibrous minerals (amosite, chrysotile, crocidolite, and the fibrous varieties of tremolite, actinolite and anthophyllite) that occur naturally in the environment. Asbestos minerals have separable long fibres that are strong and flexible enough to be spun and woven and are heat resistant.

Because of these characteristics, asbestos has been used for a wide range of manufactured goods, mostly in building materials (roofing shingles, ceiling and floor tiles, paper products, and asbestos cement products), friction products (automobile clutch, brake, and transmission parts), heat-resistant fabrics, packaging, gaskets, and coatings. Some vermiculite or talc products may also contain asbestos.

Asbestos fibres may be released into the air by the disturbance of ACM during product use, renovation or demolition work, building or home maintenance, repair and remodeling. In general, exposure may occur only when the ACM is disturbed in some way to release particles and fibres into the air.

6.3.2. Friable vs. Non-Friable ACM

Based on the requirements of O. Reg. 278/05 and due diligence, an asbestos survey and report must be available at any workplace where asbestos exists identifying locations and types of ACM in the building. The survey must include both friable and non-friable materials confirmed to contain asbestos, as well as any other materials which were not sampled but are suspected (presumed) ACM. The term friable refers to material(s) that could be readily reduced to dust or powder when crushed by hand or moderate pressure. Friable materials have a much greater chance of releasing airborne asbestos fibres when disturbed.

In the past, the most commonly used friable asbestos-containing building materials were surfacing materials (e.g., sprayed on fireproofing, texture, decorative or acoustic plaster) as well as thermal insulation. Examples of manufactured asbestos-containing materials include vinyl floor tiles, ceiling tiles, gasket materials, asbestos cement (transite) pipes or boards, and asbestos textiles. Depending on the above noted formulation, these materials range from non-friable to friable. Although some products are considered non-friable when in Good condition, severe damage or deterioration may cause non-friable materials to generate airborne dust more readily. Severely damaged non-friable materials, or those to be worked on with powered tools, may be considered as friable ACM for abatement purposes.

Examples of common types of ACM by friability include:

- Friable ACM



- Sprayed Materials (or materials installed by roller or trowel), such as fireproofing, thermal insulation, texture finishes, etc.
 - Mechanical Insulation such as boiler and breeching, ductwork, piping, tanks and associated equipment.
 - Plaster
- Potentially Friable ACM
 - Acoustic Ceiling Tiles
 - Vinyl Sheet Flooring
- Non-Friable ACM
 - Vinyl Floor Tiles
 - Asbestos cement (“transite”) piping or paneling
 - Window Caulking

6.3.3. Regulations

Exposure to asbestos is controlled by two Regulations passed under Ontario’s Occupational Health and Safety Act (OHSA), R.R.O. 1990.

- O. Reg. 490/09 – *Designated Substances* regarding asbestos applies to:
 - every employer operating a mine for the purpose of mining, crushing, grinding or sifting asbestos;
 - every employer processing, adapting or using asbestos in connection with manufacturing or assembling of goods or products;
 - every employer engaged in the repair, alteration or maintenance of machinery, equipment, aircraft, ships, locomotives, railway cars and vehicles;
 - every employer engaged in work on a building that is necessarily incidental to the repair, alteration or maintenance of machinery or equipment; and,
 - to those workers of such employers who are likely to be exposed to asbestos.

Exposure limits for this substance are set at 0.1 f/cc (TWA) for all types of asbestos.

- O. Reg. 278/05 - *Asbestos on Construction Projects and in Buildings and Repair Operations* applies to buildings that contain friable and non-friable ACM and to the repair, alteration and/or maintenance of these buildings.

In addition to regulations for controlling work around asbestos-containing building materials there are regulations for packaging, transportation and disposal of asbestos-containing waste:

- O. Reg. 558/00 made under the Ministry of Environment (MOE) Environmental Protection Act, amending O. Reg. 347 - *General Waste Management*; and,



- The Transport of Dangerous Goods Act (TDGA) provides regulations for the transport of asbestos-containing materials and wastes.

6.3.4. Findings

Samples of homogenous materials suspected to contain asbestos were collected and submitted for analysis. Fisher collected six (6) bulk samples of building materials found within the specified work areas and that could potentially contain asbestos. Findings of all building materials identified within the specified work area(s) are outlined in further detail below.

6.3.4.1. Sprayed or Troweled Fireproofing and Thermal Insulation

No indication of sprayed or troweled fireproofing and / or thermal insulation was noted in any of the specified work areas during the current survey.

6.3.4.2. Texture Finish

No indication of texture finish was noted in any of the specified work areas during the current survey.

6.3.4.3. Mechanical Insulation

The majority of mechanical insulation observed throughout the building are either not insulated or are insulated with fiberglass which is not suspected to contain asbestos.

6.3.4.4. Acoustic Ceiling Tile

During the current survey, two (2) visually distinct styles of ceiling tiles were observed within the specified work areas.

- Ceiling Tile 1 (2'x4' Pinhole Fissure), and
- Ceiling Tile 2 (2'x4' Pinhole Long Fissure).

The previous report confirmed that Ceiling Tile 1 and Ceiling Tile 2 were previously sampled for analysis. The results of analysis revealed both types of ceiling tiles do not contain asbestos.

6.3.4.5. Plaster / Drywall Joint Compound

Plaster was not observed within the specified work areas during the current survey.

Drywall Joint Compound (DJC) was observed throughout the building. The previous report indicated drywall joint compound (DJC) was sampled for analysis. The results of analysis revealed that the DJC does not contain asbestos.

6.3.4.6. Asbestos Cement Products

No asbestos cement products, such as Transite pipe or board, were noted in any of the specified work areas during the current survey.



6.3.4.7. Vinyl Sheet Flooring

No vinyl sheet flooring was noted in any of the specified work area(s) during the current survey.

6.3.4.8. Vinyl Floor Tile

During the current survey, two (2) varieties of vinyl floor tile were observed within the specified work areas.

- Vinyl Floor Tile 1 (12" x 12", White with Beige Specs), and
- Vinyl Floor Tile 2 (12" x 12", Brown with White Specs).

The previous report confirmed that Vinyl Floor Tile 1 and Vinyl Floor Tile 2 were previously sampled for analysis. The results of analysis revealed both varieties of vinyl floor tile do not contain asbestos.

6.3.4.9. Other ACM

Mortar

Mortar was observed on the brick wall within the specified work areas during the current survey. Three (3) samples of the mortar were collected for analysis. The results of analysis revealed that the mortar does not contain asbestos.

Brown Caulking

Brown Caulking was observed around the door frame leading to the front foyer. Three (3) samples of the brown caulking were collected for analysis. The results of analysis revealed that the brown caulking does not contain asbestos.

6.3.5. Recommendations

No asbestos-containing materials were identified in any of the specified work area(s). Therefore, no recommendations with regards to ACM are warranted at this time.

Note: Fire doors, present within the specific work areas, may contain asbestos-containing thermal insulation inside the door panel. Removal of any asbestos containing fire doors, in intake condition, will require Type 1 to abatement procedures, as outlined in O. Reg. 278/05 and dispose of as asbestos waste.

The presence of ACM should be presumed in locations not accessed during this survey. It is possible that ACM is present at the Site that is not identified in this report. Should additional suspected ACM be discovered, it should be presumed as ACM until sample analysis determines asbestos content.

Due to the limited nature of the current scope of work and the presence of solid building finishes (i.e., plaster or drywall walls and ceilings etc.) in many locations, the full extent of ACM may not be confirmed. Precautions should be taken when dismantling solid wall or ceiling finishes, or



any other building surfaces which may conceal potential ACM. Such precautions include, but are not limited to, isolation measures and appropriate personal protective equipment.

6.4. Benzene

Benzene would not be expected to be present at the Site and was not observed during the current survey. No recommendations for Benzene are warranted at this time.

6.5. Coke Oven Emissions

Coke oven emissions would not be expected to be present at the Site and were not observed during the current survey. No recommendations for coke oven emissions are warranted at this time.

6.6. Ethylene Oxides

Ethylene oxides would not be expected to be present at the Site and were not observed during the current survey. No recommendations for ethylene oxides are warranted at this time.

6.7. Isocyanates

Isocyanates would not be expected to be present at the Site and were not observed during the current survey. No recommendations for isocyanates are warranted at this time.

6.8. Lead

6.8.1. General Information

Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. Most lead in the environment comes from human activities such as burning fossil fuels, mining and manufacturing. Lead is used in the production of batteries, ammunition, metal products (solder and pipes) and X-ray devices.

Lead does not break down but lead compounds are changed by sunlight, air and water. Exposure occurs when eating food or drinking water that contains lead. Deteriorated lead paint can contribute to lead dust. The main target for lead toxicity is the nervous system.

6.8.2. Regulations and Guidelines

The Ontario MOL has not prescribed criteria defining an analyzed sample of bulk material as "lead-containing". Further, the MOL has not established a lower limit for concentrations of lead in paint, below which precautions do not need to be considered during construction projects. However, except for very aggressive disturbance of painted finishes, (e.g., abrasive blasting, torch cutting, or grinding), Fisher believes that a lead content below 0.1% by weight (1,000 ug/g or 1000 ppm) represents a concentration in which the lead content is not the limiting hazard for construction hygiene purposes. Regular construction dust suppression techniques and worker



hygiene practices are sufficient for disturbance of paint finishes determined to contain less than 0.1% lead by weight, provided that work is limited to non-aggressive operations.

The regulation for the designated substance lead applies to every employer and worker at a workplace where lead is present, produced, processed, used, handled or stored and at which a worker is likely to be exposed to lead. Exposure limits for this substance are set at 0.05 – 0.10 mg/m³ (TWA) depending on the type of lead, and for tetraethyl lead 0.30 mg/m³ (STEL).

Additionally, in 2011 the MOL revised *Guideline: Lead on Construction Projects* outlining practices that should be followed during construction projects to protect workers from exposure to lead. This includes the methods and equipment employed in the removal of lead-containing coatings that reduce the creation of dust, providing appropriate facilities for workers to wash after each shift, and providing protective clothing and respirators where necessary.

6.8.3. Findings

Based on the age of the building, it is possible that lead-based paint and lead plumbing are present within the building. Lead can also be present in various ceramic tiles. During the current survey, one (1) bulk sample of grey wall paint was collected and submitted to Fisher Environmental Laboratories for lead analysis. The results of analysis revealed that grey paint contains <10 ppm of lead.

6.8.4. Recommendations

Measurable quantities of lead concentration were detected in some of the previously collected paint samples, however below the action limit. Based on the observations and findings outlined above, Fisher recommends that the planned construction activities do not require lead abatement procedures.

6.9. Mercury

6.9.1. General Information

Mercury is a naturally occurring metal. It is a shiny, silver-white and odourless liquid. It combines with other elements to form inorganic compounds or salts. Metallic mercury is used to produce chlorine gas and caustic soda, and is used in thermostats and thermometers, fluorescent light bulbs, dental fillings and batteries. Exposure occurs when eating fish or shellfish contaminated with methyl mercury, breathing vapors from spills, incinerators, etc.

The nervous system is very sensitive to all forms of mercury. Exposure to high levels of metallic inorganic or organic mercury can permanently damage the brain, kidneys and developing fetus. Short-term exposure may cause lung damage, nausea, vomiting and diarrhea as well as skin and eye irritation.



6.9.2. Regulations

The regulation for mercury applies to every employer and worker at a workplace where mercury is present, produced, processed, used, handled or stored and at which a worker is likely to be exposed to mercury. Exposure limits for this substance are set at 0.025 – 0.01 mg/m³ (TWA) for all forms of mercury excluding alkyl, and for alkyl compounds of mercury 0.03 mg/m³ (STEL).

6.9.3. Findings

Mercury is presumed to be present in fluorescent light tubes and thermostatic controls. With the exception of fluorescent light bulbs and building thermostats, no other evidence of mercury was noted during the current survey.

6.9.4. Recommendations

Prior to the planned renovation work, Fisher recommends that any presumed mercury-containing fluorescent light tubes and thermostats that will be impacted are to be removed and disposed of in accordance with O. Reg. 558/00.

6.10. Silica

6.10.1. General Information

Silica is a crystalline compound occurring abundantly as quartz, sand, and many other minerals, and used to manufacture a variety of materials, especially glass and concrete. When mining this substance, silica can be deadly when it becomes airborne. If inhaled, silica dust can cause silicosis which can be fatal.

Some of the following industries have a high potential for risk to workers: construction (sandblasting, rock drilling, masonry work, jack hammering, tunneling), mining (cutting or drilling through sandstone or granite), foundry work (grinding, mouldings, shakeout, core room), stone cutting (sawing, abrasive blasting, chipping, grinding), manufacturing and use of abrasives, etc.

6.10.2. Regulations

The regulation for silica applies to every employer and worker at a workplace where silica is present, produced, processed, used, handled or stored and at which a worker is likely to be exposed to silica. Exposure limits for this substance are set at 0.05 - 0.10 mg/m³ (TWA), depending on the type of silica.

Additionally, in 2011 the MOL revised *Guideline: Silica on Construction Projects* outlining practices that should be followed during construction projects to protect workers' from exposure to silica. This includes the methods and equipment employed in the removal of silica-containing materials that reduce the creation of dust, providing appropriate facilities for workers to wash after each shift, and providing protective clothing and respirators where necessary.



6.10.3. Findings

No sampling for silica was conducted. However, as the building is constructed of concrete, brick and/or block walls with concrete floors, silica is expected to be found within these components of the buildings.

6.10.4. Recommendations

If these materials will be disturbed during the planned renovation work, appropriate precautions should be taken to protect workers from inhaling silica dusts and debris. Refer to MOL *Guideline: Silica on Construction Projects* for details.

6.11. Vinyl Chloride

Vinyl chloride would not be expected to be present at the Site and was not observed during the current survey. No recommendations for vinyl chloride are warranted at this time.

6.12. Mould

During the current survey, no visible mould or favourable conditions for mould growth were observed in the specified work area(s). No action is recommended with regard to mould.



7.0. LIMITATIONS

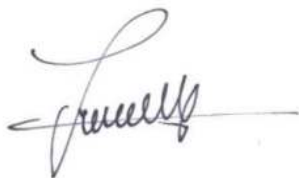
Fisher Environmental Ltd. accepts responsibility for the competent performance of its duties in executing this assignment within the normal standards of the profession, but disclaims responsibility for consequential damages, if any.

The scope of the survey is based on prior agreement with the client, and the rationale given in this report. The survey findings rely on professional interpretation of selective sampling and analysis. Sample analysis results have been applied to homogenous materials in unsampled locations; it was not within the scope of work to carry out an exhaustive sampling and analysis program. For non-accessible building spaces, the likelihood of the presence or absence of asbestos and other designated substances has been described, but such assessment is not a definitive statement of presence or absence.

This report was prepared for the IBI Group. The scope of services performed may not be appropriate for the purposes of other users, and any use or reuse of this document or its findings or recommendations represented herein is at the sole risk of any other user.

We trust that the information provided in the report meets your current requirements. If you have any questions or concerns, please do not hesitate to contact the undersigned.

Respectfully submitted,



Muhammad Junayed, B.Sc., EP
Project Manager

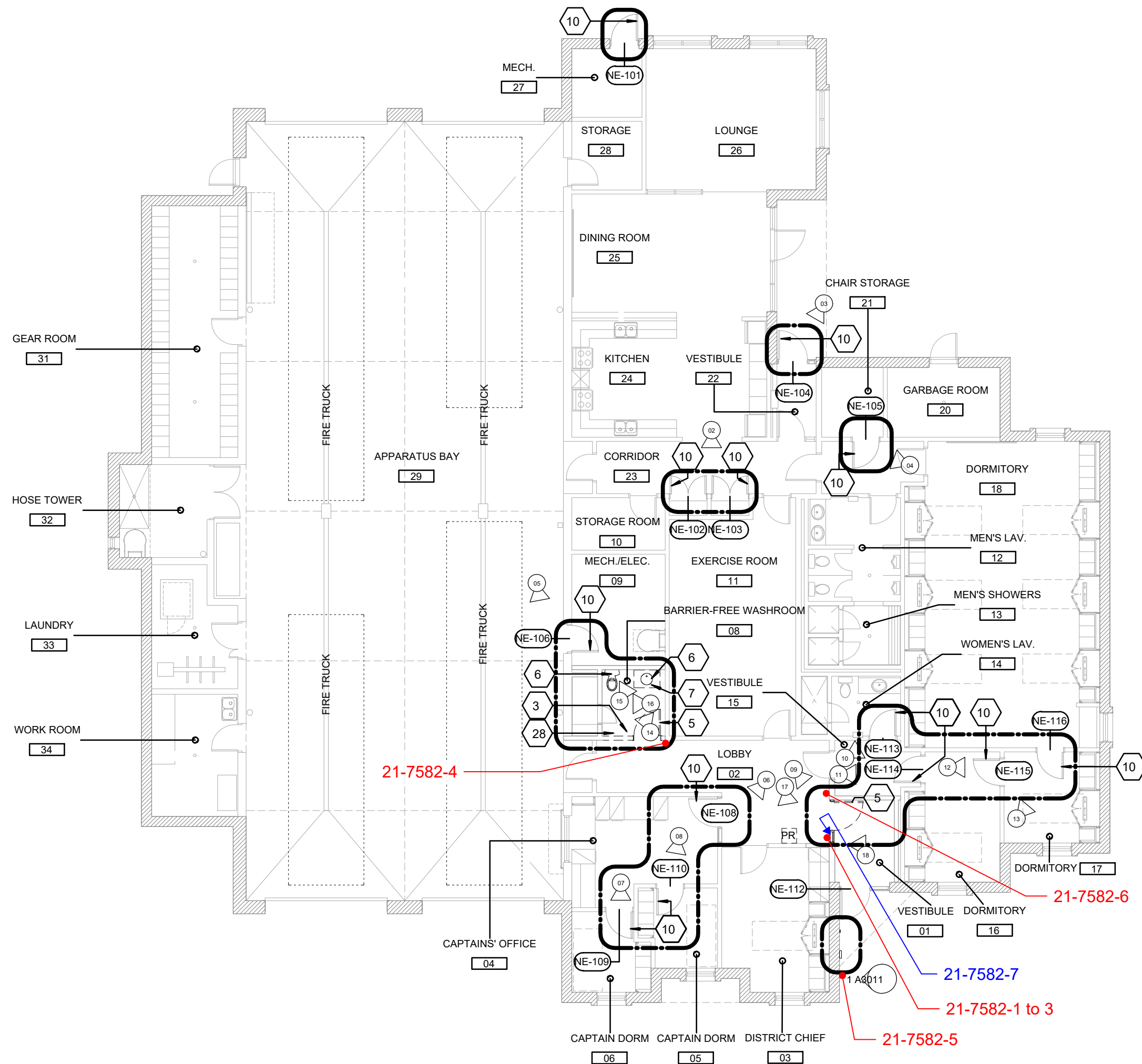


David A. Fisher, B.A.Sc., C.Chem., P.Eng.
Principal



APPENDIX A – SITE PLAN(S)





Legend



Area of Work



Asbestos Sample Location



Lead Sample Location

Figure 1

LOCATION:

3600 Danforth Avenue
Toronto, Ontario

BUILDING NAME:

Fire Hall NO. 225

First Floor Plan
Pre-Reno DSS
Asbestos and Lead Sample Locations

CLIENT:

IBI Group

PROJECT NUMBER: FE-P 21-11706

DATE: November 2021

DRW BY: ZA

CAD FILE: FIG1

SCALE: Not to Scale

CHK BY: MJ



400 Esna Park Dr., #15
Markham, Ontario
L3R 3K2

Tel: 905 475-7755
Fax: 905 475-7718

APPENDIX B – CERTIFICATE(S) OF ANALYSIS



Fisher Environmental Ltd

Project No. FE-P 21-11706, December 15, 2021



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Tel.: 416-679-1930
E-mail:
Attn: Faraz Bolourian

F.E. Job #: 21-7582
Project Name: Pre-Reno DSS
Project ID: FE-P 21-11706
Date Sampled: 9-Nov-2021
Date Received: 23-Nov-2021
Date Reported: 26-Nov-2021
Location: 3600 Danforth Avenue

Certificate of Analysis

Analysis Requested:	Asbestos, Lead
Sample Description:	7 Bulk Sample(s)

Client Sample ID	Lab Sample ID	Sample Matrix	Fibre Type	Asbestos Content
01A - Caulking Brown, around Door Frame	21-7582-1	Caulking		Not Detected
01B - Caulking Brown, around Door Frame	21-7582-2	Caulking		Not Detected
01C - Caulking Brown, around Door Frame	21-7582-3	Caulking		Not Detected
02A - Mortar, Wall	21-7582-4	Mortar		Not Detected
02B - Mortar, Wall	21-7582-5	Mortar		Not Detected
02C - Mortar, Wall	21-7582-6	Mortar		Not Detected

Fisher Environmental Laboratories (Lab ID #: 2745) is accredited by CALA (Canadian Association for Laboratory Accreditation Inc.) for asbestos analysis by PLM.

ANALYTICAL METHOD:

Asbestos has been done in accordance with normal professional standard using the following Fisher Environmental Lab Method: Asbestos by PLM (Polarized Light Microscope) F-26, Rev.2.2.

Certificate of Analysis

Analysis Requested:	Asbestos, Lead
Sample Description:	7 Bulk Sample(s)

Client Sample ID	Lab Sample ID	Sample Matrix	Lead (ppm)	Comments
LP101 - Paint, Grey, Wall	21-7582-7	Paint	<10	

< result obtained was below RL (Reporting Limit).

QA/QC Report

Parameter	Blank (ppm)		LCS (%)		CRM/MS (%)	
	Result	RL	Recovery	AR	Recovery	AR
Lead	<10	10	93	80-120	95	70-130

Parameter	Duplicate (%)					
	RPD	AR				
Lead	3.8	0-30				

LEGEND:

RL - Reporting Limit

LCS - Laboratory Control Sample

MS - Matrix Spike

AR - Acceptable Range

RPD - Relative Percent Difference

ANALYTICAL METHODS:

Metals (Lead) - Method # F-1, Rev. 4.5, Standard Operation Procedure for determination of Metals by the Inductively Coupled Plasma- Optical.

Method used by Fisher Environmental Lab complies with the Standard Methods for the Examination of Water and Wastewater, 20th Ed 3120-B.

Authorized by:

Roger Lin
 Roger Lin, Ph. D., C. Chem.
 Laboratory Manager



APPENDIX C – PREVIOUS DSS REPORT





DESIGNATED SUBSTANCE SURVEY



TORONTO FIRE STATION 225 3600 DANFORTH AVENUE

Toronto, Ontario

Presented to:

Meaghan Aldcroft

City of Toronto
Facilities Management

Fisher Environmental Ltd.
Project Number: FE-P 14-6915

OCTOBER, 2014

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APPENDIX V – SITE PHOTOGRAPHS

1. INTRODUCTION AND REGULATORY REQUIREMENTS

1.1 Introduction and Scope

Fisher Environmental Ltd. was retained by the City of Toronto, Facilities Management to conduct a Designated Substance Survey of building materials in Toronto Fire Station 225 located at 3600 Danforth Avenue in Toronto, Ontario.

The objectives of the Designated Substance Survey (DSS) are to establish locations, conditions and types of designated substances contained within a building and, if necessary, provide recommendations to fulfill requirements set forth under the Ontario Occupational Health and Safety Act (OHSA) to achieve regulatory compliance. Preparation of the DSS report, which includes a brief description of the materials present, and the findings of the DSS, will fulfill the requirements of the Ontario Ministry of Labour (MOL) regulations for designated substances; O. Reg. 490/09 – Designated Substances and O. Reg. 278/05 – Asbestos on Construction Projects and in Buildings and Repair Operations.

The DSS should also include an examination for the presence of polychlorinated biphenyls (PCBs) and visible mould growth. . This document should be filed as an addendum to the original survey, which was conducted by ECOH Management Inc. on August 9, 2007.

The *Designated Substance Survey* report is intended for management purposes only to demonstrate compliance with regulations. It is not to be used to establish the designated substance content within building materials before renovation or demolition activities. Prior to any work activities that may disturb building materials, a thorough Pre-Renovation or Pre-Demolition survey of the work area for designated substances and hazardous materials shall be conducted. Peter Milosh of Fisher Environmental Ltd. performed the fieldwork on October 24, 2014.

2. SURVEY METHODOLOGY

2.1 General Approach

To ensure familiarity with the building, the Surveyor made reference to the previous assessment and reassessment reports provided by the City of Toronto prior to commencing the survey. The Surveyor also made reference to facility floor plans included in the previous assessment reports, or provided independently by the City of Toronto. Facility drawings identifying locations of asbestos-containing materials, if present, are included in Appendix IV. Site photographs are included in Appendix V.

2.2 Survey Methodology

The City of Toronto provided the consultant with the previous DSS report and / or other survey reports of designated substances identified within the facility, if available. . Prior to conducting the DSS, the reports were reviewed by Fisher Environmental Ltd. and updated with all available information regarding ACM, including that from past assessments and reassessments.

The survey was conducted in compliance with the Ontario Ministry of Labour (MOL) regulations for designated substances; O. Reg. 490/09 - *Designated Substances* and O. Reg. 278/05 - *Asbestos*

on Construction Projects and in Buildings and Repair Operations made under the Occupational Health and Safety Act (OHSA), R.S.O. 1990.

The Surveyor conducted a visual reassessment of all known and assumed asbestos-containing materials in all accessible areas of the building, as detailed in past survey reports and the Reassessment Survey Form, and recorded the condition (GOOD, FAIR or POOR) of each known or assumed ACM on the Asbestos Reassessment Survey Form. The Surveyor also recorded detailed descriptions of previously-unidentified potential ACM, if observed. Please refer to Appendix I for the updated Reassessment Survey Form.

Materials confirmed to be asbestos-containing during previous assessments were not sampled for this reassessment survey. Additionally, samples were not collected of materials that were previously confirmed to be non-asbestos by the requirements of Ontario Regulation 278/05.

Any other potential asbestos-containing materials noted during the reassessment survey that had not been identified in a previous survey, or were not sampled in accordance with the requirements of O. Reg. 278/05, were sampled as part of the reassessment.

The DSS is based on a walk-through inspection of the facility and shall be conducted room by room to establish locations, conditions and types of designated substances. The survey shall also include an examination for the presence of polychlorinated biphenyls (PCBs) and visible mould growth.

3. FINDINGS AND RECOMMENDATIONS

3.1 Asbestos

Asbestos fibres may be released into the air by the disturbance of asbestos containing material (ACM) during product use, demolition work, building or home maintenance, repair and remodeling. In general, exposure may occur only when the ACM is disturbed in some way to release particles and fibres into the air.

3.1.1 Findings

Previously identified assumed ACM include the following:

- Roofing Materials,
- Window Caulking,
- Plaster/Drywall Joint Compound, and
- Ceiling Tiles – two (2) varieties.

All previously identified assumed ACM were observed to be in Good condition at the time of the reassessment. Although samples of these materials may have been collected during previous assessment surveys, samples were not necessarily collected with sufficient frequency to categorize the material as non-asbestos in accordance with O. Reg. 278/05.

During this reassessment survey, additional samples of readily accessible materials (excluding roofing materials and window caulking) were collected to meet the bulk sampling requirements

outlined in O. Reg. 278/05. Table 1 below summarizes the analytical results for the sampled assumed ACM.

TABLE 1 Summary of Analysis of Bulk Samples collected and analysed during this reassessment			
Sample Number	Sample Description	Sample Location	Analytical Results
14-9614-01	Drywall Joint Compound	Loc. 1-09, Kitchen	None Detected
14-9614-02	Drywall Joint Compound	Loc. 1-09, Kitchen	None Detected
14-9614-03	Drywall Joint Compound	Loc. 1-09, Kitchen	None Detected
14-9614-04	Drywall Joint Compound	Loc. 1-14, Men's Washroom	None Detected
14-9614-05	Drywall Joint Compound	Loc. 1-19, Women's Washroom	None Detected
14-9614-06	Ceiling Tile 02, 2' x 4' Pinhole Long Fissure	Loc. 1-09, Kitchen	None Detected
14-9614-07	Ceiling Tile 02, 2' x 4' Pinhole Long Fissure	Loc. 1-13, Fitness Room	None Detected
14-9614-08	Ceiling Tile 02, 2' x 4' Pinhole Long Fissure	Loc. 1-15, Dormitory	None Detected
14-9614-09	Ceiling Tile 01, 2' x 4' Pinhole Fissure	Loc. 1-02, Storage	None Detected
14-9614-10	Ceiling Tile 01, 2' x 4' Pinhole Fissure	Loc. 1-03, Bunker Room	None Detected
14-9614-11	Ceiling Tile 01, 2' x 4' Pinhole Fissure	Loc. 1-05, Laundry	None Detected

Laboratory analysis determined each material sampled to not contain asbestos. The laboratory analysis report is included with this report as Appendix II.

3.1.2 Recommendations

All generally accessible building materials previously suspected to be ACM were determined to not contain asbestos and no immediate recommendations are made.

Any other building materials suspected to contain asbestos which are not outlined in this report should be assumed to be asbestos-containing until sample analysis determines asbestos content.

Ontario Ministry of Labour Regulation 278/05 requires that an Asbestos Management Program (AMP) be implemented as long as asbestos-containing materials are present in a building. The AMP, original survey report and subsequent reassessment reports must be available at the work place, and must identify the type of asbestos, and where asbestos can be found on a room-by-room basis.

NOTE: Interpretation of all sources of asbestos-related information, including but not limited to the original asbestos survey report, asbestos reassessment reports, room-by-room survey data, survey drawings and reports from previous asbestos abatement projects, should be completed by a

competent person trained in the historical application of asbestos in building materials, building design and preferably by a person with site-specific knowledge and/or experience.

Information contained within any of the above-noted sources may not relieve the Regulatory responsibility of building Owners, or project Employers/Constructors, to complete a detailed site inspection prior to commencement of a project.

This report should not be used as a substitute for a detailed site inspection to identify asbestos-containing building materials, which must be specifically tailored to the scope and nature of any given project, and completed prior to any maintenance, renovation or demolition work that may cause disturbance to building materials.

3.2 Lead

Most lead in the environment comes from human activities such as burning fossil fuels, mining and manufacturing. Lead is used in the production of batteries, ammunition, metal products such as solder and pipes, and x-ray devices. Exposure happens when eating food or drinking water that contains lead. Deteriorated lead paint can contribute to lead dust. The main target for lead toxicity is the nervous system.

The regulation for lead applies to every employer and worker at a workplace where lead is present, produced, processed, used, handled or stored and at which a worker is likely to be exposed to lead.

Additionally, in 2004 the MOL issued *Guideline: Lead on Construction Projects* outlining practices that should be followed during construction projects to protect workers' from exposure to lead. This includes the methods and equipment employed in the removal of lead containing coatings that reduce the creation of dust, providing appropriate facilities for workers to wash after each shift, and providing protective clothing and respirators where necessary.

3.2.1 Findings

Based on the age of the building, it is possible that lead-based paint and lead plumbing are present within the building.

No other indication of lead-containing materials was observed during the building audit, with the exception of that which may be contained within batteries.

3.2.2 Recommendations

During the disturbance of any painted surfaces that contain lead, it would be recommended that appropriate procedures and use of respirators be followed to protect workers.

No immediate corrective actions were recommended with regard to lead.

3.3 Acrylonitrile

Acrylonitrile is used to make other chemicals such as plastics, synthetic rubber and acrylic fibres. Breathing high concentrations of acrylonitrile will cause nose and throat irritation, tightness in chest, difficulty breathing, nausea, dizziness, weakness, headache, impaired judgment and convulsions. These symptoms usually disappear when exposure has stopped. If spilled on the skin, acrylonitrile will burn the skin and cause blisters and redness. Acrylonitrile is believed to be carcinogenic.

3.3.1 Findings

Acrylonitrile based polymers may have been utilized in the production of some of the building construction materials (e.g. paints, sealants, and adhesives). Although these polymers are generally volatile, they are expected to produce significant acrylonitrile exposure only during or shortly after application of the subject material. If present on site, acrylonitrile would not be expected to be a concern during future renovation or demolition works. Acrylonitrile was not evident in its pure form anywhere within the subject areas of the building.

3.3.2 Recommendations

No immediate corrective actions were recommended with regard to acrylonitrile.

3.4 Arsenic

Inorganic arsenic compounds are mainly used to preserve wood. Organic arsenic compounds are used as pesticides. Arsenic occurs naturally in soil and minerals and therefore may enter air and water. Breathing high levels of arsenic may cause sore throat and irritated lungs. Ingesting high levels of arsenic can result in death. Arsenic is a suspected carcinogenic substance.

3.4.1 Findings

Low levels of arsenic may be contained within paints or coatings utilized on building construction materials, however exposure levels resulting from personal contact are not expected to be significant. Arsenic or arsenic containing compounds were not encountered during the building survey works.

3.4.2 Recommendations

No immediate corrective actions were recommended with regard to arsenic.

3.5 Benzene

Benzene is colourless liquid with a sweet odour. Benzene utilization has historically been associated with solvents, paints, stains, adhesives, and in the manufacturing of various rubber products. While its current use in building materials has greatly decreased due to an increased awareness of associated health concerns, it may still be present in trace quantities in various industrial solvents. Gasoline sold in Canada contains approximately 4% benzene.

Breathing very high levels of benzene can result in death, while high levels may cause drowsiness, dizziness, rapid heart rate, headaches, and unconsciousness.

3.5.1 Findings

While it may be expected, given the age of the building, that the original construction materials utilized did contain some trace levels of benzene, it is likely that any has since volatilized and would not exceed the permissible exposure values. During future renovation or demolition works, it would not be expected to be a concern. No evidence of benzene was noted during the building survey, with the exception of that which may be contained in regular gasoline fuel burning equipment.

3.5.2 Recommendations

No immediate corrective actions were recommended with regard to benzene.

3.6 *Coke Oven Emissions*

Coke oven emissions are released during the carbonization of bituminous coal for the production of coke. Exposure routes include inhalation, skin and / or eye contact. Coke oven emissions are potential occupational carcinogens.

3.6.1 Findings

This substance would not be expected to be found in the building. No evidence of the burning of coke was found during the building survey.

3.6.2 Recommendations

No immediate corrective actions were recommended with regard to coke oven emissions.

3.7 *Ethylene Oxides*

Ethylene oxide is a man-made chemical used primarily to make ethylene glycol (antifreeze and polyester). Breathing low levels of ethylene oxides for a prolonged period of time causes eye, skin and respiratory irritations, and can affect nervous system. Higher levels of exposure for shorter time produce symptoms that are similar but more severe.

3.7.1 Findings

This substance would not be expected to be found in the building. No evidence of ethylene oxides was found during the building survey.

3.7.2 Recommendations

No immediate corrective actions were recommended with regard to ethylene oxides.

3.8 *Isocyanates*

Isocyanates are a family of highly reactive, low molecular weight chemicals. They are widely used in the manufacture of flexible and rigid foams, fibres, and coatings such as paints and varnishes, and elastomers and various building materials (e.g. spray on polyurethane products).

Isocyanates are powerful irritants to the eyes, skin, and respiratory and gastrointestinal tracts.

3.8.1 Findings

Use of isocyanates or isocyanate compounds would not be expected in the building. No evidence of isocyanates was found during the building survey.

3.8.2 Recommendations

No immediate corrective actions were recommended with regard to isocyanates.

3.9 Mercury

Mercury is a naturally occurring metal. It is a shiny, silver-white and odourless liquid. It combines with other elements to form inorganic compounds or salts. Metallic mercury is used to produce chlorine gas and caustic soda, and is used in thermostats and thermometers, fluorescent light bulbs, dental fillings and batteries. Exposure occurs when breathing vapors from spills, incinerators, etc.

The nervous system is very sensitive to all forms of mercury. Exposure to high levels of metallic inorganic or organic mercury can permanently damage the brain, kidneys and developing fetus. Short-term exposure may cause lung damage, nausea, vomiting and diarrhea as well as skin and eye irritation.

3.9.1 Findings

Mercury can be found in fluorescent light bulbs and building thermostats. Prior to future renovation or demolition works, it would be recommended that these products be safely removed. The disposal of mercury containing items are regulated under the Environmental Protection Act, and it would be recommended that for disposal purposes any mercury containing thermostats and fluorescent light bulbs be disposed of at an MOE licensed receiver. With the exception of fluorescent light bulbs and building thermostats, no other evidence of mercury was noted during the building survey.

3.9.2 Recommendations

No immediate corrective actions were recommended with regard to mercury.

3.10 Silica

Silica is a crystalline compound occurring abundantly as quartz, sand, and many other minerals, and used to manufacture a variety of materials, especially glass and concrete. When mining this substance, silica can be deadly when it becomes airborne. If inhaled, silica dust can cause silicosis which can be fatal.

Additionally, in 2004 the MOL issued *Guideline: Silica on Construction Projects* outlining practices that should be followed during construction projects to protect workers' from exposure to silica. This includes the methods and equipment employed in the removal of silica containing materials that reduce the creation of dust, providing appropriate facilities for workers to wash after each shift, and providing protective clothing and respirators where necessary.

3.10.1 Findings

As the building is constructed of concrete block and brick, with concrete floors, silica is expected to be found within these components of the building. During any significant renovation or demolition works where concrete dust is generated, dust suppression techniques should be utilized to control worker exposure to silica. Silica is expected to be present in concrete and masonry products in the building.

3.10.2 Recommendations

No immediate corrective actions were recommended with regard to silica.

3.11 Vinyl Chloride

Vinyl chloride is used to make polyvinyl chloride (PVC) which is found in a variety of plastic products, including pipes, wires, cable coatings and packaging materials. Breathing high levels of vinyl chloride can cause dizziness, unconsciousness and death. Prolonged exposure causes changes in liver, nerve damage, immune reactions and changes in blood flow.

3.11.1 Findings

PVC pipe is generally stable and does not allow for the liberation of vinyl chloride, under normal conditions. During future renovation or demolition works, this substance would not be expected to be a concern. Vinyl chloride was not evident in its pure form, anywhere in the subject dwellings.

3.11.2 Recommendations

No immediate corrective actions were recommended with regard to vinyl chloride.

3.12 Polychlorinated Biphenyls (PCBs)

PCBs are mixtures of synthetic organic chemicals with the same basic chemical structure and similar physical properties ranging from oily liquids to waxy solids. Due to their non-flammability, chemical stability, high boiling point and electrical insulating properties, PCBs were used in hundreds of industrial and commercial applications including electrical, heat transfer, and hydraulic equipment; as plasticizers in paints, plastics and rubber products; in pigments, dyes and carbonless copy paper and many other applications.

PCBs have been demonstrated to cause a variety of adverse health effects. PCBs have been shown to cause cancer.

3.12.1 Findings

No PCB containing equipment with the potential exception of fluorescent lighting ballasts was observed on site. Fluorescent lighting was observed in use in several areas of the building and inspection of three random light ballasts revealed that they did not contain PCB's. The disposal of PCB containing equipment is regulated under MOE Reg. 558, and it would be recommended that during any ballast replacement works the generated ballasts be evaluated for PCB content, with any PCB ballasts being consolidated and sent for disposal to an MOE licensed PCB receiver under waste class 243D.

3.12.2 Recommendations

It would be recommended that during any ballast replacement works the generated ballasts be evaluated for PCB content. Any PCB ballasts identified should be consolidated and sent for disposal to an MOE licensed PCB receiver under waste class 243D.

3.13 Mould

Mould contamination inside buildings has become a concern to both building owners and occupants. Exposure to moulds is known to cause a variety of health effects in some people. Many fungal spores are considered to be allergenic to susceptible persons, though individual susceptibility varies greatly.

Elevated levels of indoor mould are usually attributed to the chronic moist conditions due to water leaks, floods or elevated humidity. Under these conditions, already low levels of fungal spores in

air from plants and other sources may multiply on cellulose containing materials such as carpets, wallboards, and wood, and result in mould contamination and, if left untreated, can be destructive to certain building materials.

At present, no Federal or Provincial regulations are in effect with respect to reasonable levels of airborne mould spores and other contaminants inside buildings. Health Canada has provided strategies and guidelines related to some indoor contaminants to assist in conducting indoor air quality investigations in their publication *Indoor Air Quality in Office Buildings: A Technical Guide*, 1995. Health Canada recommends that indoor varieties of airborne mould spores should be qualitatively and quantitatively similar to those varieties found outdoors. The presence of one or more fungal species indoors that are not found outdoors suggests the presence of an amplifier in the building.

An additional resource that places numerical limits on acceptable indoor fungal spores is found in the Calgary Health Region's guidelines for *Fungal Air Testing, Investigation and Reporting* for remediated marihuana grow houses. These guidelines suggest that indoor fungal spores are acceptable if found to be elevated by as much as 2 or 3 times the outdoor measurement, depending on the type of mould spore. Refer to attached guidelines.

The Canadian Construction Association (CCA) has provided guidelines regarding investigation and remediation works in *CCA82 - 2004 Mould Guidelines for the Canadian Construction Industry* to protect the health and safety of workers who may be exposed to mould in the course of building renovations.

3.13.1 Findings

During the current investigation, no visible mould or favourable conditions for mould growth were observed in the surveyed areas.

3.13.2 Recommendations

No immediate corrective action is recommended with regard to mould contamination.

4. CORRECTIVE ACTIONS

No corrective actions were recommended.

5. STATEMENT OF LIMITATIONS

Fisher Environmental Ltd. accepts responsibility for the competent performance of its duties in executing this assignment within the normal standards of the profession, but disclaims responsibility for consequential damages, if any.

The extent of the building survey of asbestos containing materials (ACM) and other designated substances is based on prior agreement of the scope of work with the client, and the rationale given in this report. The building survey findings rely on professional interpretation of selective sampling and analysis. Sample analysis results have been applied to homogenous materials in unsampled locations; it was not within the scope of work to carry out an exhaustive sampling and analysis program. For non-accessible building spaces, the likelihood of the presence or absence of asbestos and other designated substances has been described, but such assessment is not a definitive statement of presence or absence.

This report was prepared for the City of Toronto, Facilities Management. The scope of services performed may not be appropriate for the purposes of other users, and any use or reuse of this document or its findings or recommendations represented herein is at the sole risk of any other user.

We trust that the information provided in the report meets your current requirements. If you have any questions or concerns, please do not hesitate to contact the undersigned.

6. SIGN-OFF

We trust that this report meets with City of Toronto requirements and we thank you for the opportunity to be of service. Should you have any questions, please do not hesitate to contact us.

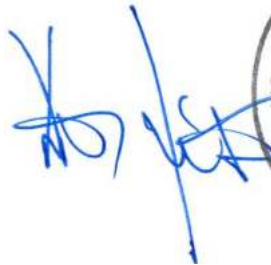
Fisher Environmental Ltd.

Prepared By:



Peter Milosh, B.E.S.
Project Manager

Reviewed By:




David Fisher, P. Eng., C. Chem.
Principal



APPENDIX I

REASSESSMENT SURVEY FORM

APPENDIX I - REASSESSMENT SURVEY FORM

Building Address:	3600 Danforth Avenue, Toronto	Date(s) of Current Reassessment:	October 24, 2014
Building Name:	Toronto Fire Station 225	Organization Completing Reassessment:	Fisher Environmental Ltd. / Project FE-P 14-6915
Original Survey Conducted By:	ECOH Management Inc.	Name of Surveyor:	Peter Milosh
Date(s) of Original Survey:	August 9, 2007	Signature of Surveyor:	

Summary of Findings

All Hazardous Materials observed in Good condition.

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	Not Sampled	ACM Assumed	9000 SF	N/A	
0-00	Exterior	Windows	Window Caulking	Asbestos	Not Sampled	ACM Assumed	All	Good	
0-00	Exterior	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
1-01	Garage	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-01	Garage	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
1-01	Garage	Ceiling	Not Found	N/A	N/A	N/A	N/A	N/A	Open to deck
1-02	Storage	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
1-02	Storage	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
1-02	Storage	Ceiling	Ceiling Tile 1	Asbestos	14-9614-09*	None Detected	20 SF	Good	2' x 4' Pinhole Fissure *From Fisher Project No. 14-6915, dated October 2014
1-02	Storage	Ceiling	Ceiling Tile 2	Asbestos	Homogeneous w. 14-9614-06 to 08	None Detected	45 SF	Good	2' x 4' Pinhole Long Fissure

APPENDIX I - REASSESSMENT SURVEY FORM

<i>Location Number</i>	<i>Location Name</i>	<i>Building System</i>	<i>Material Observed</i>	<i>Potential Hazardous Material</i>	<i>Sample ID</i>	<i>Analytical Result</i>	<i>Quantity</i>	<i>Condition</i>	<i>Notes / Recommended Actions</i>
1-03	Bunker Room	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-03	Bunker Room	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
1-03	Bunker Room	Ceiling	Ceiling Tile 1	Asbestos	14-9614-10*	None Detected	50 SF	Good	2' x 4' Pinhole Fissure *From Fisher Project No. 14-6915, dated October 2014
1-03	Bunker Room	Ceiling	Ceiling Tile 2	Asbestos	Homogeneous w. 14-9614-06 to 08	None Detected	250 SF	Good	2' x 4' Pinhole Long Fissure
1-04	Hose Tower	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-04	Hose Tower	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
1-04	Hose Tower	Ceiling	Not Found	N/A	N/A	N/A	N/A	N/A	Open to deck
1-05	Laundry	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-05	Laundry	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
1-05	Laundry	Ceiling	Ceiling Tile 1	Asbestos	14-9614-11*	None Detected	25 SF	Good	2' x 4' Pinhole Fissure *From Fisher Project No. 14-6915, dated October 2014
1-05	Laundry	Ceiling	Ceiling Tile 2	Asbestos	Homogeneous w. 14-9614-06 to 08	None Detected	115 SF	Good	2' x 4' Pinhole Long Fissure
1-06	Storage	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-06	Storage	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
1-06	Storage	Ceiling	Ceiling Tile 1	Asbestos	Homogeneous w. 14-9614-09 to 11	None Detected	N/A	N/A	2' x 4' Pinhole Fissure NOT OBSERVED
1-06	Storage	Ceiling	Ceiling Tile 2	Asbestos	Homogeneous w. 14-9614-06 to 08	None Detected	130 SF	Good	2' x 4' Pinhole Long Fissure

APPENDIX I - REASSESSMENT SURVEY FORM

Location Number	Location Name	Building System	Material Observed	Potential Hazardous Material	Sample ID	Analytical Result	Quantity	Condition	Notes / Recommended Actions
1-07	Corridor	Floor	Vinyl Floor Tile 1	Asbestos	12348-B-24-01a* 12348-B-24-01b*	None Detected	100 SF	N/A	12" x 12" White with Beige Specks *From Survey Report 2008
1-07	Corridor	Floor	Vinyl Floor Tile 2	Asbestos	12348-B-24-02b*	None Detected	100 SF	N/A	12" x 12" Brown with White Specks *From Survey Report 2008
1-07	Corridor	Walls	Ceramic	N/A	N/A	N/A	N/A	N/A	
1-07	Corridor	Ceiling	Ceiling Tile 1	Asbestos	Homogeneous w. 14-9614-09 to 11	None Detected	10 SF	Good	2' x 4' Pinhole Fissure
1-07	Corridor	Ceiling	Ceiling Tile 2	Asbestos	Homogeneous w. 14-9614-06 to 08	None Detected	190 SF	Good	2' x 4' Pinhole Long Fissure
1-08	Storage Closet	Floor	Vinyl Floor Tile 1	Asbestos	Homogeneous w. 12348-B-24-01	None Detected	60 SF	N/A	12" x 12" White with Beige Specks
1-08	Storage Closet	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
1-08	Storage Closet	Ceiling	Ceiling Tile 1	Asbestos	Homogeneous w. 14-9614-09 to 11	None Detected	N/A	N/A	2' x 4' Pinhole Fissure NOT OBSERVED
1-08	Storage Closet	Ceiling	Ceiling Tile 2	Asbestos	Homogeneous w. 14-9614-06 to 08	None Detected	60 SF	Good	2' x 4' Pinhole Long Fissure
1-09	Kitchen	Floor	Vinyl Floor Tile 1	Asbestos	Homogeneous w. 12348-B-24-01	None Detected	320 SF	N/A	12" x 12" White with Beige Specks
1-09	Kitchen	Floor	Vinyl Floor Tile 2	Asbestos	12348-B-24-02a*	None Detected	320 SF	N/A	12" x 12" Brown with White Specks *From Survey Report 2008
1-09	Kitchen	Floor	Vinyl Floor Tile 3	Asbestos	Homogeneous w. 12348-B-24-03	None Detected	10 SF	N/A	12" x 12" Brown Mosaic
1-09	Kitchen	Floor	Vinyl Floor Tile 4	Asbestos	Homogeneous w. 12348-B-24-04	None Detected	10 SF	N/A	12" x 12" Mauve Mosaic
1-09	Kitchen	Walls	Drywall (DJC)	Asbestos	14-9614-01 to 03*	None Detected	720 SF	Good	*From Fisher Project No. 14-6915, dated October 2014
1-09	Kitchen	Ceiling	Ceiling Tile 1	Asbestos	11850-B-24-01C*	None Detected*	30 SF	N/A	2' x 4' Pinhole Fissure *From Survey Report 2007
1-09	Kitchen	Ceiling	Ceiling Tile 2	Asbestos	14-9614-06*	None Detected	290 SF	Good	2' x 4' Pinhole Long Fissure *From Fisher Project No. 14-6915, dated October 2014
1-09	Kitchen	Ceiling	Drywall (DJC)	Asbestos	Homogeneous w. 14-9614-01 to 05	None Detected	320 SF	Good	

APPENDIX I - REASSESSMENT SURVEY FORM

Location Number	Location Name	Building System	Material Observed	Potential Hazardous Material	Sample ID	Analytical Result	Quantity	Condition	Notes / Recommended Actions
1-10	Lounge	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
1-10	Lounge	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
1-10	Lounge	Ceiling	Ceiling Tile 1	Asbestos	Homogeneous w. 14-9614-09 to 11	None Detected	30 SF	Good	2' x 4' Pinhole Fissure
1-10	Lounge	Ceiling	Ceiling Tile 2	Asbestos	Homogeneous w. 14-9614-06 to 08	None Detected	290 SF	Good	2' x 4' Pinhole Long Fissure
1-11	Foyer	Floor	Vinyl Floor Tile 1	Asbestos	Homogeneous w. 12348-B-24-01	None Detected	20 SF	N/A	12" x 12" White with Beige Specks
1-11	Foyer	Floor	Vinyl Floor Tile 2	Asbestos	Homogeneous w. 12348-B-24-02	None Detected	20 SF	N/A	12" x 12" Brown with White Specks
1-11	Foyer	Walls	Drywall (DJC)	Asbestos	Homogeneous w. 14-9614-01 to 05	None Detected	N/A	N/A	NOT OBSERVED
1-11	Foyer	Ceiling	Drywall (DJC)	Asbestos	Homogeneous w. 14-9614-01 to 05	None Detected	40 SF	Good	
1-12	Storage	Floor	Vinyl Floor Tile 2	Asbestos	Homogeneous w. 12348-B-24-02	None Detected	60 SF	N/A	12" x 12" Brown with White Specks
1-12	Storage	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
1-12	Storage	Ceiling	Ceiling Tile 1	Asbestos	Homogeneous w. 14-9614-09 to 11	None Detected	5 SF	Good	2' x 4' Pinhole Fissure
1-12	Storage	Ceiling	Ceiling Tile 2	Asbestos	Homogeneous w. 14-9614-06 to 08	None Detected	55 SF	Good	2' x 4' Pinhole Long Fissure
1-13	Fitness Room	Floor	Rubber	N/A	N/A	N/A	N/A	N/A	
1-13	Fitness Room	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
1-13	Fitness Room	Ceiling	Ceiling Tile 1	Asbestos	Homogeneous w. 14-9614-09 to 11	None Detected	85 SF	Good	2' x 4' Pinhole Fissure
1-13	Fitness Room	Ceiling	Ceiling Tile 2	Asbestos	14-9614-07*	None Detected	255 SF	Good	2' x 4' Pinhole Long Fissure *From Fisher Project No. 14-6915, dated October 2014
1-13	Fitness Room	Ceiling	Drywall (DJC)	Asbestos	Homogeneous w. 14-9614-01 to 05	None Detected	100 SF	Good	Observed around the skylight

APPENDIX I - REASSESSMENT SURVEY FORM

Location Number	Location Name	Building System	Material Observed	Potential Hazardous Material	Sample ID	Analytical Result	Quantity	Condition	Notes / Recommended Actions
1-14	Men's Washroom	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
1-14	Men's Washroom	Walls	Drywall (DJC)	Asbestos	14-9614-04*	None Detected	100 SF	Good	*From Fisher Project No. 14-6915, dated October 2014
1-14	Men's Washroom	Ceiling	Ceiling Tile 1	Asbestos	Homogeneous w. 14-9614-09 to 11	None Detected	10 SF	Good	2' x 4' Pinhole Fissure
1-14	Men's Washroom	Ceiling	Ceiling Tile 2	Asbestos	Homogeneous w. 14-9614-06 to 08	None Detected	110 SF	Good	2' x 4' Pinhole Long Fissure
1-15	Dormitory	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
1-15	Dormitory	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
1-15	Dormitory	Ceiling	Ceiling Tile 1	Asbestos	11850-B-24-01B*	None Detected*	N/A	N/A	2' x 4' Pinhole Fissure *From Survey Report 2007 NOT OBSERVED
1-15	Dormitory	Ceiling	Ceiling Tile 2	Asbestos	14-9614-08*	None Detected	750 SF	Good	2' x 4' Pinhole Long Fissure *From Fisher Project No. 14-6915, dated October 2014
1-16	Bedroom	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
1-16	Bedroom	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
1-16	Bedroom	Ceiling	Ceiling Tile 1	Asbestos	Homogeneous w. 14-9614-09 to 11	None Detected	N/A	N/A	2' x 4' Pinhole Fissure NOT OBSERVED
1-16	Bedroom	Ceiling	Ceiling Tile 2	Asbestos	Homogeneous w. 14-9614-06 to 08	None Detected	120 SF	Good	2' x 4' Pinhole Long Fissure
1-17	Bedroom	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
1-17	Bedroom	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
1-17	Bedroom	Ceiling	Ceiling Tile 1	Asbestos	Homogeneous w. 14-9614-09 to 11	None Detected	N/A	N/A	2' x 4' Pinhole Fissure NOT OBSERVED
1-17	Bedroom	Ceiling	Ceiling Tile 2	Asbestos	Homogeneous w. 14-9614-06 to 08	None Detected	160 SF	Good	2' x 4' Pinhole Long Fissure

APPENDIX I - REASSESSMENT SURVEY FORM

Location Number	Location Name	Building System	Material Observed	Potential Hazardous Material	Sample ID	Analytical Result	Quantity	Condition	Notes / Recommended Actions
1-18	Vestibule	Floor	Vinyl Floor Tile 1	Asbestos	Homogeneous w. 12348-B-24-01	None Detected	30 SF	N/A	12" x 12" White with Beige Specks
1-18	Vestibule	Floor	Vinyl Floor Tile 2	Asbestos	Homogeneous w. 12348-B-24-02	None Detected	30 SF	N/A	12" x 12" Brown with White Specks
1-18	Vestibule	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
1-18	Vestibule	Ceiling	Ceiling Tile 1	Asbestos	Homogeneous w. 14-9614-09 to 11	None Detected	N/A	N/A	2' x 4' Pinhole Fissure NOT OBSERVED
1-18	Vestibule	Ceiling	Ceiling Tile 2	Asbestos	Homogeneous w. 14-9614-06 to 08	None Detected	60 SF	Good	2' x 4' Pinhole Long Fissure
1-19	Women's Washroom	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
1-19	Women's Washroom	Walls	Drywall (DJC)	Asbestos	14-9614-05*	None Detected	100 SF	Good	*From Fisher Project No. 14-6915, dated October 2014
1-19	Women's Washroom	Ceiling	Ceiling Tile 1	Asbestos	Homogeneous w. 14-9614-09 to 11	None Detected	N/A	N/A	2' x 4' Pinhole Fissure NOT OBSERVED
1-19	Women's Washroom	Ceiling	Ceiling Tile 2	Asbestos	Homogeneous w. 14-9614-06 to 08	None Detected	80 SF	Good	2' x 4' Pinhole Long Fissure
1-20	Corridor	Floor	Vinyl Floor Tile 1	Asbestos	Homogeneous w. 12348-B-24-01	None Detected	115 SF	N/A	12" x 12" White with Beige Specks
1-20	Corridor	Floor	Vinyl Floor Tile 2	Asbestos	Homogeneous w. 12348-B-24-02	None Detected	115 SF	N/A	12" x 12" Brown with White Specks
1-20	Corridor	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
1-20	Corridor	Ceiling	Drywall (DJC)	Asbestos	Homogeneous w. 14-9614-01 to 05	None Detected	50 SF	Good	Observed around the skylight
1-20	Corridor	Ceiling	Ceiling Tile 1	Asbestos	11850-B-24-01A*	None Detected*	N/A	N/A	2' x 4' Pinhole Fissure *From Survey Report 2007 NOT OBSERVED
1-20	Corridor	Ceiling	Ceiling Tile 2	Asbestos	Homogeneous w. 14-9614-06 to 08	None Detected	230 SF	Good	2' x 4' Pinhole Long Fissure

APPENDIX I - REASSESSMENT SURVEY FORM

<i>Location Number</i>	<i>Location Name</i>	<i>Building System</i>	<i>Material Observed</i>	<i>Potential Hazardous Material</i>	<i>Sample ID</i>	<i>Analytical Result</i>	<i>Quantity</i>	<i>Condition</i>	<i>Notes / Recommended Actions</i>
1-21	Main Office	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-21	Main Office	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
1-21	Main Office	Ceiling	Ceiling Tile 1	Asbestos	Homogeneous w. 14-9614-09 to 11	None Detected	18 SF	Good	2' x 4' Pinhole Fissure
1-21	Main Office	Ceiling	Ceiling Tile 2	Asbestos	Homogeneous w. 14-9614-06 to 08	None Detected	162 SF	Good	2' x 4' Pinhole Long Fissure
1-22	Bedroom	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
1-22	Bedroom	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
1-22	Bedroom	Ceiling	Ceiling Tile 1	Asbestos	Homogeneous w. 14-9614-09 to 11	None Detected	N/A	N/A	2' x 4' Pinhole Fissure NOT OBSERVED
1-22	Bedroom	Ceiling	Ceiling Tile 2	Asbestos	Homogeneous w. 14-9614-06 to 08	None Detected	60 SF	Good	2' x 4' Pinhole Long Fissure
1-23	Bedroom	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
1-23	Bedroom	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
1-23	Bedroom	Ceiling	Ceiling Tile 1	Asbestos	Homogeneous w. 14-9614-09 to 11	None Detected	N/A	N/A	2' x 4' Pinhole Fissure NOT OBSERVED
1-23	Bedroom	Ceiling	Ceiling Tile 2	Asbestos	Homogeneous w. 14-9614-06 to 08	None Detected	60 SF	Good	2' x 4' Pinhole Long Fissure

APPENDIX I - REASSESSMENT SURVEY FORM

Location Number	Location Name	Building System	Material Observed	Potential Hazardous Material	Sample ID	Analytical Result	Quantity	Condition	Notes / Recommended Actions
1-24	Front Foyer	Floor	Vinyl Floor Tile 1	Asbestos	12348-B-24-01c*	None Detected	30 SF	N/A	12" x 12" White with Beige Specks *From Survey Report 2008
1-24	Front Foyer	Floor	Vinyl Floor Tile 2	Asbestos	12348-B-24-02c*	None Detected	30 SF	N/A	12" x 12" Brown with White Specks *From Survey Report 2008
1-24	Front Foyer	Floor	Vinyl Floor Tile 3	Asbestos	12348-B-24-03a,b,c*	None Detected	5 SF	N/A	12" x 12" Brown Mosaic *From Survey Report 2008
1-24	Front Foyer	Floor	Vinyl Floor Tile 4	Asbestos	12348-B-24-04a,b,c*	None Detected	5 SF	N/A	12" x 12" Mauve Mosaic *From Survey Report 2008
1-24	Front Foyer	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
1-24	Front Foyer	Ceiling	Drywall (DJC)	Asbestos	Homogeneous w. 14-9614-01 to 05	None Detected	70 SF	Good	
1-25	Office	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
1-25	Office	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
1-25	Office	Ceiling	Ceiling Tile 1	Asbestos	Homogeneous w. 14-9614-09 to 11	None Detected	N/A	N/A	2' x 4' Pinhole Fissure NOT OBSERVED
1-25	Office	Ceiling	Ceiling Tile 2	Asbestos	Homogeneous w. 14-9614-06 to 08	None Detected	190 SF	Good	2' x 4' Pinhole Long Fissure
1-26	Washroom	Floor	Vinyl Floor Tile 1	Asbestos	Homogeneous w. 12348-B-24-01	None Detected	N/A	N/A	12" x 12" White with Beige Specks NOT OBSERVED
1-26	Washroom	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
1-26	Washroom	Ceiling	Ceiling Tile 1	Asbestos	Homogeneous w. 14-9614-09 to 11	None Detected	40 SF	Good	2' x 4' Pinhole Fissure
1-26	Washroom	Ceiling	Ceiling Tile 2	Asbestos	Homogeneous w. 14-9614-06 to 08	None Detected	40 SF	Good	2' x 4' Pinhole Long Fissure
1-27	Utility Room	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-27	Utility Room	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
1-27	Utility Room	Ceiling	Not Found	N/A	N/A	N/A	N/A	N/A	Open to deck

APPENDIX I - REASSESSMENT SURVEY FORM

Location Number	Location Name	Building System	Material Observed	Potential Hazardous Material	Sample ID	Analytical Result	Quantity	Condition	Notes / Recommended Actions
1-28	Storage	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-28	Storage	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
1-28	Storage	Ceiling	Not Found	N/A	N/A	N/A	N/A	N/A	Open to deck
1-29	Storage	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-29	Storage	Walls	Masonry	N/A	N/A	N/A	N/A	N/A	
1-29	Storage	Ceiling	Not Found	N/A	N/A	N/A	N/A	N/A	Open to deck
Surveyor's Field Notes									

APPENDIX II

RESULTS OF BULK SAMPLE ANALYSIS



FISHER ENVIRONMENTAL LABORATORIES

FULL RANGE ANALYTICAL SERVICES • SOIL/WATER/AIR TESTING • ENVIRONMENTAL
COMPLIANCE PACKAGES • 24 HOUR EMERGENCY RESPONSE • CALA ACCREDITED

400 ESNA PARK DRIVE #15
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TEL: 905 475-7755
FAX: 905 475-7718
www.fisherenvironmental.com

Client: City of Toronto
Facilities Management
Address: 2nd Floor, Metro Hall
55 John Street, Toronto, ON
M5V 3C6
Tel.: 416-392-9024
E-mail: maldcro@toronto.ca
Attn: Meaghan Aldcroft

F.E. Job #: 14-9614
Project Name: 2014 Reassessment
Project ID: FE-14-6915
Date Sampled: 24-Oct-14
Date Received: 28-Oct-14
Date Reported: 30-Oct-14
Location: 3600 Danforth Ave
Toronto, ON

Certificate of Analysis

Analysis Requested:	Asbestos
Sample Description:	11 Bulk Samples

Client Sample ID	Lab Sample ID	Sample Matrix	Fibre Type	Asbestos Content
01A - Location 1-09 - DJC	14-9614-01	Drywall Joint Compound		Not Detected
01B - Location 1-09 - DJC	14-9614-02	Drywall Joint Compound		Not Detected
01C - Location 1-09 - DJC	14-9614-03	Drywall Joint Compound		Not Detected
01D - Location 1-14 - DJC	14-9614-04	Drywall Joint Compound		Not Detected
01E - Location 1-19 - DJC	14-9614-05	Drywall Joint Compound		Not Detected
02A - Location 1-09 - Ceiling Tile 02	14-9614-06	Ceiling Tile		Not Detected
02B - Location 1-13 - Ceiling Tile 02	14-9614-07	Ceiling Tile		Not Detected
02C - Location 1-15 - Ceiling Tile 02	14-9614-08	Ceiling Tile		Not Detected
03A - Location 1-02 - Ceiling Tile 01	14-9614-09	Ceiling Tile		Not Detected
03B - Location 1-03 - Ceiling Tile 01	14-9614-10	Ceiling Tile		Not Detected
03C - Location 1-05 - Ceiling Tile 01	14-9614-11	Ceiling Tile		Not Detected

Fisher Environmental Laboratories (Lab ID #: 2745) is accredited by CALA (Canadian Association for Laboratory Accreditation Inc.) for asbestos analysis by PLM.

ANALYTICAL METHOD:

Asbestos has been done in accordance with normal professional standard using the following Fisher Environmental Lab Method: Asbestos by PLM (Polarized Light Microscope) F-26, Rev.2.2.

Authorized by:


Roger Lin, Ph. D., C. Chem.

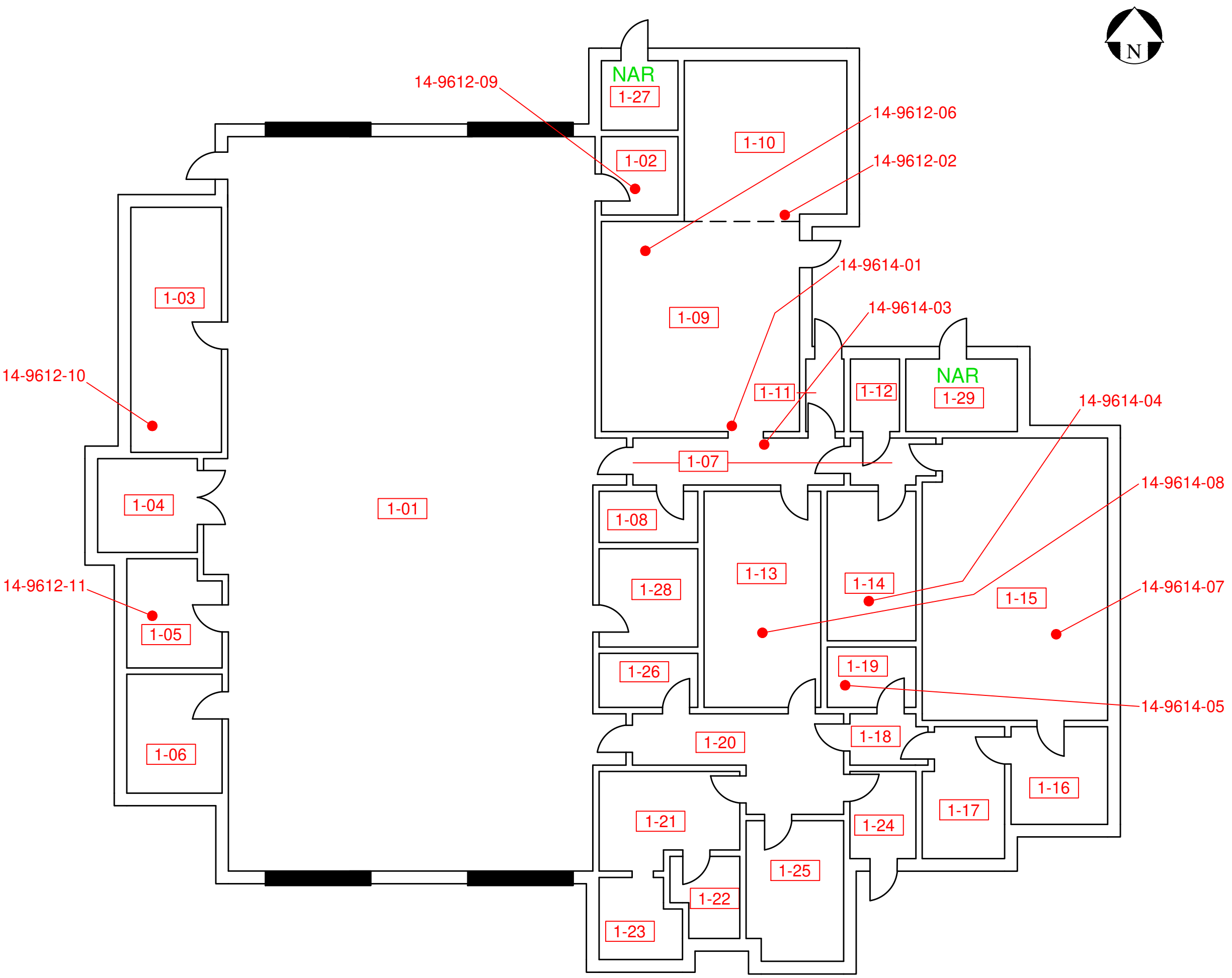


APPENDIX III

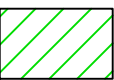




CORRECTIVE ACTIONS INSPECTION REPORT

(NO INFORMATION TO REPORT)

APPENDIX IV
SURVEY DRAWINGS



Legend

-  Asbestos-Containing Material
-  Location Number
-  No Access to Room
-  Asbestos Sample Location
-  Lead Sample Location

The drawing does not illustrate locations of drywall joint compound, plaster, window caulking or roofing materials, for reasons discussed in Section 6 of the Standard Operating Procedure for Designated Substance Surveys. Please refer to the Designated Substance Survey Form in Appendix I for information regarding the locations and asbestos or lead-content of these materials.

Figure 1

LOCATION:
3600 Danforth Avenue
Toronto, Ontario

BUILDING NAME:
Toronto Fire Station 225

First Floor Plan
Asbestos-Containing Material Locations

CLIENT: City of Toronto		
PROJECT NUMBER: FE-P 14-6915	DATE: OCT 2014	DRW BY: AH
CAD FILE: First Floor	SCALE: Not to Scale	CHK BY: PM



APPENDIX V

SITE PHOTOGRAPHS

(NO INFORMATION TO REPORT)

APPENDIX C1

Part 3 of City RFQ for Elevators

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RFQ No. Doc2471878011

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1. Background

.1 **Accessibility for Ontarians with Disabilities Act and City's Commitment**

The Accessibility for Ontarians with Disabilities Act, 2005 (AODA) is provincial legislation designed to achieve accessibility for Ontarians with disabilities with respect to goods, services, facilities, accommodation, employment, buildings, structures and premises by January 1, 2025.

In August 2009, City Council adopted and endorsed a 'Statement of Commitment to Creating an Accessible City'. In June 2018, City Council adopted the City of Toronto Corporate Accessibility Policy, which states that the City will ensure accessibility at all its facilities and public spaces.

Refer to Appendix A for the City Corporate Accessibility Policy.

.2 **Corporate Real Estate Management Capital Accessibility Upgrades Program**

The Corporate Real Estate Management (CREM) Division is implementing an accessibility upgrades program for over 350 City buildings under its management with the intent to complete most of it by the end of 2024.

These buildings will be upgraded to meet the requirements of the latest version of the Toronto Accessibility Design Guidelines (TADG) wherever feasible.

In order to complete the accessibility upgrades at these buildings, CREM is establishing a roster of general contractors under a separate procurement call. The work assignments will be carried out pursuant to a second stage competition process consisting of a tender for a group of five (5) to twenty (20) construction projects, bundled generally by a geographic area.

Depending on the project, the work will consist of major and / or minor renovations to the exterior and interior spaces of existing buildings. The majority of buildings, spaces and sites are currently occupied and operational with a short list of vacancies.

In some cases where a building is planned for other repair, rehabilitation, or renovation work, all scopes will be combined together with the accessibility upgrades in the same tender package for a general contractor.

The need for new elevators at these buildings was identified as part of the accessibility upgrades. The City of Toronto estimates between 35 – 50 elevators will be required to complete the upgrades. Refer to Appendix B for the list of 42 addresses, identified as potential candidates for new elevator installations at the time of the RFQ posting. Work continues on accessibility audits and detailed design, therefore this number may be adjusted up or down.

The City of Toronto will direct general contractors selected to deliver accessibility upgrades to procure elevators and associated services defined in this RFQ from the Successful Supplier at the unit pricing negotiated by the City.

3. Scope of Work and Associated Deliverables

Please refer to Appendices D, E, F, and G of Part 3 – Technical Specifications and Requirements for Deliverables. The Specifications detail the Scope of Work requirements in detail by type of equipment. The information provided in this section is a summary of requirements only – refer to the Appendices listed for the full requirements of this Request for Quotation.

- .1 The scope of this RFQ is for the provision of unit pricing for the non-exclusive supply, delivery and installation of Elevators and Necessary Equipment for the City of Toronto's Accessibility Upgrades Capital Program to Various Locations, as and when required from the date of award. General contractors selected to deliver accessibility upgrades will procure elevators and all associated services from the Successful Supplier at the unit pricing negotiated by the City under this RFQ.
- .2 The selected Supplier will be required to execute a Contract with the City for the provision of unit pricing for the Deliverables. Subsequently, the selected Supplier will be required to enter into contracts to supply, deliver and install elevators and necessary equipment with general contractors chosen by the City to deliver accessibility upgrades to City buildings. Master Service Agreement between the City and general contractors is included in Appendix I to this Part 3 - Technical Specifications and Requirements for Deliverables. **Suppliers should review the terms and conditions set out in Part 2 (FORM OF AGREEMENT) to understand the Contract being entered into with the City.**

4. Performance Security – Not Applicable

5. Insurance Requirements

- .1 The Supplier shall comply with all insurance requirements, and all WSIB prior to the execution of the Contract. The Supplier shall bear all costs, expenses, losses and damages of its own and those of the General Contractor and the City, which may arise as a result of the Supplier failing to or delaying in promptly complying with this condition.
- .2 The Supplier agrees to purchase and maintain in force, at its own expense and for the duration of the Contract and as required in any contract with a general contractor, pursuant to this RFQ, the following policies of insurance, which policies shall be in a form and with an insurer acceptable to the City. A certificate evidencing these policies signed by the insurer or an authorized agent of the insurer must be delivered to the City prior to the commencement of services:
 - a) Commercial General Liability provided that the policy:
 - (i) is in the amount of not less than Five Million Dollars (\$5,000,000.00), per occurrence;
 - (ii) adds the City of Toronto as an additional insured;
 - (iii) includes Non-Owned Automobile Liability, Employer's Liability and/or Contingent Employer's Liability, and any other provision relevant to the services;

- (iv) includes a clause which will provide the City with thirty (30) days' prior written notice of cancellation (15 days if cancellation is due to non-payment of premium).
- b) Automobile Liability insurance with a minimum limit of Two Million Dollars (\$2,000,000) for all owned or leased licensed motorized vehicles used in the performance of services.

It is understood and agreed that the coverage and limits of liability noted above are not to be construed as the limit of liability of the vendor in the performance of services. It is also agreed that the above insurance policies may be subject to reasonable deductible amounts, which deductible amounts shall be borne by the vendor. At the expiry of the policies of insurance, original signed Certificates evidencing renewal will be provided to the City without notice or demand.

The successful vendor is responsible for any loss or damage whatsoever to any of its materials, goods, equipment or supplies and will maintain appropriate all-risk coverage as any prudent owner of such materials, goods, supplies and equipment. The successful vendor shall have no claim against the City or the City's insurers for any damage or loss to its property and shall require its property insurers to waive any right of subrogation against the City.

6. Delivery

- .1 The Supplier must deliver the specified Deliverables as per their Quotation without substitution or deviation.
- .2 The Supplier shall provide staff who are qualified to undertake the installation services required under the terms of this RFQ. The Supplier's staff must be certified to maintain, repair, install and set-up the types of equipment and associated parts in Part 5 – Pricing Form.
- .3 Late Delivery, partial shipments or shipment of unauthorized Product may result in the Contract being cancelled.
- .4 The Supplier shall restore all property temporarily removed, damaged, or destroyed during the supply, delivery, and installation, of Deliverables to the reasonable satisfaction of the City or to its previous state and at no cost to the City. The Supplier, before final payment, shall remove all surplus materials and any debris of every nature resulting from its operation and put the site(s) in a neat, orderly condition; thoroughly clean. If the Supplier fails to clean up at the completion of the supply, delivery, and installation of the Products, then the City may do so and charge the Supplier for the costs thereof, or deduct said costs from any monies still owing to the Supplier through the general contractor.
- .5 The Supplier shall furnish all labour, materials, services, supplies, tools, equipment, apparatus, transportation, facilities and incidentals required and perform all operations necessary to accomplish the complete installation of the Deliverables.
- .6 A hard copy packing slip must accompany the products delivered and include at a minimum, the purchase order number, the requisitioner's name and address, a

description of the items delivered complete with serial numbers, part numbers, and quantity shipped.

7. Substitutions of Deliverables

- .1 Suppliers must not substitute contract approved product(s), commodity(s) or service(s) without prior written approval from City of Toronto through the approval by the Consultant, on either City of Toronto letter head or City of Toronto originating email. This will be enforced via subsequent tender documents. Any approved substitution must meet or exceed the approved good, approved commodity or approved service to be substituted, at no additional cost to the City of Toronto. Supplier will reimburse all substitution evaluation costs, including labour and testing costs, to City of Toronto PMMD Standards and Specifications Unit.

8. Warranty

- .1 Please refer to Part 3 - Technical Specifications and Requirements for Deliverables - Appendix D, Section 1.5

9. Usage Reports

- .1 If requested, the Supplier shall demonstrate the ability to provide an electronic Usage Report in MS Excel 2013 or higher version, of invoice details by providing the following report criteria:

Dollar value and usage information by,

- a) Cost Centre
 - b) Location
 - c) Invoice Number
 - d) By quantity
 - e) By elevator type
 - f) By delivery date
 - g) Usage
 - h) Cumulative Total by month or as requested by the City
- .2 The Supplier shall be required to submit to the City of Toronto, "Usage Reports" on a monthly basis, or as requested, within 30 days after the end of each month and 15 days after the Term expiry date based on Part 5 – Pricing Form and the above report criteria. The Supplier shall also provide a cumulative report at the end of the Contract term based on the aforementioned criteria.
 - .3 The City may further request a detailed Usage Report at any time during the Term to verify releases on the Contract. The Supplier will provide the information within five (5) Business Days of request. Usage Reports shall be provided by the Supplier at no cost to the City.
 - .4 **If requested**, a sample Usage Report detailing the criteria noted above should be included by the Supplier. If a sample Usage Report is not included with Bid submission, the Supplier will provide the report within five (5) Business Days of request at no cost to the City. Failure to provide the sample report within the specified period may result in the Supplier being declared Non-Compliant.

10. Product and Service Specifications

- .1 The Supplier shall be able to provide the Deliverables within the Greater Toronto Area (GTA) as defined in Appendices D, E, F, and G of Part 3 – Technical Specifications and Requirements for Deliverables.
- .2 The Supplier shall be able to carry out inspections, tests and maintenance tasks in accordance with Part 3 – Technical Specifications and Requirements for Deliverables – Appendix E and F.
- .3 The Supplier shall provide emergency repair Services as and when required during weekends and after Business Hours.
- .4 All work must be performed to the Ministry of Labour requirements and to manufacturer's specification.
- .5 All specifications are minimum requirements that must be met or exceeded. Bids containing one or more items that do not meet or exceed the minimum specifications will be declared Non-Compliant.
- .6 Suppliers must fully complete the Specifications Form in Part 4 – Submission Items by entering “yes”, meaning the Deliverables being quoted meet or exceed the minimum specifications, or “no”.
- .7 Suppliers that do not fully complete the Specification Forms will be declared Non-Compliant.

APPENDICES

APPENDIX A – CITY OF TORONTO CORPORATE ACCESSIBILITY POLICY

APPENDIX B – BUILDING ADDRESSES AND ESTIMATED CONSTRUCTION DATES

APPENDIX C – WORK HOURS

APPENDIX D – CONVEYANCE GENERAL REQUIREMENT (14 01 20)

APPENDIX E – HYDRAULIC CONVEYANCE REQUIREMENT (14 20 06)

APPENDIX F – TRACTION CONVEYANCE REQUIREMENT (14 24 06)

APPENDIX G – CAB DESIGNS

APPENDIX H – FAIR WAGE POLICY

APPENDIX I – AGREEMENT WITH GENERAL CONTRACTORS

APPLICABLE CITY POLICIES

For a copy of the City of Toronto Procurement Policies, please download a copy of the Policy by clicking any of the links as provided below or by visiting the following website (www.toronto.ca/purchasing/policies):

(1) **FAIR WAGE POLICY***

*Fair Wage Policy – (extracted from Schedule A of the City of Toronto Municipal Code, Chapter 67)
FW R (10/07)

The policy and schedules are available on the Fair Wage Office website –
www.toronto.ca/fairwage

LABOUR TRADES CONTRACTUAL OBLIGATIONS IN THE CONSTRUCTION INDUSTRY*

Labour Trades Contractual Obligations – (extracted from Schedule B of the City of Toronto Municipal Code, Chapter 67)

(2) **ACCESSIBILITY STANDARDS FOR CUSTOMER SERVICE TRAINING REQUIREMENTS POLICY**

(3) **ENVIRONMENTALLY RESPONSIBLE PROCUREMENT STATEMENT**

(4) **POLICY ON DONATIONS TO THE CITY FOR COMMUNITY BENEFITS**

(5) **RIGHT TO REJECT DEBTORS AND SET OFF POLICY**

No.	Building Type	City	Start of Work no sooner than:	End of Work no later than:	Workdays
1.	X1	Toronto	8:00pm	6:00am	Sunday to Saturday
2.	X2	Toronto	8:00pm	6:00am	Sunday to Saturday
3.	X3	Toronto	8:00pm	6:00am	Sunday to Saturday
4.	Y1	Toronto	8:00pm	6:00am	Sunday to Saturday
5.	Y2	Toronto	8:00pm	6:00am	Sunday to Saturday
6.	Y3	Toronto	8:00pm	6:00am	Sunday to Saturday

Appendix D

Conveyance General Requirement (14 01 20)

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1. General

1.1. General requirements

1. Conform to the latest editions of the CAN/CSA B44-19 and its applicable appendices and requirements as amended from time to time;
2. Conform to the latest requirements of all Technical Standards and Safety Authority (TSSA) requirements and all relevant TSSA Rulings; and
3. Conform to 209/01 and all code adoption documents. (Collectively the "Code").
4. Conform to the latest requirements of the City of Toronto Accessibility Design Guidelines (TADG).
5. Install the following equipment:

Building	Bank	Machine Type	Number of Devices
Schedule A	Schedule A	Schedule B	Schedule A

6. all above device(s) are located in the Greater Toronto Area (GTA).

1.2. Scope

1. Provide labour, materials, products, equipment, and services necessary for the installation of the elevators in compliance with all relevant codes and barrier free access under Appendix E of the CAN/CSA B44-2019.

1.3. Definitions

1. The term "Consultant", as used herein, refers to "IBI GROUP".
2. The term "Owner", as used herein, refers to "City of Toronto".
3. The term "Architect", as used herein, refers to "IBI GROUP".
4. The term "Building", "Site" and "Location" refers to Schedule A.
5. The term "Address" refers to Schedule A.
6. The term "Inspecting Authorities", as used herein, refers to authorized agents of governments charged with the responsibility of carrying out periodic inspections and tests on vertical transportation equipment.
7. The term "Provide" or "provide", as used herein, means to supply and install new equipment.
8. The term NEMA as used herein, refers to the National Electrical Manufacturers Association.
9. The term ADAAG as used herein, refers to ADA Accessibility Guidelines.
10. The term FEO-K1 as used herein, refers to the ASME A17.1, "Safety Code for Elevators and Escalators" codified this key, designated "FEO-K1", as the universal standard key for firefighter's emergency operation.
11. The term LED as used herein, refers to Light Emitting Diodes.
12. The term GUI as used herein, refers to General User Interface.
13. The term LCD as used herein, refers to Liquid Crystal Display.

14. The term USB-KIT as used herein, refers to Universal Serial Bus and KIT represents a set of articles or equipment needed for a specific purpose.
15. The term ANSI as used herein, refers to American National Standards Institute.
16. The term MOL as used herein, refers to Ministry of Labour in Ontario.
17. The term Central Monitoring System as used herein, refers to remote elevator monitoring as described in section 1.52.
18. The term WHMIS as used herein, refers to Workplace Hazardous Material Information System and now the Globally Harmonized System of Classification and Labelling of Chemicals (GHS).
19. The term TSSA as used herein, refers to Technical Standards and Safety Authority.
20. The term UL, CSA and CE as used herein, refers to certification that the product, process and service have been tested according to Canadian or U.S. or European standards and that they comply with the requirements of this standard.
21. The term Optic Series refers to a series of buttons with dual lighting. One light is in the button (halo or on the surface) and another on the braille.
22. The term Schedule 40 pipe refers to a pipe typically made from a low-carbon or mild steel. These steels are typically categorized by having a carbon content less than 2 percent.
23. The term PVC as used herein, refers to polymerizing vinyl chloride.
24. The term "Occupational Health and Safety Act" (OHSA) as used herein, refers to Ontario's legislation for workplace health and safety which deals with the prevention of occupational injury and disease and the Human Rights Code, which often has to be considered in dealing with occupational health and safety issues.
25. The Term "Notice of Project" as used herein, means the Ministry of Labour Training and Skills Development notice submitted prior to starting a project as set out in section 6(1) of the Regulation for Construction Projects, O. Reg 213/91.
26. "Substantial Performance" or "Substantial Completion" shall be the point at which all the new equipment has been installed, inspected and passed by the Inspecting Authorities and the elevators are operating as a group with all required features operational, as per Specification Documents. The Consultant shall certify the Substantial Performance of the work.
27. "Total Performance" per building means when the entire installation is complete as required by the specification documents 14 01 20, 14 20 06, 14 20 16, 14 24 06, 14 24 16 (the "Specifications") and is so certified by the Consultant. Notwithstanding the requirements of Canadian Construction Documents Committee (CCDC), and in addition to the foregoing, Total Performance shall be achieved when the elevator performance is in compliance with Section 14 01 20.1.42.
28. Any terms in the Specifications that are not otherwise defined shall have the definitions as given in the latest edition of the Code CAN/CSA B44-19, including where applicable, the latest supplements, for elevators, dumbwaiters, escalators and moving walks.

1.4. Assignment

1. The Supplier shall not assign any work, payment or other obligation of the resulting contract without the written consent of the Owner.

1.5. Warranty

1. The elevator Supplier shall warrant the materials and workmanship of the installation and will make good any defects not due to ordinary wear and tear or improper use or carelessness that may develop within two (2) years from the date of Substantial Performance of the project.
2. The elevator Supplier shall provide a minimum of quarterly maintenance in accordance with the latest requirement of CAN/CSA B44-2019 for the duration of the Warranty period. The cost for the maintenance shall also be included in the price. Regular time callbacks shall be included.

1.6. Hoarding

1. Provide hoarding for the protection of the public and workers at the site. The hoarding design provided to be approved by the Owner.
2. Install temporary barriers between the hoistways as required by Code.
3. The hoarding shall cover the entire entranceway and should have signage design and verbiage approved by the Owner. If access is required at multiple floors, install the barrier on these floors.
4. Provide a solid barrier with fire retardant properties. Allow access only through a lockable 914.4mm by 1828.8 mm (36"x72") door.

1.7. Removal of equipment

1. The Supplier shall at its own expense remove all unused, replaced equipment and rubbish in the machine room.

1.8. Conduct

1. Supervise your personnel so that they present a neat appearance and their movement in the building is within the requirements of their work.
2. Provide uniforms or other obvious means of identification for personnel.
3. Materials, tools and other equipment shall be stored in areas designated by the Owner where space permits. The Supplier is responsible for equipment storage.
4. Any work (regular or noisy work) shall be performed at times suitable to the Owner and between the hours noted in **Appendix C** and shall be within the limits of the local municipal, city and provincial noise by-law.
5. If work is disruptive to the common areas, then approval of the Owner is required and the work should be provided after hours at no additional cost.
6. The rules and regulation shall be adhered to at all times while work is being performed on site. The Supplier shall endeavor to disseminate the information provided within the guideline to all field personnel and shall, at a minimum, meet or exceed the requirements of the Owner under the guidelines.
7. Parking and storage is not the responsibility of the Owner. The Owner may assist where possible in providing suitable space, but shall not be required to do so.
8. Provide the team members with proper tools and communicating equipment to eliminate loud vocal noises and shouting in the hoistway.
9. Comply with Owner's rules and regulation related to: signing, parking, storage, badges, clothing, music, language, use of facilities, etc...

10. The Supplier shall commit to regularly scheduled meetings with the Consultant and Owner to ensure that the escalator removal is going according to plan. The Supplier shall also provide support to the Consultant and disseminate information regarding the Work as requested and required by the Consultant.
- 1.9. Codes and Ordinances
 1. Supply equipment and do work in accordance with building codes, by-laws, regulations and requirements of the local, provincial and federal authorities in effect at the time of the execution of the work.
 2. Supply equipment and do work in accordance with the latest edition of the Code and any other code, which may govern the requirements of the installation.
 3. Comply with the requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.
 4. Prior to submission of the bid and throughout the duration of work, give prompt notification in writing of any regulations or requirements known to be in process that might affect the acceptability of the work.
 5. If changes in codes or regulations result in extra costs, those taking effect subsequent to the date of bid submission shall be treated as an extra to the contract.
- 1.10. Certificates of Inspection
 1. Obtain and pay for certificates of approval and all other necessary permits and inspections.
 2. Prior to Substantial Performance, arrange for and pay for a safety inspection of the equipment by the TSSA.
 3. Submit, prior to Total Performance, the approved safety inspection report.
- 1.11. Materials and Workmanship
 1. Provide all new materials and equipment.
 2. Install equipment in a neat, accurate, workmanlike manner.
 3. Comply with the directives of the Consultant.
- 1.12. Trade Marks
 1. Do not apply any trademarks to the car stations without the permission of the Owner.
- 1.13. Fixture Type and Finish
 1. Provide fixtures and finishes as requested by Owner in **Schedule F**. Also provide 5 complete sets (a set contains two keys) of keys (for each key type) to the Owner during the technical seminar.
 2. Where braille is specified, braille marking must meet the approval of the Owner.
- 1.14. Machine Guarding
 1. Engineer proper machine guarding compliant with municipal, provincial and federal Authority Having Jurisdiction (AHJ) over all moving components located in the machine room.
 1. This includes but is not limited to: governors; exposed armatures; brake arms; exposed electrical and high voltage components; rotating sheaves; exposed ropes;

exposed rope brake or secondary safety brake; selectors; selector tape; secondary sheaves; secondary space with moving or rotating parts; and any other rotating equipment or space considered a pinching, sheering or electrical hazard.

2. Provide inspection ports and access to allow visual inspection without dismantling.
3. Provide components that prevent accidental pinching hazards.
4. Provide equipment and components that can deflect a 68kg (150 lbs) falling object.
5. Paint the components and guards with matching paint to that of the equipment being guarded.
6. Paint all moving parts in bright yellow colour.
7. Submit the design to the Consultant and Owner for review within 14 days from award of contract.
8. Provide an engineer's letter of certification that the guarding provided at the site meets with all the requirements of the AHJ.

1.15. Electrical Diagrams

1. Supply wiring diagrams and data as required for the execution of the work herein described including schematics for speed control, dispatching system, and interface printed circuit boards.
2. Incorporate, as part of the schematic diagrams, a reference index (road map) giving the location of electrical components and wiring interconnections for relay coils, relay contracts, field equipment, integrated circuits and other such devices, so that the position on the schematics of any of these items can be readily determined.
3. Supply, prior to the Total Performance inspection, three prints and one reproducible of the wiring and schematic diagrams revised to show changes that have been made.
4. If changes are subsequently made to the wiring or control, supply an additional two sets of marked-up prints of the schematics and field wiring diagrams showing the changes.
5. The wiring diagrams to be the property of the Owner
6. The wiring diagram shall be laminated and properly mounted on a clip board.

1.16. Maintenance Manual

1. Supply to the Owner prior to the Substantial Performance inspection, a maintenance manual as set out in the maintenance section of the specifications
2. The maintenance manual to be the property of the Owner.

1.17. Operation Manual

1. Supply to the Owner prior to the Total Performance inspection, three sets of manuals describing in detail the operation of the equipment including special features, dispatching sequences, and such items as intercom systems and security systems.
2. Set out in step-by-step form the operation for special features such as firefighter's service, independent service, code blue, emergency power service and special emergency service.
3. Supply, as part of the manual, drawings of operating panels (e.g. car panels, central control consoles) with descriptions of the function of switches and indicators.

4. The operation manual to be the property of the Owner.
- 1.18. Technical Seminar
 1. At the time of Total Performance, arrange with the Owner to provide a seminar for the Owner's staff.
 2. Include in the seminar a complete review of the documentation, operation of the equipment and demonstration of any special features.
 3. Provide to the satisfaction of the Owner training on the use of the building management system when it is supplied.
 - 1.19. Painting
 1. Ensure that machine room floors, machine room equipment, hoistways equipment, oxidizing guide rails, top and bottom of car, pit as well as pit equipment are painted.
 2. Paint with low odor paint products all visible sections of the pit steel. At a minimum, ensure that pit floors, pit hoistways equipment, rusted rails and pit steel are painted with Owner approved low odour, rust resistant paint.
 - 1.20. Operating Environment
 1. Arrange that the equipment be capable of operating normally and within the requirements of the Specifications when the ambient temperature is between 3.5 and 36 degrees Celsius (38 and 97 degrees Fahrenheit).
 2. Arrange that the equipment be capable of operating normally and within the requirements of the Specifications when the supply voltage is within minus 10% and plus 10% of the nominal voltage and the frequency is within 5% of the nominal frequency.
 3. The Current Total Harmonic Distortion (THD RMS Voltage) not to exceed 5.0% as per the IEEE 519 standards for filtering of SCR motor equipment. Where the drive does not meet this requirement, provide harmonic filters to meet this requirement.
 4. Provide all necessary drive adjustments to allow for the operation of the elevators under emergency power condition in the event that the emergency power is not suitable to operate the elevators at nominal or rated speed.
 - 1.21. Acceleration of Work
 1. If the work falls behind the schedule submitted to the Owner, take action as necessary to meet the schedule, including, but not limited to, extra personnel and overtime work.
 2. Pay any costs associated with this action unless the delay is caused by acts of government, civil commotion, malicious mischief, act of God or any cause beyond the control of the Supplier.
 - 1.22. Test Data Form: Elevator
 1. After completion of the work, and prior to Substantial Performance, submit a test data form certifying that the unit is complete and ready for inspection. Where the Owner has provided a specific data sheet (usually in the maintenance contract) populate said data sheet.
 2. Arrange that the person responsible for the performance of the work sign this form.
 3. Include a check list of the items in the Specifications as well as other performance data such as door times, operating times, starting, running, stopping currents and voltages, and in general, settings of any adjustable devices.

4. List on this form safety devices, together with their settings and indicate whether they have been checked and adjusted.
- 1.23. Inspection of Elevators
 1. The Consultant will make an acceptance inspection of each elevator after the government inspection test and before the elevator is put into service for the public. The Supplier shall assist the Consultant in the inspection.
 2. The Consultant will make an acceptance inspection of the complete elevator group and all group functions. The Supplier shall assist the Consultant in the inspection.
 - 1.24. Generic Maintenance
 1. Arrange that the equipment can be maintained and adjusted by any competent elevator company without the use of proprietary tools, information or equipment or, if such tools, information or equipment are required, provide them.
 2. Do not incorporate any running time, cycle counters or trip counters that would cause the equipment to shut down or alter its operation in any way.
 3. Provide evidence that all parts needed to maintain and operate the elevating device(s) are available and can be ordered directly by the competition. Provide an affidavit of such claim as well as all supporting documents (catalogue), phone numbers, etc...
 4. Provide all parts including motherboards at a non-exchange basis (i.e. the boards do not have to be exchanged to be secured). All parts shall be made available for purchase and be made available at commercially reasonable and competitive rates.
 5. Provide all required laptops, computers and tools (including adjuster dongles and Bluetooth connectors to allow for adjusting and troubleshooting). Where training is required to provide such access, provide the training.
 6. Provide training on demand (price for training shall be at commercially reasonable and competitive rates) to include adjusting and troubleshooting as well as setting up drives, landing systems, control features, encoders, floor tables, etc...
 - 1.25. Non-Proprietary
 1. All control equipment shall be non-proprietary.
 2. Proof of non-proprietary shall be given in writing and documentation such as brochures and instruction manuals shall accompany the bid pricing.
 3. Supplier shall submit to the Owner proof substantiating the claim of non-proprietary equipment status.
 - 1.26. Diagnostic
 1. Provide non-proprietary diagnostics.
 2. The control system shall provide comprehensive means of accessing the computer memory for elevator diagnostic purposes.
 3. The controller shall have permanent indicators for important elevator statuses as an integral part of the controller.
 4. Any tool required to change parameters such door dwell timing, nudging, securing floors etc. shall be included with the control equipment.

- 1.27. Temporary Group Controller:
 1. Not needed.
- 1.28. Installation Flow Chart Schedule
 1. Assign two teams to perform the installation.
 2. Removal of a team during the installation is forbidden and prohibited unless approved by the Owner. Failure to keep the teams on site is considered a breach of contract and is subject to financial remedies by the Owner.
 3. Provide the Owner and Consultant with an installation flow chart. The flow chart should consist of the following:
 1. The starting date.
 2. The sequence of the installation procedures.
 3. The length of time required to complete each of the procedures.
 4. Length of time to complete the first car and each car thereafter.
 5. The completion date.
 4. Following the award letter of intent, provide a complete technical brief on the mechanical and electrical requirements as well as heat dissipation and reactions
 5. Under no circumstances shall either party be liable for any loss, damage or delay due to any cause beyond either party's reasonable control, including but not limited to acts of government, strikes, lockouts, labour disputes, fire, explosion, theft, weather damage, flood, earthquake, riot, civil commotion, war, mischief or act of God.
 6. In no event shall the Supplier have any liability for loss of profits, loss of business revenue, failure to realize expected savings, other commercial or other economic loss of any kind whatsoever or for any indirect, special or consequential damages.
 7. If there is any delay beyond the Supplier's reasonable control or a delay caused by the Owner, the penalty outlined in the general conditions shall not apply for the delay period.
- 1.29. Conflict Resolution
 1. Any disputes related to this contract shall be resolved utilizing an alternative dispute resolution by a mutually accepted arbitrator to be chosen by the Owner and the Supplier take out period within thirty (30) days after written notice by one of the parties demanding binding arbitration.
 2. Neither one of the parties may unreasonably withhold consent to the selection of an arbitrator, and the Owner and the Supplier will share the cost of the arbitrator equally.
 3. By mutual agreement, however, the Owner and the Supplier may postpone arbitration until both parties have completed some specified but limited discovery about the dispute. The parties may also agree to replace arbitration with some other form of binding alternate dispute resolution procedure.
- 1.30. Venue, Jurisdiction, and Jury Waiver
 1. The venue of any judicial proceedings shall be in the city of Toronto unless otherwise agreed by the Parties. Each Party irrevocably submits to the exclusive jurisdiction of the federal and provincial/territorial courts located in Toronto unless otherwise agreed by the

Parties. Each Party waives to the fullest extent permitted by law, trial by jury of all Disputes arising out of or relating to this agreement.

1.31. Attorneys' Fees

1. If legal action, including an alternative dispute resolution process, is necessary by either Party to enforce or interpret this agreement or resolve a Dispute arising hereunder, the prevailing Party shall be entitled to recover reasonable attorneys' fees and costs, including fees on any appeal.

1.32. Waiver

1. No waiver of the terms, provisions, conditions and covenants of this agreement shall be binding and effective unless the same shall be in writing signed by the Parties. A waiver of any breach of the terms, provisions, conditions and covenants of this agreement shall be for that one time only and shall not apply to any subsequent breach.

1.33. Energy Saving

1. The Supplier shall provide supporting document evidencing that the proposed solution (hydraulic, MRL, etc...) is more energy efficient than the alternative.

1.34. Words

1. No change or modification of the Contract shall be valid unless it is in writing and signed by the Supplier and the Owner.

1.35. Additional or Hidden Costs

1. The Owner through this Tender, hopes to identify and price all costs associated with the installation. Therefore, any additional or hidden costs that the elevator Supplier is aware of must be identified.
2. Include as part of your tender over-time hours for the following or for any other similar tasks needed to complete the installation:
 1. Testing of the fire recall, emergency power and service once the elevators are turned over;
 2. Loading and transporting of material to the machine room or floors if such work is disruptive to building common areas or space after building occupancy.
 3. Transferring of hall call riser after building occupancy;
 4. Rewiring of dispatcher after building occupancy; or
 5. Removal of two or more cars out of group service after building occupancy.

1.36. Workplace Safety and Insurance Board Coverage

1. The Supplier clearly understands and agrees that it is not, nor is anyone hired by it, covered by the Owner under the Workplace Safety and Insurance Act S.O. 1997, c16, Sch.A, as amended and the Supplier shall be responsible for and shall pay all dues and assessments payable under the Workplace Safety and Insurance Act, the Employment Insurance Act, S.C. 1996, c23 or any Act, whether provincial or federal, in respect of itself, its employees and operations, and shall furnish the Owner, if requested, with such satisfactory evidence that it has complied with the provisions of any such Acts. If the vendor fails to do so, the Owner shall have the right to withhold payment of such sum or sums of money due to that would be sufficient to cover its default and the Owner shall have the right to pay same.

2. The Owner is not the employer of the Supplier or its personnel under any circumstances whatsoever.
- 1.37. Non-Compliance
1. This agreement may be terminated without notice by the Owner upon non-performance of Contract terms; however, in doing so, the Owner does not waive its right to rely upon any obligations or commitments agreed to by the Supplier as part of this Contract. Specifically, the Supplier will be liable for the Owner's acquisition costs (including but not limited to administrative costs) exceeding the contract price required to obtain an alternative Supplier.
 2. Where there is a question of non-performance, payment in whole or in part may be withheld at the discretion of the Owner. This action shall not prevent the Owner from taking early payment discounts otherwise applicable.
- 1.38. Security System
1. Assist the security contractor access the elevator car operating station, car top and provide wiring and power to re-install security cameras in the elevators at no additional charge.
- 1.39. Security Card Access
1. Assist the security contractor access the elevator car operating panels and car top and provide wiring and power to install card access in the elevators at no additional charge.
 2. Provide all needed assistance and support to install card access systems in the elevators. Provide required boards or interfacing hardware to track users and identify which buttons were activated.
- 1.40. Hoistway Access by Others
1. The contractor shall assist the Owner and its representative by providing access to the elevator hoistway so that installation of the life support systems can be expedited at no additional cost to the Owner.
- 1.41. Performance
1. The purpose of this installation is to increase reliability and maintain the elevator performance. Notwithstanding any CCDC-2 requirements or other contractual terms and conditions to the contrary, the elevator installation shall not be considered complete unless:
 1. The elevators are performing in accordance with the specifications and performance table in 14100;
 2. The callback ratio is 0.25 call per elevator per month;
 3. Each individual elevator does not exceed two callbacks per Quarter; and
 4. Not more than one elevator is shutdown at a time.
 2. The Supplier shall demonstrate compliance with the conditions noted in Section 1.41.1, 90 days immediately prior to the date of claimed Substantial Performance. If the required performance was not achieved in the 90 days immediately prior to claimed Substantial Performance, then the contract shall be extended for an additional 120 days subsequent to that to demonstrate reliability.

3. If the Supplier can demonstrate that there were any extraordinary or extenuating circumstances which prevent it from meeting the specifications, the Owner and Consultant may, in their sole and absolute discretion, choose to waive their rights to rely upon the above terms and conditions.
- 1.42. Eco Friendly Alternative
 1. The City of Toronto is interested in the use of eco-friendly alternatives wherever possible. Conventional oils are expected to be used wherever the alternatives are not possible provided that sufficient justifications are provided.
 - 1.43. Remote Elevator Monitoring System
 1. Where the elevator controller is provided, ensure that the elevator system can support remote elevator monitoring that meets the intent of the following specifications:
 1. Provide either a communications protocol that communicates to Solucore board and exchanges the information related to the operation, status and error logs from the elevator; or
 2. Provide 13 dry contacts and terminate on a terminal blocks located on top of the controller. Provide the following dry contacts: run, shutdown, up, down, maintenance, close limit, open limit, phone button, inspection, independent service, and power failure. provide a top call and bottom call inputs.
 - 1.44. Singular or Plural
 1. Where words are used in the singular, the Supplier shall not assume that it refers to one item and it is incumbent on the Supplier to qualify that only the singular was assumed. If the Supplier does not provide the clarification, it shall be assumed that the price shall include the installation of equipment.
 2. Provide pricing to perform all the work in accordance with industry standards and as approved by the Consultant. Where the cost carried to perform singular work had been assumed, the Supplier shall clarify the cost carried herein the clarification document.
 1. Example of singular and plural wording includes but is not limited to:
 - (a) Replacing one hall risers where two risers needed (rear entrance);
 - (b) Replacing one car station when the elevator has two (main and auxiliary) stations;
 - (c) Replacing the front door locks in the elevator shaft but not replacing the rear ones;
 - (d) Providing a car buffer but not the counterweight buffer because the specification referenced a buffer and all buffers;
 - (e) Replacing one compensating chain when the site has two compensating chains;
 - (f) Replacing the front buttons but not the rear buttons;
 - (g) Replacing a door operator or an infrared detector but the elevator has two door operators (front and rear);
 - (h) Other examples would include position indicators, car directional arrows, car and counterweight governors, etc...

2. The Supplier shall not omit any work unless CLEARLY noted in the qualification document. The Consultant shall assume that singular and plural work will be performed.
 3. The Supplier shall omit the work when the Consultant specifically indicates that the work is not required. An example of such clarifications would include:
 - (a) Replace the front door operator only;
 - (b) Provide a singular riser only;
 - (c) Delete the auxiliary car station;
 - (d) Retain the counterweight governor;
 - (e) Etc...
- 1.45. Notice of Project
1. The Supplier must provide a Notice of Project to the Ministry of Labour (MOL) prior to starting the project as set out in section 6(1) of the Regulation for Construction Projects, O. Reg. 213/91.
 2. Provide a copy of the Notice of Project, sign and post it in a conspicuous place at the site for review by the Consultant and a Ministry of Labour inspector.
 3. Where applicable, ensure that each subcontractor on the project provides a completed approved registration form.
 4. A Supplier who submits a report under subsection 51 (1) of the Act (notice of death or injury) or gives a notice under section 52 or 53 of the Act (notice of accident, etc.) shall also provide, within 14 days after the occurrence, a professional engineer's written opinion stating the cause of the occurrence.
 5. Post in a conspicuous place at the project, and keep posted while work is done, a notice setting out:
 1. The Supplier's name, and if the Supplier carries on business in a different name, the business name.
 2. The address and telephone number of the Supplier's head office or principle place of business in the province or territory.
 3. The address and phone number of the nearest office of the Ministry.
 4. Within 48 hours of selection for a project, the name, trade and employer of each health & safety representative (H&S Rep) or joint health and safety committee member (JHSC).
 6. Appoint a supervisor for each project with 5 or more workers working at the same time.
 7. Establish written emergency procedures and ensure that they are followed in case of an emergency; Post them in a conspicuous place at the project; review them with JHSC or H&S Rep as applicable.
 8. Ensure that each worker has ready access to a telephone or other system of two-way communication system on the project in the event of an emergency.
 9. Keep records required by this regulation for at least one year after the project completion.

10. The Supplier shall keep the design of a horizontal life line system at the project while the system is in use.
 11. The Supplier shall keep the design drawings on the project while the hoisting and rigging system is being used.
 12. The Supplier shall give notice to the Ministry office located nearest the project, in person, by telephone, by fax or by electronic means before the first multi-tiered load hoisting operation is started at a project.
 13. The Supplier shall make available to an inspector upon request a copy of the certification by the professional engineer who would have verified and certified the results of a test on the structural components of a scaffold and the corresponding rated load of the scaffold.
 14. The Supplier shall keep at a project the design drawings and the written statement for a scaffold, while the scaffold is erected, for scaffolds designed by a professional engineer.
 15. The Supplier shall keep a copy of the design drawings and the required statement on a project while the suspended scaffold or suspended platform that is subject to the requirements of the section is on the Project.
 16. The Supplier shall,
 1. Ensure that written measures and procedures for complying with this section are established and implemented, so that workers are adequately protected from electrical shock and burn; and
 2. Make a copy of the written measures and procedures available to every employer on the project.
- 1.46. Errors and Omissions
1. While the Consultant has used considerable effort to ensure an accurate representation of information in this Request For Quote (RFQ), the information contained in the RFQ is supplied solely as a guideline for Suppliers. The information is not guaranteed nor warranted to be accurate by the Consultant, nor is it necessarily comprehensive or exhaustive. Nothing in the RFQ is intended to relieve the respondents from forming their own opinions and conclusions with respect to the matters addressed in the RFQ.
- 1.47. Equipment Identification
1. Each elevator in the building shall be assigned with a unique alphabetic, numeric, or alphanumeric identification. The identification assigned shall be a minimum of 50 mm (2 in.) in height and have a contrasting colour to its background. The following but not limited to, should be identified in the form of painting, engraving, or securely attached:
 1. Driving machine
 2. Motor
 3. Governor
 4. Controller
 5. Disconnecting means
 6. Crosshead (visible from landing)
 7. Car operating panel (min 13 mm / 0.5 in.)

8. On both door jambs of every elevator entrance at the designated level, alternate level, the level where means necessary for test i.e. access switches (top & bottom).
9. Buffers or pit channel (visible from the pit access door landing)
10. All other locations where testing, inspection is performed.

No.	Building Address	Group	Number of Stops	Construction Period Start	Construction Period Finish
1	4222 Kingston Rd.	G01	3	2022-05	2022-12
2	188 Bermondsey Rd (21 Old Eglinton Ave)	G04	2	2022-09	2023-04
3	160 Duncan Mill Rd	G05	2	2022-03	2022-09
4	175 Memorial Park Ave	G06	2	2021-08	2022-03
5	44 Beechwood Dr	G06	2	2021-08	2022-03
6	5151 Yonge St	G07	2	2021-03	2021-12
7	1026 Finch Ave W	G08	2	2021-05	2021-12
8	1401 Castlefield Ave	G10	2	2021-03	2021-10
9	150 Disco Rd	G11	2	2020-10	2021-05
10	150 Disco Rd	G11	2	2020-10	2021-05
11	100 Turnberry Ave	G13	2	2021-05	2021-11
12	126 Pape Avenue	G14	2	2022-03	2022-09
13	301 Broadview Ave	G14	3	2022-03	2022-09
14	433 Eastern Ave	G14	2	2022-03	2022-09
15	433 Eastern Ave	G14	2	2022-03	2022-09
16	433 Eastern Ave	G14	2	2022-03	2022-09
17	786 Dundas St E	G14	2	2022-03	2022-09
18	875 Eastern Ave	G14	2	2022-03	2022-09
19	111 King St E	G15	3	2023-06	2024-01

No.	Building Address	Group	Number of Stops	Construction Period Start	Construction Period Finish
20	192 Carlton St	G16	2	2023-08	2024-03
21	270 Milan St	G16	3	2023-08	2024-03
22	474 Ontario St	G16	2	2023-08	2024-03
23	1435 Eglinton Ave W	G17	3	2022-05	2022-11
24	146 Crescent Rd	G19	2	2023-04	2023-11
25	146 Crescent Rd	G19	4	2023-04	2023-11
26	441 & 443 Bloor St. E	G19	2	2023-04	2023-11
27	56 Wellesley St. E	G19	2	2023-04	2023-11
28	756 Ossington Ave	G20	2	2022-07	2023-02
29	973 Lansdowne Ave.	G20	2	2022-07	2023-02
30	1313 Queen St W	G21	3	2022-11	2023-05
31	16 Ossington Avenue	G21	2	2022-11	2023-05
32	3 Eireann Quay	G22	3	2023-01	2023-08
33	539 Queens Quay West	G22	2	2023-01	2023-08
34	1395 Lake Shore Blvd W	G23	4	2022-10	2023-05
35	90 Quebec St	G23	2	2022-10	2023-05
36	16 Ryerson Ave	G24	2	2023-01	2023-08
37	75 Elizabeth St	G24	4	2023-01	2023-08
38	160 Queen St W	G25	4	2023-04	2023-11

No.	Building Address	Group	Number of Stops	Construction Period Start	Construction Period Finish
39	20 Lower Spadina Ave	G26	3	2023-09	2024-04
40	259 Queens Quay West	G26	2	2023-09	2024-04
41	101 Coxwell Ave	G28	3	2021-11	2022-06
42	97 Main Street	G28	3	2021-11	2022-06

No.	Building Name	City	Bank Arrangement	No. of Elevators
1.	All buildings	Toronto	Simplex	1

DEVICE TYPE and OPENINGS

No.	Building Type	Device Type	As Required by Specs	No. of Openings Front	No. of Openings Rear or side
1.	X1	Traction	14 24 06	2	0
2.	X2	Traction	14 24 06	3	0
3.	X3	Traction	14 24 06	4	0
4.	Y1	Hydraulic	14 20 06	2	0
5.	Y2	Hydraulic	14 20 06	3	0
6.	Y3	Hydraulic	14 20 06	4	0

HOISTWAY DIMENSIONS

The following dimensions are for front openings only.

Building Type	Hoistway Width	Hoistway Depth	Cab Clear Width	Cab Clear Depth	Cab Height	Type of Door	Opening Size (W X H)	Overhead
X1	8'-4 3/8"(2550mm) ¹	5'-10 1/8"(1782mm)	5'-7 15/16"(1725mm)	4'-3"(1295mm)	8'-0"(2438.4mm)	1SPD / C/O ¹	3'-0"(914mm) X 7'-0"(2134mm)	15'-6"(4724mm)
X2	8'-4 3/8"(2550mm) ¹	5'-10 1/8"(1782mm)	5'-7 15/16"(1725mm)	4'-3"(1295mm)	8'-0"(2438.4mm)	1SPD / C/O ¹	3'-0"(914mm) X 7'-0"(2134mm)	15'-6"(4724mm)
X3	7'-8 3/16"(2342mm) ¹	6'-8 13/16"(2052mm)	5'-0 1/16"(1525mm)	5'-0 1/16"(1525mm)	8'-0"(2438.4mm)	1SPD / C/O ¹	3'-0"(914mm) X 7'-0"(2134mm)	15'-6"(4724mm)
Y1	7'-3 7/8"(2231mm) ²	6'-8 13/16"(2052mm)	5'-0 1/16"(1525mm)	5'-0 1/16"(1525mm)	8'-0"(2438.4mm)	1SPD / C/O ²	3'-0"(914mm) X 7'-0"(2134mm)	13'-0"(3962mm)
Y2	7'-3 7/8"(2231mm) ²	6'-8 13/16"(2052mm)	5'-0 1/16"(1525mm)	5'-0 1/16"(1525mm)	8'-0"(2438.4mm)	1SPD / C/O ²	3'-0"(914mm) X 7'-0"(2134mm)	13'-0"(3962mm)
Y3	7'-5 7/8"(2283mm)	5'-10 1/8"(1782mm)	5'-7 15/16"(1725mm)	4'-3"(1295mm)	8'-0"(2438.4mm)	1SPD / C/O	3'-0"(914mm) X 7'-0"(2134mm)	13'-0"(3962mm)

*NOTE:
1 Hoistway Width is 2 1/2 inch wider for Center Opening C/O
2 Hoistway Width is 4 inch smaller for Center Opening, C/O

Building Type	Hoistway Width	Hoistway Depth	Cab Clear Width	Cab Clear Depth	Cab Height	Type of Door	Opening Size (W X H)	Overhead
X1	8'-2 3/8"(2498.7mm)	5'-10 1/8"(1782mm)	5'-7 15/16"(1725mm)	4'-3"(1295mm)	8'-0"(2438.4mm)	1SPD / SO	3'-0"(914mm) X 7'-0"(2134mm)	15'-6"(4724mm)
X2	8'-2 3/8"(2498.7mm)	5'-10 1/8"(1782mm)	5'-7 15/16"(1725mm)	4'-3"(1295mm)	8'-0"(2438.4mm)	1SPD / SO	3'-0"(914mm) X 7'-0"(2134mm)	15'-6"(4724mm)
X3	7'-6 3/16"(2290.7mm)	6'-8 13/16"(2052mm)	5'-0 1/16"(1525mm)	5'-0 1/16"(1525mm)	8'-0"(2438.4mm)	1SPD / SO	3'-0"(914mm) X 7'-0"(2134mm)	15'-6"(4724mm)
Y1	7'-7 7/8"(2333.6mm)	6'-8 13/16"(2052mm)	5'-0 1/16"(1525mm)	5'-0 1/16"(1525mm)	8'-0"(2438.4mm)	1SPD / SO	3'-0"(914mm) X 7'-0"(2134mm)	13'-0"(3962mm)
Y2	7'-7 7/8"(2333.6mm)	6'-8 13/16"(2052mm)	5'-0 1/16"(1525mm)	5'-0 1/16"(1525mm)	8'-0"(2438.4mm)	1SPD / SO	3'-0"(914mm) X 7'-0"(2134mm)	13'-0"(3962mm)
Y3	7'-5 7/8"(2283mm)	5'-10 1/8"(1782mm)	5'-7 15/16"(1725mm)	4'-3"(1295mm)	8'-0"(2438.4mm)	1SPD / SO	3'-0"(914mm) X 7'-0"(2134mm)	13'-0"(3962mm)

HOISTWAY DIMENSIONS

The following dimensions are for front and rear openings only.

Building Type	Hoistway Width	Hoistway Depth	Cab Clear Width	Cab Clear Depth	Cab Height	Type of Door	Opening Size (W X H)	Overhead
X1 - FR	8'-4 3/8"(2550mm) ¹	6'-7 1/2"(2019mm)	5'-7 15/16"(1725mm)	4'-3"(1295mm)	8'-0"(2438.4mm)	1SPD / C/O ¹	3'-0"(914mm) X 7'-0"(2134mm)	15'-6"(4724mm)
X2 - FR	8'-4 3/8"(2550mm) ¹	6'-7 1/2"(2019mm)	5'-7 15/16"(1725mm)	4'-3"(1295mm)	8'-0"(2438.4mm)	1SPD / C/O ¹	3'-0"(914mm) X 7'-0"(2134mm)	15'-6"(4724mm)
X3 - FR	7'-8 3/16"(2342mm) ¹	7'-4 9/16"(2249mm)	5'-0 1/16"(1525mm)	5'-0 1/16"(1525mm)	8'-0"(2438.4mm)	1SPD / C/O ¹	3'-0"(914mm) X 7'-0"(2134mm)	15'-6"(4724mm)
Y1 - FR	7'-3 7/8"(2231mm) ²	7'-4 9/16"(2249mm)	5'-0 1/16"(1525mm)	5'-0 1/16"(1525mm)	8'-0"(2438.4mm)	1SPD / C/O ²	3'-0"(914mm) X 7'-0"(2134mm)	13'-0"(3962mm)
Y2 - FR	7'-3 7/8"(2231mm) ²	7'-4 9/16"(2249mm)	5'-0 1/16"(1525mm)	5'-0 1/16"(1525mm)	8'-0"(2438.4mm)	1SPD / C/O ²	3'-0"(914mm) X 7'-0"(2134mm)	13'-0"(3962mm)
Y3 - FR	7'-5 7/8"(2283mm)	6'-7 1/2"(2019mm)	5'-7 15/16"(1725mm)	4'-3"(1295mm)	8'-0"(2438.4mm)	1SPD / C/O	3'-0"(914mm) X 7'-0"(2134mm)	13'-0"(3962mm)

*NOTE: 1 Hoistway Width is 2 1/2 inch wider for Center Opening C/O
2 Hoistway Width is 4 inch smaller for Center Opening, C/O

Building Type	Hoistway Width	Hoistway Depth	Cab Clear Width	Cab Clear Depth	Cab Height	Type of Door	Opening Size (W X H)	Overhead
X1 - FR	8'-2 3/8"(2498.7mm)	6'-7 1/2"(2019mm)	5'-7 15/16"(1725mm)	4'-3"(1295mm)	8'-0"(2438.4mm)	1SPD / SO	3'-0"(914mm) X 7'-0"(2134mm)	15'-6"(4724mm)
X2 - FR	8'-2 3/8"(2498.7mm)	6'-7 1/2"(2019mm)	5'-7 15/16"(1725mm)	4'-3"(1295mm)	8'-0"(2438.4mm)	1SPD / SO	3'-0"(914mm) X 7'-0"(2134mm)	15'-6"(4724mm)
X3 - FR	7'-6 3/16"(2290.7mm)	7'-4 9/16"(2249mm)	5'-0 1/16"(1525mm)	5'-0 1/16"(1525mm)	8'-0"(2438.4mm)	1SPD / SO	3'-0"(914mm) X 7'-0"(2134mm)	15'-6"(4724mm)
Y1 - FR	7'-7 7/8"(2333.6mm)	7'-4 9/16"(2249mm)	5'-0 1/16"(1525mm)	5'-0 1/16"(1525mm)	8'-0"(2438.4mm)	1SPD / SO	3'-0"(914mm) X 7'-0"(2134mm)	13'-0"(3962mm)
Y2 - FR	7'-7 7/8"(2333.6mm)	7'-4 9/16"(2249mm)	5'-0 1/16"(1525mm)	5'-0 1/16"(1525mm)	8'-0"(2438.4mm)	1SPD / SO	3'-0"(914mm) X 7'-0"(2134mm)	13'-0"(3962mm)
Y3 - FR	7'-5 7/8"(2283mm)	6'-7 1/2"(2019mm)	5'-7 15/16"(1725mm)	4'-3"(1295mm)	8'-0"(2438.4mm)	1SPD / SO	3'-0"(914mm) X 7'-0"(2134mm)	13'-0"(3962mm)

FINISHES

No.	Building Type	1 st Landing Finish	2 nd Landing Finish	3 rd Landing Finish	4 th Landing Finish	LED Car Colour	LED Hall Colour
1.	X1	Painted	Painted	n/a	n/a	Blue, White or Green	Blue, White, Red or Green
2.	X2	Painted	Painted	Painted	n/a	Blue, White or Green	Blue, White, Red or Green
3.	X3	Painted	Painted	Painted	Painted	Blue, White or Green	Blue, White, Red or Green
4.	Y1	Painted	Painted	n/a	n/a	Blue, White or Green	Blue, White, Red or Green
5.	Y2	Painted	Painted	Painted	n/a	Blue, White or Green	Blue, White, Red or Green
6.	Y3	Painted	Painted	Painted	Painted	Blue, White or Green	Blue, White, Red or Green

Appendix E

Hydraulic Conveyance Requirement (14 20 06)

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1. General
 - 1.1. General Requirements
 1. Conform to section 14 01 20.
 - 1.2. Number of Elevators
 1. Provide elevator(s) in accordance with Schedule A.
 - 1.3. Device Type: Hydraulic
 1. Provide hydraulic equipment for each site identified and where noted in Schedule B.
 - 1.4. Arrangement
 1. Provide elevator(s) arranged to operate in accordance with the Bank requirement noted in Schedule A.
 - 1.5. Designations
 1. The elevators are numbered in numerical order as required by the Architect.
 - 1.6. Drive Method
 1. Arrange all cars in standard cantilevered above ground arrangement.
 - 1.7. Speed
 1. The contract speed for all elevators should be 100 fpm.
 - 1.8. Capacity
 1. Provide for capacity of 954kg (2100 lbs) on all cars.
 - 1.9. Openings and Stops
 1. The elevators should be arranged to serve the floors outlined in Schedule B.
 - 1.10. Dimensions
 1. Provide equipment to suit the hoistway, overhead and pit dimensions as per the attached Drawings.

Hydraulic Elevator	Information Location
Hoistway Width per car	Schedule C
Hoistway Depth per car	Schedule C
Pit Depth	Schedule C
Cab height	Schedule C
Elevator Speed	100 fpm
Overhead (top landing to slab)	Schedule C
 - 1.11. Door Type
 1. Provide single slide, horizontal sliding car and hoistway doors.
 - 1.12. Door Entrances
 1. Provide 915mm (36") wide by 2133.6mm (84") high doors.
 - 1.13. Related Work
 1. All work by others shall conform to governing codes. Any other work required to complete the installation or satisfy the regulatory authorities and not specifically listed herein shall be the responsibility of the elevator Sub-contractor. To complete the elevator installation, the following items must be performed or installed by trades other than the elevator Sub-contractor:

1. Provide suitable machine room ventilation to maintain the machine room temperature between 10° Celsius and 30° Celsius.
 2. Provide a fused disconnect switch or circuit breaker for each elevator, with feeder branch wiring to each controller. The switches and size of wires to conform to the Canadian Electrical Code. The disconnect switches are to be mounted in a code approved location.
 3. Provide a 120 volts, AC, 15 amps fused, single-phase power supply with a fused disconnect switch for each elevator, with feeder wiring to each controller for car lights. Location to be in a code approved location.
 4. Provide a separate single-phase power supply of the same voltage as each elevator supply, with 15 amps fused disconnect switch.
 5. Provide suitable machine room lights, and convenience outlets in the machine room. The light switch is to be mounted in a code approved location.
 6. Provide machine room and building smoke detector wiring to the elevator controllers.
 7. Provide wiring and contacts to the elevator controllers for the operation of the special emergency service and emergency power as required by code.
 8. Only where applicable, the wiring for elevator security including camera, card readers, hands-free phone, lobby control panel and central elevator monitoring will be terminated in the machine room. The wiring from that hoistway location to the termination point is work by others. The termination point will be the lobby panel, security desk, monitoring station or remote hall station.
 9. Provide a separate 120 volts, AC, 15 amps fused, single phase power supply to each elevator monitoring and control system.
 10. Provide a signal from the emergency power generator to indicate that the power will be switched from emergency generated to utility generated power.
 11. Perform any cutting, patching and painting for the installation of the hall buttons, hall lanterns, position indicators and main floor monitor panel.
 12. The contractor to provide the hoistway divider steel beams (where applicable) and the machine room hoist beam.
 13. Provide suitable pit lights, and convenience outlets.
 14. Provide dedicated ground wiring.
 15. Where required, a safe pathway/catwalk needed with handrails as per the MOL requirements for building rooftops with a low parapet of less than 42".
- 1.14. Changes in Material and Work
1. Any change or substitution in the approved equipment must have prior written approval from the Owner and Construction Manager.
 2. Any changes in the approved work must have prior written approval from the Owner and Construction Manager.
- 1.15. Cutting, Patching and Other work
1. Any cutting, patching, painting or other restorative work required to accommodate the installation of the new equipment not specifically listed herein as work by others, shall be the responsibility of the Sub-contractor.

2. Prior to proceeding with any such work the Sub-contractor shall obtain approval from the Owner and Construction Manager.
- 1.16. Remote Conduit and Wiring
1. Where provided, any remote conduit and wiring required to interconnect the elevator controllers and the lobby panel, elevator remote monitoring or an elevator management control system, or any other equipment provided under these specifications, and not specifically listed herein as being by others, shall be the responsibility of the Sub-contractor.
 2. Portions of this work may be sub-contracted with approval of the Owner and Construction Manager.
 3. The Sub-contractor is responsible for providing all wiring needed for remote wiring to the lobby panel or security desk.
2. Machine Room
- 2.1. Motors
1. Provide a self-contained unit consisting of the following items:
 1. Oil reservoir with tank cover capable of supporting 200 lbs and controller compartment with cover.
 2. An oil hydraulic pump.
 3. An electric motor.
 4. Oil control unit to comply with hydraulic valve specified.
 5. Pump: Positive displacement type pump specifically manufactured for oil-hydraulic elevator service
 - (a) Pump shall be designed for steady discharge with minimum pulsation to give smooth and quiet operation.
 - (b) Output of pump shall not vary more than 10 percent between no load and full load on the elevator car.
 2. The drive shall be by direct coupling with the pump and motor submerged in the oil reservoir. Drive type shall be determined based primarily on the load on the car, travel, and speed.
 3. The motor shall be specifically designed for a heavy duty oil-hydraulic elevator service. Duty rating shall comply with specified speeds and loads.
 4. Power controller shall contain electrical contactors, electro-mechanical switches and thermal overload relays. Mount components in a NEMA 1 enclosure.
 5. Logic control system shall be microprocessor based and protected from environmental extremes and excessive vibrations.
 6. Provide a solid state soft starting device to comply with specification below.
 7. Provide new hydraulic oil.
 8. Provide a system rated for over 80 starts an hour.

2.2. Hydraulic Valve

1. Provide a new EECO or Maxton valve. Provide a valve that includes pressure sensing device to allow the valve to operate at the same speed in both directions.
2. Install new schedule 40 piping to accommodate for the installation of the new valve.
3. Provide a bi-direction two speed valve.
4. A control section including control solenoids shall direct the main valve and control:
 1. Up and down starting.
 2. Acceleration.
 3. Transition from full speed to levelling speed.
 4. Up and down stops.
 5. Pressure relief.
 6. Manual lowering.
5. All of these functions shall be fully adjustable for maximum smoothness and to meet contract conditions.
6. Relief valve shall be externally adjustable and be capable of bypassing the total oil flow without increasing back pressure more than 10 percent above that required to barely open the valve.
7. Provide a valve with pressure compensation for constant down speed control. This modification of the down piston assembly delivers constant Down Speed Control between no load and full load conditions.
8. Provide a certified valve that can operate reliably between 90 psi minimum and 800 psi maximum.
9. Provide a certified valve that can operate reliably between a temperature range of 80⁰ F (27⁰ C) minimum, 150⁰ F (65⁰ C) maximum.

2.3. Controllers

1. Provide non-proprietary microprocessor controllers designed to give the required operation as herein specified.
2. Mount panels securely on substantial, self-supporting steel frames designed for floor or wall mounting.
3. Provide completely enclosed controllers with covers.
4. Install wiring on the controllers, whether control or field wiring, in a neat workman like manner.
5. Mark relays, contactors, fuses, printed circuit boards and other components clearly and permanently with designations as shown on the schematics.
6. Mount the designations for plug in components on the controller adjacent to the components.
7. Where required, provide an interface for a Central Monitoring System.
8. Provide non-proprietary diagnostics tools.

9. The control system shall provide comprehensive means of accessing the computer memory for elevator diagnostic purposes.
10. The controllers shall have permanent indicators for important elevator statuses as an integral part of the controller.
11. The controllers shall have the hardware to connect, to interrupt, to transfer power, and to protect the motor against overloads.
12. Provide means for the elevator system to restart and resume proper operation automatically in the event of a power failure.
13. The controllers shall be designed to accept as a minimum the re-programming of the following:
 1. Door Close Times
 2. Door Open Times
 3. Door Dwell Times
 4. Acceleration
 5. Deceleration
 6. Jerk Rates
 7. Floor Parking and Options
 8. Recall Levels
14. The controllers shall be provided with on-board diagnostics and status LEDS to aid in troubleshooting, adjusting and maintenance.
15. Permanent status LEDS shall be provided to indicate the following:
 1. safety circuit
 2. door locks
 3. independent service
 4. normal service
 5. inspection operation
 6. emergency power
 7. out of service
 8. drive failure
16. Provide on-board diagnostics to include an event monitor and fault log.
17. Provide a programmable elevator security system and the required interface to lock floors, hall calls and elevators.
 1. Allow for the security system to track users
 2. Provide all additional boards, relays, contacts and interfaces needed for such system
 3. Provide all labour needed to coordinate such system

- 2.4. Grounding
 - 1. Ground the control system and all field apparatus using colour coded bonding wire.
 - 2. The accidental grounding or a short circuit shall not defeat any safety device, and shall not allow the elevator to start or run.
- 2.5. Solid State Starters
 - 1. Provide solid state motor control starter with the following requirement:
 - 1. All digital control using a processor.
 - 2. Adjustable current limit starting Inside the Delta Electronic Motor.
 - 3. Overload Projection.
 - 4. Capable of interfacing with 6 or 12 lead wye delta motors.
 - 5. Detection capability of miswired motors.
 - 6. Onboard 16 character LCD display for parameterization and diagnostic troubleshooting.
 - 7. UL/CSA/CE certification.
 - 8. Minimum capacity of (80) Starts/hour.
- 2.6. MINI PI
 - 1. Assist the Owner in the initial design and general user interface of the panel of the MINI PI manufactured by CE Electronics.
 - 2. Provide training, hardware and software support to install the Mini PI as well as all related support needed to maintain it in the future.
 - 3. Provide and assist the Owner with the programming of the MINI PI including but not limited to providing a USB-KIT for the MINI PI.
 - 4. Ensure proper operation and function of all the position indicators.
 - 5. Provide the Owner with a copy of the software required to program these units as well as a copy of all the related images and graphics at the end of the job.
- 2.7. Victaulic Piping and Coupling
 - 1. Provide the shutoff valve, Victaulic couplings and joints in the machine room and pit.
 - 2. Provide the hydraulic pipes with Schedule 40 piping.
 - 1. Provide grooved piping suitable for hydraulic Victaulic fitting.
 - 2. Provide new pipes from the machine room to the pit.
 - 3. Ensure that all piping is above ground or is protected in PVC piping if buried.
- 2.8. Hydraulic pipeline identification, where required
 - 1. Provide marking to accessible piping located outside the elevator machine room or hoistway labelled "Elevator Hydraulic Line" in letters that are at least 0.75 inches high in a contrasting color.
 - 2. The marking shall be visible after installation and applied at intervals not greater than 9 feet.
 - 3. Provide means to prevent the marking from peeling or fading away.

4. Heat resisting paint stencilled on the piping is the preferred method.
- 2.9. Rupture Valve
1. Provide a rupture valve of the ball-seat valve design.
 2. Provide a rupture valve with a screw-type mounting method.
 3. Provide a rupture valve that prevents uncontrolled movement of the cylinder if a pipe or hose burst occurs.
 4. Provide a rupture valve that interrupts the flow of oil when the pressure difference in the valve exceeds a value that corresponds to the preloading pressure.
 5. Provide a pipe rupture valve which opened automatically when the pressure at the pipe is higher than that at the cylinder.
 6. Provide a valve that seals the opening passage leak-free.
 7. Provide a rupture valve with settable closing flow.
 8. Ensure that the design is of the leak-free closing type.
 9. Ensure that the design allows for proper connection to the cylinder head.
 10. Mount the rupture valve directly to the cylinder and without any isolation, gate valve or noise coupling in between.
 11. Provide a valve with minimal spatial requirement and a compact design.
 12. Attach the rupture valve directly to the cylinders.
3. Hoistway Equipment
- 3.1. Guide Rails
1. Provide #1 guide rails for the main rails.
 2. Install the guide rails using brackets affixed to the hoistway structure.
 3. The brackets should be spaced as follows:
 1. The main rail bracket spacing should accommodate the existing building floor height.
 2. Provide rail clips for fastening the rails to the brackets.
 3. The rail clips should prevent the horizontal movement of the rails.
 4. The rail clips should allow the vertical movements of the rail as the building settles.
- 3.2. Pit Equipment
1. Provide car buffers as required by code.
 2. Provide all required slowdown and limit switches.
 3. Provide all pit steel required to support the buffers.
- 3.3. Hall Door Entrances
1. Provide hall door entrances, headers, and sills for the width and height specified.
 2. Align and fasten the entrances, headers, and sills to the building structure.
 3. Provide fascia plates between the landings, on the top-landing header and on the bottom-landing sill.

4. Provide elevator identification on the entrances as required by code. The identification shall be a minimum of 75mm in height.
 5. Provide, on each hall entrance jamb, raised tactile metallic markings to designate the floor at the height required by code.
 6. Provide fire retainers on hall doors that can withstand 200lbs of impact on the door.
 7. Provide hall door entrances and jambs in specified finishes as noted in Schedule F.
- 3.4. Hall Doors and Hardware
1. Provide doors that matches the cab doors with respect to type and style.
 2. Provide each hall door with pick-up rollers for the car door clutches.
 3. Provide the hall door related equipment required for the installation and proper operation of the hall doors.
 4. Provide code approved hall door locks and interlocks.
 5. Provide eccentric rollers and hangers that are suitable for the door height and weight.
 6. Ensure that each door panel is properly labeled for hoistway fire rating.
 7. Provide durable heavy-duty doors with integral hangers and sound proofing where stainless-steel cladding is required.
 8. Ensure that the equipment and installation of the entrances and doors conforms to all code requirements and fire rating.
 9. Provide floor numbers on the interior walls and/or doors of the hoistway at intervals where a person in a stalled elevator upon opening the car door can determine the floor position.
 10. Provide emergency rescue escutcheon in brass steel finish on each landing to facilitate the rescuing of passengers.
 11. Provide heavy duty Smartork spirators at all landings and ensure that on the lowest landings where air supply can enter the building (main access or egress, parking, path system, etc...) and the top landings where air can escape a second set of door closer is provided (sill closer or gravity closer).
 12. Provide grouting sills at each landing and confirm in writing the floor finishes on each floor so that the sill is flush with the finished floor.
 13. Provide aluminum sills on all landings.
- 3.5. Buffers, Pit Steel and Switches
1. Provide buffers and buffer stand and a new pit steel base.
 2. Fix the pit steel firmly to the pit floor.
 3. Stroke:
 1. The stroke of the buffer spring, as marked on its marking plate
 4. Load Rating
 1. Ensure that the buffers for cars and counterweights are capable of supporting, without being compressed solid or to a fixed stop, a static load having a minimum of 2 times the total weight of:
 - (a) the car and its rated load for car buffers

- (b) the counterweight for counterweight buffers
 - 2. Buffers for cars and counterweights shall be compressed solid or to a fixed stop with a static load of three times the weight of:
 - (a) the car and its rated load for car buffers
 - (b) the counterweight for counterweight buffers
 - 5. Marking Plates
 - 1. Provide each spring buffer with a marking plate showing its load rating and stroke and the number of springs.
 - 2. Where the springs are removable, each spring shall be identified, and the assembly marking plate shall indicate this identification.
 - 3. Markings shall be made in a permanent and legible manner.
 - 6. Paint all the pit steel located underneath the car and counterweight buffer.
 - 7. Ensure that the pit steel is painted with black rust inhibiting painted.
- 3.6. Car Sling and Platform
- 1. Provide a cantilevered car slings of sufficient strength for the speed and capacity as specified.
 - 2. Provide car platforms of sufficient size and strength to accommodate the capacity as specified.
 - 3. Provide fabricated platform frame of formed or structural steel shapes, gusseted and rigidly welded with a wood sub floor. Underside of the platform shall be fireproofed.
 - 4. Mount the platform on isolation pads to prevent any vibration or noise being transmitted from the car sling to the platform.
 - 5. Statically balance the cars, at the halfway point in the hoistway, with the top roller guides removed so that the cars hang in the center between the rails.
 - 6. Provide dynamic balancing assembly with weights arranged on adjustable guides to appropriately balance each cab.
- 3.7. Car Roller Guides
- 1. Provide roller guide assemblies on the top and bottom of the elevators.
 - 2. Provide roller guide assemblies with adjustable float and spring tension.
 - 3. Provide roller guide assemblies with rollers being a minimum of 6" in diameter.
 - 4. Provide neoprene roller wheels.
 - 5. Provide rollers with adjustable stops and solid spacers to eliminate "knee action".
 - 6. Include a cover plate assembly over the rollers.
 - 7. Provide fully adjustable guides for all rails up to 3/4" width standard; which cannot be used on 8lb. rail.
- 3.8. Hall Stations
- 1. Provide a single riser hall stations. The hall stations are to conform to existing codes. The design of the hall stations to be approved by the Architect. The material of the hall stations to be brushed brass steel.

2. Ensure that the center of the button is located at 42" from the landing floor and that the fixture does not protrude more than ½".
 3. Provide hall stations in #4 finish stainless steel.
 4. Provide stainless steel hall stations with DUPAR/MAD Optic Series button with white LED illumination.
 5. Provide in each hall station two buttons (up and down) on the intermediate floors and one button on the terminal floor.
 6. Provide hall fixture at the lobby level to incorporate the special emergency service required under the code.
 7. Owner/Architect to approve the design and material of the hall stations.
- 3.9. Hall Position Indicators
1. Provide seven segment white LED digital position indicators at the lobby level (front and rear). Install the position indicators above the door entrance using stainless steel fixtures in brushed finish.
 2. Provide fixtures, which conform to barrier free access.
 3. Integrate a hall lantern and chime into the position indicator where possible, otherwise mount separately above door.
 4. Provide a car directional indicator in the position indicator which displays the direction of the elevator at all times and in the absence of one, the last known direction.
 5. Provide position indicators with characters at least 2.5" in height to be clearly visible from the landing.
 6. Ensure that the position indicator is visible in normal daylight and working properly.
- 3.10. Lobby Fixtures
1. Provide at the lobby level the following:
 1. A stainless steel panel in brushed finish.
 2. Where available, emergency power switch and LEDs.
 3. Emergency recall switch and LEDs.
 4. Emergency fire recall key in enclosed glass case.
 5. The lobby emergency panels to conform to all current codes.
 6. The final design and location of the lobby panels to be approved by the Owner.
- 3.11. New Jack (Cylinder and Plunger)
1. Installation
 1. Install the holeless jack unit.
 - (a) Set the jack unit assembly so that it is plumb and true.
 - (b) Set jack unit cylinder assembly plumb, centered accurately and shimmed to proper elevation, using centering lugs to prevent dislocation during filling.
 2. Jack specification
 1. Provide cylinder and plunger.

2. The cylinder shall be constructed of steel pipe of sufficient thickness and suitable for the operating pressure.
3. The top of the cylinder shall be equipped with a cylinder head with a drip ring to collect any oil seepage as well as an internal guide ring and self-adjusting packing.
4. Provide a low pressure return line to the tank to minimize the use of oil collection devices in the pit.
5. The plunger shall be constructed of seamless selected steel tubing or pipe of proper diameter machined true and smooth with a fine polished finish.
6. The plunger shall be provided with a stop ring electrically welded to it to prevent the plunger from leaving the cylinder.
7. Means shall be provided to bleed air from the jack unit.
8. Ensure that the plunger is free from knocking noise, vibrations or binding.
9. The plunger head shall be isolated from the platen to prevent electrolytic corrosion.
10. Where more oil is needed or bigger Victaulic pipe is required, include in your cost the replacement of such components.
11. The cylinder should be designed to minimize deflection and to operate without the use of followers.
3. Two Stage Hydraulic
 1. Where two stage hydraulic elevator is provided, ensure that the system is synchronized properly and effectively.
 2. Provide mechanical means to keep the jacks synchronized.
4. Roped Hydraulic
 1. Where needed, provide a roped hydraulic system to provide access to high floors.
 2. Where a three stage hydraulic elevator is proposed, provided roped hydraulic instead.
5. Ride quality
 1. The Contractor shall measure the existing ride quality. These measurements will be compared to the ride quality after the work is performed.
 2. In the event that the ride quality deteriorated by more than 1 mgs peak-peak with the 1999 ISO filter applied, the Contractor is required to correct the ride.
6. System pressure
 1. Do not reduce the jack size.
 2. Do not exceed the normal full load Relief and bypass pressures usually associated with this system.
 3. Provide all required engineering submission to the governing authority.
- 3.12. Electrical Ducts, Troughs and Wireways
 1. Provide hoistway trough designed to protect electrical wiring from dust, dirt, oil, and water.
 2. Provide trough designed to carry hoistway wiring, branch circuits, travelling cable wiring and other groups of conductors.

3. Provide troughs that are open on one side so wires and cables can be laid in along an entire hoistway run.
 4. Provide troughs that would require no pulling of wires or cables.
 5. Provide troughs with NEMA 1 rating (dust).
 6. Provide dual dimensions concentric knockouts for ½" and ¾" conduits.
 7. Provide connectors that would allow for sections and fittings to be rigidly joined together.
 8. Provide vertical slots with ½" overlap that would allow for settling of the building. Paint the connector in contrasting colour (black or yellow) so that when the overlap is reduced it would become visibly apparent.
 9. Provide troughs furnished in ANSI 49 gray polyester powder finish inside and out over phosphatized surfaces.
 10. Provide a strain bars installed every 100 feet (30.5m) in vertical runs for wire support.
4. Elevator Cab
- 4.1. Elevator Cab
1. Provide car cabs with a height of 2438 mm (96").
 2. Provide car doors for the width and height specified.
 3. Provide that the transom, posts, headers, base and reveals are provided in #4 finish stainless steel.
 4. Provide car doors in brushed stainless steel finish.
 5. Provide all the necessary hardware for mounting the car doors.
 6. Ensure that each car door panel has a clutch/skate.
 7. Provide electrical and mechanical gate switches.
 8. Provide on top of each cab an exhaust fan with a minimum capacity of 450 cfm.
 9. Ensure that the fan is isolated from the cab to prevent any noise or vibration.
 10. Provide where required provisions and assist in the installation of security camera in the elevator cab.
 11. Provide pad hooks in all cars.
 12. Provide one set of protective pads covering all exposed wall surfaces, but leave access to the car buttons.
 13. Review material and design and ensure that it meets Barrier-Free requirements as stated in Appendix E or the CAN/CSA B44-2019; and
 14. Provide cab interior finishes as per Appendix G (Cab Design A, B or C).
- 4.2. Car Direction Indicators and Chimes
1. Provide car travelling lanterns to operate as per specification (sec.5.12).
 2. Install flush mounted lanterns. Do not provide bulky or surface mounted equipment that protrudes more than 1.0" from the face of the wall.
 3. Provide stainless steel finish to match hall buttons fixtures.
 4. Provide electronic chimes and LED/LCD directional displays.

5. Provide white LED colour digital displays.
 6. Provide displays that are visible under all lighting conditions and can be seen within 180 degrees of the hall direction.
 7. Owner to approve the design and material of the travelling directional lanterns.
- 4.3. Car Slings
1. Statically balance the cars, at the halfway point in the hoistway, with the top guides removed so that the cars hang in the center between the rails.
 2. Ensure that the weight of the car accurately reflects the weight on the crosshead data tag.
 3. Ensure that the sling is balanced and properly supported. Where roller guides are being damaged due to excess pressure, the Contractor shall be held liable for the design.
- 4.4. Top of Car Stations
1. Provide, on top of each car, an inspection station consisting of an emergency stop button, up, down and common inspection buttons, on-off inspection switch.
 2. Provide on top of each car a duplex electrical outlet and light with a guard and switch.
- 4.5. Infra-Red Door Detector
1. Provide infra-red door reversal devices.
 2. Provide new three dimensional (3D) infrared door detection system on every car door.
 3. If the door protective device detects a person or object in its path, at any point during the door closing operation, the doors shall re-open.
 4. The infrared shall be equipped with red/green indicators to highlight door movement.
 5. Provide a system with an eighteen foot range.
 6. The detection device and door operation should be adjusted so that the doors re-open without striking any object or person.
 7. Provide a three-dimensional electronic door detectors on all car doors with the following specifications:
 1. The infrared detector should provide complete door protection.
 2. Distance between beams not to exceed 1.50".
 3. Visible light immunity of 100,000 lux.
 4. Interleaved scan.
 5. Minimal number of sensors 80.
 6. Average response time of 90 ms.
 7. Nudging capable feature.
 8. Fault code.
 9. Audible noise emitted when beam interrupted.
 10. Sensitivity adjustment.
 8. Comply with Sections 5.3 and 5.4.

4.6. Hoistway Access

1. Provide hoistway access key switches to access the car top.
2. The access function to conform to all code requirements.
3. Provide one at the top and another at the bottom of the shaft.
4. Provide access keys to be located in the sight guard or door jamb.

4.7. Car Stations

1. Provide new main and auxiliary swing return Car Operating Panels (COP) in not less than 14Ga stainless steel and finishes to match the front of the cab.
2. Main and auxiliary panels to conform to barrier free access and current code requirements. Provide DUPAR US 91CC LED push buttons with car call registration feedback.
3. Panels to conform to barrier free access and current code requirements.
4. Provide concealed fastening locks.
5. Provide heavy duty hinges that can support the weight of the COP.
6. The building name and logo, car number, government number and the capacity to be engraved in the appropriate place on the return panel.
7. Owner to approve the design and material of the car stations.
8. Main and auxiliary Car stations to tentatively include the following features and layout:
 1. Hands-free emergency phone with one way video and messaging.
 2. Display and camera for the video and messaging system. (internet network with four (4) hour battery back up to be provided by the owner)
 3. CEE Electronics EMN57 Digital LCD car position indicator.
 4. Where provided, install the Pattison and /or Captivate Media Screen and provide the required support for the electrical power, connection and access for proper operation.
 5. Car call buttons marked to correspond to floors served. Provide car call registration feedback.
 6. Door open and door close buttons.
 7. Alarm button with amber illumination.
 8. Provide a hands-free telephone system with automatic dialler integrated into the car station to meet barrier-free access as well as these requirements:
 - (a) Provide a push button identified as "Phone" to initiate communication along with a speaker.
 - (b) Identify the button with a raised international symbol for telephones and Braille markings.
 - (c) Provide visual indication which is activated to acknowledge that the communication has been established. Extinguish the visual indication when the connection is terminated.
 - (d) Provide a display and buttons so that authorized/emergency personnel can communicate via messaging and obtain responses from a trapped passenger who cannot communicate verbally or is hearing impaired.
 - (e) Provide a camera to display video positioned to observe passengers at any location on the car floor.

- (f) Provide four (4) hour battery backup for the entire communication system.
 - (g) Arrange that the communication cannot be terminated from within the cab.
 - (h) Provide twin conductor shielded wiring from the cab to the elevator machine room.
 - (i) Terminate the wiring for all elevator in the machine room at a separate terminal block mounted on the side of a controller.
 - (j) Connect and program the phone to the lobby rescue station (auxiliary lobby telephone equipment) to meet the new code requirements.
 - (k) Provide equipment and wiring compatible with the building's telephone system.
 - (l) Use the lobby rescue station to connect to the elevators so that they can share one telephone line and someone calling into an elevator can select which elevator to call.
 - (m) Provide a line seizure device, including installation, to connect elevator phones (i.e. such as office fax line).
9. Provide a fire fighter switch as follows:
- (a) This key will be of a tubular, 7 pin, style 137 construction and shall have a bitting code of 6143521. The key will be coded "FEO-K1".
 - (b) A three-position ("OFF," "HOLD," and "ON," in that order) key-operated switch shall be labeled "FIRE OPERATION"; provided in an operating panel in each car; and shall be readily accessible.
 - (c) The label "FIRE OPERATION" lettering shall be a minimum of 5 mm (0.25 in.) high in red or a color contrasting with a red background. It shall become effective only when Phase I Emergency Recall Operation is in effect and the car has been returned to the recall level. The switch shall be rotated clockwise to go from "OFF" to "HOLD" to "ON." The "FIRE OPERATION" switch, the "CALL CANCEL" button, the "STOP" switch], the door open button(s), the door close button(s), the additional visual signal, and the operating instructions shall be grouped together at the top of a main car operating panel behind a locked cover.
 - (d) The firefighters' operation panel cover shall be openable by the same key that operates the "FIRE OPERATION" switch.
 - (e) Ensure that when the key is in the "FIRE OPERATION" switch, the cover shall not be capable of being closed. When closed, the cover shall be self-locking.
 - (f) Where rear doors are provided, buttons for both the front and rear doors shall be provided in the firefighters' operation panel. The door open and door close buttons for the rear entrance shall be labelled "OPEN REAR" and "CLOSE REAR."
 - (g) All buttons and switches shall be readily accessible, located not more than 1 800 mm (72 in.) above the floor and shall be arranged as required by Code.
 - (h) The front of the cover shall contain the words "FIREFIGHTERS' OPERATION" in red letters at least 10 mm (0.4 in.) high.
10. The following switches shall be enclosed in a service cabinet: light switch, two speed fan switch, floor passing tone disable switch, voice annunciator disable switch, inspection switch, independent service switch, USB for the PI, emergency light test switch, and emergency stop switch. Also include a GFI 110 AC Volts outlet in the service panel.
11. Provide an EPCO TCEL emergency cab light system which uses the cab lighting for emergency lighting.

12. The car number, government number, building name, no smoking sign and the capacity to be engraved in the appropriate place on the return panel.
 13. Provide a service panel for the security card reader in a separate compartment 8" wide by 8" height with keyed access door and a smokey lens 3.25" x 3.25". In addition provide a spare metal cover plate to fill in smokey lens if card readers are not used.
 14. Provide a bi-lingual male/female voice enunciator with preset and programmable floor designation:
 - (a) Provide a CE Electronics micro com style AMCUM-MMB Digitized Voice Annunciator which utilizes actual male and female voices in a system that is capable of up to 5 minutes of speech.
 - (b) Provide a system which complies with ADAAG 4.10.13 handicap code.
 - (c) The sound should be field selectable and the volume adjustable.
 - (d) The Digitized Voice Annunciator should advise at a minimum of the following:
 - (i) Direction.
 - (ii) Stay away from closing door.
 - (iii) Nudging functions.
 - (iv) Special emergency service.
 - (v) Out of service condition.
- 4.8. Traveling Cables
1. Provide elevator traveling cables. Cables to include a minimum of six (6) shielded pairs of 20 AWG and one (1) coaxial cable.
 2. Provide spare wires consisting of at least 10% of the total number of wires with a minimum of ten (10) spare wires. Do not include in your calculation two (2) coaxial cables, four (4) shielded pairs and three (3) 14 gauge wires.
 3. The traveling cables should form a continuous run from the controller to the elevator cab. Do not terminate the traveling cables at a junction box under the car or in the hoistway.
- 4.9. Wiring
1. Provide machine room, hoistway and car wiring as required for the installation and operation of the elevators.
 2. Provide that the installation of all wiring is in accordance with the Canadian Electrical Code.
 3. Provide wiring for security (where applicable), cab phone, and central monitoring from controllers to a hoistway wiring termination point.
- 4.10. Barrier Free Access
1. Provide barrier free access on all cars as defined in Appendix E of the CAN/CSA B44-13.
- 4.11. Floor Passing Tone
1. Provide a floor passing tone in the cab, which chimes as the elevator is passing a floor.
 2. The sound should be field selectable and the volume adjustable.
 3. The floor passing tone should have a disable function in the car station.

- 4.12. Crosshead Data Plate
 1. Provide new crosshead data plate with the proper weight, date, capacity, speed and date of the elevator manufacturing and modernization.
 2. Provide a tag 2.0" by 3.0" 0.12" thick aluminum with square corners, black background and silver copy.
 3. Attach the tag to the crosshead using 3M adhesive backing and ensure that it is mounted on a clean background to resist casual removal.
- 4.13. Door Operators
 1. Provide closed loop, heavy duty, solid-state door operator.
 2. Provide one ½ hp motor and heavy duty sprocket, chain, belt, and sheaves.
 3. Provide closed loop regulated speed performance.
 4. Provide onsite one hand-held keypad programming unit.
 5. Provide and store the adjustments on the handheld unit.
 6. Provide an operator with adjustable door obstruction reversal.
 7. Provide optical cams with LED indicators.
 8. Provide test switches for open, close, nudging and speed zone set up.
 9. Provide universal inputs for open, close, and nudging.
 10. Provide robust drive linkages to the car door.
 11. Provide a door operator with two pedestal bearing on the main drive shaft.
 12. Provide the car door rollers and track.
 13. Adjust the door closing force so that it does not exceed 30 lbs.
 14. Provide a door operator that would automatically calculate the door weight and speed to regulate the kinetic energy. Where infrared detectors are used, the closing door system shall conform to the following requirements:
 1. The kinetic energy computed for the average closing speed as determined in accordance with 2.13.4.2.2 shall not exceed 10 J (7.37 ft-lbf).
 2. The kinetic energy computed for the actual closing speed at any point in the code zone distance defined by 2.13.4.2.2 shall not exceed 23 J (17 ft-lbf).
 15. Provide a door restrictor.
- 4.14. Car Gate Switches
 1. Provide car gate switches (ensure that the switch is located on the slave arm side or non-locking side).
- 4.15. Car Top Solid State Reader Head
 1. Provide new solid state car top reader head.
 2. Provide new rust resistant hoistway tape with magnetic targets.
 3. Provide proper tensioning equipment to maintain the stability and strength of the hoistway tape.
 4. Provide consistent stopping accuracy within 1/8".

5. Permanently secure the magnet to the steel tape.
 6. Provide low friction guides to ride along the steel tape with no more than 1/8" tolerance.
- 4.16. Car Door Clutch
1. Provide a skate or clutch to suite.
- 4.17. Car Top Railing
1. Provide where needed, on top of the car, metal railing to protect the elevator mechanic from falling.
 2. Install the handrails on all cars at the commencement of the contract award.
 3. Provide a substantial metal guard rail on the sides of the car top.
 4. The guard shall consist of a top rail located approximately 42" above the car top and an intermediate rail located approximately 22" above the car top.
 5. A five (5) inch toeguard shall be provided at the base of the guard.
 6. The guard rails must be designed and installed to withstand a load of 550 N (125 lb.) applied perpendicular to the span in a horizontal at any point on the top rail and a vertical downward load of 1.5 kN per meter (100 lb. per foot) along the top rail.
 7. The horizontal and vertical loads need not be considered to act simultaneously.
 8. Submit as part of your submission, the car top railing as part of your government submission.
- 4.18. Car Door Equipment
1. Provide car doors with vandal resistant stainless steel doors.
 2. Provide all car door rollers.
 3. Provided reversable car door track.
 4. Provide worn or damaged astragals on the leading edge of the doors.
 5. Completely provide the car door panels with vandal resistant stainless steel ones.
- 4.19. Car Top Inspection Station
1. Provide on top of the car, an inspection station consisting of:
 1. An emergency stop button (red colour). The stop switch shall be permanently located on the car top and readily accessible to a person, while standing at the hoistway entrance normally used for access to the car top;
 2. Up and down continuous-pressure type inspection buttons (white colour). A separate device of the continuous-pressure type labeled "ENABLE" shall be provided adjacent to the inspection operating devices. The inspection operating devices shall become effective only when the "ENABLE" device is activated. The inspection operating devices, shall be permitted to be of the portable type provided that:
 - (a) the "ENABLE" device, and a stop switch, in addition to the stop switch required with the stationary inspection station are included in the portable unit; and the flexible cord is permanently attached so that the portable unit cannot be detached from the car top.

3. On-off inspection transfer switch (green switch). The transfer switch shall be located on the car top and shall be so designed as to prevent accidental transfer from the "INSPECTION" to "NORMAL" position;
 4. Duplex electrical outlet;
 5. Provide a secondary hand-held fluorescent trouble light; and
 - (a) Provide two 13 watt fluorescent "H" tube;
 - (b) Not less than eight foot CSA listed Cord; and
 - (c) Provide a handy clip for hanging or strong magnetic base for mounting.
 6. Primary car top lighting with a guard activated by an on/off switch.
 - 4.20. Car Restrictor
 1. Provide a mechanical door restrictor that requires no electrical solenoid or components which can stretch or fail.
 2. Provide a collapsible door restrictor or other moving parts to engage and disengage.
 3. Ensure that the car door remains locked when outside the door zone.
 - 4.21. Car Apron
 1. Passenger elevators currently operated in an apartment building, condominium apartment building or educational institution shall include at the entrance side with a smooth apron made of metal not less than 1.5 millimetres thick, or made of material of equivalent strength and stiffness, reinforced and braced to the car platform such that,
 1. it does not extend less than the full width of the widest hoistway door opening;
 2. it has a straight vertical face, extending below the floor surface of the car-platform, of not less than 1,200 millimetres, except that for an existing elevator this may be reduced where the hoistway pit is not deep enough to accommodate a larger vertical face;
 3. its lower portion is bent back at an angle not less than 60 degrees and not more than 75 degrees from the horizontal; and
 4. will be installed in addition to door restrictors.
 5. Elevator Control and Dispatching
 - 5.1. Door Operation
 1. Provide a heavy duty close loop door operator.
 2. The door operator will facilitate smooth operation under varying environmental influences such as, temperature, wind, friction, and component variation. The processor will monitor the door's actual position and velocity compared to its desired position and velocity.
 3. If variations are detected in the profile the command will be automatically corrected. The Closed Loop Door Operator control system shall not require machine room door control equipment.
 4. Door opening shall be automatic as the car arrives at a landing, and close at the expiration of the door open timer. Doors shall remain open for a time period as follows:
 1. A car call time shall predominate when a car call only is being answered.

2. The hall call time shall predominate when a hall call or both a hall call and car call are being answered.
 3. A short door time shall predominate after a door reversal from the door detector or the door open button.
 4. A short door time shall predominate on a hall call or car call after the beam of the door protective device has been broken.
- (a) The values for the door timers shall be independently field adjustable:

Car Groups	Maximum Door Opening	Maximum Door Closing	Maximum Car Call Door Dwell	Maximum Hall Call Door Dwell	Maximum Short Door Dwell Time
All	2.7 sec	3.5 sec.	3.0 sec.	5.0 sec.	3.0 sec.

5.2. Delayed Car Operation

1. If the elevator is delayed at a landing for a predetermined adjustable time while there are calls in the system, the car shall be removed from the group operation.

5.3. Door Failure Protection

1. If the elevator doors are prevented from closing for a predetermined adjustable time, the door protective device shall become inoperative, and audible signal shall sound, and the door shall close at a reduced speed. Normal door operation shall resume at the next stop.
2. Door Protective Device
3. Provide new two dimensional (2D) and three dimensional (3D) combination infrared door detection systems on every car door.
4. The door re-opening device shall:
 5. Detect cylindrical target(s) approaching the entrance opening of the landing-side doors, at any point during the door closing operation, the doors shall re-open;
 6. Detect approaching objects up to a speed of 1 m/s (3 ft/s);
 7. Detect objects moving towards the entrance between 9" (225mm) – 20" (500mm) from the landing side of the door;
 8. Provide sensor technology not affected by reflected ambient light;
 9. Ignore stationary objects within the three dimensional (3D) zone, whilst still detecting movement towards the door; and
 10. Differentiate movement from the side of the three dimensional (3D) zone and movement approaching the doors.
11. The infrared shall be equipped with red/green indicators to highlight door movement.
12. Provide a system with an eighteen foot range.
13. The detection device and door operation should be adjusted so that the doors re-open without striking any object or person.
14. Provide door detection means on all car doors with the following specifications:
15. The infrared detector should provide complete door protection.

16. Distance between beams not to exceed 1.50".
 17. Visible light immunity of 100,000 lux.
 18. Interleaved scan.
 19. Minimal number of sensors 80.
 20. Average response time of 90 ms.
 21. Nudging capable feature.
 22. Fault code.
 23. Audible noise emitted when beam interrupted.
 24. Sensitivity adjustment.
- 5.4. Advance Door Opening
1. Arrange the door circuit so that the doors start to open as the elevator is leveling into the floor, and are halfway open when the car stops level with the landing.
- 5.5. Performance Criteria
1. The control equipment shall be capable of operating within the specified performance criteria.
 2. Flight time shall be measured from the start of the door close cycle until the doors are 2/3 open at the next landing on a one floor run.

Car Groups	Maximum Flight Time	A95 Vertical Horizontal	Maximum Jerk	Maximum Acceleration	Levelling Accuracy	Speed Variation
All	12.0 sec.	6 mg	7.0 ft/sec ³	3.5 ft/sec ²	+/- 1/8"	+/- 2%

- 5.6. Noise Levels
1. Door operation noise level shall be taken during the door opening, door closing, and door reversal cycles.
 2. The cab noise level shall be taken during a full run, bottom to top, and return.
 3. The machine room noise level shall be taken with all cars operating.

Car Groups	Door Operation	Cab	Machine Room
All	62dBA	50dBA	80dBA

- 5.7. Independent Service
1. Provide a key switch in the car panel which, when actuated will take the car out of riser call operation and allow operation from the car buttons only. Door operation shall be activated by constant pressure on the door close button.
 2. Independent service operation shall de-activate the hall and in car lanterns.
 3. Independent service operation shall de-activate the door reversal device.

- 5.8. Inspection
 - 1. Provide a key switch in the main car panel which, when actuated will take the elevator out of service. An inspection-operating fixture on top of the elevator will allow the elevator to be controlled on inspection mode as per code.
- 5.9. Riding Lantern Operation
 - 1. Provide electronic hall chimes with LED light fixtures.
 - 2. Riding lanterns shall illuminate and produce an audible signal to indicate the direction of travel.
 - 3. The audible signal shall sound once for up and twice for down.
 - 4. The volume of the audible signal shall be field adjustable.
 - 5. The lantern shall remain illuminated until the door dwell time has expired.
 - 6. The hall lantern shall provide a five (5) second advance signal before the arrival of the elevator.
- 5.10. Levelling
 - 1. The control circuit shall cause the car to stop automatically at floor level regardless of load or direction of travel within 1/8" with respect to the hoistway sill.
 - 2. The control circuit shall correct for over travel, under travel and cable stretch return.
 - 3. Ensure that the elevator levelling will be maintained under all conditions including building settling otherwise include all required maintenance work to sustain it.
- 5.11. Automatic Emergency Recall Operation: initiation
 - 1. When special emergency service has been initiated, return the elevator to a designated floor, open the doors and maintain the doors opened.
 - 2. In the event that special emergency service is initiated by the actuation of a device at the designated floor, return the elevator to an alternative designated floor approved by the enforcing authority.
 - 3. Arrange the operation for this phase of special emergency service as follows:
 - 1. Reverse an elevator traveling away from the designated floor at the next available floor without opening its doors and cause it to proceed to the designated floor without stopping for car or hall calls.
 - 2. Close the doors of an elevator standing at a floor other than the designated floor under all operating modes, except on car-top maintenance, and cause it to proceed to the designated floor without stopping for car or hall calls.
 - 3. Give a visible and audible signal on the car.
 - 4. Render the emergency stop button, door protective device, door open, door close, and car and hall buttons inoperative.
 - 5. Provide a call cancellation button.
 - 6. Park at the designated floor with the doors open.
 - 4. Arrange that special emergency service is initiated by means of the three position special emergency service keyed switch marked "EMERGENCY RECALL" in red lettering, in either of the following ways:

1. Automatically by actuation of smoke detectors or fire alarm connected through the "AUTO" position of the switch.
 2. By turning the switch to the "ON" position.
- 5.12. Automatic Emergency Recall Operation: return to designated floor
1. After the initiation of special emergency services and after the return to lobby procedure described above has been completed, arrange the circuits so that the elevator runs on special emergency service when the key switch in the car is in the "On" position, using the same key as required for the return to lobby procedure above.
 2. Provide the following operation of the car under these conditions:
 1. Restrict the operation of the elevator to the person in the car.
 2. Prevent the elevator from responding to hall calls.
 3. Render inoperative door protective devices.
 4. Cause the car to respond to a registered car call provided that the doors have been closed by constant pressure on the close button if provided, or otherwise by constant pressure on a car call push button.
 5. Cause the doors to immediately re-open if the pressure on the button is released before the doors have fully closed.
 6. Upon completion of door closing, cause the car to run to the car call floor and stop without opening the doors.
 7. Arrange the circuits so that doors can be opened only by constant pressure on the "door open" button.
 8. Cause the doors to immediately re-close if the pressure on the button is released before the doors have fully opened.
 9. Once fully opened, cause the doors to remain open until closing is initiated as described above.
 10. Cause all car calls to be cancelled by momentarily turning off the keyed special emergency switch in the car.
- 5.13. Manual Emergency Recall Operation: Initiation
1. Arrange that special emergency service is initiated by means of the two position special emergency service keyed switch marked "EMERGENCY RECALL" in yellow lettering, in the following way:
 1. By turning the switch to the "ON" position.
- 5.14. Automatic Emergency Recall Operation: termination
1. Terminate special emergency service under the following conditions:
 1. All cars at the designated floor.
 2. All key switches associated with special emergency service in the "Off" position.
 3. Smoke or heat sensing devices associated with special emergency service either in the normal status or the three-position special emergency service keyed switch turned to the off position for cancellation of special emergency service.

4. The special emergency operation shall comply with all current code regulation in force.
- 5.15. Remote Monitoring System
 1. Provide for the controller to support remote elevator monitoring.
- 5.16. Ride Quality Improvement System
 1. Provide the following information before commencement of modernization:
 1. Documentation with current ride quality readings.
 2. Should the ride quality analyzer indicate that rails are out of alignment and that the ride quality is compromised, the contractor shall re-align the rails.

Appendix F

Traction Conveyance Requirement (14 24 06)

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1. General

1.1 General Requirements

1. Conform to section 14 01 20.

1.2 Number of Elevators

1. Provide elevator(s) in accordance with Schedule A.

1.3 Device Type: Traction

1. Provide traction equipment for each site identified and where noted in Schedule B.

1.4 Arrangement

1. Provide elevator(s) arranged to operate in accordance with the Bank requirement noted in Schedule A.

1.5 Designations

1. The elevators are numbered in numerical order as required by the Architect.

1.6 Drive Method

1. Arrange all cars in standard cantilevered traction arrangement.

1.7 Speed

1. The contract speed for all elevators should be 0.5m/s (100 fpm).

1.8 Capacity

1. Provide for capacity of 954kg (2100 lbs) on all cars.

1.9 Openings and Stops

1. The elevators should be arranged to serve the floors outlined in Schedule B.

1.10 Dimensions

1. Provide equipment to suit the hoistway, overhead and pit dimensions as per the following table and related references.

Traction Elevator	Information Location
Hoistway Width per car	Schedule C
Hoistway Depth per car	Schedule C
Pit Depth	Schedule C
Cab height	Schedule C
Elevator Speed	100 fpm
Overhead (top landing to slab)	Schedule C

1.11 Door Type

1. Provide single slide, horizontal sliding car and hoistway doors.

1.12 Door Entrances

1. Provide 915mm (36") wide by 2133.6mm (84") high doors.

1.13 Related Work

1. All work by others shall conform to governing codes. Any other work required to complete the installation or satisfy the regulatory authorities and not specifically listed herein shall be the responsibility of the elevator Supplier. To complete the elevator installation, the following items must be performed or installed by trades other than the elevator Supplier:

1. Provide suitable machine room ventilation to maintain the machine room temperature between 10° Celsius and 30° Celsius.
2. Provide a fused disconnect switch or circuit breaker for each elevator, with feeder branch wiring to each controller. The switches and size of wires to conform to the Canadian Electrical Code. The disconnect switches are to be mounted in a code approved location.
3. Provide 120 volts, AC, 15 amps fused, single-phase power supply with a fused disconnect switch for each elevator, with feeder wiring to each controller for car lights. Location to be in a code approved location.
4. Provide a separate single-phase power supply of the same voltage as each elevator supply, with 15 amps fused disconnect switch.
5. Provide suitable machine room lights, and convenience outlets in the machine room. The light switch is to be mounted in a code approved location.
6. Provide machine room and building smoke detector wiring to the elevator controllers.
7. Provide wiring and contacts to the elevator controllers for the operation of the special emergency service and emergency power as required by code.
8. Only where applicable, the wiring for elevator security including camera, card readers, hands-free phone, lobby control panel and central elevator monitoring will be terminated in the machine room. The wiring from that hoistway location to the termination point is work by others. The termination point will be the lobby panel, security desk, monitoring station or remote hall station.
9. Provide a separate 120 volts, AC, 15 amps fused, single phase power supply to each elevator monitoring and control system.
10. Provide a signal from the emergency power generator to indicate that the power will be switched from emergency generated to utility generated power.
11. Perform any cutting, patching and painting for the installation of the hall buttons, hall lanterns, position indicators and main floor monitor panel.
12. The Supplier to provide the hoistway divider steel beams (where applicable) and the machine room hoist beam.
13. Provide suitable pit lights, and convenience outlets.
14. Provide dedicated ground wiring.
15. Where required, a safe pathway/catwalk needed with handrails as per the MOL requirements for building rooftops with a low parapet of less than 1066.8mm (42").

1.14 Changes in Material and Work

1. Any change or substitution in the approved equipment must have prior written approval from the Owner and Construction Manager.
2. Any changes in the approved work must have prior written approval from the Owner and Construction Manager.

- 1.15 Cutting, Patching and Other work
 1. Any cutting, patching, painting or other restorative work required to accommodate the installation of the new equipment not specifically listed herein as work by others, shall be the responsibility of the Supplier.
 2. Prior to proceeding with any such work the Supplier shall obtain approval from the Owner and Construction Manager.
- 1.16 Remote Conduit and Wiring
 1. Where provided, any remote conduit and wiring required to interconnect the elevator controllers and the lobby panel, elevator remote monitoring or an elevator management control system, or any other equipment provided under these specifications, and not specifically listed herein as being by others, shall be the responsibility of the Supplier.
 2. Portions of this work may be sub-contracted with approval of the Owner and Construction Manager.
 3. The Supplier is responsible for providing all wiring needed for remote wiring to the lobby panel or security desk.
2. Machine Room
 - 2.1 Motors
 1. Provide gearless machine consisting of an AC motor directly connected to a braking device and to a grooved traction sheave.
 2. Provide Machine beams to mount the deflector sheave where required.
 3. Provide CSA/UL certified permanent magnet synchronous active current motor;
 4. Provide a gearless machine to include:
 1. Traction sheave;
 2. Brake; and
 3. Encoder.
 5. Self-cooling motor that require no additional blowers or fans;
 6. NEMA classifications F insulation rating;
 7. Provide a motor with 44 poles, 90% efficiency rating and absolute shaft mounted encoder;
 8. Provide a heavy duty cast cover for the encoder;
 9. Sheave shaft load that can support double the load or better;
 10. Removable sheave that is capable of supporting a minimum of 10-year rope life;
 11. Sheave hardness between 220-260 Brinell hardness.
 12. Compact design for easy access to the machine room;
 13. Cast iron frame with ribbed design for cooling;
 14. Lubrication fittings for long bearing life and maintenance;
 15. Provide a maintainable thermal sensing device;
 16. Provide instant start-up without the need for pre-torque;

17. Provide a motor that consumes no power at rest;
18. Ensure a quiet and smooth operation;
19. Provide 45% counterweight balance; and
20. Provide sheave groove for a 12.7mm (½") rope diameter.

2.2 Machine Brake

1. Provide a dual action independent brake solenoid with manual brake release;
 1. Ensure that each brake shoe holds 125% of the elevator capacity;
 2. Ensure that the dual brake meets the intent of the ascending car protection; and
 3. Unintended car movement.

2.3 Auxiliary Braking Device

1. Provide auxiliary braking device that is activated on the elevator ropes to prevent unintended car movement or to prevent ascending car overspeed.
2. Provide devices that act independently of the normal stopping or holding braking device.
3. The auxiliary braking devices shall be capable of stopping the elevator in an upward or downward motion at the full rated speed and load.
4. Activate such brake to prevent ascending car overspeed from striking the hoistway overhead structure as a result of a failure in:
 1. The electric driving-machine motor, brake, coupling, shaft, or gearing;
 2. The control system; or
 3. Any other component upon which the speed of the car depends, except the suspension ropes and the drive sheave of the traction machine.
5. Activate such brake to prevent unintended upward car movement away from the landing with the hoistway door not in the locked position and the car door not in the closed position, as a result of failure in:
 1. The electric driving-machine motor, brake, coupling, shaft, or gearing;
 2. The control system; or
 3. Any other component upon which the speed of the car depends, except the suspension ropes and the drive sheave of the traction machine
6. Arrange for the device and components to be readily accessible for maintenance.
7. Restrict the deceleration effected by the auxiliary braking device to between 25% and 100% of gravity.

2.4 Governor and Governor Ropes

1. Provide car governor with the appropriate overspeed and slow-down switches.
2. Provide counterweight (CWT) governor with the appropriate overspeed and slow-down switches.
3. Provide governor rope.
4. Provide the required governor mounting channels.

5. Provide self-resetting governor that can be reset remotely.
6. Provide robust pit idler installed with channels to allow for rope stretching. Do not install pivoting arms.
7. Provide self-resetting governor that can be reset remotely.

2.5 Hoist Ropes

1. Provide hoist ropes of sufficient size and number for the speed and capacity as specified.
2. Provide all the required shackles and springs on the car and counterweight.
3. Provide hoist ropes capable of meeting the requirements of large gearless machine sheave hardness between 220-260 Brinell hardness.
4. Provide a minimum rope diameter of ½" with steel reinforced natural fiber core to provide reduced stretching and cross-section deformation.

2.6 Controllers

1. Provide non-proprietary microprocessor controllers designed to give the required operation as herein specified.
2. Mount panels securely on substantial, self-supporting steel frames designed for floor or wall mounting.
3. Provide completely enclosed controllers with covers.
4. Install wiring on the controllers, whether control or field wiring, in a neat workman like manner.
5. Mark relays, contactors, fuses, printed circuit boards and other components clearly and permanently with designations as shown on the schematics.
6. Mount the designations for plug in components on the controller adjacent to the components.
7. Where required, provide an interface for a Central Monitoring System.
8. Provide non-proprietary diagnostics tools.
9. The control system shall provide comprehensive means of accessing the computer memory for elevator diagnostic purposes.
10. The controllers shall have permanent indicators for important elevator statuses as an integral part of the controller.
11. The controllers shall have the hardware to connect, to interrupt, to transfer power, and to protect the motor against overloads.
12. Provide means for the elevator system to restart and resume proper operation automatically in the event of a power failure.
13. The controllers shall be designed to accept as a minimum the re-programming of the following:
 1. Door Close Times.
 2. Door Open Times.
 3. Door Dwell Times.

4. Acceleration.
5. Deceleration.
6. Jerk Rates.
7. Floor Parking and Options.
8. Recall Levels.
14. The controllers shall be provided with on-board diagnostics and status LEDS to aid in troubleshooting, adjusting and maintenance.
15. Permanent status LEDS shall be provided to indicate the following:
 1. Safety Circuit.
 2. Door Locks.
 3. Independent Service.
 4. Normal Service.
 5. Inspection Operation.
 6. Emergency Power.
 7. Out of Service.
 8. Drive Failure.
16. Provide on-board diagnostics to include an event monitor and fault log.
17. Provide a programmable elevator security system and the required interface to lock floors, hall calls and elevators.
 1. Allow for the security system to track users.
 2. Provide all additional boards, relays, contacts and interfaces needed for such system.
 3. Provide all labour needed to coordinate such system.
- 2.7 Emergency Battery Lowering
 1. Provide a new and independent auxiliary power supply.
 2. Provide proper NEMA rated enclosure independent of the controller.
 3. Provide all the wiring and connections to the controller from the power supply.
 4. Fasten the power supply to the new controller cabinet so that it is not easily removed.
 5. Disable the elevator should the auxiliary power supply fail or become disabled.
 6. Provide a device with the following capabilities:
 1. Automatic charger with battery centric circuits that prevents overcharging.
 2. LED status display with load and battery bar graphs.
 3. Automatic voltage regulation.
 4. Intelligent battery management.
 5. Load Meter.

6. Replace Battery Indicator.
 7. Self-testing.
 8. Sine-wave output.
 9. Site wiring fault indicator.
 10. User replaceable batteries.
 11. Wide input voltage range.
 12. Input voltage 120VAC.
 13. Output voltage 120VAC.
 14. LED status light for: "replace battery" and "overload indicators".
 15. Provide sufficient power to operate the elevator from the top landing to the lowest landing with intermediate stops.
 16. Provide sufficient power to the door operator, valve, emergency lighting, cab lighting, alarm buttons, door open button, safety circuits, down direction circuit and any other devices required for the proper operation of the elevator during power failure.
 17. Provide an additional auxiliary reserve power for no less than 10 minutes.
- 2.8 Auxiliary Disconnect Micro Switch
1. Provide auxiliary disconnect micro switch.
 2. The micro switch should enable the auxiliary power to engage if the disconnect arm is in the "on" position but the power is not available.
 3. The auxiliary switch should prevent the emergency power from engaging if the disconnect arm is in "off" position.
- 2.9 Solid State Motor Drives
1. Provide a closed loop solid-state negative feedback variable-voltage/variable-frequency (VVVF) drives to control the speed, acceleration, and deceleration.
 2. Provide a Matching VVVF Drive with the following features:
 1. Pulse Width Modulation: 16,000 sinusoidal, pulse width modulation for comparing a high frequency triangular carrier wave with a three-phase sinusoidal waveform.
 2. PC interface for drive setup;
 3. Battery backup mode which allows the drive to run on low-power emergency source;
 4. Immediate control assertion;
 5. IGBT power circuits: IGBT power devices in each phase to be switched on where the sine and triangle waves intersect;
 6. Extensive over-current, over-voltage, and over-temperature protection;
 7. Hardware current regulation; and
 8. Integrated, temperature-controlled cooling fan.
 3. Provide a regenerative drive with filters to reduce harmonics in the line.

- 2.10 Solid State Position Encoder
 - 1. Provide a new solid state car position encoder. Provide a position transducer device to transmit to the controller the exact car position with an accuracy of $\pm 1/8"$ at any position in the hoistway.
 - 2. Provide absolute encoder capable of monitoring distance, speed, direction and absolute position of elevator.
 - 3. Provide absolute encoders feature a special pulse disc that consists of a series of tracks. Each track, executed as a binary bit, has its own series of clear and opaque lines that creates an on/off signal.
 - 4. Provide governor based disks or independently mounted device with wheels but do not provide slotted tapes with reader head.
 - 5. Provide consistent stopping accuracy within $1/8"$.
- 2.11 Feedback Devices
 - 1. Provide position transducer devices to transmit to the controllers the exact car position with an accuracy of $\pm 1/8"$ at any position in the hoistway.
 - 2. Provide velocity transducer devices to transmit to the controllers the precise speed of the elevators to be compared to the velocity profiles. This shall control the velocity, acceleration and deceleration.
 - 3. The elevator brakes shall be provided with brake switches to monitor and provide feedback as to the status of the brakes.
- 2.12 Auxiliary Disconnects
 - 1. Provide auxiliary disconnecting means to remove power from the equipment when line of sight to the main disconnecting switches is obstructed.
- 2.13 Grounding
 - 1. Ground the control system and all field apparatus using colour coded bonding wire.
 - 2. The accidental grounding or a short circuit shall not defeat any safety device, and shall not allow the elevator to start or run.
- 3. Hoistway Equipment
 - 3.1 Guide Rails
 - 1. Provide 12# guide rails for the main rails.
 - 2. Provide minimum of 8# guide rails for the counterweight rails.
 - 3. Install the guide rails using brackets affixed to the hoistway structure.
 - 4. The brackets should be spaced as follows:
 - 1. The main rail bracket spacing should accommodate the existing building floor height.
 - 2. Maximum spacing of 4267.2mm (14'-0") for counterweight rails.
 - 3. Provide rail clips for fastening the rails to the brackets.
 - 4. The rail clips should prevent the horizontal movement of the rails.
 - 5. The rail clips should allow the vertical movements of the rail as the building settles.

- 3.2 Counterweights
 - 1. Provide counterweights that have an over balance of 45% of the car weight.
 - 2. Statically balance the counterweights at the halfway point in the hoistway after completing the cab finishes.
 - 3. Provide counterweight buffer extensions.
- 3.3 Counterweight Roller Guides
 - 1. Provide roller guide assemblies on the top and bottom of the counterweight frame.
 - 2. Provide roller guide assemblies with adjustable float and spring tension.
 - 3. Provide roller guide assemblies with rollers being a minimum of 88.9mm (3.5") in diameter.
 - 4. Provide neoprene roller wheels.
 - 5. Provide rollers with adjustable stops and solid spacers to eliminate "knee action".
 - 6. Include a cover plate assembly over the rollers.
 - 7. Provide fully adjustable guides for all rails up to 19.05mm (3/4") width standard; which can be used on 3.6gk (8lbs). rail.
- 3.4 Buffers, Pit Steel and Switches
 - 2. Provide buffers and buffer stand and a new pit steel base.
 - 3. Fix the pit steel firmly to the pit floor.
 - 4. Stroke:
 - 1. The stroke of the buffer spring, as marked on its marking plate
 - 5. Load Rating
 - 1. Ensure that the buffers for cars and counterweights are capable of supporting, without being compressed solid or to a fixed stop, a static load having a minimum of 2 times the total weight of:
 - (a) the car and its rated load for car buffers
 - (b) the counterweight for counterweight buffers
 - 2. Buffers for cars and counterweights shall be compressed solid or to a fixed stop with a static load of three times the weight of:
 - (a) the car and its rated load for car buffers
 - (b) the counterweight for counterweight buffers
 - 6. Marking Plates
 - 1. Provide each spring buffer with a marking plate showing its load rating and stroke and the number of springs.
 - 2. Where the springs are removable, each spring shall be identified, and the assembly marking plate shall indicate this identification.
 - 3. Markings shall be made in a permanent and legible manner.
 - 7. Paint all the pit steel located underneath the car and counterweight buffer.

8. Ensure that the pit steel is painted with black rust inhibiting painted.
- 3.5 Hall Door Entrances
1. Provide hall door entrances, headers, and sills for the width and height specified.
 2. Align and fasten the entrances, headers, and sills to the building structure.
 3. Provide fascia plates between the landings, on the top-landing header and on the bottom-landing sill.
 4. Provide elevator identification on the entrances as required by code. The identification shall be a minimum of 75mm in height.
 5. Provide, on each hall entrance jamb, raised tactile metallic markings to designate the floor at the height required by code.
 6. Provide fire retainers on hall doors that can withstand 90.7gk (200lbs) of impact on the door.
 7. Provide hall door entrances and jambs in specified finishes as noted in Schedule F.
- 3.6 Hall Doors and Hardware
1. Provide doors that matches the cab doors with respect to type and style.
 2. Provide each hall door with pick-up rollers for the car door clutches.
 3. Provide the hall door related equipment required for the installation and proper operation of the hall doors.
 4. Provide code approved hall door locks and interlocks.
 5. Provide eccentric rollers and hangers that are suitable for the door height and weight.
 6. Ensure that each door panel is properly labeled for hoistway fire rating.
 7. Provide durable heavy-duty doors with integral hangers and sound proofing where stainless-steel cladding is required.
 8. Ensure that the equipment and installation of the entrances and doors conforms to all code requirements and fire rating.
 9. Provide floor numbers on the interior walls and/or doors of the hoistway at intervals where a person in a stalled elevator upon opening the car door can determine the floor position.
 10. Provide emergency rescue escutcheon in brass steel finish on each landing to facilitate the rescuing of passengers.
 11. Provide heavy duty Smartork spirators at all landings and ensure that on the lowest landings where air supply can enter the building (main access or egress, parking, path system, etc...) and the top landings where air can escape a second set of door closer is provided (sill closer or gravity closer).
 12. Provide grouting sills at each landing and confirm in writing the floor finishes on each floor so that the sill is flush with the finished floor.
 13. Provide aluminum sills on all landings.
- 3.7 Car Sling and Platform
1. Provide car slings of sufficient strength for the speed and capacity as specified.

2. Provide car platforms of sufficient size and strength to accommodate the capacity as specified.
 3. Provide fabricated platform frame of formed or structural steel shapes, gusseted and rigidly welded with a wood sub floor. Underside of the platform shall be fireproofed.
 4. Mount the platform on isolation pads to prevent any vibration or noise being transmitted from the car sling to the platform.
 5. Statically balance the cars, at the halfway point in the hoistway, with the top roller guides removed so that the cars hang in the center between the rails.
 6. Provide dynamic balancing assembly with weights arranged on adjustable guides to appropriately balance each cab.
- 3.8 Car Roller Guides
1. Provide roller guide assemblies on the top and bottom of the elevators.
 2. Provide roller guide assemblies with adjustable float and spring tension.
 3. Provide ELSCO roller guide assemblies with rollers being a minimum of 76.2mm (3") in diameter.
 4. Provide neoprene roller wheels.
 5. Provide rollers with adjustable stops and solid spacers to eliminate "knee action".
 6. Include a cover plate assembly over the rollers.
 7. Provide fully adjustable guides for all rails up to 19.05mm (3/4") width standard; which cannot be used on 3.6gk (8lbs). rail.
- 3.9 Hall Stations
1. Provide a single riser hall stations. The hall stations are to conform to existing codes. The design of the hall stations to be approved by the Architect. The material of the hall stations to be brushed stainless steel.
 2. Ensure that the center of the button is located at 1066.8mm (42") from the landing floor and that the fixture does not protrude more than 12.7mm (1/2").
 3. Provide hall stations in #4 finish stainless steel.
 4. Provide stainless steel hall stations with DUPAR US91cc Optic Series button with Green for the up and Red for the down LED illumination.
 5. Provide in each hall station two buttons (up and down) on the intermediate floors and one button on the terminal floor.
 6. Provide hall fixture at the lobby level to incorporate the special emergency service required under the code.
 7. Owner/Architect to approve the design and material of the hall stations.
- 3.10 Hall Position indicators
1. Provide seven segment white LED digital position indicators at the lobby level (front and rear). Install the position indicators above the door entrance using stainless steel fixtures in brushed finish.
 2. Provide fixtures, which conform to barrier free access.

3. Integrate a hall lantern and chime into the position indicator where possible, otherwise mount separately above door.
4. Provide a car directional indicator in the position indicator which displays the direction of the elevator at all times and in the absence of one, the last known direction.
5. Provide position indicators with characters at least 63.5mm (2.5") in height to be clearly visible from the landing.
6. Ensure that the position indicator is visible in normal daylight and working properly.

3.11 Lobby Fixtures

1. Provide at the lobby level the following:
 1. A stainless steel panel in brushed finish.
 2. Where available, emergency power switch and LEDs.
 3. Emergency recall switch and LEDs.
 4. Emergency fire recall key in enclosed glass case.
 5. The lobby emergency panels to conform to all current codes.
 6. The final design and location of the lobby panels to be approved by the Owner.

3.12 Electrical Ducts, Troughs and Wireways

1. Provide hoistway trough designed to protect electrical wiring from dust, dirt, oil, and water.
2. Provide trough designed to carry hoistway wiring, branch circuits, travelling cable wiring and other groups of conductors.
3. Provide troughs that are open on one side so wires and cables can be laid in along an entire hoistway run.
4. Provide troughs that would require no pulling of wires or cables.
5. Provide troughs with NEMA 1 rating (dust).
6. Provide dual dimensions concentric knockouts for 12.7mm (½") and ¾" conduits.
7. Provide connectors that would allow for sections and fittings to be rigidly joined together.
8. Provide vertical slots with 12.7mm (½") overlap that would allow for settling of the building. Paint the connector in contrasting colour (black or yellow) so that when the overlap is reduced it would become visibly apparent.
9. Provide troughs furnished in American National Standards Institute (ANSI) 49 gray polyester powder finish inside and out over phosphatized surfaces.
10. Provide a strain bars installed every 100 feet (30.5m) in vertical runs for wire support.

4. Elevator Cab

4.1 Elevator Cab

9. Provide car cabs with a height of 2438 mm (96").
10. Provide car doors for the width and height specified.
11. Provide that the transom, posts, headers, base and reveals are provided in #4 finish stainless steel.

12. Provide car doors in brushed stainless steel finish.
 13. Provide all the necessary hardware for mounting the car doors.
 14. Ensure that each car door panel has a clutch/skate.
 15. Provide electrical and mechanical gate switches.
 16. Provide on top of each cab an exhaust fan with a minimum capacity of 450 cfm.
 17. Ensure that the fan is isolated from the cab to prevent any noise or vibration.
 18. Provide where required provisions and assist in the installation of security camera in the elevator cab.
 19. Provide pad hooks in all cars.
 20. Provide one set of protective pads covering all exposed wall surfaces, but leave access to the car buttons.
 21. Review material and design and ensure that it meets Barrier-Free requirements as stated in Appendix E of the CAN/CSA B44-2019; and
 22. Provide cab interior finishes as per Appendix G (Cab Design A, B or C).
- 4.2 Car Direction Indicators and Chimes
1. Provide car travelling lanterns to operate as per specification (sec.5.14 hall lantern operation).
 2. Install flush mounted lanterns. Do not provide bulky or surface mounted equipment that protrudes more than 25.4mm (1.0") from the face of the wall.
 3. Provide stainless steel finish to match hall buttons fixtures.
 4. Provide electronic chimes and LED/LCD directional displays.
 5. Provide white LED colour digital displays.
 6. Provide displays that are visible under all lighting conditions and can be seen within 180 degrees of the hall direction.
 7. Owner to approve the design and material of the travelling directional lanterns.
- 4.3 Car Slings
1. Statically balance the cars, at the halfway point in the hoistway, with the top guides removed so that the cars hang in the center between the rails.
 2. Ensure that the weight of the car accurately reflects the weight on the crosshead data tag.
 3. Ensure that the sling is balanced and properly supported. Where roller guides are being damaged due to excess pressure, the Supplier shall be held liable for the design.
- 4.4 Top of Car Stations
1. Provide, on top of each car, an inspection station consisting of an emergency stop button, up, down and common inspection buttons, on-off inspection switch.
 2. Provide on top of each car a duplex electrical outlet and light with a guard and switch.
- 4.5 Infra-Red Door Detector
1. Provide infra-red door reversal devices.

2. Provide new three dimensional (3D) infrared door detection system on every car door.
 3. If the door protective device detects a person or object in its path, at any point during the door closing operation, the doors shall re-open.
 4. The infrared shall be equipped with red/green indicators to highlight door movement.
 5. Provide a system with a 5486.4mm (18 foot) range.
 6. The detection device and door operation should be adjusted so that the doors re-open without striking any object or person.
 7. Provide a three-dimensional electronic door detectors on all car doors with the following specifications:
 1. The infrared detector should provide complete door protection.
 2. Distance between beams not to exceed 38.1mm (1.50").
 3. Visible light immunity of 100,000 lux.
 4. Interleaved scan.
 5. Minimal number of sensors 80.
 6. Average response time of 90 ms.
 7. Nudging capable feature.
 8. Fault code.
 9. Audible noise emitted when beam interrupted.
 10. Sensitivity adjustment.
 8. Comply with Sections 5.3 (door nudging operation) and 5.4 (door protective device).
- 4.6 Load Weighing Devices
1. Provide a load-weighing device to measure the load in the car.
 2. Provide means to sense changes in weight with tolerances no less than 22 kg (48.5 pounds).
 3. Provide feedback to the drive to prevent rollback.
 4. Provide load weighing sensors that mount to the elevator cables or below the platform or at the dead-end hitch (preferred).
 5. Provide hidden legend in the car operating panel to indicate if the elevator is overloaded or when maximum load has been reached.
- 4.7 Hoistway Access
1. Provide hoistway access key switches to access the car top.
 2. The access function to conform to all code requirements.
 3. Provide one at the top and another at the bottom of the shaft.
 4. Provide access keys to be located in the sight guard or door jamb.

██████████ Car Stations

1. Provide new main and auxiliary swing return Car Operating Panels (COP) in not less than 14Ga stainless steel and finishes to match the front of the cab.
2. Main and auxiliary panels to conform to barrier free access and current code requirements. Provide DUPAR US 91CC LED push buttons with car call registration feedback.
3. Panels to conform to barrier free access and current code requirements.
4. Provide concealed fastening locks.
5. Provide heavy duty hinges that can support the weight of the COP.
6. The building name and logo, car number, government number and the capacity to be engraved in the appropriate place on the return panel.
7. Owner to approve the design and material of the car stations.
8. Main and auxiliary Car stations to tentatively include the following features and layout:
 1. Hands-free emergency phone with one way video and messaging.
 2. Display and camera for the video and messaging system. (internet network with four (4) hour battery back up to be provided by the owner)
 3. CEE Electronics EMN57 Digital LCD car position indicator.
 4. Where provided, install the Pattison and /or Captivate Media Screen and provide the required support for the electrical power, connection and access for proper operation.
 5. Car call buttons marked to correspond to floors served. Provide car call registration feedback.
 6. Door open and door close buttons.
 7. Alarm button with amber illumination.
 8. Provide a hands-free telephone system with automatic dialler integrated into the car station to meet barrier-free access as well as these requirements:
 - (a) Provide a push button identified as "Phone" to initiate communication along with a speaker.
 - (b) Identify the button with a raised international symbol for telephones and Braille markings.
 - (c) Provide visual indication which is activated to acknowledge that the communication has been established. Extinguish the visual indication when the connection is terminated.
 - (d) Provide a display and buttons so that authorized/emergency personnel can communicate via messaging and obtain responses from a trapped passenger who cannot communicate verbally or is hearing impaired.
 - (e) Provide a camera to display video positioned to observe passengers at any location on the car floor.
 - (f) Provide four (4) hour battery backup for the entire communication system.
 - (g) Arrange that the communication cannot be terminated from within the cab.
 - (h) Provide twin conductor shielded wiring from the cab to the elevator machine room.
 - (i) Terminate the wiring for all elevator in the machine room at a separate terminal block mounted on the side of a controller.

- (j) Connect and program the phone to the lobby rescue station (auxiliary lobby telephone equipment) to meet the new code requirements.
 - (k) Provide equipment and wiring compatible with the building's telephone system.
 - (l) Use the lobby rescue station to connect to the elevators so that they can share one telephone line and someone calling into an elevator can select which elevator to call.
 - (m) Provide a line seizure device, including installation, to connect elevator phones (i.e. such as office fax line).
9. Provide a fire fighter switch as follows:
- (a) This key will be of a tubular, 7 pin, style 137 construction and shall have a bitting code of 6143521. The key will be coded "FEO-K1".
 - (b) A three-position ("OFF," "HOLD," and "ON," in that order) key-operated switch shall be labeled "FIRE OPERATION"; provided in an operating panel in each car; and shall be readily accessible.
 - (c) The label "FIRE OPERATION" lettering shall be a minimum of 5 mm (0.25 in.) high in red or a color contrasting with a red background. It shall become effective only when Phase I Emergency Recall Operation is in effect and the car has been returned to the recall level. The switch shall be rotated clockwise to go from "OFF" to "HOLD" to "ON." The "FIRE OPERATION" switch, the "CALL CANCEL" button, the "STOP" switch], the door open button(s), the door close button(s), the additional visual signal, and the operating instructions shall be grouped together at the top of a main car operating panel behind a locked cover.
 - (d) The firefighters' operation panel cover shall be openable by the same key that operates the "FIRE OPERATION" switch.
 - (e) Ensure that when the key is in the "FIRE OPERATION" switch, the cover shall not be capable of being closed. When closed, the cover shall be self-locking.
 - (f) Where rear doors are provided, buttons for both the front and rear doors shall be provided in the firefighters' operation panel. The door open and door close buttons for the rear entrance shall be labelled "OPEN REAR" and "CLOSE REAR."
 - (g) All buttons and switches shall be readily accessible, located not more than 1 800 mm (72 in.) above the floor and shall be arranged as required by Code.
 - (h) The front of the cover shall contain the words "FIREFIGHTERS' OPERATION" in red letters at least 10 mm (0.4 in.) high.
10. The following switches shall be enclosed in a service cabinet: light switch, two speed fan switch, floor passing tone disable switch, voice annunciator disable switch, inspection switch, independent service switch, USB for the PI, emergency light test switch, and emergency stop switch. Also include a GFI 110 AC Volts outlet in the service panel.
11. Provide an EPCO TCEL emergency cab light system which uses the cab lighting for emergency lighting.
12. The car number, government number, building name, no smoking sign and the capacity to be engraved in the appropriate place on the return panel.
13. Provide a service panel for the security card reader in a separate compartment 8" wide by 8" height with keyed access door and a smokey lens 3.25" x 3.25". In

addition provide a spare metal cover plate to fill in smokey lens if card readers are not used.

14. Provide a bi-lingual male/female voice enunciator with preset and programmable floor designation:
 - (a) Provide a CE Electronics micro com style AMCUM-MMB Digitized Voice Annunciator which utilizes actual male and female voices in a system that is capable of up to 5 minutes of speech.
 - (b) Provide a system which complies with ADAAG 4.10.13 handicap code.
 - (c) The sound should be field selectable and the volume adjustable.
 - (d) The Digitized Voice Annunciator should advise at a minimum of the following:
 - (i) Direction.
 - (ii) Stay away from closing door.
 - (iii) Nudging functions.
 - (iv) Special emergency service.
 - (v) Out of service condition.

4.8 Traveling Cables

1. Provide elevator traveling cables. Cables to include a minimum of six (6) shielded pairs of 20 AWG and one (1) coaxial cable.
2. Provide spare wires consisting of at least 10% of the total number of wires with a minimum of ten (10) spare wires. Do not include in your calculation two (2) coaxial cables, four (4) shielded pairs and three (3) 14 gauge wires.
3. The traveling cables should form a continuous run from the controller to the elevator cab. Do not terminate the traveling cables at a junction box under the car or in the hoistway.

4.9 Wiring

1. Provide machine room, hoistway and car wiring as required for the installation and operation of the elevators.
2. Provide that the installation of all wiring is in accordance with the Canadian Electrical Code.
3. Provide wiring for security (where applicable), cab phone, and central monitoring from controllers to a hoistway wiring termination point.

4.10 Barrier Free Access

1. Provide barrier free access on all cars as defined in Appendix E of the CAN/CSA B44-19.

4.11 Door Operators

1. Provide closed loop, heavy duty, solid-state door operator.
2. Provide one ½ hp motor and heavy duty sprocket, chain, belt, and sheaves.
3. Provide closed loop regulated speed performance.
4. Provide onsite one hand-held keypad programming unit.
5. Provide and store the adjustments on the handheld unit.

6. Provide an operator with adjustable door obstruction reversal.
 7. Provide optical cams with LED indicators.
 8. Provide test switches for open, close, nudging and speed zone set up.
 9. Provide universal inputs for open, close, and nudging.
 10. Provide robust drive linkages to the car door.
 11. Provide a door operator with two pedestal bearing on the main drive shaft.
 12. Replace the car door rollers and track.
 13. Adjust the door closing force so that it does not exceed 13.6gk (30lbs).
 14. Provide a door operator that would automatically calculate the door weight and speed to regulate the kinetic energy. Where infrared detectors are used, the closing door system shall conform to the following requirements:
 1. The kinetic energy computed for the average closing speed as determined in accordance with 2.13.4.2.2 shall not exceed 10 J (7.37 ft-lbf).
 2. The kinetic energy computed for the actual closing speed at any point in the code zone distance defined by 2.13.4.2.2 shall not exceed 23 J (17 ft-lbf).
 15. Provide a door restrictor.
- 4.12 Car Gate Switches
1. Provide car gate switches (ensure that the switch is located on the slave arm side or non-locking side).
- 4.13 Car Door Clutch
1. Provide a skate or clutch to suite.
- 4.14 Car Top Railing
1. Provide where needed, on top of the car, metal railing to protect the elevator mechanic from falling.
 2. Install the handrails on all cars at the commencement of the contract award.
 3. Provide a substantial metal guard rail on the sides of the car top.
 4. The guard shall consist of a top rail located approximately 1066.8mm (42") above the car top and an intermediate rail located approximately 558.8mm (22") above the car top.
 5. A 127mm (5") toeguard shall be provided at the base of the guard.
 6. The guard rails must be designed and installed to withstand a load of 550 N (125 lb.) applied perpendicular to the span in a horizontal at any point on the top rail and a vertical downward load of 1.5 kN per meter (100 lb. per foot) along the top rail.
 7. The horizontal and vertical loads need not be considered to act simultaneously.
 8. Submit as part of your submission, the car top railing as part of your government submission.
- 4.15 Car Restrictor
1. Provide a mechanical door restrictor that requires no electrical solenoid or components which can stretch or fail.

2. Provide a collapsible door restrictor or other moving parts to engage and disengage.
 3. Ensure that the car door remains locked when outside the door zone.
- 4.16 Car Safeties
1. Provide, on the bottom of each car Type A instantaneous guide clamp safeties with the following characteristics:
 1. Designed in compliance with all requirements of CAN/CSA B44 and ASME A17.1 code;
 2. Stopping force automatically exerted equally on both sides of each guide rail and readily adjustable thorough compression spring on each safety block;
 3. Full swivel of rail grips provides full and uniform contact on all rail faces when safety is actuated;
 4. Simple mounting under plank channels spaced for stile members of any size;
 5. All operating linkage is adjustable and located under the car for easy installation, inspection, and maintenance from elevator pit;
 6. Car safety switch operated by linkage under the counterweight and automatically resets;
 7. Arranged for mounting guide shoes of any type;
 8. Dust tight, watertight, and explosion proof switches to withstand rust and water damage.
5. Elevator Control and Dispatching
- 5.1 Door Operation
1. Provide a heavy duty close loop door operator.
 2. The door operator will facilitate smooth operation under varying environmental influences such as, temperature, wind, friction, and component variation. The processor will monitor the door's actual position and velocity compared to its desired position and velocity.
 3. If variations are detected in the profile the command will be automatically corrected. The Closed Loop Door Operator control system shall not require machine room door control equipment.
 4. Door opening shall be automatic as the car arrives at a landing, and close at the expiration of the door open timer. Doors shall remain open for a time period as follows:
 1. A car call time shall predominate when a car call only is being answered.
 2. The hall call time shall predominate when a hall call or both a hall call and car call are being answered.
 3. A short door time shall predominate after a door reversal from the door detector or the door open button.
 4. A short door time shall predominate on a hall call or car call after the beam of the door protective device has been broken.
 5. The values for the door timers shall be independently field adjustable:

Car Groups	Maximum Door Opening Time	Maximum Door Closing Time	Maximum Car Call Door Dwell Time	Maximum Hall Call Door Dwell Time	Maximum Short Door Dwell Time
Car 1	2.8 sec.	4.1 sec.	3.0 sec.	5.0 sec.	3.0 sec.

5.2 Delayed Car Operation

1. If the elevator is delayed at a landing for a predetermined adjustable time while there are calls in the system, the car shall be removed from the group operation.

5.3 Door Nudging Operation

1. If the elevator doors are prevented from closing for a predetermined adjustable time, the door protective device shall become inoperative, and audible signal shall sound, and the door shall close at a reduced speed. Normal door operation shall resume at the next stop.

5.4 Door Failure Protection

1. If the elevator doors are prevented from closing for a predetermined adjustable time, the door protective device shall become inoperative, and audible signal shall sound, and the door shall close at a reduced speed. Normal door operation shall resume at the next stop.
2. Door Protective Device
3. Provide new two dimensional (2D) and three dimensional (3D) combination infrared door detection systems on every car door.
4. The door re-opening device shall:
5. Detect cylindrical target(s) approaching the entrance opening of the landing-side doors, at any point during the door closing operation, the doors shall re-open;
6. Detect approaching objects up to a speed of 1 m/s (3 ft/s);
7. Detect objects moving towards the entrance between 9" (225mm) – 20" (500mm) from the landing side of the door;
8. Provide sensor technology not affected by reflected ambient light;
9. Ignore stationary objects within the three dimensional (3D) zone, whilst still detecting movement towards the door; and
10. Differentiate movement from the side of the three dimensional (3D) zone and movement approaching the doors.
11. The infrared shall be equipped with red/green indicators to highlight door movement.
12. Provide a system with an eighteen foot range.
13. The detection device and door operation should be adjusted so that the doors re-open without striking any object or person.
14. Provide door detection means on all car doors with the following specifications:
15. The infrared detector should provide complete door protection.
16. Distance between beams not to exceed 1.50".
17. Visible light immunity of 100,000 lux.

18. Interleaved scan.
19. Minimal number of sensors 80.
20. Average response time of 90 ms.
21. Nudging capable feature.
22. Fault code.
23. Audible noise emitted when beam interrupted.
24. Sensitivity adjustment.

5.5 Advance Door Opening

1. Arrange the door circuit so that the doors start to open as the elevator is leveling into the floor, and are halfway open when the car stops level with the landing.

5.6 Performance Criteria

1. The control equipment shall be capable of operating within the specified performance criteria.
2. Flight time shall be measured from the start of the door close cycle until the doors are 2/3 open at the next landing on a one floor run.

Car Groups	Maximum Flight Time	A95 Vertical Horizontal	Maximum Jerk	Maximum Acceleration	Levelling Accuracy	Speed Variation
Car 1	14.0 sec.	6 mg	7.0 ft/sec ³	3.5 ft/sec ²	+/- 1/8"	+/- 2%

5.7 Noise Levels

1. Door operation noise level shall be taken during the door opening, door closing, and door reversal cycles.
2. The cab noise level shall be taken during a full run, bottom to top, and return.
3. The machine room noise level shall be taken with all cars operating.

Car Groups	Door Operation	Cab	Machine Room
Car 1	62dBA	50dBA	80dBA

5.8 Independent Service

1. Provide a key switch in the car panel which, when actuated will take the car out of riser call operation and allow operation from the car buttons only. Door operation shall be activated by constant pressure on the door close button.
2. Independent service operation shall de-activate the hall and in car lanterns.
3. Independent service operation shall de-activate the door reversal device.

- 5.9 Inspection
 - 1. Provide a key switch in the main car panel which, when actuated will take the elevator out of service. An inspection-operating fixture on top of the elevator will allow the elevator to be controlled on inspection mode as per code.
- 5.10 Anti-Nuisance
 - 1. The anti-nuisance feature provided shall cancel all car calls when the number of car calls exceeds the measured load setting.
- 5.11 Load By-pass
 - 1. The elevator shall by-pass all hall calls in the direction of travel if loaded to a predetermined adjustable capacity. This shall be initially set at 60% of full load.
- 5.12 Load Weighing
 - 1. The load-weighing operation shall prevent the elevator from running if the load capacity is exceeded.
 - 2. The load-weighing signal shall be used to pre-torque the hoist motor prior to picking the brake to prevent rollback due to an unbalanced car.
- 5.13 Hall Lantern Operation
 - 1. Provide electronic hall chimes with LED light fixtures.
 - 2. Hall lanterns shall illuminate and produce an audible signal to indicate the direction of travel.
 - 3. The audible signal shall sound once for up and twice for down.
 - 4. The volume of the audible signal shall be field adjustable.
 - 5. The hall lantern shall remain illuminated until the door dwell time has expired.
 - 6. The lobby lantern shall only be illuminated on the assigned car.
 - 7. The hall lantern shall provide a five (5) second advance signal before the arrival of the elevator.
 - 8. The illumination shall be green for up and red for down and clearly visible in daylight.
- 5.14 Leveling
 - 1. The control circuit shall cause the car to stop automatically at floor level regardless of load or direction of travel within 1/8" with respect to the hoistway sill.
 - 2. The control circuit shall correct for over travel, under travel and cable stretch return.
 - 3. Ensure that the elevator levelling will be maintained under all conditions including building settling otherwise include all required maintenance work to sustain it.
- 5.15 Automatic Emergency Recall Operation: initiation
 - 1. Arrange that special emergency service is initiated by means of the three position special emergency service keyed switch marked "EMERGENCY RECALL" in red lettering, in either of the following ways:
 - 1. Automatically by actuation of smoke detectors or fire alarm connected through the "AUTO" position of the switch.
 - 2. By turning the switch to the "ON" position.

- 5.16 Automatic Emergency Recall Operation: return to designated floor
1. When special emergency service has been initiated, return the elevator to a designated floor, open the doors and maintain the doors opened.
 2. In the event that special emergency service is initiated by the actuation of a device at the designated floor, return the elevator to an alternative designated floor approved by the enforcing authority.
 3. Arrange the operation for this phase of special emergency service as follows:
 1. Reverse an elevator traveling away from the designated floor at the next available floor without opening its doors and cause it to proceed to the designated floor without stopping for car or hall calls.
 2. Close the doors of an elevator standing at a floor other than the designated floor under all operating modes, except on car-top maintenance, and cause it to proceed to the designated floor without stopping for car or hall calls.
 3. Give a visible and audible signal on the car.
 4. Render the emergency stop button, door protective device, door open, door close, and car and hall buttons inoperative.
 5. Provide a call cancellation button.
 6. Park at the designated floor with the doors open.
- 5.17 Automatic Emergency Recall Operation: car operation
1. After the initiation of special emergency services and after the return to lobby procedure described above has been completed, arrange the circuits so that the elevator runs on special emergency service when the key switch in the car is in the "On" position, using the same key as required for the return to lobby procedure above.
 2. Provide the following operation of the car under these conditions:
 1. Restrict the operation of the elevator to the person in the car.
 2. Prevent the elevator from responding to hall calls.
 3. Render inoperative door protective devices.
 4. Cause the car to respond to a registered car call provided that the doors have been closed by constant pressure on the close button if provided, or otherwise by constant pressure on a car call push button.
 5. Cause the doors to immediately re-open if the pressure on the button is released before the doors have fully closed.
 6. Upon completion of door closing, cause the car to run to the car call floor and stop without opening the doors.
 7. Arrange the circuits so that doors can be opened only by constant pressure on the "door open" button.
 8. Cause the doors to immediately re-close if the pressure on the button is released before the doors have fully opened.
 9. Once fully opened, cause the doors to remain open until closing is initiated as described above.

10. Cause all car calls to be cancelled by momentarily turning off the keyed special emergency switch in the car.
- 5.18 Automatic Emergency Recall Operation: termination
1. Terminate special emergency service under the following conditions:
 1. All cars at the designated floor.
 2. All key switches associated with special emergency service in the "Off" position.
 3. Smoke or heat sensing devices associated with special emergency service either in the normal status or the three-position special emergency service keyed switch turned to the off position for cancellation of special emergency service.
 4. The special emergency operation shall comply with all current code regulation in force.
- 5.19 Firefighter's Elevator
1. Provide that Car 1 can be a designated firefighter's elevator. The firefighter's elevator shall conform to all current codes.
- 5.20 Emergency Power - Provision
1. The elevator Supplier shall provide an affidavit confirming the proper operation of the fire recall signals and confirmation of provision for emergency generator operation.
 2. The elevator Supplier shall provide contacts on the controllers to receive signals from the normal and emergency power contacts.
 3. The transfer between the normal and the emergency power shall be automatic.
 4. The Supplier shall provide the means to limit the transformer inrush current when emergency power is activated.
 5. A signal light marked "ELEVATOR EMERGENCY POWER" shall be provided in the lobby at street level to indicate emergency power is in effect.
 6. The emergency power operation shall be as follows:
 1. Upon loss of normal power and receipt of emergency power the elevators shall automatically return, one at a time, to the lobby floor, or other designated floor.
 2. Any car that is unable to move on command within a preset time interval shall be bypassed and another car shall be selected.
 3. After all cars, that were able to respond to the return to lobby command, have returned to the lobby, a car(s) shall be automatically selected to provide normal elevator service.
 4. Failure of the selected car to move shall cause power to be transferred to another car.
 5. Provide an emergency power selection switch marked "ELEVATOR EMERGENCY POWER" in red lettering at the lobby at street level.
 6. The selector switch shall have a position marked "AUTO" to permit automatic power selection, and shall be locked in that position.
 7. The selector switch shall have positions corresponding to the elevator identification for manual selection of emergency power operation.

8. The emergency power operation shall comply with all current code regulation in force.

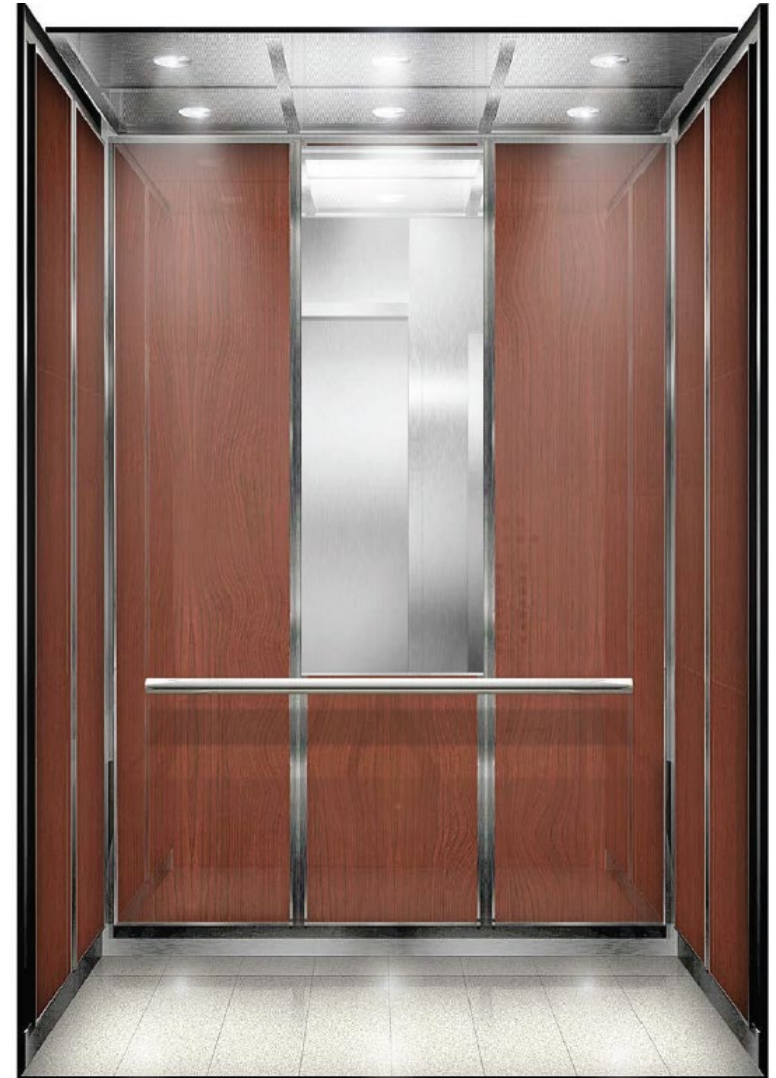
In addition to the cab interior section provided in the various section, the following design is applicable to the interior finishes. The Owner shall have the option to select any one of three cab options as provided herein:

CAB DESIGN - A

1.1. Cab Renovation - A

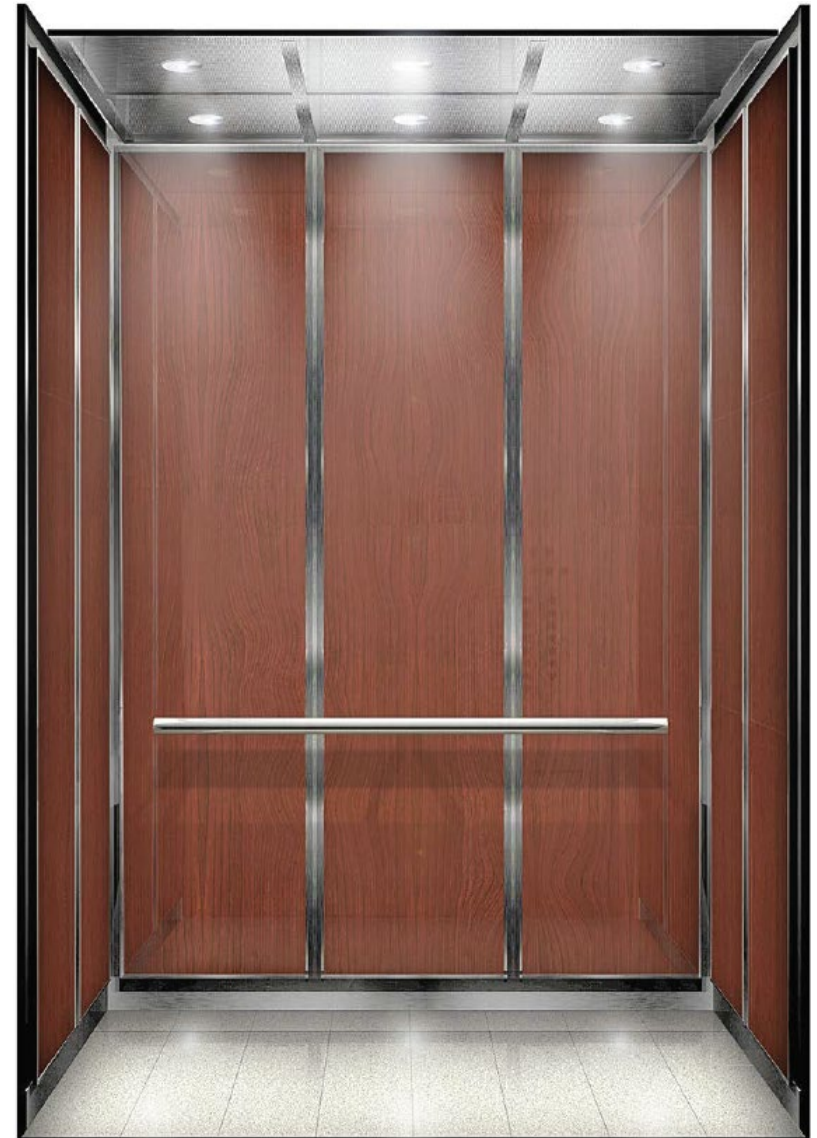
1. Provide new upgraded cabs as per the following:
2. Flooring
 1. Provide porcelain tile flooring with the following provisions:
 - (a) Provide tile with typical width of 300mm and length of 600mm;
 - (b) Provide a compound design flooring Provide a diagonal grid in the centre of the cab;
 - (c) Provide a minimum tile thickness of 12.5mm;
 - (d) Provide tile to match the finishes of the lobby
 - (e) Install tile on thinset mortar bed. Joints to be no more than 3mm wide.
 - (f) Custom grout colour to match lobby tile colour; and
 - (g) Submit samples for Architect and Owner approval.
3. Ceiling
 1. Provide new ceiling with a stainless steel centre surrounded by six inch (350mm) boarder on all sides.
 2. Provide ample lighting by installing six or more LED fixtures centered in the bordering stainless ceiling:
 - (a) Install all required hardware to make the LED perform as required with dimming switch.
 - (b) Provide high output LED lamps.
 - (c) 255 lumens with cool white;
 - (d) Provide lighting with high color rendition.
 - (e) Provide high lumen output of no less than 150 lux at any point in the elevator cab.
4. Rear Walls
 1. Provide three equally sized panels with a j-trim stainless steel panels.

2. Provide a clear mirror in the centre panel and two P-Lam panels both sides of the mirror.
3. Provide stainless steel reveals and kick-plates.
5. Side Walls
 1. Provide two equally sized horizontally mounted P-Lam surrounded by a protruding ¼" stainless steel trim from the handrail to the kick plate separated by brushed #4 stainless steel reveals.
 2. Provide a single piece clear glass mirror mounted above the handrail and claded by a stainless steel J-trim.
6. Handrails
 1. Provide dual 1½" diameter tubular stainless steel handrail located on all three sides of the cab wall meeting the latest barrier free requirement.
 2. Provide cornered or turned in handrails in the corner and front side of the cab.
7. Provide sample material, drawings and colour chips for the Architect and Owner to choose from.
8. The cab design shall consist of a mirror at the back of the cab, laminates at the side of the cab and stainless-steel reveals and drop ceilings.
9. Where conflicts are identified between regulatory compliance and architectural design, identify the conflict and bring to the attention of the Consultant;
10. Provide a light receptacle, low voltage LED lamp in each panel;
11. Provide six stainless panel drop ceiling. Ensure that each light is centered within the ceiling tile panel;
12. Provide hang on panel from your elegant line of cab interiors; and
13. Provide that each panel has stainless steel #4 finish j-trim (bonding).



1.2. Cab Renovation - B

1. Provide new upgraded cabs as per the following:
2. Flooring
 1. Provide vinyl tile flooring with the following provisions:
 - (a) Provide tile with typical width of 600mm and length of 600mm;
 - (b) Provide a compound design flooring Provide a diagonal grid in the centre of the cab;
 - (c) Provide marine rated subflooring that resists water and fluids;
 - (d) Submit samples for Architect and Owner approval.
3. Ceiling
 1. Provide new ceiling with a stainless steel panels.
 2. Provide ample lighting by installing six LED fixtures centered on each of the six panels:
 - (a) Provide high output LED lamps.
 - (b) 255 lumens with cool white;
 - (c) Provide lighting with high color rendition.
 - (d) Provide high lumen output of no less than 150 lux at any point in the elevator cab.
4. Rear Walls
 1. Provide three equally sized panels with stainless steel j-trim laminate panels.
 2. Provide stainless steel reveals and kick-plates.
5. Side Walls
 1. Provide two equally sized horizontally mounted P-Lam surrounded with stainless steel j-trim.
 2. Provide stainless steel reveals and kick-plates.



6. Handrails
 1. Provide dual 1½" diameter tubular stainless steel handrail located on all three sides of the cab wall meeting the latest barrier free requirement.
 2. Provide cornered or turned in handrails in the corner and front side of the cab.
7. Provide sample material, drawings and colour chips for the Architect and Owner to choose from.

1.3. Cab Renovation - C

1. Provide new upgraded cabs as per the following:
2. Flooring
 1. Provide porcelain tile flooring with the following provisions:
 - (a) Provide tile with typical width of 600mm and length of 600mm;
 - (b) Provide a compound design flooring Provide a diagonal grid in the centre of the cab;
 - (c) Provide marine rated subflooring that resists water and fluids;
 - (d) Submit samples for Architect and Owner approval.
3. Ceiling
 1. Provide new ceiling with a stainless steel panels.
 2. Provide ample lighting by installing six LED fixtures centered on each of the six panels:
 - (a) Provide high output LED lamps.
 - (b) 255 lumens with cool white;
 - (c) Provide lighting with high color rendition.
 - (d) Provide high lumen output of no less than 150 lux at any point in the elevator cab.
4. Rear Walls
 1. Provide three equally sized panels with a j-trim stainless steel panels from handrail to floor.



2. Provide a mirror finish (#8) stainless steel panel with anti-fingerprint coating surrounded by outer panels with a j-trim stainless steel located from handrail to ceiling.
 3. Provide stainless steel reveals and kick-plates.
5. Side Walls
 1. Provide two equally sized j-trim vandal resistant 5WL stainless steel panels.
6. Handrails
 1. Provide dual 1½" diameter tubular stainless steel handrail located on all three sides of the cab wall meeting the latest barrier free requirement.
 2. Provide cornered or turned in handrails in the corner and front side of the cab.
7. Provide sample material, drawings and colour chips for the Architect and Owner to choose from.

APPENDIX C2

Part 2 of City RFQ for Elevators

This Agreement entered into on the **[Note to Finalization before Execution: Insert Date of Execution]**

between

CITY OF TORONTO

("City")

and

● **[Note to Finalization before Execution: Insert Legal Name of Supplier]**

("Supplier")

WHEREAS the City prequalified general contractors to carry out Work for the City's Accessibility Upgrades Program through a separate Request for Supplier Qualification process, and intends to contract with some or all of those prequalified general contractors through a competitive tender process that will lead to accessibility upgrades of approximately 350 City buildings under the Accessibility Upgrades Program, including elevator installation at some locations;

WHEREAS the City wishes to pre-select a supplier for the supply, delivery and installation of elevators and necessary equipment for the City's Accessibility Upgrades Program ("Deliverables");

WHEREAS the City issued Request for Quotations No. **[Note to Finalization before Execution: insert RFQ No.]** dated **[Note to Finalization before Execution: insert RFQ date]** including Addendum No. **[Note to Finalization before Execution: insert any addenda numbers and their respective issuance dates]** respectively, (collectively the "RFQ") and in response to the RFQ, the Supplier submitted a response dated **[Note to Finalization before Execution: insert RFQ submission date]** ("RFQ Response"); and

WHEREAS the Supplier will be required to enter into direct contracts with General Contractors in order to provide Deliverables;

WHEREAS the City and Supplier now wish to enter into this Agreement to establish the terms and prices under which the Supplier will provide Deliverables;

NOW THEREFORE in consideration of the mutual covenants herein contained, the City and the Contractor agree as follows:

1. DEFINITIONS

The definitions contained in the RFQ are incorporated into and form a part of this Agreement in addition to the following definitions:

"Accessibility Upgrades Program" means the City's accessibility upgrades program for approximately 350 City buildings, including the installation of new elevators in some buildings.

"Contract Documents" have the meaning in section 3 of the Agreement.

"Deliverables" has the meaning set out in the recitals and further defined in the RFQ.

"Elevator Supply Contract" means any contract between the Supplier and a General Contractor retained by the City for Work to be provided for the Accessibility Upgrades Program.

"Equipment" means the elevators and other necessary equipment to be supplied by the Supplier as part of the Deliverables.

"General Contract" means a contract that the Supplier enters into with a General Contractor for the purpose of providing Work/Services with respect to elevators for the Accessibility Upgrades Program.

"General Contractor" means a prequalified general contractor retained by the City for the Accessibility Upgrades Program.

"Warranty Period" has the meaning set out in Appendix D of the RFQ.

"Work" means the work being performed by General Contractors.

2. THE DELIVERABLES AND WORK

- (1) The Supplier will do and fulfill everything indicated in the Contract Documents.
- (2) The Supplier agrees to provide the Deliverables under any Elevator Supply Contract under the terms and prices set out in the RFQ, RFQ Response, and this Agreement.
- (3) The Supplier acknowledges and agrees that the City does not guarantee the value or volumes of work and that this Agreement forms a standing offer to the Supplier that is subject to the City entering into an a General Contract.
- (4) In the event the Supplier enters into an Elevator Supply Contract, the Supplier shall provide warranty for and maintenance services to the elevators provided under said Elevator Supply Contract to the City, pursuant to the RFQ.

3. CONTRACT DOCUMENTS

The Agreement is comprised of the following Contract Documents, which are incorporated by reference. The following is a list, in order of precedence of the Contract Documents. In

the event of any inconsistency between, or an omission or ambiguity with respect to any provisions contained in any of the following Contract Documents, the following documents shall apply and prevail in the following order of priority to the extent of such conflict, inconsistency, mission, ambiguity or incongruity:

- (a) any duly authorized amendments to the Agreement;
- (b) the Agreement;
- (c) addenda to the RFQ in the order of most recent date issued;
- (d) RFQ; and
- (e) RFQ Response.

Should any discrepancies appear or differences of opinion or misunderstanding arise as to the meaning of the Agreement or as to any omissions therefrom or statements therein in any respect, or as to the quality or dimensions or sufficiency of the Equipment, materials, services or work or any part thereof, or as to the due and proper execution of the Contract Documents, the same shall, subject to the terms of the Contract Documents, be determined by the City.

4. RELATIONSHIP OF THE PARTIES

The Supplier, in providing the Services for the Work to be performed by the General Contractor under the General Contract, shall and is deemed to be an independent contractor to the General Contractor and not the agent or employee of the City and nothing in the RFQ or Contract Documents shall be deemed or construed as creating any such relationship. Neither is there any intention to create a partnership, joint venture or joint enterprise between the Supplier and the City.

5. GENERAL CONTRACTOR'S OBLIGATIONS

- (1) The Supplier acknowledges that upon award of a General Contract by the City to a General Contractor, the General Contractor shall be responsible for:

- (a) procuring the Deliverables from the Supplier; and
- (b) making all payments for the Deliverables;

all as if the General Contractor had selected the Supplier for the Services.

- (2) The Elevator Supply Contract from the General Contractor shall be in accordance with the scope, terms and conditions of these RFQ Documents.
- (3) The Supplier acknowledges that General Contractors will be required to enter into General Contracts with the City in the form of agreement set out in Appendix I to the RFQ.

6. PAYMENT TO SUPPLIER FOR DELIVERABLES

- (1) The Supplier acknowledges the General Contractor will be responsible for paying the Supplier for all payments with respect to the supply of the Deliverables, and the General Contractor will be responsible for making all payments to the Supplier for the Deliverables in accordance with the terms of payment, as described herein, from, but

not necessarily limited to, money received by the General Contractor from the City in payment for the supply of the Deliverables under the General Contract.

- (2) The City shall pay the General Contractor for the supply of the Deliverables, subject to the holdback provisions of the *Construction Act, R.S.O. 1990*.
- (3) The selection of the Equipment and the Supplier by the City pursuant to this RFQ, or the approval of payment under the General Contract for the supply thereof, shall in no way constitute a waiver by the City of its rights to return or reject such Equipment and/or claim damages for: (a) non-compliance with the terms of the RFQ Documents, (b) breach of an expressed or implied warranty or guarantee, or (c) the enforcement of any contractual, legal, equitable or other rights which the City may have under the Contract Documents or General Contract.

7. REPRESENTATIONS AND WARRANTIES

- (1) Without limiting or restricting in any way any other responsibilities and obligations of the Supplier under the Contract Documents, the Supplier represents, warrants and guarantees to the City and shall warrant to the General Contractor (and acknowledges that the City and the General Contractor is relying thereon) that any Deliverables resulting from or to be supplied or developed under the Elevator Supply Contract and all Equipment, and the supply thereof:
 - (a) shall be in strict accordance with all applicable Laws and the City's functional and technical requirements set out in the RFQ including, without limiting the generality of the foregoing, the specifications for the said Equipment, and will function or otherwise perform in accordance with such requirements;
 - (b) shall be free from defects in design, engineering, material, manufacture, workmanship or title;
 - (c) shall perform efficiently and without unwanted interruption during the Warranty Period;
 - (d) shall have any breakage, damage, defects or deterioration (other than those due to the negligence of the General Contractor or the City or to normal wear and tear) in the Equipment that occurs or is detected and is reported to the Supplier within the Warranty Period made good promptly by the Supplier at its expense including the expense of all necessary labour, supervision, travelling, replacement parts, transportation and otherwise; and
- (2) All representations, warranties and guarantees provided herein are in addition to any other representations, warranties and guarantees contained in the Supplier's RFQ Response, including manufacturer's warranties, and all such representations, warranties and guarantees shall be completely transferable by the General Contractor to, and completely enforceable by, the City.
- (3) No inspection, examination, test, acceptance or use of all or any part of the Equipment or services furnished hereunder nor the failure to inspect, examine or test the same nor acceptance thereof nor the expression of any approval by the General Contractor, or by the City pursuant to the General Contract or otherwise, shall constitute acceptance of any defect or shall affect the Supplier's obligation under these warranty provisions, or be deemed to relieve Supplier from any of its obligations under the Contract

Documents, including among others the obligation to supply the Equipment and services satisfying the warranties set forth herein. Such warranties shall survive inspection, test, acceptance and use.

- (4) The Supplier agrees that all representations, warranties and guarantees provided in the Agreement and which are to be incorporated into the Elevator Supply Contract, are fully assignable to and enforceable by the City (where not already expressly reserved to the City) at the City's sole option and further agrees that the City's right to a complete assignment of same shall be included in the Elevator Supply Contract, without any additional compensation payable by the City (including indirectly by the General Contractor) or further approval by the Supplier. The Supplier acknowledges that the City is relying on the representations, warranties and guarantees of the Supplier and, but for same, the City would not have selected the Equipment or Supplier. The Supplier's representations, warranties and guarantees herein shall run to the City, its successors, and assigns.

8. DEFECTIVE EQUIPMENT, SERVICES

- (1) In the event of failure of the Equipment or any part or parts or supply thereof, during the Warranty Period, due to defects of design, materials, or workmanship or other breach of a representation or warranty provided herein, the affected Equipment, or part or parts or supply thereof, shall be replaced promptly upon notice by the General Contractor or the City. All replacement parts shall be furnished, delivered, and installed at the expense of the Supplier.
- (2) Upon receipt of any notice of defect from the General Contractor, the Supplier, at its own expense, shall immediately:
- (a) correct; or
 - (b) re-perform; or
 - (c) replace and fit with new parts; or
 - (d) repair and refit,
- or any combination of the foregoing, without cost or charge to the General Contractor or the City,
- (i) any error, defect, deficiency or malfunction in the Equipment, or any parts, materials or workmanship thereof or services related thereto supplied by the Supplier; or
 - (ii) non-conformance of the Equipment or the supply thereof with the warranty provisions set forth herein or other requirements of the Contract Documents,
- upon notification of the Supplier by the General Contractor or the City within Warranty Period.
- (3) Notwithstanding subsection (2) above, should the Equipment fail to meet the representations and warranties set forth herein in any material respect, such failure shall be deemed cause for the rejection and removal of the unit and for its replacement with an acceptable unit, and the City shall be entitled to require the General Contractor to do so at the sole option of the City, which shall be done at the sole expense of the General Contractor, and if appropriate, the Supplier.

- (4) The Supplier's obligation herein shall include, without limitation, all transportation costs for parts and/or Equipment both ways between the Supplier's factory or repair depot and the point of use. In the case of remedial work to be performed by Supplier hereunder, the Supplier shall provide all labour, supervision, equipment, tools and materials necessary to perform the remedial work and shall bear all expenses in connection therewith or incidental thereto. The Supplier shall perform, at its own cost, such tests as may be reasonably required to verify that corrected, repaired or replaced Equipment conforms to the warranties above.
- (5) Subject to subsection (3) above, if the Supplier chooses to effect a repair under subsection (2) it shall immediately fit a replacement part to enable the Equipment to continue in use until the original part has been repaired and refitted.
- (6) The City will provide the General Contractor reasonable access to such Equipment to assist the General Contractor or Supplier in having work carried out on installed Equipment or in removing or replacing installed Equipment or parts thereof.
- (7) Any Equipment or service or part thereof that is corrected, replaced or repaired in accordance with the warranty provisions herein shall carry and be subject to the same warranty terms as set forth herein, except that the Warranty Period shall start from the date on which the correction, re-performance, replacement or repair is completed and the Equipment is properly operational.
- (8) The Supplier acknowledges that the failure of the Equipment, or any part thereof, to operate and perform properly and in accordance with the warranties provided herein could result in disruption of the Project and substantial revenue loss to City. The Supplier agrees to use its best efforts to perform all warranty work hereunder as expeditiously as is reasonably possible and in a manner which minimizes Project disruption and revenue loss. The Supplier recognizes and agrees that City's operational requirements may require immediate repairs or reworking of defective goods, without notice to the Supplier and without affecting the City's warranty rights hereunder. In such event, the Supplier shall reimburse the City and shall be required to reimburse the General Contractor all costs, delays, or other damages which the City has incurred as a result of such failure. In the event of an emergency breakdown, the Supplier shall attend the location of the emergency breakdown within twenty-four (24) hours of the incident being reported, failing which the City shall have the right to undertake repairs as required and charge the Supplier the cost of the repairs. Subject to subsection (7) above, the Supplier's responsibility shall be discharged when the City is satisfied that the necessary correction, replacement or repair has been properly effected, subject to any warranty applicable thereto.
- (9) The Supplier shall be liable for all damage, loss or expense arising from any failure of the Equipment or delay or failure to perform warranty work hereunder or in restoring the Equipment to working order.
- (10) Nothing in this section shall be construed, in any way, to prejudice or limit the City's contractual rights under the Agreement or the General Contract or any equitable or common law rights available to it.

9. PERFORMANCE

In addition to any other provision concerning the performance and personnel of the Supplier:

(1) Under the Elevator Supply Contract:

(a) the Supplier shall make available appropriately skilled workers, consultants or subcontractors, as appropriate, and must be able to provide the necessary materials, tools, machinery and supplies to fulfill its obligations to supply the Equipment in accordance with the terms and conditions of the Contract Documents.

(b) Without limiting the foregoing, the Supplier shall be responsible for complying with the *Occupational Health and Safety Act* (OHSA) at all times during the supply of the Deliverables. The City shall in no way be considered the constructor with respect to any part of the supply of Equipment for the purposes of the OHSA.

(c) It shall be the Supplier's responsibility to co-ordinate, control and check the work of and the provision of the goods and services by its own forces and of all its subcontractors and to ascertain that all work is performed in accordance with all requirements of the Contract Documents. Without limiting the generality of any other provision herein, the Supplier shall be liable for all costs or damages arising from acts, errors or omissions, negligence or wilful misconduct of its subcontractors.

(2) The City shall not be construed to have any contractual relationship with any of the Supplier's employees or subcontractors or material suppliers or their employees or supplier.

(3) The City's general conditions for its General Contract are included in Appendix I to the RFQ and will form part of the General Contract. The Supplier agrees to be bound by the terms and conditions contained therein as they affect the supply of the Deliverables to the Work and the Supplier as a subcontractor to the General Contractor.

(4) Any Equipment, services, work, material or incidentals, not explicitly specified in the RFQ Documents but which are necessary to conform to generally accepted industry, safety or product standards, good construction practice, to produce a finished appearance, or required by the Ontario Building Code or other governing codes, or which may be fairly implied as "included", shall be done or supplied by the Supplier as if such Equipment, services, work, material or incidentals had been explicitly specified.

10. COMPLIANCE WITH LAWS

(1) The Supplier, at all times, shall comply with and conform to all statutes, laws, by-laws, regulations, requirements, codes, ordinances, notices, rulings, orders, directives, policies and controls of the municipal, provincial and federal governments and any other lawful authority and all court orders, judgments and declarations of a court of competent jurisdiction (collectively referred to as the "Laws"), applicable to the Equipment and the supply thereof, and the responsibilities and obligations of, the Supplier under the Contract Documents. The Supplier shall ensure that all persons performing the supply of the Deliverables to the Work hold all valid and current permits, licences (including municipal), consents and approvals required by Law with respect to such services to be provided and/or Equipment to be supplied by them.

- (2) The Supplier, at all times, shall cooperate with the General Contractor and the City, as Owner, in promptly furnishing any information that may be required by the Ministry of Labour and any other government regulatory authority with jurisdiction over any matter applicable to the supply of the Deliverables.

11. W.H.M.I.S.

The Equipment shall be supplied in compliance with Canada's Workplace Hazardous Materials Information System (W.H.M.I.S.). Without exception, all Equipment and all parts and material comprising same shall be ASBESTOS-free and TAR-free.

12. PROHIBITED PRODUCTS

- (1) The Supplier must provide the General Contractor with a list of designated substances that will be brought to the Work Site prior to commencing the supply of the Deliverables to the Work. The tender for the General Contract will require that the General Contractor maintain at the Project site, copies of all Materials Safety Data Sheets (MSDS) and an inventory of hazardous materials for each substance on the Project.
- (2) Hazardous products and materials containing any Class A1 carcinogen substance, as indicated in their appropriate Material Safety Data Sheets, shall not comprise any part of the Equipment, or the supply thereof, and are prohibited from City property and the Work Site.
- (3) The Supplier agrees to fully indemnify and save harmless the City, its employees and consultants and the General Contractor from any and all charges, fines, penalties and costs that may be incurred or paid by the City or the General Contractor, as the case may be, or any of their respective employees or if the City or the General Contractor or any of their respective employees shall be made a party to any charge under the *Occupational Health and Safety Act* in relation to any violation of such Act arising out of the supply of the Deliverables.

13. OWNERSHIP OF PROJECT DOCUMENTATION

All information, data, plans, specifications, reports, estimates, summaries, photographs and all other documentation prepared by the Supplier specifically in the connection with the supply of the Deliverables, whether they are in draft or final format, shall be the property of the General Contractor, upon delivery of such documents to the General Contractor, which shall be completely and absolutely transferable to the City under the General Contract.

14. PATENT AND COPYRIGHTS

- (1) Where the supply and incorporation of the Equipment, or any component thereof, to the Work and use of such Equipment, or any component thereof, requires the installation or use of any patented, trademarked, copyrighted or other protected intellectual property ("Intellectual Property"),
 - (a) belonging to the Supplier, the Supplier shall grant to the General Contractor an irrevocable and perpetual license to permit the General Contractor to use such Intellectual Property for the supply, installation and use of the Equipment and all components thereof, as contemplated in the Contract Documents, which licence

shall be completely assignable to the City upon acceptance of the Equipment by the City;

- (b) belonging to any other person, the Supplier shall acquire from and pay for the an irrevocable and perpetual license from the owner thereof entitling the General Contractor to use such third party Intellectual Property for the supply, installation and use of the Equipment and all components thereof, as contemplated in the Contract Documents, which licence shall further be completely assignable to the City, upon acceptance of the Equipment by the City.
- (2) The Equipment price shall include all payments made or to be made or required to be made for the use of any and all Intellectual Property, as provided in subsection (1) above.
- (3) The Supplier, at its sole expense, shall defend, indemnify and save harmless the City, and its employees, officers, consultants and agents, from all and every claim, action or proceeding for damages, costs (including legal fees on a substantial indemnity basis), charges, expenses, royalties, or fees for the alleged infringement or infringement of any patent, trademark, trade secret, copyright or other proprietary right occasioned by them in connection with the supply of the Deliverables by the Supplier or the installation or use of the Equipment by the General Contractor or the City, as contemplated in this Agreement, as well as for any alleged unfair competition resulting from similarity in design, trademark or appearance of goods or services furnished hereunder. The City may, at its option, be represented at any such proceeding.
- (4) If the Equipment or the supply of the Deliverables or the installation or use of the Equipment is held in any such claim, action or proceeding to constitute an infringement, the Supplier, at its expense and in compliance with the Specifications, shall forthwith either procure for the General Contractor or the City, as the case may be, the right to use and continue to use such material or Equipment; or replace same with substantially equal but non-infringing material and Equipment; or modify same to make them substantially equal but non-infringing; or remove same and refund the purchase price and transportation and installation costs and all other costs of the General Contractor or the City related to the removal and loss of use.

15. CONFIDENTIALITY

All correspondence, documentation and information of any kind provided by City, or by any other person on the City's behalf including its consultant, contract administrator or General Contractor, to or which comes to the attention of the Supplier in connection with, or arising out of, or by reason of the RFQ or the supply of the Deliverables remains the property of the City; must be treated as confidential; and must not be used for any purpose other than as contemplated herein and shall not be reproduced, disclosed or disseminated, except as required by Law or as expressly permitted in advance by the City in writing. The RFQ is subject to the *Municipal Freedom of Information and Protection of Privacy Act*, R.S.O. 1990, c. M.56, as amended.

16. SPARE PARTS

The Supplier shall maintain a complete inventory of spare parts commonly needed for the Equipment specified at a location within the Province of Ontario or, alternately, spare parts

must be made available to the General Contractor within 48-hours of any spare part order by the General Contractor during the Warranty Period and, after the Warranty Period, to the City, as soon as reasonably possible but no later than within 30 days. The Supplier represents and warrants that such spare parts inventory shall be maintained for the Equipment for a period of no less than ten (10) years or the life cycle for the Equipment quoted by the Supplier in its RFQ Response, whichever is greater.

17. LATE DELIVERY/LIQUIDATED DAMAGES

- (1) The City accepts no responsibility for any claim made by the General Contractor against the Supplier on account of actual damages or additional costs incurred, or allegedly incurred, by the General Contractor on account of late delivery by the Supplier of any item of Equipment or the Deliverables. Any dispute between the Supplier and the General Contractor with respect to any such claim shall be settled between the Supplier and the General Contractor.
- (2) Failure to meet the completion schedule will subject the Supplier to damages, including liquidated damages, in accordance with the General Contract. The Liquidated Damages assessed by the City against the General Contractor for failure to complete the project within the Contract Time stipulated in the General Contract shall be determined by the City for each General Contract. The General Contractor shall have the right to assess this amount against the Supplier to the extent the Supplier is the reason for any portion of the delay in completion. This is without prejudice to any other remedy of the City or the General Contractor in contract or otherwise at law.

18. TRANSFER OF TITLE

The title to Equipment, components, and materials to be furnished in accordance with the Contract Documents including replacements or substitutions shall pass to the General Contractor upon its acceptance of the Equipment. The passing of the title to the General Contractor (or the subsequent transfer of the Equipment to the City) shall not relieve Supplier from any other liabilities or obligations under the Elevator Supply Contract or the Agreement, which shall remain in full force and effect.

19. STORAGE OF EQUIPMENT

The Supplier shall coordinate the storage of the Equipment at the Work Site with the General Contractor. The Supplier shall be responsible for providing the General Contractor with full instructions in writing of all precautions to be observed in connection with the storing and protection of the Equipment. A copy of all instructions shall be provided to the Contract Administrator. The General Contractor will be responsible for proper storage of the delivered and accepted Equipment, appurtenances and materials until it is installed and for their protection against weather, deterioration, loss, damage or theft.

20. COORDINATION WITH WORK BY OTHERS

- (1) The Supplier shall cooperate and liaise with the General Contractor to make appropriate working arrangements to ensure the satisfactory execution and timely completion of the supply of the Deliverables and related services.

- (2) The City shall provide the General Contractor reasonable access to the Work site necessary to enable the Supplier to complete the supply and services herein.

21. UNPAID ACCOUNTS AND LIENS

- (1) The Supplier shall be required to covenant to the General Contractor to pay all charges incurred by or on behalf of the Supplier for any services, work or materials which may be supplied, done or performed in respect of the supply of the Deliverables and the Supplier shall be required to forthwith discharge and obtain a release of any liens or encumbrances whatsoever arising therefrom at any time claimed or registered against or in respect of the supply of the Deliverables or any part thereof. In the event that the Supplier shall fail to cause any such liens or encumbrances forthwith to be discharged and released after being notified thereof, then, in addition to any other right or remedy of the General Contractor, the General Contractor may, but shall not be obliged to, discharge same by paying the amount claimed to be due and any other amounts necessary to obtain such a discharge and the amount so paid by the General Contractor and all costs and expenses, including reasonable legal fees on a substantial indemnity basis, incurred by the General Contractor in procuring the discharge and release of such lien or encumbrance, shall be payable by the Supplier forthwith.
- (2) The Supplier shall be required to indemnify the General Contractor from all claims arising out of unpaid accounts relating to the supply of the Deliverables including any claims of the City. The General Contractor shall have the right at any time to require satisfactory evidence that the work in respect of which any payment has been made or is to be made by the General Contractor to the Supplier is free and clear of liens, attachments, claims, and demands, charges or other encumbrances.
- (3) In the event that the Supplier shall fail to cause any liens or encumbrances any time claimed or registered against the lands of the Owner in respect of any improvement which the supply of the Deliverables may constitute under the *Construction Act*, R.S.O.1990 to be discharged and released forthwith after being notified thereof, then, in addition to any other right or remedy the City may have by contract, law, statute or in equity, the City may, but shall not be obliged to, discharge same by paying the amount claimed to be due and any other amounts necessary to obtain such a discharge and the amount so paid by the City and all costs and expenses, including reasonable legal fees on a substantial indemnity basis, incurred by the City in procuring the discharge and release of such lien or encumbrance, shall be payable to the City by the Supplier and the General Contractor forthwith. The City shall have the right at any time to require satisfactory evidence that the work in respect of which any payment has been made or is to be made by the City to the General Contractor is free and clear of liens, attachments, claims, and demands, charges or other encumbrances.

22. INDEMNIFICATION

- (1) In consideration of the Supplier being pre-selected by the City for the supply of the Deliverables to the Work under the General Contract, the Supplier covenants and agrees at all times to defend, fully indemnify and save harmless the General Contractor, the City, their councillors, officers, directors, employees, agents and representatives, successors, and assigns (hereinafter called the "Indemnitees") from and against any and

all claims of any nature whatsoever and howsoever caused to, sustained or suffered by, or imposed upon or made or instituted against any of the Indemnitees or to which any of them may be liable by reason of or arising from or related to:

- (a) any act or omission, neglect, default or wilful misconduct on the part of the Supplier as well as any officer, employee, servant, subcontractor, consultant, invitee, agent or assign of the Supplier relating to the supply of the Deliverables; or
 - (b) attributable to or connected with the performance, non-performance or purported performance of the Supplier's obligations pursuant to the Elevator Supply Contract; or
 - (c) in consequence of or in any way arising out of any defect in the Equipment; or
 - (d) by reason of any default, breach, violation, misrepresentation, non-performance or non-compliance of or with any covenant, term, obligation, warranty (express or implied), condition or provision in or related to the Agreement or the Elevator Supply Contract by the Supplier, or
 - (e) any infringement or alleged infringement or other breach, actual or alleged of any Canadian, American or other patent, industrial design, trade secret, trademark, copyright, service mark, trade name, official mark, moral right or any other intellectual property right of any person conferred by contract, common law, statute or otherwise, for which the Supplier is responsible or which is occasioned by the Supplier in connection with the supply of the Deliverables or material to the Work and related services performed by it under the Agreement or the Elevator Supply Contract, or anyone else for whom at law it is responsible; or
 - (f) breach of any confidentiality obligations under the Elevator Supply Contract, except to the extent that the same are directly caused by the negligence or deliberate wrong-doing of the General Contractor.
- (2) In the event any claim is asserted in respect to which any of the Indemnitees is entitled to indemnification under this section, without prejudice to any other right or remedy it may have, the General Contractor shall be entitled to deduct or withhold a reasonable sum on account of such claim, including legal costs, from monies owed or payable by the General Contractor to the Supplier under the Elevator Supply Contract, pending the final determination or settlement of such Claim.
- (3) Upon assuming the defence of any claim covered under this section the Supplier shall keep the party or parties entitled to indemnification herein reasonably informed of the status of the matter, and the Supplier shall make no admission of liability or fault on any GC Indemnatee's part without prior written consent the party or parties entitled to indemnification herein.
- (4) The rights to indemnity provided for in this section shall be deemed to be in addition to and not in lieu of any insurance to be provided by the Supplier and any rights with respect to insurance in favour of the General Contractor. The rights to indemnity provided herein shall survive the expiration or any termination of the Elevator Supply Contract.
- (5) The Supplier acknowledges and agrees that the City, at its option, shall have the right to an assignment of the General Contractor's rights of indemnification herein related to the supply of the Deliverables and may directly enforce such rights against the Supplier.

23. INSURANCE

- (1) The Supplier shall comply with all insurance requirements, and all WSIB prior to the execution of this Agreement. The Supplier shall bear all costs, expenses, losses and damages of its own and those of the General Contractor and the City, which may arise as a result of the Supplier failing to or delaying in promptly complying with this condition.

- (2) The Supplier agrees to purchase and maintain in force, at its own expense and for the duration of the Agreement, the following policies of insurance, which policies shall be in a form and with an insurer acceptable to the City. A certificate evidencing these policies signed by the insurer or an authorized agent of the insurer must be delivered to the City prior to the commencement of services:
 - (a) Commercial General Liability provided that the policy:
 - (i) is in the amount of not less than Five Million Dollars (\$5,000,000.00), per occurrence;
 - (ii) adds the City of Toronto as an additional insured;
 - (iii) includes Non-Owned Automobile Liability, Employer's Liability and/or Contingent Employer's Liability, and any other provision relevant to the services;
 - (iv) includes a clause which will provide the City with thirty (30) days' prior written notice of cancellation (15 days if cancellation is due to non-payment of premium).

 - (b) Automobile Liability insurance with a minimum limit of Two Million Dollars (\$2,000,000) for all owned or leased licensed motorized vehicles used in the performance of services.

- (3) It is understood and agreed that the coverage and limits of liability noted above are not to be construed as the limit of liability of the vendor in the performance of services. It is also agreed that the above insurance policies may be subject to reasonable deductible amounts, which deductible amounts shall be borne by the vendor. At the expiry of the policies of insurance, original signed Certificates evidencing renewal will be provided to the City without notice or demand.

- (4) The Supplier is responsible for any loss or damage whatsoever to any of its materials, goods, equipment or supplies and will maintain appropriate all-risk coverage as any prudent owner of such materials, goods, supplies and equipment. The Supplier shall have no claim against the City or the City's insurers for any damage or loss to its property and shall require its property insurers to waive any right of subrogation against the City.

24. CONTRACT CANCELLATION

- (1) The City may cancel the Agreement between the City and the Supplier for any reason, prior to the execution of the Elevator Supply Contract, without any financial obligation to the Supplier. Should for any reason the City not enter into a General Contract which includes the supply of the Deliverables, then the City will notify the Supplier in writing and the Supplier for this Project will be cancelled without any financial obligation to the Supplier.
- (2) In the event of any cancellation, the Supplier shall immediately stop all work related to the Supply Contract, and shall immediately cause any and all suppliers and subcontractors to do the same.
- (3) In the event of any cancellation the City shall not incur any liability to the Supplier apart from payment to the General Contractor, which the General Contractor shall pay over to the Supplier, of the reasonable costs directly incurred by the Supplier for Equipment, work or services that have been satisfactorily delivered or performed by the Supplier prior to the notice of cancellation. Such reasonable costs incurred shall be supported by audit, if necessary, carried out by auditors acceptable to the City, prior to payment of same. Neither the City nor General Contractor shall be liable to the Supplier for loss of anticipated profit on the cancelled portion or portions of the General Contract or the supply of the Deliverables. Neither the City nor General Contractor shall be liable to the Supplier for consequential, economic or indirect losses or damages arising as a result of such cancellation.
- (4) The Supplier shall not be paid for any Equipment supplied or services or work done after receipt of the notice of cancellation or for any costs incurred by the Supplier or its suppliers or subcontractors which such persons could reasonably have avoided or mitigated. The Supplier shall not unreasonably anticipate the requirements of a Purchase Order for the Equipment.

25. CHANGES IN THE WORK

The City may, without invalidating the Agreement or General Contract, direct the General Contractor to make changes to the work which may include changes to the supply of the Deliverables by the Supplier. When a change causes an increase or decrease in the Work related to the supply of the Deliverables, the Deliverables price shall be increased or decreased by the application of RFQ Response prices to the quantum of such increase or decrease, or in the absence of applicable RFQ Response prices, by an amount to be agreed upon between the City and the General Contractor and correspondingly between the General Contractor and the Supplier, under their respective contracts. All such changes shall be in writing. The General Contractor shall, without invalidating the Elevator Supply Contract, have the right to make a corresponding change in the Elevator Supply Contract.

26. NON-WAIVER

No condoning, excusing or overlooking by the General Contractor under the Elevator Supply Contract, or the City under this Agreement, of any default, breach or non-observance by the Supplier at any time or times in respect of any provision herein contained shall operate as a waiver of the General Contractor's or the City's right, as the

case may be, hereunder in respect of any continuing or subsequent default, breach or non-observance, or so as to defeat or affect in any way the rights of the General Contractor or City herein in respect of any such continuing or subsequent default or breach. No waiver shall be inferred from or implied by anything done or omitted by the General Contractor or the City, save only by express waiver in writing. The doing of anything by the General Contractor required by the Elevator Supply Contract to be done by the Supplier shall not relieve the Supplier of its continuing obligation to do that thing. No delay or omission by the City in exercising any right or remedy shall operate as a waiver of them or of any other right or remedy, and no single or partial exercise of a right or remedy shall preclude any other or further exercise of them or the exercise of any other right or remedy.

27. SUCCESSORS AND ASSIGNS

- (1) All terms, covenants, conditions and provisions provided herein relating to the Elevator Supply Contract shall be binding upon and shall enure to the benefit of the Supplier and their respective permitted assigns, successors and legal representatives.
- (2) The Supplier shall not assign, subcontract, transfer or encumber in any manner or part of the Elevator Supply Contract or any interest therein without the prior written consent of the General Contractor, which consent shall not be unreasonably withheld. Any attempt to assign, transfer or encumber any of the duties or obligations of Supplier without such consent is void.
- (3) Any delay in the commencement of the supply of the Deliverables or in the performance of any related services or the Supplier's obligations under the Elevator Supply Contract related to or arising from the General Contractor's consideration of the Supplier's request for an assignment, transfer or encumbrance in any manner or part of the Elevator Supply Contract or any interest therein or a subcontractor change and the costs of same shall be solely borne by the Supplier.
- (4) No assignment or subcontracting by the Supplier shall, in any circumstances, relieve the Supplier from any responsibility for the full performance of all of its responsibilities and obligations and undertaking of its liabilities under the Elevator Supply Contract and this Agreement. Notwithstanding the approval of any subcontractors by the General Contractor, the Supplier shall be fully responsible for every subcontractor's performance, activities, work, acts or omissions as if the Supplier were performing the subcontracted portion of the supply of the Deliverables with its own resources.
- (5) The General Contractor(s) shall be responsible to the City for the performance of all of its subcontractors, including the Supplier. The City shall require any and all such subcontractors to sign agreements with the General Contractor that bind the subcontractors to abide by the terms and conditions hereof. Upon the request of the City, the General Contractor shall furnish the City with copies of such agreements.

28. NON-EXCLUSIVE REMEDIES

The rights and remedies of the City provided in the Contract Documents shall not be exclusive and are in addition to any other rights and remedies provided by contract, law or in equity, including the right of specific performance and offset.

29. FURTHER ASSURANCES

The Supplier shall draw, execute and deliver at its own expense, all such instruments and documents, and do all such acts and things as the General Contractor or City may from time to time reasonably consider necessary or advisable for the purpose of carrying out the intent and provisions of the Contract Documents.

30. GOVERNING LAW

The Contract Documents shall be governed by, subject to and construed in accordance with the laws of the Province of Ontario and the laws of Canada, as applicable to the matters herein. Any action or other legal proceeding arising under or with respect to the Contract Documents (including any motion or other interlocutory proceeding) shall be brought in a Court or a tribunal, whichever may be applicable, sitting in Toronto, Ontario. The Supplier and the City each irrevocably submit to the exclusive jurisdiction of the courts of the Province of Ontario in accordance with the foregoing.

31. SEVERANCE WHERE PROVISION ILLEGAL, ETC.

If any provision or provisions of the Contract Documents or parts thereof or the application thereof to any person or circumstances shall be found is/are found to be invalid, unenforceable or void by any court or tribunal of competent jurisdiction, such provision or provisions or parts thereof shall be deemed severable and all other provision or provisions or parts of the Contract Documents shall be deemed to be separate and independent therefrom and continue in full force and effect unless and until similarly found void and/or unenforceable. The remaining terms and provisions of the Contract Documents and its application to any person or circumstances shall not be affected thereby, but this provision shall apply only insofar as the effect of that severance is not to change the fundamental nature of the obligations assumed respectively by each of the parties thereto.

32. ENTIRE AGREEMENT

This Agreement embodies and constitutes the sole and entire agreement between the parties hereto. There are no terms, obligations, covenants or conditions between the parties hereto, other than as contained herein. No alteration, amendment or modification hereof shall be valid unless executed by an instrument in writing by the parties. Neither this Agreement, nor any term hereof, can be changed, modified or abandoned, in whole or in part, except by such instrument in writing, and no subsequent oral agreement shall have any validity whatsoever.

33. COUNTERPART AND ELECTRONIC SIGNATURE

This Agreement may be executed in counterpart and may be executed by electronic signature that is received by the City in a file format acceptable to the City. Such electronic signature shall be deemed to be an original signature for the purpose of this Agreement with the same legal effect as an original signature.

[signatures on next page]

The parties hereto have executed this Agreement by the hands of their duly authorized representatives.

SIGNED AND DELIVERED

in the presence of:

CITY OF TORONTO

By:

Name: ●
Title: ●
I have authority to bind the
corporation

By:

Name: ●
Title: ●
I have authority to bind the
corporation

● **[Note to Finalization before Execution:
Insert Legal Name of Supplier]**

By:

Name: ●
Title: ●
I have authority to bind the
corporation

By:

Name: ●
Title: ●
I have authority to bind the
corporation

APPENDIX C3

Elevator Pricing List

Elevator Pricing List
Supplier/Sub-Contractor: Modern Elevator

Item No.	Description	Price
	Elevator Type - 2 Stop	
1.1	Traction MRL	\$243,264.00
1.2	Hydraulic	\$193,821.00
	Elevator Type - 3 Stop	
2.1	Traction MRL	\$272,338.00
2.2	Hydraulic	\$222,818.00
3	Elevator Type - 4 Stop	
3.1	Traction MRL	\$305,102.00
3.2	Hydraulic	\$255,580.00
4	Cab Design	
4.1	Cab Design A	\$9,822.00
4.2	Cab Design B	\$8,965.00
4.3	Cab Design C	\$10,683.00
5	Additional Cab Openings (Rear/Cornerpost Opening)	
5.1	Additional Cab Opening	\$11,455.00

APPENDIX D1

Part 3 of City RFQ for ADO's

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RFQ No. Doc2399202340

PART 3 – TECHNICAL SPECIFICATIONS AND REQUIREMENTS FOR DELIVERABLES

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Appendices

~~Appendix A – City of Toronto Corporate Accessibility Policy~~ **NOT INCLUDED**

Appendix B – Technical Specifications 08 71 13 Low Energy Auto Operators

~~Appendix C – Fair Wage Policy~~ **NOT INCLUDED**

~~Appendix D – Master Service Agreement between the City and General Contractors~~ **NOT INCLUDED**

1. Background

.1 **Accessibility for Ontarians with Disabilities Act and City's Commitment**

The Accessibility for Ontarians with Disabilities Act, 2005 (AODA) is provincial legislation designed to achieve accessibility for Ontarians with disabilities with respect to goods, services, facilities, accommodation, employment, buildings, structures and premises by January 1, 2025.

In August 2009, City Council adopted and endorsed a 'Statement of Commitment to Creating an Accessible City'. In June 2018, City Council adopted the City of Toronto Corporate Accessibility Policy, which states that the City will ensure accessibility at all its facilities and public spaces.

Refer to Appendix A for the City Corporate Accessibility Policy.

.2 **Corporate Real Estate Management Capital Accessibility Upgrades Program**

The Corporate Real Estate Management (CREM) Division is implementing an accessibility upgrades program for over 350 City buildings under its management with the intent to complete most of it by the end of 2024.

These buildings will be upgraded to meet the requirements of the latest version of the Toronto Accessibility Design Guidelines (TADG) wherever feasible.

In order to complete the accessibility upgrades at these buildings, CREM is establishing a roster of general contractors under a separate procurement call. The work assignments will be carried out pursuant to a second stage competition process consisting of a tender for a group of five (5) to twenty (20) construction projects, bundled generally by a geographic area.

Depending on the project, the work will consist of major and / or minor renovations to the exterior and interior spaces of existing buildings. The majority of buildings, spaces and sites are currently occupied and operational with a short list of vacancies.

In some cases where a building is planned for other repair, rehabilitation, or renovation work, all scopes will be combined together with the accessibility upgrades in the same tender package for a general contractor.

The need for new automatic door openers at these buildings was identified as part of the accessibility upgrades. The City of Toronto estimates between 4,000 – 5,000 low voltage door operators will be required to complete the upgrades.

The City of Toronto will direct general contractors selected to deliver accessibility upgrades to procure automatic door openers, push buttons and associated services defined in this RFQ from the Successful Supplier at the unit pricing negotiated by the City.

2. Scope of Work and Associated Deliverables

Please refer to Appendix B of Part 3 – Technical Specifications and Requirements for Deliverables. The Specifications detail the Scope of Work requirements in detail by type of equipment. The information provided in this section is a summary of requirements only – refer to the Appendices listed for the full requirements of this Request for Quotation.

- .1 The scope of this RFQ is for the provision of unit pricing for the Supply, Delivery and Installation of Automatic Door Openers and Push Buttons for the City of Toronto's Accessibility Upgrades Capital Program to Various Locations, as and when required from the date of award. General contractors selected to deliver accessibility upgrades will procure Automatic Door Openers, Push Buttons and all associated services from the Successful Supplier at the unit pricing negotiated by the City under this RFQ.
- .2 The selected Supplier will be required to execute a Contract with the City for the provision of unit pricing for the Deliverables. Subsequently, the selected Supplier will be required to enter into contracts to supply, deliver and install automatic door openers, push buttons and necessary equipment with general contractors chosen by the City to deliver accessibility upgrades to City buildings. Master Service Agreement between the City and general contractors is included in Appendix D to this Part 3 - Technical Specifications and Requirements for Deliverables. **Suppliers should review the terms and conditions set out in Part 2 (FORM OF AGREEMENT) to understand the Contract being entered into with the City.**

3. Performance Security – Not Applicable

4. Work Hours

The work on the accessibility upgrades will be executed according to a strategy devised by general contractors to ensure continuity of operation of the existing facilities, and to also minimize disruption to occupants. After hours and weekend work will be required for a majority of the projects to minimize the disruption to the facility and occupants. Detailed specifications and requirements will be provided in each Tender.

5. Insurance Requirements

- .1 The Supplier shall comply with all insurance requirements, and all WSIB prior to the execution of the Contract. The Supplier shall bear all costs, expenses, losses and damages of its own and those of the General Contractor and the City, which may arise as a result of the Supplier failing to or delaying in promptly complying with this condition.
- .2 The Supplier agrees to purchase and maintain in force, at its own expense and for the duration of the Contract and as required in any contract with a general contractor, pursuant to this RFQ, the following policies of insurance, which policies shall be in a form and with an insurer acceptable to the City. A certificate evidencing these policies signed by the insurer or an authorized agent of the insurer must be delivered to the City prior to the commencement of services:
 - a) Commercial General Liability provided that the policy:
 - (i) is in the amount of not less than Two Million Dollars (\$2,000,000.00), per occurrence;

- (ii) adds the City of Toronto as an additional insured;
- (iii) includes a clause which will provide the City with thirty (30) days' prior written notice of cancellation (15 days if cancellation is due to non-payment of premium).
- b) Automobile Liability insurance with a minimum limit of Two Million Dollars (\$2,000,000) for all owned or leased licensed motorized vehicles used in the performance of services.

It is understood and agreed that the coverage and limits of liability noted above are not to be construed as the limit of liability of the vendor in the performance of services. It is also agreed that the above insurance policies may be subject to reasonable deductible amounts, which deductible amounts shall be borne by the vendor. At the expiry of the policies of insurance, original signed Certificates evidencing renewal will be provided to the City without notice or demand.

The successful vendor is responsible for any loss or damage whatsoever to any of its materials, goods, equipment or supplies and will maintain appropriate all-risk coverage as any prudent owner of such materials, goods, supplies and equipment. The successful vendor shall have no claim against the City or the City's insurers for any damage or loss to its property and shall require its property insurers to waive any right of subrogation against the City.

6. Delivery

- .1 The Supplier must deliver the specified Deliverables as per their Quotation without substitution or deviation.
- .2 The Supplier shall provide staff who are qualified to undertake the installation services required under the terms of this RFQ. The Supplier's staff must be certified to maintain, repair, install and set-up the types of equipment and associated parts in Part 5 – Pricing Form.
- .3 Late Delivery, partial shipments or shipment of unauthorized Product may result in the Contract being cancelled.
- .4 The Supplier shall restore all property temporarily removed, damaged, or destroyed during the supply, delivery, and installation of Deliverables to the reasonable satisfaction of the City or to its previous state and at no cost to the City. The Supplier, before final payment, shall remove all surplus materials and any debris of every nature resulting from its operation and put the site(s) in a neat, orderly condition; thoroughly clean. If the Supplier fails to clean up at the completion of the supply, delivery, and installation of the Products, then the City may do so and charge the Supplier for the costs thereof, or deduct said costs from any monies still owing to the Supplier through the general contractor.
- .5 The Supplier shall furnish all labour, materials, services, supplies, tools, equipment, apparatus, transportation, facilities and incidentals required and perform all operations necessary to accomplish the complete installation of the Deliverables.

- .6 A hard copy packing slip must accompany the products delivered and include at a minimum, the purchase order number, the requisitioner's name and address, a description of the items delivered complete with serial numbers, part numbers, and quantity shipped.

7. Substitutions of Deliverables

- .1 Suppliers must not substitute contract approved product(s), commodity(s) or service(s) without prior written approval from City of Toronto through the approval by the Consultant, on either City of Toronto letter head or City of Toronto originating email. This will be enforced via subsequent tender documents. Any approved substitution must meet or exceed the approved good, approved commodity or approved service to be substituted, at no additional cost to the City of Toronto. Supplier will reimburse all substitution evaluation costs, including labour and testing costs, to City of Toronto PMMD Standards and Specifications Unit.

8. Warranty

- .1 Please refer to Part 3 - Technical Specifications and Requirements for Deliverables - Appendix B, Section 1.10

9. Usage Reports

- .1 If requested, the Supplier shall demonstrate the ability to provide an electronic Usage Report in MS Excel 2013 or higher version, of invoice details by providing the following report criteria:

Dollar value and usage information by,

- a) Cost Centre
 - b) Location
 - c) Invoice Number
 - d) By quantity
 - e) By automatic door opener type
 - f) By delivery date
 - g) Usage
 - h) Cumulative Total by month or as requested by the City
- .2 The Supplier shall be required to submit to the City of Toronto, "Usage Reports" on a monthly basis, or as requested, within 30 days after the end of each month and 15 days after the Term expiry date based on Part 5 – Pricing Form and the above report criteria. The Supplier shall also provide a cumulative report at the end of the Contract term based on the aforementioned criteria.
- .3 The City may further request a detailed Usage Report at any time during the Term to verify releases on the Contract. The Supplier will provide the information within five (5) Business Days of request. Usage Reports shall be provided by the Supplier at no cost to the City.
- .4 **If requested**, a sample Usage Report detailing the criteria noted above should be included by the Supplier. If a sample Usage Report is not included with Bid submission, the Supplier will provide the report within five (5) Business Days of

request at no cost to the City. Failure to provide the sample report within the specified period may result in the Supplier being declared Non-Compliant.

10. Product and Service Specifications

- .1 The Supplier shall be able to provide the Deliverables within the Greater Toronto Area (GTA) as defined in Appendix B of Part 3 – Technical Specifications and Requirements for Deliverables.
- .2 The Supplier shall provide emergency repair Services as and when required during
- .3 All work must be performed to the Ministry of Labour requirements and to manufacturer's specification.
- .4 All specifications are minimum requirements that must be met or exceeded. Bids containing one or more items that do not meet or exceed the minimum specifications will be declared Non-Compliant.
- .5 Suppliers must fully complete the Specifications Form in Part 4 – Submission Items by entering “yes”, meaning the Deliverables being quoted meet or exceed the minimum specifications, or “no”.
- .6 Suppliers that do not fully complete the Specification Forms will be declared Non-Compliant.
- .7 **Optional Maintenance Service.** The City may require that the successful bidder performs service once a year on the automatic swing door units for the period of the warranty (2 years) in its entirety (to the total of 2 services over 2 years). Warranty begins once Substantial Completion is provided for the building where the equipment is installed.

Any defective item in relation to the opening that may affect the performance of the auto operator units or its warranty is to be reported immediately to the City of Toronto facilities maintenance department. This may include but is not limited to: Hinges, pivots, seals, thresholds, locks, panic bars, security devices or any site condition not listed here.

A checklist including the following inspection points is to be submitted to City of Toronto facilities maintenance department upon completion of each service:

- TIGHTEN TOP DOOR TRACK, SLIDE BLOCK & PIN
- CU TIGHTEN DOOR ARMS, LUBE ROD ENDS
- TIGHTEN ROD ARM BOLTS
- CHECK OPERATOR MOUNT BOLTS
- OPERATOR LOVE JOY COUPLER (WEAR, TIGHTNESS)
- MOTOR LOVE JOY COUPLER (WEAR, TIGHTNESS)
- EXAMINE LOVE JOY SPIDER
- TEST & ADJUST MOTION DETECTORS
- TIGHTEN MOTOR BOLTS
- EXAMINE MOTOR BRUSHES
- OPERATOR RUBBER GROMMETS

- EXAMINE & ADJUST DOOR LIMITER
- TEST OPERATION (OPENING, CLOSING, BACK & LATCH)
- INSPECT & TEST (ACTIVE & SAFETY CARPETS, SCANS OR PUSH SWITCHES)
- INSPECT & LUBE TOP DOOR PIVOT
- INSPECT & LUBE BOTTOM DOOR PIVOT
- ADJUST DOOR PIVOTS IF NECESSARY
- INSPECT & LUBE HINGES
- INSPECT FINGERGUARD
- INSPECT DOOR WEATHER-STRIPPING (TOP, BOTTOM, & SIDES)
- INSPECT DOOR HANDLES & PUSH BARS
- CHECK DOOR LOCK

APPENDICES:

APPENDIX A – CITY OF TORONTO CORPORATE ACCESSIBILITY POLICY

**APPENDIX B – TECHNICAL SPECIFICATIONS 08 71 13 LOW ENERGY AUTO
OPERATORS**

APPENDIX C – FAIR WAGE POLICY

**APPENDIX D – MASTER SERVICE AGREEMENT BETWEEN THE CITY AND GENERAL
CONTRACTORS**

APPLICABLE CITY POLICIES

For a copy of the City of Toronto Procurement Policies, please download a copy of the Policy by clicking any of the links as provided below or by visiting the following website (www.toronto.ca/purchasing/policies):

(1) **FAIR WAGE POLICY***

*Fair Wage Policy – (extracted from Schedule A of the City of Toronto Municipal Code, Chapter 67)
FW R (10/07)

The policy and schedules are available on the Fair Wage Office website –
www.toronto.ca/fairwage

LABOUR TRADES CONTRACTUAL OBLIGATIONS IN THE CONSTRUCTION INDUSTRY*

Labour Trades Contractual Obligations – (extracted from Schedule B of the City of Toronto Municipal Code, Chapter 67)

(2) **ACCESSIBILITY STANDARDS FOR CUSTOMER SERVICE TRAINING REQUIREMENTS POLICY**

(3) **ENVIRONMENTALLY RESPONSIBLE PROCUREMENT STATEMENT**

(4) **POLICY ON DONATIONS TO THE CITY FOR COMMUNITY BENEFITS**

(5) **RIGHT TO REJECT DEBTORS AND SET OFF POLICY**

SECTION 08 71 13 – LOW ENERGY AUTOMATIC DOOR OPERATORS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This section includes the following types of automatic door operators:
 - 1. Low-energy door operators for swinging doors.
- B. Related Sections:
 - 1. Division 8 Sections for "Aluminum-Framed Entrances and Storefronts" for entrances furnished and installed separately in Division 8 Section.
 - 2. Division 8 Section "Door Hardware" for hardware to the extent not specified in this section.
 - 3. Division 8 Section "Glazing" for materials and installation requirements of glazing for automatic entrances.
 - 4. Division 26 and 28 Sections for electrical connections including conduit and wiring for automatic entrance operators and access-control devices.

1.3 REFERENCES

- A. References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. OBC – Ontario Building Code.
 - 3. CUL – Approved for use in Canada.
 - 4. NFPA 80 - Fire Doors and Windows.
 - 5. NFPA 101 - Life Safety Code.
- B. American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA).
 - 1. ANSI/BHMA A156.19 Standards for Power Assist and Low Energy Power Operated Doors.
- C. Underwriters Laboratories (UL).
 - 1. UL10C – Positive Pressure Fire Tests of Door Assemblies.
 - 2. UL 325 - Standard for Safety for Door, Drapery, Gate, Louver, and Window Operators and Systems.

1.4 DEFINITIONS

- A. Activation device: Device that, when actuated, sends an electrical signal to the door operator to initiate the door operation.
- B. Monitored Safety Devices: A tested system that works in conjunction with the automatic door control that detects the presence of a person or an object within a zone where contact could occur and provides a signal to stop the movement of the door.
- C. AAADM: American Association of Automatic Door Manufacturers.
- D. Operating ambient Temperature Range: minus 30 C to 50 degrees C.
- E. For automatic door terminology, refer to ANSI/BHMA A 156.19 for definitions of terms.

1.5 PERFORMANCE REQUIREMENTS

- A. General: Provide automatic doors that have been designed and fabricated to comply with specified performance requirements, as demonstrated by testing manufacturers corresponding systems.
- B. Compliance:
 - 1. OBC Ontario Building Code – Most Current Edition
 - 2. ANSI/BHMA A 156.19 American National Standard for Power Operated Doors Pedestrian Doors.
 - 3. UL 325 Listed
 - 4. NFPA 101 Life Safety Code
 - 5. CUL Approved for use in Canada
 - 6. UL Listed Fire Door Operator with Automatic Closer
- C. Automatic Door equipment accommodates medium to heavy pedestrian traffic.
- D. Opening Force Requirements:
 - 1. Power-Operated swinging doors shall open with a manual force not to exceed 30 lbf (133N) to set the door in motion and 15 lbf to fully open the door with force applied at 1" (25mm) from the latched edge of the door. The required force to prevent a stopped door from opening or closing shall not exceed 15 lbf (67N) measured 1" (25mm) from the latch edge of the door at any point during the opening or closing.
- E. Closing Time:
 - 1. Door operators shall be field adjustable to close 90 degrees to 10 degrees in 3 seconds or longer per ANSI/BHMA A 156.19 standard.
 - 2. Door shall be field adjusted to close from 10 degrees to fully closed position in not less than 1.5 seconds.

1.6 SUBMITTALS

- A. Comply with Division 01 – Submittal Procedures.
- B. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles fabrication, operational descriptions and finishes.
- C. Shop Drawings: For automatic entrances. Include plans, elevations, sections, details, hardware mounting heights, additional accessories and attachments to other work.
- D. Samples: color samples of exposed finish as required.
- E. Manufacturers Field Reports: Submit manufacturer's field reports from AAADM certified technician of inspection and approval of doors for compliance with ANSI/BHMA A 156.19 after completion of installation.
- F. Operating and Maintenance Manuals: Provide manufacturers operating, owners and maintenance manuals for each item specified as required in Division 01, Closeout Submittals.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: 10 years minimum of documented experience in manufacturing door equipment similar to that indicated within this specification with a proven record of successful service performance.
- B. Installer Qualifications: Installers, trained by the primary product manufacturers, with a minimum 5 years documented experience installing and maintenance of units similar in material, design, and extent to that indicated in this specification and whose work has resulted in construction with a record of successful in-service performance. Manufacturer's authorized representative who is trained and approved for installation and maintenance of units by AAADM required for this Project

- C. Source Limitations for Automatic Operators: Obtain each type of automatic door operator and supplementary components specified in this section from a single source / single manufacturer where possible.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Power-Operated Door Standard: ANSI/BHMA A 156.19 Current year.
- F. Emergency-Exit Door Requirements: Comply with requirements of authorities having jurisdiction for automatic entrances serving as a required means of egress.

1.8 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings to receive automatic entrances by field measurements before fabrication.

1.9 COORDINATION

- A. Coordinate door operators with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish. Coordinate hardware for automatic entrances with hardware required for rest of project.
- B. Electrical System Roughing-in: Coordinate layout and installation of automatic power door operator with connections to power supplies and access-control system.

1.10 WARRANTY

- A. Automatic Door Operators to be free of defects in material and workmanship for a period of 2 years from the date of substantial completion. This includes the installation of said products.
- B. Safety Sensors to be free of defects in material and workmanship for a period of 2 years from the date of substantial completion.
- C. Activation Devices (Push Buttons (all types) / Wave Buttons / Wireless Buttons / Safety Sensors / Motion Sensors) shall be free of defects in material and workmanship for a period of 2 years from the date of substantial completion.
- D. During the warranty period all warranty work shall be performed during evening hours.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Requests for substitution and product approval in compliance with the specification must be submitted in writing and in accordance with the procedures outlined in Division 1. Approval of requests is at the discretion of the architect, owner, and their designated consultants.
- B. Pre- Approved models are listed below: others may acceptable to the owner. To present a substitution proceed with substitution procedures as outlined in division 1. All substitutions must meet all the criteria of this specification to be considered.

C. PRE-APPROVED MODELS

- D. Auto operators

(1) Dorma light duty interior use - ED100, Dorma heavy duty exterior and high traffic use ED250

(2) Besam light duty interior use - SW100, Besam heavy duty exterior and high traffic use SW200i

(3) Omega light duty interior use – OA-100, Omega heavy duty exterior and high traffic use OA-100HD

E. Activation Devices

(1) Camden

(2) BEA

(3) WIKK

F. Emergency Call Kits

(1) Camden CX-WEC10K2

G. Push to Lock Kits

(1) Camden Aura CX-WC13XSM or CX-WC13XFM

H. Safety Sensors

(1) Optex - OA-EDGE with LED Indicator

2.2 AUTOMATIC SWING DOOR OPERATOR

A. An Integrated, self-learning automatic swing door operator with an advanced CPU, a multistage gearbox with real time adaptive software and available user interface.

1. Automatic Door Configuration:

- a. Configuration: Single swing door or pair of doors swinging.
- b. Traffic Pattern: One Way
- c. Mounting: Surface applied

B. Control Features

1. Power-hold Close
2. Built in Lock Delay
3. On-Off-Hold Open switch control to control door function, (Automatic-Hold Open- Exit Only)
4. On-Off Power Switch
5. Fire Alarm Integration
6. Field Adjustable Handing
7. Push and Go
8. Power Assist Opening Activation
9. Intergrated Connections for Monitored Safety Sensors and other accessories.
10. Integrated access control
11. Wind Load and Stack Pressure microprocessor monitored with power boost to ensure secure opening and closing in changing conditions.

C. Door Control Features:

1. Door Weight Max: Light Duty Operators for interior use 220lbs
2. Door Weight Max: Heavy Duty Operators for exterior & high traffic use 600lbs

D. Header Size: **not to exceed** 4 5/16" Height x 6" Depth

2.3 ACTIVATION DEVICES

1. Push Plate(Standard Application) : Hard wired, 4 ½" x 4 ½" square or 6" round stainless steel push plate engraved with "Push to Open" with a handicap logo and complete with mounting box (surface or flush mount – site determined) made by the same manufacturer. Mounting boxes on the exterior shall be complete with weathertight seals.
2. Wireless Push Plate (Site Related Alternate Device) : Radio controlled, 900 MHZ wireless or kinetic, 4 ½" x 4 ½" square or 6" round stainless steel push plate engraved with "Push to Open" with a handicap logo and complete with mounting box (surface or flush mount – site determined) made by the same manufacturer. Mounting boxes on the exterior shall be complete with weathertight seals.
3. Touchless Wave Plate (Owner Optional Device): 4 ½" x 4 ½" square with LED lit activation sensor. Microwave or infrared technology has an adjustable range of 1"-28" and complete with mounting box (surface or flush mount – site determined) made by the same manufacturer. Mounting boxes on the exterior shall be complete with weathertight seals.
4. All Openings requiring the use of access control devices (card readers, intercoms) shall be equipped with an advanced logic relay CX-33 from Camden Controls.

E.

OBC UNIVERSAL & BARRIER FREE WASHROOM REQUIRMENTS

1. All universal and barrier free washrooms are to be equipped with an emergency call kit as outlined in OBC. This kit shall contain the following items:
 - 1) "PRESS FOR ASSISTANCE" Maintained mushroom button & assistance requested LED Annunciator with adjustable sounder
 - 2) Single gang LED Dome light with adjustable sounder
 - 3) White Panel sign 6" x 10 5/8" with red letters on a white background stating "IN THE EVENT OF AN EMERGENCY PUSH EMERGENCY BUTTON AND AUDIBLE AND VISUAL SIGNAL WILL ACTIVATE"
2. All universal and barrier free washrooms are to be equipped with a Push to Lock kit. This kit shall contain the following items:
 - 1) Hard wired, 4 ½" x 4 ½" square stainless-steel push plate engraved with "Push to Open" with a handicap logo and complete with mounting box (surface or flush mount – site determined) made by the same manufacturer.
 - 2) Hard wired, 4 ½" x 4 ½" square stainless steel push plate engraved with "Push to Open" with a handicap logo and complete with AURA LED switchable mounting box (surface or flush mount – site determined) made by the same manufacturer.
 - 3) Hard wired, 4 ½" x 4 ½" square stainless-steel push plate engraved with "Push to Lock" and complete with AURA LED switchable mounting box (surface or flush mount – site determined) made by the same manufacturer.
 - 4) 1 x Door Contact
 - 5) 1x CX33 Logic Relay

2.4 SAFETY DEVICES

- A. Provide door controls in accordance with ANSI/BHMA standards A 156.19 and complying with cited BHMA standard for condition of exposure and for long-term, maintenance-free operation under normal traffic load. When presence sensors are used, they shall be monitored in accordance with ANSI/BHMA A 156.10. Coordinate controls with door operation and door operators.
- B. Door Mounted Presence Sensor:
 1. Adaptive Door Mounted Sensor System (When required – to be determined by the architect:

- a. Adaptive Door Mounted Safety Systems (ADMSS): Door mounted presence sensor, where the sensor shall be mounted on both the swing (pull) side and the approach (push) side of the door. No header mounted sensor is required.
 - 1) The sensor shall provide a full detection pattern that covers the entire swing path of the door and provides detection in the fully open and full close position. While the door is in motion, the pattern shall be capable of providing door panels from 24" to 48"
 - 2) The sensor will provide secondary activation as required for "knowing act" doorways.
 - 3) Sensors to be field installed and adjusted in accordance with applicable safety standards.
- b. System will reactivate a closing door, stop/stall an opening door, keep a closed door closed and keep an open-door open if a person is within the detection zone of the sensors.
- c. System shall be equipped with an external LED display that allows installer to easily determine detection area and make fine adjustments.
- d. Sensor automatically learns distance to floor and automatically adjusts based upon application requirements.
- e. Sensor shall cover entire door width minus 1" and be equipped with the correct quantity of sensors required to properly cover the entire area of detection.

2.5 ELECTRICAL

- A. Provide 115-120 volt, 60 cycle, single phase, maximum 15 ampere service for 1-2 operators, 30 ampere service for 3-4 operators, and as follows:
 1. Coordinate with Division 26 for provision of service to each operator from junction box for multiple operators.
 2. Provide electrical conduit and wiring from specified controls to operators as outlined on manufacturer's drawings.

2.6 FINISHES

- B. Anodized Finish:
- C. Operators shall be finished in the most appropriate finish listed below to match the opening and the existing building finishes.
 1. Clear Anodized Finish:
 2. Dark Bronze or Black Anodized Finish:

EXECUTION

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames with Installer present, for compliance with requirements for installation tolerances, wall and floor construction and other conditions affecting performance of automatic entrances.
- B. Examine roughing in for electrical source power to verify actual locations of wiring connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure non-movement joints.

- B. Entrances: Install automatic entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.
 - 1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
 - 2. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.
- C. Door Operators: Connect door operators to electrical power distribution system as specified in Division 26 Sections.
- D. Sealants: Comply with requirements specified in Division 07 Section "Joint Sealants" to provide seal between the operator housing and wall surface. Installation.
- E. Signage: Apply signage on both sides of each door and each sidelight as required by ANSI/BHMA A 156.19

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's representative shall provide technical assistance and guidance for installation of automatic doors.
 - 1. Factory trained and AAADM certified representative shall test and inspect each automatic door to determine compliance of the installed system to ANSI/BHMA A 156.19

3.4 ADJUSTING

- A. Adjust door operators and controls for smooth and safe operation.

3.5 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by automatic operator installation promptly after installation .

3.6 DEMONSTRATION

- A. Engage a factory authorized representative to train Owner's maintenance personnel to adjust, operate, and maintain safe operation of automatic entrances.

END OF SECTION 087113

Standard Packages

Package #1A

Door Description: Single door with card access and latch retraction panic bars (Exterior)

Quantity	Item Description
1	Heavy Duty Model Operator
2	4 ½" x 4 ½" Push Button – C/W Barrier free logo & "Push to Open"
1	4 ½" x 4 ½" Surface Mount Box (Interior)
1	4 ½" x 4 ½" Surface Mount Box Weatherized (Exterior)
1	CX-33 Logic Relay
1	Latch Retraction Panic Bars TO BE PROVIDED BY HARDWARE SUPPLIER

Package #1B

Door Description: Pair of doors with card access and latch retraction panic bars (Exterior)

Quantity	Item Description
2	Heavy Duty Model Operator
2	4 ½" x 4 ½" Push Button – C/W Barrier free logo & "Push to Open"
1	4 ½" x 4 ½" Surface Mount Box (Interior)
1	4 ½" x 4 ½" Surface Mount Box Weatherized (Exterior)
1	CX-33 Logic Relay
2	Latch Retraction Panic Bars TO BE PROVIDED BY HARDWARE SUPPLIER

Package #1C

Door Description: Pair of doors with card access and latch retraction panic bars (Exterior)

Quantity	Item Description
1	Heavy Duty Model Operator
2	4 ½" x 4 ½" Push Button – C/W Barrier free logo & "Push to Open"
1	4 ½" x 4 ½" Surface Mount Box (Interior)
1	4 ½" x 4 ½" Surface Mount Box Weatherized (Exterior)
1	CX-33 Logic Relay
1	Latch Retraction Panic Bars TO BE PROVIDED BY HARDWARE SUPPLIER

Package #2A

Door Description: Single door with Push / Pull Application (Exterior)

Quantity	Item Description
1	Heavy Duty Model Operator
2	4 ½" x 4 ½" Push Button – C/W Barrier free logo & "Push to Open"
1	4 ½" x 4 ½" Surface Mount Box (Interior)
1	4 ½" x 4 ½" Surface Mount Box Weatherized (Exterior)
1	Key Switch to turn off at night CM2210 x 7224
1	Mortise Cylinder for Key Switch

Package #2B

Door Description: Pair of doors with Push / Pull Application (Exterior)

Quantity	Item Description
2	Heavy Duty Model Operator
2	4 ½" x 4 ½" Push Button – C/W Barrier free logo & "Push to Open"
1	4 ½" x 4 ½" Surface Mount Box (Interior)
1	4 ½" x 4 ½" Surface Mount Box Weatherized (Exterior)
1	Key Switch to turn off at night CM2210 x 7224
1	Mortise Cylinder for Key Switch

Package #2C

Door Description: Pair of doors with Push / Pull Application (Exterior)

Quantity	Item Description
1	Heavy Duty Model Operator
2	4 ½" x 4 ½" Push Button – C/W Barrier free logo & "Push to Open"
1	4 ½" x 4 ½" Surface Mount Box (Interior)
1	4 ½" x 4 ½" Surface Mount Box Weatherized (Exterior)
1	Key Switch to turn off at night CM2210 x 7224
1	Mortise Cylinder for Key Switch

Package #3

Door Description: Single door with card access (interior)

Quantity	Item Description
1	Standard Duty Model Operator
2	4 ½" x 4 ½" Push Button – C/W Barrier free logo & "Push to Open"
2	4 ½" x 4 ½" Surface Mount Box (Interior)
1	CX33 Logic Relay
1	Electric Strike TO BE PROVIDED BY HARDWARE SUPPLIER

Package #3B

Door Description: Pair of doors with card access (interior)

Quantity	Item Description
2	Standard Duty Model Operator
2	4 ½" x 4 ½" Push Button – C/W Barrier free logo & "Push to Open"
2	4 ½" x 4 ½" Surface Mount Box (Interior)
1	CX33 Logic Relay
1	Electric Strike TO BE PROVIDED BY HARDWARE SUPPLIER

Package #3C

Door Description: Pair of doors with card access and latch retraction panic bars (Interior)

Quantity	Item Description
2	Standard Duty Model Operator
2	4 ½" x 4 ½" Push Button – C/W Barrier free logo & "Push to Open"
2	4 ½" x 4 ½" Surface Mount Box (Interior)
1	CX-33 Logic Relay
2	Latch Retraction Panic Bars TO BE PROVIDED BY HARDWARE SUPPLIER

Package #3D

Door Description: Pair of doors with card access and latch retraction panic bars (Interior)

Quantity	Item Description
1	Standard Duty Model Operator
2	4 ½" x 4 ½" Push Button – C/W Barrier free logo & "Push to Open"
2	4 ½" x 4 ½" Surface Mount Box (Interior)
1	CX-33 Logic Relay
1	Latch Retraction Panic Bars TO BE PROVIDED BY HARDWARE SUPPLIER

Package #4

Door Description: Single door push/pull washroom multi-stall (Interior)

Quantity	Item Description
1	Standard Duty Model Operator
2	4 ½" x 4 ½" Push Button – C/W Barrier free logo & "Push to Open"
2	4 ½" x 4 ½" Surface Mount Box (Interior)

Package #5

Door Description: Single door barrier free washroom or universal washroom (Interior)

Quantity	Item Description
1	Standard Duty Model Operator
1	Push to Lock Kit – CX-WC 13XSM
1	Emergency Call Kit – CX-WEC 10K2
1	Electric Strike - TO BE PROVIDED BY HARDWARE SUPPLIER

ACCESSORY ITEMS 1

QTY	Item Description
2	4 ½" x 4 ½" Wave Buttons with LED Indicator Stainless Steel Finish, with wave logo and "wave to open" – in lieu of standard buttons
2	4 ½" x 4 ½" Wireless Button Kit, includes transmitter & receiver, Stainless Steel Button with barrier free logo & "Push to Open" – in lieu of standard buttons
2	6" Round Button with surface mount box, stainless steel button with barrier free logo & "Push to Open" – in lieu of standard Buttons
2	6" x 6" Square Button with surface mount box, stainless steel button with barrier free logo & "Push to Open" – in lieu of standard Buttons

ACCESSORY ITEMS 2

QTY	Item Description
2	Motion sensor activation – example: BEA Eagle
2	Safety Sensors Push and pull side (see specifications) – Example: Optex OA-Edge-2 with LED indicator.
1	CX-33 Logic Relay
1	I021 lock out relay
1	Le 21 lock out relay
1	24V Transformer

APPENDIX D2

Part 2 of City RFQ for ADO's

This Agreement entered into on the **[Note to Finalization before Execution: Insert Date of Execution]**

between

CITY OF TORONTO

(“City”)

and

● **[Note to Finalization before Execution: Insert Legal Name of Supplier]**

(“Supplier”)

WHEREAS the City prequalified general contractors to carry out Work for the City's Accessibility Upgrades Program through a separate Request for Supplier Qualification process, and intends to contract with some or all of those prequalified general contractors through a competitive tender process that will lead to accessibility upgrades of approximately 350 City buildings under the Accessibility Upgrades Program, including installation of automatic door openers and other equipment at some locations;

WHEREAS the City wishes to pre-select a supplier for the supply, delivery and installation of automatic door openers and necessary equipment for the City's Accessibility Upgrades Program ("Deliverables");

WHEREAS the City issued Request for Quotations No. **[Note to Finalization before Execution: insert RFQ No.]** dated **[Note to Finalization before Execution: insert RFQ date]** including Addendum No. **[Note to Finalization before Execution: insert any addenda numbers and their respective issuance dates]** respectively, (collectively the "RFQ") and in response to the RFQ, the Supplier submitted a response dated **[Note to Finalization before Execution: insert RFQ submission date]** ("RFQ Response"); and

WHEREAS the Supplier will be required to enter into direct contracts with General Contractors in order to provide Deliverables;

WHEREAS the City and Supplier now wish to enter into this Agreement to establish the terms and prices under which the Supplier will provide Deliverables;

NOW THEREFORE in consideration of the mutual covenants herein contained, the City and the Contractor agree as follows:

1. DEFINITIONS

The definitions contained in the RFQ are incorporated into and form a part of this Agreement in addition to the following definitions:

"Accessibility Upgrades Program" means the City's accessibility upgrades program for approximately 350 City buildings, including the installation of new Equipment in some buildings.

"Automatic Door Opener Supply Contract" means any contract between the Supplier and a General Contractor retained by the City for Work to be provided for the Accessibility Upgrades Program.

"Contract Documents" have the meaning in section 3 of the Agreement.

"Deliverables" has the meaning set out in the recitals and further defined in the RFQ.

"Equipment" means the automatic door openers and other necessary equipment to be supplied by the Supplier as part of the Deliverables.

"General Contract" means a contract that the Supplier enters into with a General Contractor for the purpose of providing Work/Services with respect to Equipment for the Accessibility Upgrades Program.

"General Contractor" means a prequalified general contractor retained by the City for the Accessibility Upgrades Program.

"Warranty Period" has the meaning set out in Appendix B of the RFQ.

"Work" means the work being performed by General Contractors.

2. THE DELIVERABLES AND WORK

- (1) The Supplier will do and fulfill everything indicated in the Contract Documents.
- (2) The Supplier agrees to provide the Deliverables under any Automatic Door Opener Supply Contract under the terms and prices set out in the RFQ, RFQ Response, and this Agreement.
- (3) The Supplier acknowledges and agrees that the City does not guarantee the value or volumes of work and that this Agreement forms a standing offer to the Supplier that is subject to the City entering into an a General Contract.
- (4) In the event the Supplier enters into an Automatic Door Opener Supply Contract, the Supplier shall provide warranty for and maintenance services to the Equipment provided under said Automatic Door Opener Supply Contract to the City, pursuant to the RFQ.

3. CONTRACT DOCUMENTS

The Agreement is comprised of the following Contract Documents, which are incorporated by reference. The following is a list, in order of precedence of the Contract Documents. In

the event of any inconsistency between, or an omission or ambiguity with respect to any provisions contained in any of the following Contract Documents, the following documents shall apply and prevail in the following order of priority to the extent of such conflict, inconsistency, mission, ambiguity or incongruity:

- (a) any duly authorized amendments to the Agreement;
- (b) the Agreement;
- (c) addenda to the RFQ in the order of most recent date issued;
- (d) RFQ; and
- (e) RFQ Response.

Should any discrepancies appear or differences of opinion or misunderstanding arise as to the meaning of the Agreement or as to any omissions therefrom or statements therein in any respect, or as to the quality or dimensions or sufficiency of the Equipment, materials, services or work or any part thereof, or as to the due and proper execution of the Contract Documents, the same shall, subject to the terms of the Contract Documents, be determined by the City.

4. RELATIONSHIP OF THE PARTIES

The Supplier, in providing the Services for the Work to be performed by the General Contractor under the General Contract, shall and is deemed to be an independent contractor to the General Contractor and not the agent or employee of the City and nothing in the RFQ or Contract Documents shall be deemed or construed as creating any such relationship. Neither is there any intention to create a partnership, joint venture or joint enterprise between the Supplier and the City.

5. GENERAL CONTRACTOR'S OBLIGATIONS

- (1) The Supplier acknowledges that upon award of a General Contract by the City to a General Contractor, the General Contractor shall be responsible for:

- (a) procuring the Deliverables from the Supplier; and
- (b) making all payments for the Deliverables;

all as if the General Contractor had selected the Supplier for the Services.

- (2) The Automatic Door Opener Supply Contract from the General Contractor shall be in accordance with the scope, terms and conditions of these RFQ Documents.
- (3) The Supplier acknowledges that General Contractors will be required to enter into General Contracts with the City in the form of agreement set out in Appendix D to the RFQ.

6. PAYMENT TO SUPPLIER FOR DELIVERABLES

- (1) The Supplier acknowledges the General Contractor will be responsible for paying the Supplier for all payments with respect to the supply of the Deliverables, and the General Contractor will be responsible for making all payments to the Supplier for the Deliverables in accordance with the terms of payment, as described herein, from, but

not necessarily limited to, money received by the General Contractor from the City in payment for the supply of the Deliverables under the General Contract.

- (2) The City shall pay the General Contractor for the supply of the Deliverables, subject to the holdback provisions of the *Construction Act, R.S.O. 1990*.
- (3) The selection of the Equipment and the Supplier by the City pursuant to this RFQ, or the approval of payment under the General Contract for the supply thereof, shall in no way constitute a waiver by the City of its rights to return or reject such Equipment and/or claim damages for: (a) non-compliance with the terms of the RFQ Documents, (b) breach of an expressed or implied warranty or guarantee, or (c) the enforcement of any contractual, legal, equitable or other rights which the City may have under the Contract Documents or General Contract.

7. REPRESENTATIONS AND WARRANTIES

- (1) Without limiting or restricting in any way any other responsibilities and obligations of the Supplier under the Contract Documents, the Supplier represents, warrants and guarantees to the City and shall warrant to the General Contractor (and acknowledges that the City and the General Contractor is relying thereon) that any Deliverables resulting from or to be supplied or developed under the Automatic Door Opener Supply Contract and all Equipment, and the supply thereof:
 - (a) shall be in strict accordance with all applicable Laws and the City's functional and technical requirements set out in the RFQ including, without limiting the generality of the foregoing, the specifications for the said Equipment, and will function or otherwise perform in accordance with such requirements;
 - (b) shall be free from defects in design, engineering, material, manufacture, workmanship or title;
 - (c) shall perform efficiently and without unwanted interruption during the Warranty Period; and
 - (d) shall have any breakage, damage, defects or deterioration (other than those due to the negligence of the General Contractor or the City or to normal wear and tear) in the Equipment that occurs or is detected and is reported to the Supplier within the Warranty Period made good promptly by the Supplier at its expense including the expense of all necessary labour, supervision, travelling, replacement parts, transportation and otherwise.
- (2) All representations, warranties and guarantees provided herein are in addition to any other representations, warranties and guarantees contained in the Supplier's RFQ Response, including manufacturer's warranties, and all such representations, warranties and guarantees shall be completely transferable by the General Contractor to, and completely enforceable by, the City.
- (3) No inspection, examination, test, acceptance or use of all or any part of the Equipment or services furnished hereunder nor the failure to inspect, examine or test the same nor acceptance thereof nor the expression of any approval by the General Contractor, or by the City pursuant to the General Contract or otherwise, shall constitute acceptance of any defect or shall affect the Supplier's obligation under these warranty provisions, or

be deemed to relieve Supplier from any of its obligations under the Contract Documents, including among others the obligation to supply the Equipment and services satisfying the warranties set forth herein. Such warranties shall survive inspection, test, acceptance and use.

- (4) The Supplier agrees that all representations, warranties and guarantees provided in the Agreement and which are to be incorporated into the Automatic Door Opener Supply Contract, are fully assignable to and enforceable by the City (where not already expressly reserved to the City) at the City's sole option and further agrees that the City's right to a complete assignment of same shall be included in the Automatic Door Opener Supply Contract, without any additional compensation payable by the City (including indirectly by the General Contractor) or further approval by the Supplier. The Supplier acknowledges that the City is relying on the representations, warranties and guarantees of the Supplier and, but for same, the City would not have selected the Equipment or Supplier. The Supplier's representations, warranties and guarantees herein shall run to the City, its successors, and assigns.

8. DEFECTIVE EQUIPMENT, SERVICES

- (1) In the event of failure of the Equipment or any part or parts or supply thereof, during the Warranty Period, due to defects of design, materials, or workmanship or other breach of a representation or warranty provided herein, the affected Equipment, or part or parts or supply thereof, shall be replaced promptly upon notice by the General Contractor or the City. All replacement parts shall be furnished, delivered, and installed at the expense of the Supplier.
- (2) Upon receipt of any notice of defect from the General Contractor, the Supplier, at its own expense, shall immediately:
- (a) correct; or
 - (b) re-perform; or
 - (c) replace and fit with new parts; or
 - (d) repair and refit,
- or any combination of the foregoing, without cost or charge to the General Contractor or the City,
- (i) any error, defect, deficiency or malfunction in the Equipment, or any parts, materials or workmanship thereof or services related thereto supplied by the Supplier; or
 - (ii) non-conformance of the Equipment or the supply thereof with the warranty provisions set forth herein or other requirements of the Contract Documents,
- upon notification of the Supplier by the General Contractor or the City within Warranty Period.
- (3) Notwithstanding subsection (2) above, should the Equipment fail to meet the representations and warranties set forth herein in any material respect, such failure shall be deemed cause for the rejection and removal of the unit and for its replacement with an acceptable unit, and the City shall be entitled to require the General Contractor

to do so at the sole option of the City, which shall be done at the sole expense of the General Contractor, and if appropriate, the Supplier.

- (4) The Supplier's obligation herein shall include, without limitation, all transportation costs for parts and/or Equipment both ways between the Supplier's factory or repair depot and the point of use. In the case of remedial work to be performed by Supplier hereunder, the Supplier shall provide all labour, supervision, equipment, tools and materials necessary to perform the remedial work and shall bear all expenses in connection therewith or incidental thereto. The Supplier shall perform, at its own cost, such tests as may be reasonably required to verify that corrected, repaired or replaced Equipment conforms to the warranties above.
- (5) Subject to subsection (3) above, if the Supplier chooses to effect a repair under subsection (2) it shall immediately fit a replacement part to enable the Equipment to continue in use until the original part has been repaired and refitted.
- (6) The City will provide the General Contractor reasonable access to such Equipment to assist the General Contractor or Supplier in having work carried out on installed Equipment or in removing or replacing installed Equipment or parts thereof.
- (7) Any Equipment or service or part thereof that is corrected, replaced or repaired in accordance with the warranty provisions herein shall carry and be subject to the same warranty terms as set forth herein, except that the Warranty Period shall start from the date on which the correction, re-performance, replacement or repair is completed and the Equipment is properly operational.
- (8) The Supplier acknowledges that the failure of the Equipment, or any part thereof, to operate and perform properly and in accordance with the warranties provided herein could result in disruption of the Project and substantial revenue loss to City. The Supplier agrees to use its best efforts to perform all warranty work hereunder as expeditiously as is reasonably possible and in a manner which minimizes Project disruption and revenue loss. The Supplier recognizes and agrees that City's operational requirements may require immediate repairs or reworking of defective goods, without notice to the Supplier and without affecting the City's warranty rights hereunder. In such event, the Supplier shall reimburse the City and shall be required to reimburse the General Contractor all costs, delays, or other damages which the City has incurred as a result of such failure. In the event of an emergency breakdown, the Supplier shall attend the location of the emergency breakdown within twenty-four (24) hours of the incident being reported, failing which the City shall have the right to undertake repairs as required and charge the Supplier the cost of the repairs. Subject to subsection (7) above, the Supplier's responsibility shall be discharged when the City is satisfied that the necessary correction, replacement or repair has been properly effected, subject to any warranty applicable thereto.
- (9) The Supplier shall be liable for all damage, loss or expense arising from any failure of the Equipment or delay or failure to perform warranty work hereunder or in restoring the Equipment to working order.
- (10) Nothing in this section shall be construed, in any way, to prejudice or limit the City's contractual rights under the Agreement or the General Contract or any equitable or common law rights available to it.

9. PERFORMANCE

In addition to any other provision concerning the performance and personnel of the Supplier:

- (1) Under the Automatic Door Opener Supply Contract:
 - (a) the Supplier shall make available appropriately skilled workers, consultants or subcontractors, as appropriate, and must be able to provide the necessary materials, tools, machinery and supplies to fulfill its obligations to supply the Equipment in accordance with the terms and conditions of the Contract Documents.
 - (b) Without limiting the foregoing, the Supplier shall be responsible for complying with the *Occupational Health and Safety Act* (OHSA) at all times during the supply of the Deliverables. The City shall in no way be considered the constructor with respect to any part of the supply of Equipment for the purposes of the OHSA.
 - (c) It shall be the Supplier's responsibility to co-ordinate, control and check the work of and the provision of the goods and services by its own forces and of all its subcontractors and to ascertain that all work is performed in accordance with all requirements of the Contract Documents. Without limiting the generality of any other provision herein, the Supplier shall be liable for all costs or damages arising from acts, errors or omissions, negligence or wilful misconduct of its subcontractors.
- (2) The City shall not be construed to have any contractual relationship with any of the Supplier's employees or subcontractors or material suppliers or their employees or supplier.
- (3) The City's general conditions for its General Contract are included in Appendix D to the RFQ and will form part of the General Contract. The Supplier agrees to be bound by the terms and conditions contained therein as they affect the supply of the Deliverables to the Work and the Supplier as a subcontractor to the General Contractor.
- (4) Any Equipment, services, work, material or incidentals, not explicitly specified in the RFQ Documents but which are necessary to conform to generally accepted industry, safety or product standards, good construction practice, to produce a finished appearance, or required by the Ontario Building Code or other governing codes, or which may be fairly implied as "included", shall be done or supplied by the Supplier as if such Equipment, services, work, material or incidentals had been explicitly specified.

10. COMPLIANCE WITH LAWS

- (1) The Supplier, at all times, shall comply with and conform to all statutes, laws, by-laws, regulations, requirements, codes, ordinances, notices, rulings, orders, directives, policies and controls of the municipal, provincial and federal governments and any other lawful authority and all court orders, judgments and declarations of a court of competent jurisdiction (collectively referred to as the "Laws"), applicable to the Equipment and the supply thereof, and the responsibilities and obligations of, the Supplier under the Contract Documents. The Supplier shall ensure that all persons performing the supply of the Deliverables to the Work hold all valid and current permits, licences (including municipal), consents and approvals required by Law with respect to such services to be provided and/or Equipment to be supplied by them.

- (2) The Supplier, at all times, shall cooperate with the General Contractor and the City, as Owner, in promptly furnishing any information that may be required by the Ministry of Labour and any other government regulatory authority with jurisdiction over any matter applicable to the supply of the Deliverables.

11. W.H.M.I.S.

The Equipment shall be supplied in compliance with Canada's Workplace Hazardous Materials Information System (W.H.M.I.S.). Without exception, all Equipment and all parts and material comprising same shall be ASBESTOS-free and TAR-free.

12. PROHIBITED PRODUCTS

- (1) The Supplier must provide the General Contractor with a list of designated substances that will be brought to the Work Site prior to commencing the supply of the Deliverables to the Work. The tender for the General Contract will require that the General Contractor maintain at the Project site, copies of all Materials Safety Data Sheets (MSDS) and an inventory of hazardous materials for each substance on the Project.
- (2) Hazardous products and materials containing any Class A1 carcinogen substance, as indicated in their appropriate Material Safety Data Sheets, shall not comprise any part of the Equipment, or the supply thereof, and are prohibited from City property and the Work Site.
- (3) The Supplier agrees to fully indemnify and save harmless the City, its employees and consultants and the General Contractor from any and all charges, fines, penalties and costs that may be incurred or paid by the City or the General Contractor, as the case may be, or any of their respective employees or if the City or the General Contractor or any of their respective employees shall be made a party to any charge under the *Occupational Health and Safety Act* in relation to any violation of such Act arising out of the supply of the Deliverables.

13. OWNERSHIP OF PROJECT DOCUMENTATION

All information, data, plans, specifications, reports, estimates, summaries, photographs and all other documentation prepared by the Supplier specifically in the connection with the supply of the Deliverables, whether they are in draft or final format, shall be the property of the General Contractor, upon delivery of such documents to the General Contractor, which shall be completely and absolutely transferable to the City under the General Contract.

14. PATENT AND COPYRIGHTS

- (1) Where the supply and incorporation of the Equipment, or any component thereof, to the Work and use of such Equipment, or any component thereof, requires the installation or use of any patented, trademarked, copyrighted or other protected intellectual property ("Intellectual Property"),
 - (a) belonging to the Supplier, the Supplier shall grant to the General Contractor an irrevocable and perpetual license to permit the General Contractor to use such Intellectual Property for the supply, installation and use of the Equipment and all components thereof, as contemplated in the Contract Documents, which licence

shall be completely assignable to the City upon acceptance of the Equipment by the City;

- (b) belonging to any other person, the Supplier shall acquire from and pay for the an irrevocable and perpetual license from the owner thereof entitling the General Contractor to use such third party Intellectual Property for the supply, installation and use of the Equipment and all components thereof, as contemplated in the Contract Documents, which licence shall further be completely assignable to the City, upon acceptance of the Equipment by the City.
- (2) The Equipment price shall include all payments made or to be made or required to be made for the use of any and all Intellectual Property, as provided in subsection (1) above.
- (3) The Supplier, at its sole expense, shall defend, indemnify and save harmless the City, and its employees, officers, consultants and agents, from all and every claim, action or proceeding for damages, costs (including legal fees on a substantial indemnity basis), charges, expenses, royalties, or fees for the alleged infringement or infringement of any patent, trademark, trade secret, copyright or other proprietary right occasioned by them in connection with the supply of the Deliverables by the Supplier or the installation or use of the Equipment by the General Contractor or the City, as contemplated in this Agreement, as well as for any alleged unfair competition resulting from similarity in design, trademark or appearance of goods or services furnished hereunder. The City may, at its option, be represented at any such proceeding.
- (4) If the Equipment or the supply of the Deliverables or the installation or use of the Equipment is held in any such claim, action or proceeding to constitute an infringement, the Supplier, at its expense and in compliance with the Specifications, shall forthwith either procure for the General Contractor or the City, as the case may be, the right to use and continue to use such material or Equipment; or replace same with substantially equal but non-infringing material and Equipment; or modify same to make them substantially equal but non-infringing; or remove same and refund the purchase price and transportation and installation costs and all other costs of the General Contractor or the City related to the removal and loss of use.

15. CONFIDENTIALITY

All correspondence, documentation and information of any kind provided by City, or by any other person on the City's behalf including its consultant, contract administrator or General Contractor, to or which comes to the attention of the Supplier in connection with, or arising out of, or by reason of the RFQ or the supply of the Deliverables remains the property of the City; must be treated as confidential; and must not be used for any purpose other than as contemplated herein and shall not be reproduced, disclosed or disseminated, except as required by Law or as expressly permitted in advance by the City in writing. The RFQ is subject to the *Municipal Freedom of Information and Protection of Privacy Act*, R.S.O. 1990, c. M.56, as amended.

16. SPARE PARTS

The Supplier shall maintain a complete inventory of spare parts commonly needed for the Equipment specified at a location within the Province of Ontario or, alternately, spare parts

must be made available to the General Contractor within 48-hours of any spare part order by the General Contractor during the Warranty Period and, after the Warranty Period, to the City, as soon as reasonably possible but no later than within 30 days. The Supplier represents and warrants that such spare parts inventory shall be maintained for the Equipment for a period of no less than ten (10) years or the life cycle for the Equipment quoted by the Supplier in its RFQ Response, whichever is greater.

17. LATE DELIVERY/LIQUIDATED DAMAGES

- (1) The City accepts no responsibility for any claim made by the General Contractor against the Supplier on account of actual damages or additional costs incurred, or allegedly incurred, by the General Contractor on account of late delivery by the Supplier of any item of Equipment or the Deliverables. Any dispute between the Supplier and the General Contractor with respect to any such claim shall be settled between the Supplier and the General Contractor.
- (2) Failure to meet the completion schedule will subject the Supplier to damages, including liquidated damages, in accordance with the General Contract. The liquidated damages assessed by the City against the General Contractor for failure to complete the project within the Contract Time stipulated in the General Contract shall be determined by the City for each General Contract. The General Contractor shall have the right to assess this amount against the Supplier to the extent the Supplier is the reason for any portion of the delay in completion. This is without prejudice to any other remedy of the City or the General Contractor in contract or otherwise at law.

18. TRANSFER OF TITLE

The title to Equipment, components, and materials to be furnished in accordance with the Contract Documents including replacements or substitutions shall pass to the General Contractor upon its acceptance of the Equipment. The passing of the title to the General Contractor (or the subsequent transfer of the Equipment to the City) shall not relieve Supplier from any other liabilities or obligations under the Automatic Door Opener Supply Contract or the Agreement, which shall remain in full force and effect.

19. STORAGE OF EQUIPMENT

The Supplier shall coordinate the storage of the Equipment at the Work Site with the General Contractor. The Supplier shall be responsible for providing the General Contractor with full instructions in writing of all precautions to be observed in connection with the storing and protection of the Equipment. A copy of all instructions shall be provided to the Contract Administrator. The General Contractor will be responsible for proper storage of the delivered and accepted Equipment, appurtenances and materials until it is installed and for their protection against weather, deterioration, loss, damage or theft.

20. COORDINATION WITH WORK BY OTHERS

- (1) The Supplier shall cooperate and liaise with the General Contractor to make appropriate working arrangements to ensure the satisfactory execution and timely completion of the supply of the Deliverables and related services.

- (2) The City shall provide the General Contractor reasonable access to the Work site necessary to enable the Supplier to complete the supply and services herein.

21. UNPAID ACCOUNTS AND LIENS

- (1) The Supplier shall be required to covenant to the General Contractor to pay all charges incurred by or on behalf of the Supplier for any services, work or materials which may be supplied, done or performed in respect of the supply of the Deliverables and the Supplier shall be required to forthwith discharge and obtain a release of any liens or encumbrances whatsoever arising therefrom at any time claimed or registered against or in respect of the supply of the Deliverables or any part thereof. In the event that the Supplier shall fail to cause any such liens or encumbrances forthwith to be discharged and released after being notified thereof, then, in addition to any other right or remedy of the General Contractor, the General Contractor may, but shall not be obliged to, discharge same by paying the amount claimed to be due and any other amounts necessary to obtain such a discharge and the amount so paid by the General Contractor and all costs and expenses, including reasonable legal fees on a substantial indemnity basis, incurred by the General Contractor in procuring the discharge and release of such lien or encumbrance, shall be payable by the Supplier forthwith.
- (2) The Supplier shall be required to indemnify the General Contractor from all claims arising out of unpaid accounts relating to the supply of the Deliverables including any claims of the City. The General Contractor shall have the right at any time to require satisfactory evidence that the work in respect of which any payment has been made or is to be made by the General Contractor to the Supplier is free and clear of liens, attachments, claims, and demands, charges or other encumbrances.
- (3) In the event that the Supplier shall fail to cause any liens or encumbrances any time claimed or registered against the lands of the Owner in respect of any improvement which the supply of the Deliverables may constitute under the *Construction Act*, R.S.O.1990 to be discharged and released forthwith after being notified thereof, then, in addition to any other right or remedy the City may have by contract, law, statute or in equity, the City may, but shall not be obliged to, discharge same by paying the amount claimed to be due and any other amounts necessary to obtain such a discharge and the amount so paid by the City and all costs and expenses, including reasonable legal fees on a substantial indemnity basis, incurred by the City in procuring the discharge and release of such lien or encumbrance, shall be payable to the City by the Supplier and the General Contractor forthwith. The City shall have the right at any time to require satisfactory evidence that the work in respect of which any payment has been made or is to be made by the City to the General Contractor is free and clear of liens, attachments, claims, and demands, charges or other encumbrances.

22. INDEMNIFICATION

- (1) In consideration of the Supplier being pre-selected by the City for the supply of the Deliverables to the Work under the General Contract, the Supplier covenants and agrees at all times to defend, fully indemnify and save harmless the General Contractor, the City, their councillors, officers, directors, employees, agents and representatives, successors, and assigns (hereinafter called the "Indemnitees") from and against any and

all claims of any nature whatsoever and howsoever caused to, sustained or suffered by, or imposed upon or made or instituted against any of the Indemnitees or to which any of them may be liable by reason of or arising from or related to:

- (a) any act or omission, neglect, default or wilful misconduct on the part of the Supplier as well as any officer, employee, servant, subcontractor, consultant, invitee, agent or assign of the Supplier relating to the supply of the Deliverables; or
 - (b) attributable to or connected with the performance, non-performance or purported performance of the Supplier's obligations pursuant to the Automatic Door Opener Supply Contract; or
 - (c) in consequence of or in any way arising out of any defect in the Equipment; or
 - (d) by reason of any default, breach, violation, misrepresentation, non-performance or non-compliance of or with any covenant, term, obligation, warranty (express or implied), condition or provision in or related to the Agreement or the Automatic Door Opener Supply Contract by the Supplier, or
 - (e) any infringement or alleged infringement or other breach, actual or alleged of any Canadian, American or other patent, industrial design, trade secret, trademark, copyright, service mark, trade name, official mark, moral right or any other intellectual property right of any person conferred by contract, common law, statute or otherwise, for which the Supplier is responsible or which is occasioned by the Supplier in connection with the supply of the Deliverables or material to the Work and related services performed by it under the Agreement or the Automatic Door Opener Supply Contract, or anyone else for whom at law it is responsible; or
 - (f) breach of any confidentiality obligations under the Automatic Door Opener Supply Contract, except to the extent that the same are directly caused by the negligence or deliberate wrong-doing of the General Contractor.
- (2) In the event any claim is asserted in respect to which any of the Indemnitees is entitled to indemnification under this section, without prejudice to any other right or remedy it may have, the General Contractor shall be entitled to deduct or withhold a reasonable sum on account of such claim, including legal costs, from monies owed or payable by the General Contractor to the Supplier under the Automatic Door Opener Supply Contract, pending the final determination or settlement of such Claim.
- (3) Upon assuming the defence of any claim covered under this section the Supplier shall keep the party or parties entitled to indemnification herein reasonably informed of the status of the matter, and the Supplier shall make no admission of liability or fault on any GC Indemnitee's part without prior written consent the party or parties entitled to indemnification herein.
- (4) The rights to indemnity provided for in this section shall be deemed to be in addition to and not in lieu of any insurance to be provided by the Supplier and any rights with respect to insurance in favour of the General Contractor. The rights to indemnity provided herein shall survive the expiration or any termination of the Automatic Door Opener Supply Contract.

- (5) The Supplier acknowledges and agrees that the City, at its option, shall have the right to an assignment of the General Contractor's rights of indemnification herein related to the supply of the Deliverables and may directly enforce such rights against the Supplier.

23. INSURANCE

- (1) The Supplier shall comply with all insurance requirements, and all WSIB prior to the execution of this Agreement. The Supplier shall bear all costs, expenses, losses and damages of its own and those of the General Contractor and the City, which may arise as a result of the Supplier failing to or delaying in promptly complying with this condition.

- (2) The Supplier agrees to purchase and maintain in force, at its own expense and for the duration of the Agreement, the following policies of insurance, which policies shall be in a form and with an insurer acceptable to the City. A certificate evidencing these policies signed by the insurer or an authorized agent of the insurer must be delivered to the City prior to the commencement of services:

- (a) Commercial General Liability provided that the policy:

- (i) is in the amount of not less than Five Million Dollars (\$5,000,000.00), per occurrence;
- (ii) adds the City of Toronto as an additional insured;
- (iii) includes Non-Owned Automobile Liability, Employer's Liability and/or Contingent Employer's Liability, and any other provision relevant to the services;
- (iv) includes a clause which will provide the City with thirty (30) days' prior written notice of cancellation (15 days if cancellation is due to non-payment of premium).

- (b) Automobile Liability insurance with a minimum limit of Two Million Dollars (\$2,000,000) for all owned or leased licensed motorized vehicles used in the performance of services.

- (3) It is understood and agreed that the coverage and limits of liability noted above are not to be construed as the limit of liability of the vendor in the performance of services. It is also agreed that the above insurance policies may be subject to reasonable deductible amounts, which deductible amounts shall be borne by the vendor. At the expiry of the policies of insurance, original signed Certificates evidencing renewal will be provided to the City without notice or demand.

- (4) The Supplier is responsible for any loss or damage whatsoever to any of its materials, goods, equipment or supplies and will maintain appropriate all-risk coverage as any prudent owner of such materials, goods, supplies and equipment. The Supplier shall

have no claim against the City or the City's insurers for any damage or loss to its property and shall require its property insurers to waive any right of subrogation against the City.

24. CONTRACT CANCELLATION

- (1) The City may cancel the Agreement between the City and the Supplier for any reason, prior to the execution of the Automatic Door Opener Supply Contract, without any financial obligation to the Supplier. Should for any reason the City not enter into a General Contract which includes the supply of the Deliverables, then the City will notify the Supplier in writing and the Supplier for this Project will be cancelled without any financial obligation to the Supplier.
- (2) In the event of any cancellation, the Supplier shall immediately stop all work related to the Supply Contract, and shall immediately cause any and all suppliers and subcontractors to do the same.
- (3) In the event of any cancellation the City shall not incur any liability to the Supplier apart from payment to the General Contractor, which the General Contractor shall pay over to the Supplier, of the reasonable costs directly incurred by the Supplier for Equipment, work or services that have been satisfactorily delivered or performed by the Supplier prior to the notice of cancellation. Such reasonable costs incurred shall be supported by audit, if necessary, carried out by auditors acceptable to the City, prior to payment of same. Neither the City nor General Contractor shall be liable to the Supplier for loss of anticipated profit on the cancelled portion or portions of the General Contract or the supply of the Deliverables. Neither the City nor General Contractor shall be liable to the Supplier for consequential, economic or indirect losses or damages arising as a result of such cancellation.
- (4) The Supplier shall not be paid for any Equipment supplied or services or work done after receipt of the notice of cancellation or for any costs incurred by the Supplier or its suppliers or subcontractors which such persons could reasonably have avoided or mitigated. The Supplier shall not unreasonably anticipate the requirements of a Purchase Order for the Equipment.

25. CHANGES IN THE WORK

The City may, without invalidating the Agreement or General Contract, direct the General Contractor to make changes to the work which may include changes to the supply of the Deliverables by the Supplier. When a change causes an increase or decrease in the Work related to the supply of the Deliverables, the Deliverables price shall be increased or decreased by the application of RFQ Response prices to the quantum of such increase or decrease, or in the absence of applicable RFQ Response prices, by an amount to be agreed upon between the City and the General Contractor and correspondingly between the General Contractor and the Supplier, under their respective contracts. All such changes shall be in writing. The General Contractor shall, without invalidating the Automatic Door Opener Supply Contract, have the right to make a corresponding change in the Automatic Door Opener Supply Contract.

26. NON-WAIVER

No condoning, excusing or overlooking by the General Contractor under the Automatic Door Opener Supply Contract, or the City under this Agreement, of any default, breach or non-observance by the Supplier at any time or times in respect of any provision herein contained shall operate as a waiver of the General Contractor's or the City's right, as the case may be, hereunder in respect of any continuing or subsequent default, breach or non-observance, or so as to defeat or affect in any way the rights of the General Contractor or City herein in respect of any such continuing or subsequent default or breach. No waiver shall be inferred from or implied by anything done or omitted by the General Contractor or the City, save only by express waiver in writing. The doing of anything by the General Contractor required by the Automatic Door Opener Supply Contract to be done by the Supplier shall not relieve the Supplier of its continuing obligation to do that thing. No delay or omission by the City in exercising any right or remedy shall operate as a waiver of them or of any other right or remedy, and no single or partial exercise of a right or remedy shall preclude any other or further exercise of them or the exercise of any other right or remedy.

27. SUCCESSORS AND ASSIGNS

- (1) All terms, covenants, conditions and provisions provided herein relating to the Automatic Door Opener Supply Contract shall be binding upon and shall enure to the benefit of the Supplier and their respective permitted assigns, successors and legal representatives.
- (2) The Supplier shall not assign, subcontract, transfer or encumber in any manner or part of the Automatic Door Opener Supply Contract or any interest therein without the prior written consent of the General Contractor, which consent shall not be unreasonably withheld. Any attempt to assign, transfer or encumber any of the duties or obligations of Supplier without such consent is void.
- (3) Any delay in the commencement of the supply of the Deliverables or in the performance of any related services or the Supplier's obligations under the Automatic Door Opener Supply Contract related to or arising from the General Contractor's consideration of the Supplier's request for an assignment, transfer or encumbrance in any manner or part of the Automatic Door Opener Supply Contract or any interest therein or a subcontractor change and the costs of same shall be solely borne by the Supplier.
- (4) No assignment or subcontracting by the Supplier shall, in any circumstances, relieve the Supplier from any responsibility for the full performance of all of its responsibilities and obligations and undertaking of its liabilities under the Automatic Door Opener Supply Contract and this Agreement. Notwithstanding the approval of any subcontractors by the General Contractor, the Supplier shall be fully responsible for every subcontractor's performance, activities, work, acts or omissions as if the Supplier were performing the subcontracted portion of the supply of the Deliverables with its own resources.
- (5) The General Contractor(s) shall be responsible to the City for the performance of all of its subcontractors, including the Supplier. The City shall require any and all such subcontractors to sign agreements with the General Contractor that bind the subcontractors to abide by the terms and conditions hereof. Upon the request of the City, the General Contractor shall furnish the City with copies of such agreements.

28. NON-EXCLUSIVE REMEDIES

The rights and remedies of the City provided in the Contract Documents shall not be exclusive and are in addition to any other rights and remedies provided by contract, law or in equity, including the right of specific performance and offset.

29. FURTHER ASSURANCES

The Supplier shall draw, execute and deliver at its own expense, all such instruments and documents, and do all such acts and things as the General Contractor or City may from time to time reasonably consider necessary or advisable for the purpose of carrying out the intent and provisions of the Contract Documents.

30. GOVERNING LAW

The Contract Documents shall be governed by, subject to and construed in accordance with the laws of the Province of Ontario and the laws of Canada, as applicable to the matters herein. Any action or other legal proceeding arising under or with respect to the Contract Documents (including any motion or other interlocutory proceeding) shall be brought in a Court or a tribunal, whichever may be applicable, sitting in Toronto, Ontario. The Supplier and the City each irrevocably submit to the exclusive jurisdiction of the courts of the Province of Ontario in accordance with the foregoing.

31. SEVERANCE WHERE PROVISION ILLEGAL, ETC.

If any provision or provisions of the Contract Documents or parts thereof or the application thereof to any person or circumstances shall be found is/are found to be invalid, unenforceable or void by any court or tribunal of competent jurisdiction, such provision or provisions or parts thereof shall be deemed severable and all other provision or provisions or parts of the Contract Documents shall be deemed to be separate and independent therefrom and continue in full force and effect unless and until similarly found void and/or unenforceable. The remaining terms and provisions of the Contract Documents and its application to any person or circumstances shall not be affected thereby, but this provision shall apply only insofar as the effect of that severance is not to change the fundamental nature of the obligations assumed respectively by each of the parties thereto.

32. ENTIRE AGREEMENT

This Agreement embodies and constitutes the sole and entire agreement between the parties hereto. There are no terms, obligations, covenants or conditions between the parties hereto, other than as contained herein. No alteration, amendment or modification hereof shall be valid unless executed by an instrument in writing by the parties. Neither this Agreement, nor any term hereof, can be changed, modified or abandoned, in whole or in part, except by such instrument in writing, and no subsequent oral agreement shall have any validity whatsoever.

33. COUNTERPART AND ELECTRONIC SIGNATURE

This Agreement may be executed in counterpart and may be executed by electronic signature that is received by the City in a file format acceptable to the City. Such electronic signature shall be deemed to be an original signature for the purpose of this Agreement with the same legal effect as an original signature.

[signatures on next page]

The parties hereto have executed this Agreement by the hands of their duly authorized representatives.

SIGNED AND DELIVERED
in the presence of:

CITY OF TORONTO

By:

Name: ●
Title: ●
I have authority to bind the
corporation

By:

Name: ●
Title: ●
I have authority to bind the
corporation

● **[Note to Finalization before Execution:
Insert Legal Name of Supplier]**

By:

Name: ●
Title: ●
I have authority to bind the
corporation

By:

Name: ●
Title: ●
I have authority to bind the
corporation

APPENDIX D3

ADO Pricing List

ADO Pricing List Supplier/Sub-Contractor: Assa Abloy

Item No.	Automatic Door Operators Package/Accessories	Quantity	Item Description	Model Number	Brand	Price
1	Automatic Door Operator Packages					-
1.1	Package #1A	1	Heavy Duty Model Operator	SW200-Single	BESAM	\$2,862.12
		2	4 ½" x 4 ½" Push Button – C/W Barrier free logo & "Push to Open"	CM45/4	CAMDEN	
		1	4 ½" x 4 ½" Surface Mount Box (Interior)	CM-43CBL	CAMDEN	
		1	4 ½" x 4 ½" Surface Mount Box Weatherized (Exterior)	CM-43CBL W/ WEATHER GASKET	CAMDEN	
		1	CX-33 Logic Relay	CX-33	CAMDEN	
		1	Latch Retraction Panic Bars TO BE PROVIDED BY HARDWARE SUPPLIER	UNKNOWN – BY OTHERS	UNKNOWN	
1.2	Package #1B	2	Heavy Duty Model Operator	SW200-Pair	BESAM	\$5,170.57
		2	4 ½" x 4 ½" Push Button – C/W Barrier free logo & "Push to Open"	CM45/4	CAMDEN	
		1	4 ½" x 4 ½" Surface Mount Box (Interior)	CM-43CBL	CAMDEN	
		1	4 ½" x 4 ½" Surface Mount Box Weatherized (Exterior)	CM-43CBL W/ WEATHER GASKET	CAMDEN	
		1	CX-33 Logic Relay	CX-33	CAMDEN	
		2	Latch Retraction Panic Bars TO BE PROVIDED BY HARDWARE SUPPLIER	UNKNOWN – BY OTHERS	UNKNOWN	
1.3	Package #1C	1	Heavy Duty Model Operator	SW200- Single on Active Leaf Only	BESAM	\$2,783.42
		2	4 ½" x 4 ½" Push Button – C/W Barrier free logo & "Push to Open"	CM45/4	CAMDEN	
		1	4 ½" x 4 ½" Surface Mount Box (Interior)	CM-43CBL	CAMDEN	
		1	4 ½" x 4 ½" Surface Mount Box Weatherized (Exterior)	CM-43CBL W/ WEATHER GASKET	CAMDEN	
		1	CX-33 Logic Relay	CX-33	CAMDEN	
		1	Latch Retraction Panic Bars TO BE PROVIDED BY HARDWARE SUPPLIER	UNKNOWN – BY OTHERS	UNKNOWN	
1.4	Package #2A	1	Heavy Duty Model Operator	SW200-Single	BESAM	\$2,793.30
		2	4 ½" x 4 ½" Push Button – C/W Barrier free logo & "Push to Open"	CM45/4	CAMDEN	
		1	4 ½" x 4 ½" Surface Mount Box (Interior)	CM-43CBL	CAMDEN	
		1	4 ½" x 4 ½" Surface Mount Box Weatherized (Exterior)	CM-43CBL W/ WEATHER GASKET	CAMDEN	
		1	Key Switch to turn off at night CM2210 x 7224	CM2210 x 7224	CAMDEN	
		1	Mortise Cylinder for Key Switch	CM-308*BASED ON BEST CYLINDER	CAMDEN	
1.5	Package #2B	2	Heavy Duty Model Operator	SW200-Pair	BESAM	\$4,840.31
		2	4 ½" x 4 ½" Push Button – C/W Barrier free logo & "Push to Open"	CM45/4	CAMDEN	
		1	4 ½" x 4 ½" Surface Mount Box (Interior)	CM-43CBL	CAMDEN	
		1	4 ½" x 4 ½" Surface Mount Box Weatherized (Exterior)	CM-43CBL W/ WEATHER GASKET	CAMDEN	
		1	Key Switch to turn off at night CM2210 x 7224	CM2210 x 7224	CAMDEN	
		1	Mortise Cylinder for Key Switch	CM-308*BASED ON BEST CYLINDER	CAMDEN	

1.6	Package #2C	1	Heavy Duty Model Operator	SW200-Single	BESAM	\$2,798.30
		2	4 1/2" x 4 1/2" Push Button – C/W Barrier free logo & "Push to Open"	CM45/4	CAMDEN	
		1	4 1/2" x 4 1/2" Surface Mount Box (Interior)	CM-43CBL	CAMDEN	
		1	4 1/2" x 4 1/2" Surface Mount Box Weatherized (Exterior)	CM-43CBL W/ WEATHER GASKET	CAMDEN	
		1	Key Switch to turn off at night CM2210 x 7224	CM2210 x 7224	CAMDEN	
		1	Mortise Cylinder for Key Switch	CM-308*BASED ON BEST CYLINDER	CAMDEN	
1.7	Package #3A	1	Standard Duty Model Operator	SW00-Single	BESAM	\$2,644.88
		2	4 1/2" x 4 1/2" Push Button – C/W Barrier free logo & "Push to Open"	CM45/4	CAMDEN	
		2	4 1/2" x 4 1/2" Surface Mount Box (Interior)	CM43CBL	CAMDEN	
		1	CX33 Logic Relay	CX-33	CAMDEN	
		1	Electric Strike TO BE PROVIDED BY HARDWARE SUPPLIER	UNKNOWN – BY OTHERS	UNKNOWN	
1.8	Package #3B	2	Standard Duty Model Operator	SW100-Pair	BESAM	\$4,510.17
		2	4 1/2" x 4 1/2" Push Button – C/W Barrier free logo & "Push to Open"	CM45/4	CAMDEN	
		2	4 1/2" x 4 1/2" Surface Mount Box (Interior)	CM43CBL	CAMDEN	
		1	CX33 Logic Relay	CX-33	CAMDEN	
		1	Electric Strike TO BE PROVIDED BY HARDWARE SUPPLIER	UNKNOWN – BY OTHERS	UNKNOWN	
1.9	Package #3C	2	Standard Duty Model Operator	SW100-PAIR	BESAM	\$4,159.08
		2	4 1/2" x 4 1/2" Push Button – C/W Barrier free logo & "Push to Open"	CM45/4	CAMDEN	
		2	4 1/2" x 4 1/2" Surface Mount Box (Interior)	CM43CBL	CAMDEN	
		1	CX-33 Logic Relay	CX-33	CAMDEN	
		2	Latch Retraction Panic Bars TO BE PROVIDED BY HARDWARE SUPPLIER	UNKNOWN – BY OTHERS	UNKNOWN	
1.10	Package #3D	1	Standard Duty Model Operator	SW100-Single on Active Leaf Only	BESAM	\$2,740.72
		2	4 1/2" x 4 1/2" Push Button – C/W Barrier free logo & "Push to Open"	CM45/4	CAMDEN	
		2	4 1/2" x 4 1/2" Surface Mount Box (Interior)	CM43CBL	CAMDEN	
		1	CX-33 Logic Relay	CX-33	CAMDEN	
		1	Latch Retraction Panic Bars TO BE PROVIDED BY HARDWARE SUPPLIER	UNKNOWN – BY OTHERS	UNKNOWN	
1.11	Package #4	1	Standard Duty Model Operator	SW100-Single	BESAM	\$2,068.89
		2	4 1/2" x 4 1/2" Push Button – C/W Barrier free logo & "Push to Open"	CM45/4	CAMDEN	
		2	4 1/2" x 4 1/2" Surface Mount Box (Interior)	CM43CBL	CAMDEN	
1.12	Package #5	1	Standard Duty Model Operator	SW100-Single	BESAM	\$3,768.11
		1	Push to Lock Kit – CX-WC13XSM	CX-WC13XSM	CAMDEN	
		1	Emergency Call Kit – CX-WEC10K2	CX-WEC10K2	CAMDEN	
		1	Electric Strike - TO BE PROVIDED BY HARDWARE SUPPLIER	UNKNOWN – PROVIDED BY OTHERS	UNKNOWN	
2	Accessory Items 1					
2.1	4 1/2" x 4 1/2" Wave Button	2	4 1/2" x 4 1/2" Wave Buttons with LED Indicator Stainless Steel Finish, with wave logo and "wave to open" – in lieu of standard buttons	CM-330/S/W	CAMDEN	\$450.00
2.2	4 1/2" x 4 1/2" Wireless Button Kit	2	4 1/2" x 4 1/2" Wireless Button Kit, includes transmitter & receiver, Stainless Steel Button with barrier free logo & "Push to Open" – in lieu of standard	CM-RFL454F-S-D	CAMDEN	\$300.00
2.3	6" Round Button	2	6" Round Button with surface mount box, stainless steel button with barrier free logo & "Push to Open" – in lieu of standard Buttons	CM60/4 & CM69/S	CAMDEN	\$ -
2.4	6" x 6" Square Button	2	6" x 6" Square Button with surface mount box, stainless steel button with barrier free logo & "Push to Open" – in lieu of standard Buttons	6x6-3-US32D & SURF SQ6	WIKK	\$650.00

3	Accessory Items 2					-
3.1	Motion Sensor	2	Motion sensor activation – example: BEA Eagle	Eagle	BEA	\$400.00
3.2	Safety Sensors Push and Pull Side	2	Safety Sensors Push and pull side (see specifications) – Example: Optex OA-Edge-2 with LED indicator.	OA EDGE-2	OPTEX	\$1,140.00
3.3	CX-33 Logic Relay	1	CX-33 Logic Relay	CX-33	CAMDEN	\$150.00
3.4	L021 Lock Out Relay	1	L021 lock out relay	LO21	BEA	\$75.00
3.5	Le21 Lock Out Relay	1	Le21 lock out relay	LE21	BEA	\$75.00
3.6	24V Transformer	1	24V Transformer	N/A – ONBOARD UNIT	BESAM	\$30.00

APPENDIX E

Plumbing and Accessories Order Form

Commercial Plumbing Order Form

Building Address

NEXT Contract No. for AODA Program: 47023213

NEXT RFQ No.: 2037214860

Lavatories

Type L1H (Barrier Free Use)

Item #	Product No.	Description	Qty
1.1	9024001EC.020	American Standard - DECORUM WALL-HUNG LAVA CHO WHT	
1.2	8559	Moen Align sensor faucet	
1.3	MC-155A	McGuire - 1-1/4" Open Grid Strainer	
1.4	MC-8872CB	McGuire - 1 1/4" Cast Body P-Trap	
1.5	H170LK-BV-RB	McGuire - Supply Kit	
1.6	CA411-CA481	Watts - Carrier	
1.7	LFE480-10	POWERS POINT OF USE UNDER COUNTER THERMOSTATIC MIXING VALVE	
1.8	MC-PW-2000	McGuire - PROWRAPRETROFITKITFORLAV-1-1/4"	
	182538	Moen AC conversion kit	
1.9	104630	Moen AC transformer	
Section Total			

Type L1

Item#	Product No.	Description	Qty
2.1	0475047.020	American Standard - AQUALYN C-TOP LAVA CHO WHT	
2.2	8559	Moen Align sensor faucet	
2.3	MC-155A	McGuire - 1-1/4" Open Grid Strainer	
2.4	MC-8872CB	McGuire - 1 1/4" Cast Body P-Trap	
2.5	H170LK-BVRB	McGuire - Supply Kit	
2.6	LFE480-10	POWERS POINT OF USE UNDER COUNTER THERMOSTATIC MIXING VALVE	
	182538	Moen AC conversion kit	
2.7	104630	Moen AC transformer	
Section Total			

Type L1R (Regular Use)

Item#	Product No.	Description	Qty
3.1	9024.001EC.020	American Standard - DECORUM WALL-HUNG LAVA CHO WHT	
3.2	8559	Moen Align sensor faucet	
3.3	MC-155A	McGuire - 1-1/4" Open Grid Strainer	
3.4	MC-8872CB	McGuire - 1 1/4" Cast Body P-Trap	
3.5	H170LK-BVRB	McGuire - Supply Kit	
3.6	LFE480-10	POWERS POINT OF USE UNDER COUNTER THERMOSTATIC MIXING VALVE	
	182538	Moen AC conversion kit	
3.7	104630	Moen AC transformer	
Section Total			

Type L2H

Item#	Product No.	Description	Qty
4.1	0475047.020	American Standard - AQUALYN C-TOP LAVA CHO WHT	
4.2	8559	Moen Align sensor faucet	
4.3	MC-155wc	McGuire - 1-1/4" Open Grid Strainer Offset	
4.4	MC-8872CB	McGuire - 1 1/4" Cast Body P-Trap	
4.5	H170LK-BVRB	McGuire - Supply Kit	
4.6	MC-PW2000wc	McGuire - PROWRAPRETROFITKITFORLAV - 1-1/4"	
4.7	LFE480-10	POWERS POINT OF USE UNDER COUNTER THERMOSTATIC MIXING VALVE	
	182538	Moen AC conversion kit	
4.8	104630	Moen AC transformer	
Section Total			

Commercial Plumbing Order Form

Building Address

NEXT Contract No. for AODA Program: 47023213

NEXT RFQ No.: 2037214860

Type L3H (Barrier Free Use)

Item#	Product No.	Description	Qty
5.1	9134.001EC/0059.0 20EC shroud	American Standard - DECORUM WALL-HUNG LAVA CHO WHT	
5.2	8559	Moen Align sensor faucet	
5.3	MC-155A	McGuire - 1-1/4" Open Grid Strainer	
5.4	MC-8872CB	McGuire - 1 1/4" Cast Body P-Trap	
5.5	H170LK-BVRB	McGuire - Supply Kit	
5.6	LFE480-10	POWERS POINT OF USE UNDER COUNTER THERMOSTATIC MIXING VALVE	
	182538	Moen AC conversion kit	
5.7	104630	Moen AC transformer	
Section Total			

Type L3R (Regular Use)

Item#	Product No.	Description	Qty
6.1	9134.001EC/0059.0 20EC shroud	American Standard - DECORUM WALL-HUNG LAVA CHO WHT	
6.2	8559	Moen Align sensor faucet	
6.3	MC-155A	McGuire - 1-1/4" Open Grid Strainer	
6.4	MC-8872CB	McGuire - 1 1/4" Cast Body P-Trap	
6.5	H170LK-BVRB	McGuire - Supply Kit	
6.6	LFE480-10	POWERS POINT OF USE UNDER COUNTER THERMOSTATIC MIXING VALVE	
	182538	Moen AC conversion kit	
6.7	104630	Moen AC transformer	
Section Total			

Urinals

Type U1H (Barrier Free Use)

Item#	Product No.	Description	Qty
7.1	6590001.020	American Standard - WASHBROOK UNIVERSAL URINAL, TS	
7.2	8315AC05	Moen Sensor operated urinal flush valve	
7.3	CA-321	Watts - Urinal Carrier	
7.4	WUCO	WATTS WALL ACCESS CLEANOUT OUTLET SIZE UP TO 2"	
7.5	104630	Moen AC transformer	
Section Total			

Water Closets

Type W1 - Flush Valve

Item#	Product No.	Description	Qty
8.1	3351101.020	American Standard - AFWALL MILLENNIUM FLOWISE EL WITH EC, TS	
8.2	8311AC12	Moen sensor operated WC flush valve	
8.3	500STSCC	Centoco - ELONGATED, OPEN front less cover, heavy duty, with stainless steel check hinge	
8.4	ISCA-101-L/R-M11	Watts - WC Single LH Carrier	
8.5	104630	Moen AC transformer	
Section Total			

Commercial Plumbing Order Form

Building Address

NEXT Contract No. for AODA Program: 47023213

NEXT RFQ No.: 2037214860

Type W1H (Barrier Free Use) - Flush Valve

Item#	Product No.	Description	Qty
9.1	3351101.020	American Standard - AFWALL MILLENNIUM FLOWISE EL WITH EC, TS	
9.2	8311AC12	Moen sensor operated WC flush valve	
9.3	500STSCC	Centoco - ELONGATED, OPEN front less cover, heavy duty, with stainless steel check hinge	
9.4	ISCA-101-L/R-M11	Watts - WC Single LH Carrier	
	CM-16104	Back rest. Stainless steel bar uses #4 gloss with flanges and covers, with antique white solid core plastic laminate panel back	
	104585	Moen 24" flush tube	
9.5	104630	Moen AC transformer	
Section Total			

Type W2 - Flush Valve

Item#	Product No.	Description	Qty
10.1	3451001.020	American Standard - MADERA EC15" UNIV BOWL TOP SPUD WHT	
10.2	8311AC12	Moen sensor operated WC flush valve	
10.3	500STSCC	Centoco - ELONGATED, OPEN front less cover, heavy duty, with stainless steel check hinge	
10.4	12X4SPONGEGASK	Next Supply - SPONGE RUBBER CLOSET GASKET 1/2X4	
10.5	CBNW	Next Supply - 5/16-18 X 21/4 BRASS CLOSET BOLTS C/W PAIR OF	
10.6	104630	Moen AC transformer	
Section Total			

Type W2H

Item#	Product No.	Description	Qty
11.1	3461001.020	American Standard - MADERA EC 16-1/2 UN BOWL TP SPD WHT	
11.2	8311AC12	Moen sensor operated WC flush valve	
11.3	500STSCC	Centoco - ELONGATED, OPEN front less cover, heavy duty, with stainless steel check hinge	
11.4	12X4SPONGEGASK	Next Supply - SPONGE RUBBER CLOSET GASKET 1/2X4	
11.5	CBNW	Next Supply - 5/16-18 X 21/4 BRASS CLOSET BOLTS C/W PAIR OF	
11.6	104630	Moen AC transformer	
	104585	Moen 24" flush tube	
11.7	CM-16104	Back rest. Stainless steel bar uses #4 gloss with flanges and covers, with antique white solid core plastic laminate panel back	
Section Total			

Type W3

Item#	Product No.	Description	Qty
12.1	3483001.020	American Standard - CADET RH PA UNIV BOWL WHT	
12.2	4142100.020	American Standard - PA TANK, 1.1 GPF WHITE	
12.3	820STS	Centoco - ELONGATED, OPEN front with cover extra, heavy duty, commercial, stainless steel hinge	
12.4	mc-h172lk-bv	McGuire supply kit	
12.5	12X4SPONGEGASK	Next Supply - SPONGE RUBBER CLOSET GASKET 1/2X4	
12.6	CBNW	Next Supply - 5/16-18 X 21/4 BRASS CLOSET BOLTS C/W PAIR OF	
Section Total			

Commercial Plumbing Order Form

Building Address

NEXT Contract No. for AODA Program: 47023213

NEXT RFQ No.: 2037214860

Type W3H - (Barrier Free Use) - Pressure Assist Tank

Item#	Product No.	Description	Qty
13.1	3483001.020	American Standard - CADET RH PA UNIV BOWL WHT	
13.2	4142100.020	American Standard - PA TANK, 1.1 GPF WHITE	
13.3	820STS	Centoco - ELONGATED, OPEN front with cover extra, heavy duty, commercial, stainless steel hinge	
13.4	mc-h172lk-bv	McGuire supply kit	
13.5	12X4SPONGEGASK	Next Supply - SPONGE RUBBER CLOSET GASKET 1/2X4	
13.6	CBNW	Next Supply - 5/16-18 X 21/4 BRASS CLOSET BOLTS C/W PAIR OF	
Section Total			

Drinking Fountain Coolers (DFC)

Item#	Product No.	Description	Qty
14.1	EZSDWSLK	Elkay - EZH20 Cooler L/REF KITSS	
14.2	CA-311	Watts - Carrier	
14.3	HST-11LK	McGuire - Supply	
14.4	MC-8872CB	McGuire - 1 1/4" Cast Body P-Trap	
Section Total			

Hand Dryer

Item#	Product No.	Description	Qty
15.1	DysoHU02N	Dyson Sprayed Nickle	
Section Total			

Washroom Accessories

Item#	Product No.	Description	Qty
16.1	5425000000	BRADLEY BX JUMBO ROLL DISPENSER	
16.2	6A00110000	BRADLEY BX-SOAP/SANITIZER DISPENSER- SENSOR WALL MOUNT SURF	
16.3	4781110000	BRADLEY BX-NAPKIN DISPOSAL	
16.4	781018300	BRADLEY BX-CHANNEL FRAME MIRROR 18X30 BRIGHT POLISHED FINISH	
16.5	8122001240	BRADLEY BX-GRAB BAR 1 1/2" ODX24 STRAIGHT CONC FLANGE PEENED	
16.6	8122057000	BRADLEY BX-GRAB BAR 1 1/2" ODX30X30 W/STANDOFF ON BEND CONC. PEENED	
16.7	8372107000	BRADLEY BX-SWING UP GRAB BAR 1 1/4"OD-30" LONG-SAFETY GRIP FINISH	
16.8	962110000	BRADLEY BX - BABY CHANGING STATION - SATIN STEEL - SURFACE MOUNT	
16.9	2442110000	BRADLEY BX- TOWEL DISPENSER - SURFACE 400 MULTI/300 C-FOLD	
17.1	901-000000	BRADLEY BX-SOAP DISH - CHROME-PLATED SS	
17.2	9569000000	BRADLEY BX-REVERSIBLE SHOWER SEAT - WHITE PHENOLIC - ADA COMPLIANT	
17.3	6A01110000	BRADLEY BX-FOAM SOAP/SANITIZER DISPENSER- SENSOR WALL MOUNT SURF	
Section Total			


APPENDIX F1

City of Toronto Public Health, COVID-19 Guidance
for Employers, Businesses & Organizations




COVID-19 Guidance: Employers, Businesses & Organizations

Last updated: June 14, 2022 at 9:26 a.m.

Employers may notify Toronto Public Health when they become aware of two or more cases within the workplace who test positive or have symptoms of COVID-19 within a 10-day period. **Preview the reporting tool**  (<https://www.toronto.ca/wp-content/uploads/2021/02/8dda-COVID-19-Workplace-Reporting-Tool-Preview.pdf>).

Report an Exposure 

(https://s.tphsurvey.chkmkt.com/workplace_reportingtool)

To help protect workers and the public, Toronto Public Health recommends that employers implement a COVID-19 vaccination policy. See information on **establishing a vaccination policy for your workplace** (<https://www.toronto.ca/home/covid-19/covid-19-reopening-recovery-rebuild/covid-19-reopening-guidelines-for-businesses-organizations/covid-19-guidance-employers-workplaces-businesses/covid-19-vaccine-information-for-employers/?accordion=establishing-a-vaccination-policy-for-your-workplace>) and **hosting an on-site vaccination clinic**  (<https://s.tphsurvey.chkmkt.com/?e=238408&h=CA0F12653284CD0&l=en>).

Download printable posters and information cards for your setting (<https://www.toronto.ca/home/covid-19/covid-19-how-you-can-help/covid-19-spread-the-word/>) and learn about **supports available for businesses** (<https://www.toronto.ca/home/covid-19/covid-19-economic-support-recovery-for-businesses/covid-19-support-by-sector-businesses/>).

Expand All

Collapse All

COVID-19 Guidance for Businesses & Organizations

As we learn to live with COVID-19, it is still important to reduce the spread of the virus as much as possible. Learn more **about COVID-19 and how it spreads** (<https://www.toronto.ca/home/covid-19/covid-19-reduce-virus-spread/?accordion=about-covid-19-how-it-spreads>).

The following information is meant to assist businesses and organizations in reducing the spread of COVID-19 among staff and patrons. It is not intended to provide comprehensive guidance regarding the operations of any specific business, organization, or sector. Every business and organization will be different and it is the responsibility of owners and operators to review their own policies, procedures, and site-specific operations, while ensuring that the appropriate infection prevention and control measures are implemented and maintained.

Owners and operators of businesses and organizations are responsible for being aware of, and operating in compliance with, all applicable legal requirements. This information is not intended to provide legal advice, nor does it replace legal advice.

Encourage COVID-19 Vaccination

- Implement a **workplace vaccination policy** (<https://www.toronto.ca/home/covid-19/covid-19-reopening-recovery-rebuild/covid-19-reopening-guidelines-for-businesses-organizations/covid-19-guidance-employers-workplaces-businesses/covid-19-vaccine-information-for-employers/>).
- Encourage staff, workers, contractors, volunteers and patrons age 5 and older to get vaccinated for COVID-19, including any booster dose(s) (e.g. post vaccine information (<https://www.toronto.ca/home/covid-19/covid-19-reopening-recovery-rebuild/covid-19-reopening-guidelines-for-businesses-organizations/covid-19-guidance-employers-workplaces-businesses/covid-19-vaccine-information-for-employers/>) in your organization).
- Vaccinations are safe and continue to protect against serious illness from COVID-19 and variants.

Resources



- **COVID-19 Vaccines** (<https://www.toronto.ca/home/covid-19/covid-19-protect-yourself-others/covid-19-vaccines/>)

- **COVID-19 vaccine resources** (<https://www.toronto.ca/home/covid-19/covid-19-vaccines/covid-19-vaccine-resources/>), available in multiple languages.

Maintain Heating, Ventilation & Air Conditioning (HVAC) Systems



- Well-maintained HVAC systems help to prevent the spread of COVID-19 by reducing virus particles in the air.

Resources



- **COVID-19: Transmission, Aerosols and Ventilation**  (<https://www.toronto.ca/wp-content/uploads/2020/10/8de9-COVID19-Transmission-Aerosols-Ventilation.pdf>)
- **Improve Ventilation in the Workplace During COVID-19 – Infographic**  (<https://www.toronto.ca/wp-content/uploads/2021/02/8c83-Improve-Ventilation-in-the-Workplace-During-COVID-19-infographic.pdf>)

Masks



- It is strongly recommended to wear a well-fitting, high quality mask, especially in crowded indoor settings with poor ventilation.
- Masking continues to be an important part of our community's response to the pandemic. Wearing a mask is an important layer of protection we can still use to protect ourselves and one another. Businesses and organizations can encourage masking, based on the setting and situation (e.g. by implementing their own masking policies or posting signs).
- Some people may choose to continue to wear a mask in certain settings or under certain circumstances. People who are at higher risk of getting seriously sick from COVID-19, such as seniors or people who are immunocompromised, may prefer to wear a mask for added personal protection.
- Provide a respectful space for those who continue to wear masks.
- Some people may still be required to wear masks in all public settings such as if they:
 - Are a recent close contact (<https://www.toronto.ca/home/covid-19/covid-19-what-you-should-do/covid-19-what-to-do-if-you-are-a-close-contact/>) of someone with COVID-19.
 - Have completed a 5-day self-isolation after having COVID-19 (<https://www.toronto.ca/home/covid-19/covid-19-what-you-should-do/covid-19-what-to-do-if-you-have-covid-19/>).
 - Develop symptoms while in a public setting.

- Have recently returned from international travel  (<https://travel.gc.ca/travel-covid/travel-restrictions/exemptions>) and are not fully vaccinated  (<https://travel.gc.ca/travel-covid/travel-restrictions/covid-vaccinated-travellers-entering-canada>), including children with a vaccinated adult, even if exempt from quarantine.
- Attending certain health care settings, including long-term care and retirement homes.

Resources

- COVID-19: Symptoms, Illness, Exposure & Testing (<https://www.toronto.ca/home/covid-19/covid-19-what-you-should-do/>)
- COVID-19: Face Masks & Respirators (<https://www.toronto.ca/home/covid-19/covid-19-reduce-virus-spread/?accordion=face-masks-respirators>)
- Face coverings and face masks  (<https://www.ontario.ca/page/face-coverings-and-face-masks>)
- The best mask is the one that fits well  (<https://www.toronto.ca/wp-content/uploads/2021/02/94f0-The-Best-Mask-that-Fits-Well.pdf>) infographic





Promote Hand Hygiene & Respiratory Etiquette

- Post Wash your Hands  (<https://www.toronto.ca/wp-content/uploads/2020/03/971a-COVID-19-WashYourHands.pdf>) and Cover your Cough  (<https://www.toronto.ca/wp-content/uploads/2020/03/97a9-COVID-19-CoverYourCough.pdf>), signs in high traffic areas.
- Provide liquid soap, paper towel, hand sanitizer (70-90% alcohol concentration), tissues, and waste receptacles throughout the facility.
- Glove use is not a substitute for proper hand hygiene.
 - If gloves are used, it is important to change as necessary (e.g. when changing tasks, when they become dirty).
 - Hands should be washed and/or sanitized between changes.
 - When gloves are removed, new gloves should be used each time.

Improve Cleaning & Disinfecting Practices

- Clean and disinfect frequently touched surfaces as is necessary to maintain a sanitary condition.


Resources

- **Cleaning and Disinfection for Public Settings**  (<https://www.publichealthontario.ca/-/media/documents/ncov/factsheet-covid-19-environmental-cleaning.pdf>)
- **Cleaning & Disinfecting During COVID-19 Checklist for Businesses & Organizations**  (<https://www.toronto.ca/wp-content/uploads/2021/01/8dae-Maintain-a-Clean-Workplace-during-COVID-19-Workplace-Checklist.pdf>)
- **Maintain a clean workplace during COVID-19 – Infographic**  (<https://www.toronto.ca/wp-content/uploads/2020/09/8d6a-Maintain-a-clean-workspace-during-covid-19.pdf>)
- **List of hard surface disinfectants for use against COVID-19**  (<https://www.canada.ca/en/health-canada/services/drugs-health-products/disinfectants/covid-19/list.html>)


Promote COVID-19 Screening

- Consider posting signs (<https://www.toronto.ca/home/covid-19/covid-19-spread-the-word/?accordion=screening-posters-questionnaires>) in visible locations for staff and patrons to screen themselves before entering the premises.
- Ask staff and patrons to stay home if they are sick.



Resources

- **Online**  (<https://covid-19.ontario.ca/screening/worker/>) worker screening tool

Encourage Physical Distancing Where Possible

- Consider ways to reduce crowding and congestion, especially in indoor areas with poor ventilation.
- Consider **plexiglass or other impermeable barriers**  (<https://ncceh.ca/documents/evidence-review/rapid-review-use-physical-barriers-non-clinical-settings-and-covid-19>), for high frequency, short duration interactions.
- Consider requiring appointments/reservations during peak times to minimize lines, prevent crowding and control flow.


Resources

- **Physical distancing poster**  (<https://www.toronto.ca/wp-content/uploads/2022/04/9512-COVID19-PhysicalDistancingApr224.pdf>)
- **Using physical barriers in workplaces – infographic**  (<https://www.toronto.ca/wp-content/uploads/2021/03/976c-Using-Physical-Barriers-in-Workplaces.pdf>)


Modify Service Delivery & Programming

- Consider alternative methods of service (e.g. virtual, telephone, delivery or pickup) for individuals at higher risk of getting seriously sick from COVID-19 or who are not able to be vaccinated.

Promote COVID-19 Safety in Vehicles (e.g., vehicle-for-hire, carpooling)



- Consider encouraging use of masks by drivers and passengers in vehicles.
- Masks may be required in certain settings such as public transit.
- Consider installing **plastic screens or plexiglass shields**  (<https://ncceh.ca/content/blog/physical-barriers-covid-19-infection-prevention-and-control-commercial-settings>) as a physical barrier between the driver and passenger in the back seat. Ensure that these barriers do not create any new safety hazards such as visual obstructions for the driver.
- Consider asking passengers to sit in the back seat to maintain physical distance.
- Consider improving fresh air circulation using the vehicle climate control system and opening windows. Avoid the recirculated air option.

Resources

- **Reduce COVID-19 Spread When Using Taxis, Ride-Shares or Carpooling infographic**  (<https://www.toronto.ca/wp-content/uploads/2021/02/95c9-Carpooling-To-Work-Banner.pdf>)

Support Staff on Safe COVID-19 Practices



- Educate staff on:
 - Personal protective equipment (PPE) that may be required including proper use of masks (<https://www.toronto.ca/home/covid-19/covid-19-protect-yourself-others/covid-19-reduce-virus-spread/?accordion=face-masks-respirators>).

- Hand hygiene (<https://www.toronto.ca/community-people/health-wellness-care/health-programs-advice/hand-hygiene/>), proper use of gloves and respiratory etiquette  (<https://www.toronto.ca/wp-content/uploads/2020/03/97a9-COVID-19-CoverYourCough.pdf>).
- Maintaining a clean workplace during COVID-19  (<https://www.toronto.ca/wp-content/uploads/2020/09/8d6a-Maintain-a-clean-workspace-during-covid-19.pdf>)
- Consider a flexible sick policy so staff do not come to work when they are ill.

Resources

- COVID-19: Symptoms, Illness, Exposure & Testing (<https://www.toronto.ca/home/covid-19/covid-19-what-you-should-do/>)
- Guidance for Employers on Managing COVID-19 in the Workplace (<https://www.toronto.ca/home/covid-19/covid-19-reopening-recovery-rebuild/covid-19-reopening-guidelines-for-businesses-organizations/covid-19-guidance-employers-workplaces-businesses/?accordion=managing-covid-19-in-the-workplace>)

Consider Rapid Antigen Testing

- Rapid antigen testing can be used for regular workplace screening of employees based on provincial eligibility.
- Rapid testing does not replace other public health measures such as vaccination and masking, even if a person tests negative.
- Rapid antigen tests can be used by employees if they have symptoms of COVID-19 to confirm an infection (one positive test) or confirm that they are not infected (2 tests 24 to 48 hours apart and symptoms are improving).
- Some businesses/organizations/facilities are eligible to receive free rapid antigen test kits. Visit the [Toronto Region Board of Trade](https://supportbusiness.bot.com/screening-kits/)  (<https://supportbusiness.bot.com/screening-kits/>) and [Province of Ontario](https://covid-19.ontario.ca/get-free-rapid-tests)  (<https://covid-19.ontario.ca/get-free-rapid-tests>) websites for more information.

Resources

- COVID-19 testing guidance (<https://www.toronto.ca/home/covid-19/covid-19-what-you-should-do/covid-19-assessment-centres/>)

Other Resources

- **Ontario Public Health Measures and Advice** [🔗](https://covid-19.ontario.ca/public-health-measures) (<https://covid-19.ontario.ca/public-health-measures>)
- **COVID-19 Guidance: Employers, Businesses & Organizations** (<https://www.toronto.ca/home/covid-19/covid-19-reopening-recovery-rebuild/covid-19-reopening-guidelines-for-businesses-organizations/covid-19-guidance-employers-workplaces-businesses/>)

COVID-19 Vaccine Information for Employers

See Toronto Public Health's **COVID-19 vaccine information for employers** (<https://www.toronto.ca/home/covid-19/covid-19-reopening-recovery-rebuild/covid-19-reopening-guidelines-for-businesses-organizations/covid-19-guidance-employers-workplaces-businesses/covid-19-vaccine-information-for-employers/>).

Managing COVID-19 in the Workplace

The aim and purpose of this guidance is to assist employers with information related to the Ontario Government's **reopening framework** [🔗](https://www.ontario.ca/laws/statute/20r17) (<https://www.ontario.ca/laws/statute/20r17>). Employers must ensure that the **Ontario Ministry of Labour, Training, and Skills Development** [🔗](https://www.ontario.ca/page/ministry-labour-training-skills-development) (<https://www.ontario.ca/page/ministry-labour-training-skills-development>) and/or other relevant government authorities (e.g. WSIB) have been notified in accordance with the *Occupational Health and Safety Act* [🔗](https://www.ontario.ca/laws/statute/90o01) (<https://www.ontario.ca/laws/statute/90o01>), and other applicable law. More information is available on the **Province of Ontario's website** [🔗](https://www.ontario.ca/page/covid-19-coronavirus-and-workplace-health-and-safety#section-3) (<https://www.ontario.ca/page/covid-19-coronavirus-and-workplace-health-and-safety#section-3>).

Employers may report cases of COVID-19 in the workplace to Toronto Public Health using the **COVID-19 Workplace Reporting Tool**, [🔗](https://s.tphsurvey.chkmkt.com/?e=264535&h=0828798FEC87B14&l=en) (<https://s.tphsurvey.chkmkt.com/?e=264535&h=0828798FEC87B14&l=en>) if two or more cases within your workplace have tested positive or had symptoms of COVID-19 within a 10 day period.

Workplace vs. employer

- The *workplace* refers to the physical place of work – not the *employer*. A workplace can be any land, premises, location or thing at, upon, in or near which a worker works.
- The *employer* refers to a person, company, or organization that employs people or has under its service a person engaged in work.
- For example, City Hall is a workplace, while the *City of Toronto* is an employer.
- If an employer becomes aware of two or more people who test positive for COVID-19 within a 10-day period, and those people have a connection to the same physical place of work, the employer may notify TPH.
- Large employers that have many workplaces may notify TPH when there are two or more cases in the same workplace setting (e.g. the same office).

Examples:

Joe's Auto Shop	Winnie's Green Grocer
<p>Employee Susanna tested positive for COVID-19 on January 2.</p> <p>Co-op student Preya tested positive for COVID-19 on January 9.</p> <p>✓ Two people tested positive within a 10-day period</p> <p>✓ Both Susanna and Preya work at the Leaside auto shop location</p> <p>Joe may notify TPH.</p>	<p>Ahmed works at 200 Warden Ave., and tested positive for COVID-19 on February 15.</p> <p>Ilana works at 96 Jane St., and tested positive for COVID-19 on February 28.</p> <p>✓ Two people tested positive within a 10-day period</p> <p>✗ Ahmed and Ilana work at different grocery locations</p> <p>Winnie does not need to notify TPH.</p>

Employer and Employee Responsibilities

- People may enter a workplace for a variety of reasons. They may be an employee, contracted worker, customer, visitor, etc.
- The employer may report to TPH if they are aware of two or more people – workers, customers and/or visitors – at their workplace who have tested positive for COVID-19 or have symptoms of COVID-19 within a 10-day period.
 - For example, if Gary tested positive for COVID-19 and was at the workplace while he was infectious, Gary must tell his employer because

other people at the workplace may be exposed. Employees must report to their employer any situation in the workplace that is likely to be harmful to the health or safety of others in the workplace. This includes one's potential exposure to COVID-19 that caused or may cause illness to another person.

- Promote COVID-19 screening and consider **posting signs** (<https://www.toronto.ca/home/covid-19/covid-19-spread-the-word/>) at all entrances of a business or organization for patrons and employees.
 - Staff may complete **COVID-19 worker and employee screening** <https://covid-19.ontario.ca/screening/worker/> before each shift.
- Staff must stay home and self-isolate if they have new or worsening symptoms of COVID-19 or they have travelled outside of Canada and they do not meet the **Federal Quarantine Exemption** <https://travel.gc.ca/travel-covid/travel-restrictions/exemptions>. For more information on federal requirements for all returning travellers, please see **Government of Canada** <https://travel.gc.ca/travel-covid/travel-restrictions/exemptions> website.
- Follow the current **provincial guidance** <https://covid-19.ontario.ca/exposed> for:
 - Staff who are COVID-19 positive
 - Staff who may have been exposed to someone with COVID-19
 - When it is safe for an employee to return to work
- Support the Employee with COVID-19:
 - Ensure you have policies that support employees who need to be absent from work due to illness or confirmed COVID-19 infection
 - Ensure that all employees are aware of the **income replacement and workplace-related benefits** (<https://www.toronto.ca/community-people/employment-social-support/covid-19-income-support/>) to which they are entitled
- Toronto Public Health does not recommend that employers require clearance testing or doctor's notes for return to work.

Infection prevention and control

- Toronto Public Health may conduct an investigation of workplace outbreaks in some circumstances.
- Employers must cooperate with infection prevention and control personnel from TPH, which may include:
 - allowing entry into the workplace premises for inspection; and


- implementing additional measures to reduce the spread of COVID-19 to other people.

Other Resources

- **Guidance for Employers on Preventing COVID-19 in the Workplace** (<https://www.toronto.ca/home/covid-19/covid-19-reopening-recovery-rebuild/covid-19-reopening-guidelines-for-businesses-organizations/covid-19-guidance-employers-workplaces-businesses/>)
- **COVID-19 Workplace Reporting Tool** [🔗](https://s.tphsurvey.chkmkt.com/workplace_reportingtool) (https://s.tphsurvey.chkmkt.com/workplace_reportingtool)
- **Toronto Public Health: COVID-19: Reopening Guidelines for Businesses & Community Organizations** (<https://www.toronto.ca/home/covid-19/covid-19-reopening-recovery-rebuild/covid-19-reopening-guidelines-for-businesses-organizations/>)
- **Province of Ontario: Guidance to Prevent COVID-19 in the Workplace** [🔗](https://www.ontario.ca/page/resources-prevent-covid-19-workplace) (<https://www.ontario.ca/page/resources-prevent-covid-19-workplace>)(for sector-specific guidance)
- **Government of Canada: COVID-19: Your Rights and Responsibilities as an Employee** [🔗](https://www.canada.ca/en/government/publicservice/covid-19/rights-responsibilities.html) (<https://www.canada.ca/en/government/publicservice/covid-19/rights-responsibilities.html>)
- **Government of Canada: Risk-informed decision-making guidelines for workplaces and businesses during the COVID-19 pandemic** [🔗](https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/guidance-documents/risk-informed-decision-making-workplaces-businesses-covid-19-pandemic.html) (<https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/guidance-documents/risk-informed-decision-making-workplaces-businesses-covid-19-pandemic.html>)
- **Canadian Centre for Occupational Health & Safety: COVID-19 Tip Sheets** [🔗](https://www.ccohs.ca/products/publications/covid19/) (<https://www.ccohs.ca/products/publications/covid19/>)




Download this information as a PDF. [📄](https://www.toronto.ca/wp-content/uploads/2020/10/8df2-Managing-COVID-19-in-the-Workplace.pdf) (<https://www.toronto.ca/wp-content/uploads/2020/10/8df2-Managing-COVID-19-in-the-Workplace.pdf>)

Information about COVID-19 Cases/Contacts at Your Setting Form





If Toronto Public Health begins an investigation with your setting, you will be asked to complete the “Information about COVID-19 cases/contacts at your setting” form  (<https://www.toronto.ca/wp-content/uploads/2022/04/8d62-Premise-Community-Setting-Line-List-V5.5.5.xlsx>) within 24 hours of the investigation beginning. Workplace and community setting representatives should complete this document providing the requested information for all COVID-19 cases and contacts at your setting. Please complete this document to the best of your ability. If you have any questions about this document and how to complete it, please contact your assigned Communicable Disease Investigator (CDI). Please submit the completed document to your assigned CDI.

Other Resources







Checklists

- Prevent the spread of COVID-19 Workplace Checklist  (<https://www.toronto.ca/wp-content/uploads/2021/01/9597-Prevent-the-Spread-of-COVID-19-Workplace-Checklist.pdf>)
- Maintain a clean workplace during COVID-19  (<https://www.toronto.ca/wp-content/uploads/2021/01/8dae-Maintain-a-Clean-Workplace-during-COVID-19-Workplace-Checklist.pdf>)
- What to do if an employee has COVID-19  (<https://www.toronto.ca/wp-content/uploads/2020/12/91ec-CovidWorkplaceChecklistF.pdf>)

Infographics & Posters

- Who is Close Contact at Work infographic  (<https://www.toronto.ca/wp-content/uploads/2020/10/8e69-Who-is-a-Close-Contact-at-Work-FNL-Banner.pdf>)
- Who is a Close Contact infographic  (<https://www.toronto.ca/wp-content/uploads/2020/11/986b-Who-is-a-Close-Contact-Banner-FNL.pdf>)
- Healthy Workplace Practices During COVID-19 infographic  (<https://www.toronto.ca/wp-content/uploads/2020/11/90de-Healthy-Workplace-Practices.pdf>)
- Maintain a Clean Workplace During COVID-19 infographic  (<https://www.toronto.ca/wp-content/uploads/2020/09/8d6a-Maintain-a->

[clean-workspace-during-covid-19.pdf](#))

- **Improve Ventilation in the Workplace During COVID-19 infographic**  (<https://www.toronto.ca/wp-content/uploads/2021/02/8c83-Improve-Ventilation-in-the-Workplace-During-COVID-19-infographic.pdf>)
- **Using Physical Barriers in Workplaces infographic**  (<https://www.toronto.ca/wp-content/uploads/2021/03/976c-Using-Physical-Barriers-in-Workplaces.pdf>)
- **Prevent the Spread of COVID-19 in Lunchrooms and Breakrooms infographic**  (<https://www.toronto.ca/wp-content/uploads/2021/04/8f1e-Lunchrooms-Breakrooms-COVID19.pdf>)
- **Toronto's Voluntary Isolation Centre infographic**  (<https://www.toronto.ca/wp-content/uploads/2020/12/946d-Torontos-Voluntary-Isolation-Centre-NOV-Banner-English.pdf>)
- **Toronto Voluntary Isolation Centre poster for workplaces**  (<https://www.toronto.ca/wp-content/uploads/2021/03/8ecf-TVIC-Poster-Workplaces.pdf>)
- **Reduce COVID-19 Spread When Using Taxis, Ride-Shares or Carpooling infographic**  (<https://www.toronto.ca/wp-content/uploads/2021/02/95c9-Carpooling-To-Work-Banner.pdf>)

Other Resources

- **COVID-19 Mental Health Resources** (<https://www.toronto.ca/home/covid-19/covid-19-protect-yourself-others/covid-19-mental-health-resources/>)

Contact Information

Province's toll-free line

Call if you have questions about the emergency orders.

Telephone: 1-888-444-3659

APPENDIX F2

Canadian Construction Association (CCA), COVID-
19 Standardized Protocols for All Canadian
Construction Sites



COVID-19 - Standardized Protocols for All Canadian Construction Sites

Version 7
April 19, 2021

For inquiries: Contact Mary Ghobrial
at mghobrial@cca-acc.com

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COVID-19 - STANDARDIZED PROTOCOLS FOR ALL CANADIAN CONSTRUCTION SITES

The Standardized Protocols for All Canadian Construction Sites outlines the best practices for construction sites in order to maintain the health and safety of all workers required to perform duties during the COVID-19 crisis. The protocols, which include prevention, detection and response measures, will minimize the impacts of the crisis and ensure business continuity in the construction industry. This is not a legal document. Some provinces and municipalities have implemented stricter measures than those found in this document, and contractors are responsible for compliance with the rules, regulations and practices required by the applicable authorities. At the end of this document, there are links to information from some of our partner associations and other industry stakeholders that are further tailored to province specific requirements.

The objectives of the Standardized Protocols are to:

- Prioritize the health and safety of workers and of their surrounding communities;
- Apply recommendations and best practices from federal, provincial, and municipal public health authorities to construction site procedures;
- Establish and maintain a common COVID-19 Pandemic Response Plan across construction sites; and
- Foster open communication amongst stakeholders and ensure a respectful work environment.

Standardized Protocols for All Canadian Construction Sites

Prevention measures

Communication and awareness

- Clear signage is posted at entry points on the construction site and outline the commitment of the contractor to maintain health and safety measures during the COVID-19 crisis, with relevant updates from appropriate jurisdictions' public health authorities and self-identification screening tools.
- Worksite policies as they relate to the COVID-19 crisis are communicated to workers and made available on site.
- All workers exercise the following recommended practices for reducing the risk of transmission as identified by the Public Health Agency of Canada (PHAC), Health Canada, and Centers for Disease Control and Prevention, as well as provincial authorities:
 - o Avoid touching eyes, nose and mouth with unwashed hands;
 - o When coughing or sneezing:
 - Cough or sneeze into a tissue or the bend of your arm, not your hand;
 - Dispose of any tissues you have used as soon as possible in a lined waste basket and wash your hands afterwards;
 - o Clean and disinfect frequently touched objects and surfaces, including all reusable personal protective equipment (PPE);



- o Do not share personal items or supplies such as phones, pens, notebooks, tools, PPE, etc.;
- o Use and remove PPE with care, being mindful of which surfaces may be contaminated. Individuals must clean their hands after handling any used PPE;
- o Avoid common physical greetings, such as handshakes;
- o Maintain a minimum physical distance of two metres from others; and
- o Wash hands often with soap and water for at least 20 seconds after using the washroom, before handling food, after blowing nose, coughing, or sneezing, and before smoking. If hands are not visibly soiled, and soap and water are unavailable, alcohol-based hand sanitizer can be used.

Use of face masks

- All individuals on the site have facial respirators on hand at all times. N95 respirator masks, or the commercial-grade equivalent, should be worn as a potential mitigant to catching and transmitting the virus, but are not to be treated as substitutes for proper handwashing, physical distancing, and other protective measures. Masks should not be worn where they put an individual at risk (e.g. when it may get caught in machinery), however, physical distancing should be practiced in the alternative, whenever possible. Individuals working around an unmasked person without a shielding barrier should wear PPE.
- Such face masks are worn whenever individuals are:
 - o Unable to maintain two-metre distancing;
 - o Moving between zones, work areas, or other facilities;
 - o Indoors; or
 - o In non-open air environments or other areas with limited airflow.
- Individuals wash or sanitize their hands before and after applying, removing, or otherwise touching their face mask.
- Single-use facial respirators are disposed after use.

Business-related travel

- Non-essential business travel is not authorized. Business travel is limited and on an exceptional basis only.
- All individuals returning from out of country must undergo a 14-day self-isolation period, as mandated by the federal government and outlined here: Mandatory quarantine or isolation – [Travel restrictions in Canada – Travel.gc.ca](#).
- As some provincial governments impose similar restrictions for inter-provincial travel, any such requirements for self-isolation must be obeyed as applicable.

Working remotely

- Where practical, all office employees supporting a project work remotely. Meetings are held through teleconferencing or videoconferencing.
- Some provincial governments have imposed mandatory remote-working for employees, except for work that cannot be done remotely. Any such provincial requirements must be obeyed as applicable.



Access and movement to/from construction site

- Wherever possible, workers travel to site using individual modes of transportation (e.g., personal vehicle or bicycle). Additional parking arrangements are made as required.
- Whenever possible, workers should travel alone in their vehicles in order to practice physical distancing. Alternatively, the number of individuals inside a vehicle should be limited, and the number of trips should be increased to allow for physical distancing.
- If physical distancing within a vehicle cannot be respected, workers are encouraged to wear PPE.
- Workers are encouraged to change out of work clothes before entering their vehicle at the end of their shift. Work clothes should be handled carefully and washed upon arriving home.
- Entering and exiting of the worksite is monitored and controlled to ensure that the minimum physical distancing is not broken when shifts begin and end. Shift start and end times are staggered in five-minute intervals to accommodate this if needed.
- All non-essential individuals are not permitted access to the site.

Monitoring the status of workers

- Detailed tracking of worker's status on-site and off-site are kept at all times (e.g. fit to work, sick, off-work for family caring duties, etc.). A list of all quarantined workers is updated daily, with their privacy maintained.
- Records are kept of which individuals work together and when.
- Provide information, instruction, and supervision to workers to protect their health and safety.

Construction site and site trailer cleaning protocols

- All offices and jobsites implement additional cleaning measures of common areas. All door handles, railings, ladders, switches, controls, eating surfaces, shared tools and equipment, taps, toilets, and personal workstation areas are wiped down at least twice a day with a disinfectant, such as disinfectant wipes. Individuals are responsible for cleaning and disinfecting their workstations.
- Additional sanitary measures are implemented on site: hand washing stations with a posted hand washing protocol, hand sanitizer stations, provision of disinfectant wiping products. These types of facilities are made available at site entries, exits, washrooms, eating areas, offices, and any other areas with commonly touched surfaces.
- Commonly touched surfaces on vehicles and equipment are thoroughly cleaned and disinfected at the end of shifts and between users.
- All cleaning and disinfecting is carried out per PHAC's recommendations here: [COVID-19: Cleaning and disinfecting - Canada.ca](#).
- Offices and jobsites are also encouraged to develop a Cleaning and Disinfecting Program, as per CCOHS's recommendations at: [CCOHS: COVID-19 Health and Safety Resources](#).

Limiting and removing internal touch point areas

- Limit access and use of shared devices like coffee machines, water fountains, microwave ovens, and similar; and wash hands after handling such items. Means to clean and disinfect such devices between uses is to be provided.



- Limit use of common pens for sign-in sheets to construction sites. Supervisors are encouraged to sign-in for workers, or have workers sign-in through SMS, email, or other electronic means..
- Washroom modifications - Install more sinks and sinks with physical separation between users where feasible. Change out taps, paper towel dispensers and garbage cans to hands-free models.
- Remove doors/door handles - Look at all reasonable opportunities to remove doors or replace handles with hands-free options, such as foot-pull devices.
- Where touch points like door handles and water coolers remain, paper towels are provided to allow users to avoid skin contact.
- Gloves are worn whenever possible while on the worksite, but are treated the same as bare hands in terms of minimizing unnecessary touching of anything on site and the user's face.

Compartmentalization

- The construction site is to be segregated to the extent possible in zones or other methods to keep different crews/trades physically separated at all times. This promotes physical distancing and supports the containment of propagation should it arise.
- Eating is restricted to clearly identified dedicated eating areas with handwashing stations, cleaning and disinfectant materials, and adequate space to maintain minimum physical distancing.
- Upper limits are put on the number of people allowed in each zone and in facilities like washrooms, trailers, and eating areas at once to allow for the recommended minimum physical distancing.
- One-way staircases are established wherever practical to minimize worker contact.
- Freight elevators are operated/occupied by only one individual at a time or where feasible, by respecting the minimum physical distancing guidelines.

Working in close proximity

- Alternate arrangements are made as necessary to ensure workers avoid breaking the minimum physical distance with others for prolonged periods. Where this is not possible due to task-specific safety risks, a risk assessment is done to identify controls to protect the health and safety of workers. This can include methods to minimize the duration or proximity of the task, use of physical controls (such as the use of clear plastic barriers), and wearing of PPE.
- A record is kept of all tasks requiring close-proximity work, including the task-specific safety risks that justify close-proximity and all the control measures implemented to protect workers from the risk of infection. The record should be reviewed regularly to determine if there are any additional safety measures that can be implemented for each task.
- Whenever possible, allow for increased ventilation, including but not limited to keeping windows and doors open as much as possible, using portable ventilation fans, and continuing ventilation and air exchange after regular work hours.

Site operation

- The number of in person meetings is minimized. If required, meetings should involve only necessary individuals and include six people or fewer. Minimum physical distancing is maintained, and meetings are held in open



spaces when possible. If needed, 'Toolbox Talks' and similar meetings/updates are held in multiple sessions to accommodate this.

- The worksite is rearranged to reduce high-traffic areas and allow for the minimum physical distancing. Travel paths on worksites should be designated to account for physical distancing requirements.
- Site teams are encouraged to put forward split/alternating shifts to avoid extensive intermingling. Voluntary shift offset and implementing time gaps between shifts are highly encouraged.
- Vehicles, equipment, and tools are assigned to a single individual, or, to the minimum number of operators needed for safe use.
- Where work is done in crews, the work is planned to minimize or eliminate the crossover of workers between crews.
- Project teams stagger break and lunch schedules to minimize the number of people in close proximity to one another. Enclosed lunchrooms are only made available during inclement weather.
- Work schedules are adjusted to provide time for proper cleaning and disinfecting as required.

Deliveries

- Delivery zones are clearly identified and limited to receivers and deliverers only.
- When possible, nothing is passed between the deliverer and the receiver (e.g. shipment documents and pens for signatures). Deliveries are unloaded solely by receivers using proper PPE, while deliverers remain in their vehicles.

Work in occupied spaces

- When working in spaces currently occupied (e.g. private residences), the minimum physical distancing with any occupants is strictly enforced. Where possible, workers and occupants are segregated in different rooms.
- Non-emergency work should not be done in any occupied spaces where an occupant is suspected to have contracted COVID-19 or is under self-isolation (per the directions of the applicable authorities). Emergency work can be carried out provided workers are equipped with nitrile gloves, Tyvek suits or coveralls, and facial/respiratory protection.
- Hands and tools are thoroughly cleaned before entering the workplace and after leaving, and any surfaces or equipment in the occupied space are disinfected before work is done on them.

Protocol auditing

- The jobsite's safety officer is responsible for ensuring appropriate health and safety measures have been implemented, and that directions of the appropriate health authorities are followed with respect to workers returning to work following a presumed or confirmed case of COVID-19.
- Contractors are to conduct periodic audits (frequency to be determined based on project scale and scope) to verify that the appropriate measures have been implemented and are maintained.
- Display signage to reinforce health and safety policies and control measures on worksites.

Other

- Any other measures deemed to increase the safety or limit the propagation of the virus.



Detection measures

Screening at entry of construction site

- Before entering the site, individuals must confirm that:
 - o They are not currently exhibiting flu-like symptoms such as fever, tiredness, coughing, or congestion;
 - o They have not returned from outside of Canada within the past 14 days;
 - o To the best of their knowledge, they have not been in contact with someone with a confirmed or probable case of COVID-19; and
 - o They have not been working on a site that was shut down due to the virus.
- Individuals who are at increased risk of serious illness (due to age, pregnancy or other medical condition) are not to be permitted on site.
- Any responses or results of any screening measures, whether they permit an individual on site or not, are to be kept private and treated as sensitive medical information.
- Workers who are not authorized to access the site are to be safely transported directly back home, or to a preferred location of self-isolation. When unable to do so themselves, a vehicle and driver will be arranged for them.
- When transporting a potentially ill individual, both driver and passenger are to be given masks and nitrile gloves. The passenger is to sit in the backseat, and the driver is to open and close the doors for them.

Response measures

Possible cases of COVID-19

- Individuals who have been potentially exposed to the virus, or who are exhibiting flu-like symptoms such as fever, tiredness, coughing, or congestion are instructed to:
 - o Not come to work;
 - o Contact their supervisor and/or human resources department;
 - o Stay at home and self-isolate; and
 - o Contact local health authorities for further direction.

Such individuals are required to follow the directions of the local health authority and may not return to work until given approval by the proper health authorities.
- Individuals who begin to display flu-like symptoms on site are instructed to avoid touching anything, take extra care to contain coughs and sneezes, and return home immediately to undergo self-isolation as directed by the local health authority.
- All areas on site potentially infected by a confirmed or probable case are barricaded to keep individuals two metres away until the area is properly cleaned and disinfected.



- Employers must inform other workers that they may have been exposed to COVID-19 in the workplace, including details regarding the date and time of the potential exposure and where it took place. However, information that might identify the infectious person should not be shared.

Response plans

- All contractors are to complete an integrated continuity plan to respond to partial or complete shutdown of construction sites or in the case of a severe limitation of site operations.

Other

- Refer to canada.ca/en/public-health/services/diseases/coronavirus-disease-covid-19.html for the latest information.

The situation related to COVID-19 is changing rapidly. This Protocol will be updated on an as required basis to reflect the latest broadly adopted measures.

For province specific guidance, please review the resources linked below. Questions on province-specific health and safety matters can be directed to the listed contacts.

British Columbia

British Columbia Construction Association

bccassn.com/media/Guidance%20to%20Construction%20Sites%20Operating%20During%20COVID19.pdf

BC Construction Safety Alliance

Mike McKenna, Executive Director

mmckenna@bccsa.ca

Tammy Oliver, Senior Director

toliver@bccsa.ca

Alberta

Alberta Construction Association

albertaconstruction.net/wp-content/uploads/2020/04/PANDEMIC-PLANNING-FOR-THE-CONSTRUCTION-INDUSTRY.pdf

Alberta Roadbuilders and Heavy Construction Association

279e5ecb-ae4a-4a97-bda5-1b2fe77f0894.filesusr.com/ugd/77f1bc_683524748e3c482aac8a8f59e5a86218.pdf?index=true

Alberta Construction Safety Association

Dan MacLennan, CEO

dmaclennan@youracsa.ca

Tammy Hawkins, COO

thawkins@youracsa.ca



Saskatchewan*Saskatchewan Construction Association*scaonline.ca/third-party-information-bulletins.html*Saskatchewan Construction Safety Association*Thomas Archer, VP of Operations thomasa@scsaonline.caCollin Pullar, President collinp@scsaonline.ca*Heavy Construction Safety Association of Saskatchewan*Al Goldstone, Safety Director alg@hcsas.sk.ca**Manitoba***Winnipeg Construction Association*togetherwebuild.ca/*Construction Safety Association of Manitoba*Sean Scott, Executive Director sean@constructionsafety.caDerek Pott, Director of Operations derek@constructionsafety.ca*Manitoba Heavy Construction Association*Don Hurst, Director don@mhca.mb.ca**Ontario**

ORBA / OGCA / RESCON / OSPE / OHBA

orba.org/wp-content/uploads/2020/03/ORBA-branded-COVID19-resource-and-best-management-practices-document-Final.pdf*Infrastructure Health & Safety Association*Enzo Garritano, President egarritano@ihsa.caPaul Casey, Vice President pcasey@ihsa.ca**Quebec***L'Association de la construction du Québec*acq.org/coronavirus/sante-securite-du-travail/

Commission des normes, de l'équité, de la santé et de la sécurité du travail

cnesst.gouv.qc.ca/salle-de-presse/covid-19/Pages/trousse.aspx?utm_source=CNESST&utm_medium=Carrousel-accueil&utm_campaign=Trousse_doutils*ASP Construction*Sylvie L'Heureux, Executive Director slheureux@asp-construction.org

New Brunswick

New Brunswick Construction Association

nbcsa.ca/wp-content/uploads/2020/04/Construction-Site-COVID-19-Prevention-Procedures.pdf

New Brunswick Construction Safety Association

Roy Silliker, CEO rsilliker@nbcsa.ca

Shelley Poirier, Senior Safety Advisor spoirier@nbcsa.ca

Nova Scotia

Construction Association of Nova Scotia

cans.ns.ca/covid-19-managing-covid-19-on-the-worksite/

Construction Safety Association of Nova Scotia

MJ MacDonald, CEO mmacdonald@constructionsafetyns.ca

Damon Alcock, Chief Safety Officer dalcock@constructionsafetyns.ca

Prince Edward Island

Construction Association of PEI

capei.ca/member_access/LiveEditor/images/Public%20Health%20Order%20-%20March%202020.pdf

Newfoundland and Labrador

Newfoundland and Labrador Construction Association

nlca.ca/critical-information-covid-19/

Newfoundland and Labrador Construction Safety Association

Jackie Manuel, CEO jmanuel@nlcsa.com

Yukon

Northern Safety Network Yukon

Sheila Sergy, Executive Director sheila@yukonsafety.com

Northwest Territories and Nunavut

Northern Construction Safety Association

Chris Johnston, Executive Director chris@nsa-nt.ca



APPENDIX G

City of Toronto Cabling Standards



STANDARDS AND PROCEDURES

Cabling Standard

Issued by:

IT

Network Services

Version 4.4 – Jul, 4, 2018

Revision History

Date of this revision	Author
May 13, 2002	Michael Dors
Sept. 23, 2003	Mark LaFleche
April 1, 2004	Mark LaFleche
Nov 4, 2004	Mark LaFleche
Oct 2, 2007	Mark LaFleche
Jan 28, 2009	Mark LaFleche
Jan 28, 2010	Mark LaFleche
Jul 4, 2018	David Gilkes

Revision Number	Revision Date	Summary of Changes	Changes marked
1.0	June 19, 2002	Old Format	N/A
2.0	May 13, 2002	Update doc and format	Format changed to standard
3.0	Sep 26, 2003	Update specification for corporate cabling standards and cabinets	
3.1	April 1, 2004	Added Voice exceptions at the introduction, update cabinet and electrical specifications.	
3.2	Nov 4, 2004	Added some room details and updated some cabinet details	
4.0	Oct 2, 2007	Add more details relating to process, cable installation and times lines and appendices.	
4.1	Jan 28, 2009	Changed some typos, added details regarding transition to new VOR.	
4.2	Jan 28, 2010	Added in section 3.0 Updated 1.2.1 to 1.2.6	
4.3	March 19 2014	Updating sections	
4.4	Jul 4, 2018	Added Section 1.2.18, 1.4.19. Updated 1.4.11 -1.4.17	

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Introduction

This document addresses the cabling design specifications of data cabling within the City of Toronto controlled buildings or leased spaces, where the network is controlled by IT-Network Services. This document should be considered a guideline, consideration for some of the content should be reviewed before placing this into a tender document, specifically extra costs and Bell standard pricing.

Though every attempt is made to cover unforeseen issues, every building and project has its own issues, therefore IT - Network services and Telecommunication services should be included right at beginning of the project and the communication specs must be reviewed and approved by these groups within the City of Toronto.

Cabling Agreement

Effective January 10, 2010 the City of Toronto has entered a multiyear Voice and Data cabling agreement with Bell Canada. Bell Canada is to be used for all Data and Voice cabling for all owned and leased City of Toronto buildings

A pricing table of services with this agreement with unit costing is available from IT with permission to authorized recipients.

When the agreement is replaced or renewed the, current cabling vendor of record (VOR) should be used. The cable VOR should be verified by IT network Services at time of proposed work or RFP.

When a new VOR is selected, some changes may occur to some of the site specific details, standard and non-standard work in this document.

Voice Cabling

As Part of the ITI agreement Unified Communications (UC) Devices are now deployed. Also known as VOIP. Where it is cost effective and proper planning and acceptance has been completed UC phones that plug into the data network will be utilized.

It is the responsibility of the voice applications group, (telecommunication) to direct if the location will be Centrex or UC. If the location is Centrex or undetermined, then cat3 cable should be installed to every phone location as well as 1 data.

The typical user workstation is for one Data jack Cat5e or Cat 6 that will support the phone plugged into the jack and the user's computer plugged into the phone. Any other special requirements must be identified by the client.

For Analog Devices such as Fax's, POS (Dialup), modems and other specialized monitoring lines, are considered to be using Centrex, but is prudent to also supply a data cat5e/6 cable for future use and conversion.

The voice cabling system for Centrex will be supplied and installed by Bell as part of an agreement between Bell and the City of Toronto. Bell will have ownership of the voice cabling system. The system will be based on Category 3 wiring and will be provided in accordance with

Bell's specifications. There is no cost to the contractor from Bell for this service. The cost will occur when the line is energized with service

All cables and related terminations, support and grounding hardware shall be furnished, installed, wired, tested, labeled, and documented by the Telecommunications contractor as detailed in this document.

Also review business requirements with both Voice Infrastructure Group and network groups to ensure the appropriate technology is used in the locations.

Please contact IT-Telecommunications Services, voice infrastructure group for more details.

Commercial Building Wiring Standard

In Canada this is the CSA T529-95 standard "Telecommunications Cabling Systems in Commercial Buildings", which adopts the American ANSI/TIA/EIA-568-A standard "Commercial Building Telecommunications Cabling Standard". This standard covers the following:

- Horizontal cabling
- Backbone cabling
- Telecommunications Closets
- Equipment rooms
- Entrance facilities
- Cable standards

Other cabling system standards and recognized telecommunications industry standards. Are incorporated for reference:

- ANSI/TIA/EIA-568-B.1 and its addendum
- ANSI/TIA/EIA-568-B.2 and its addendum
- ANSI/TIA/EIA-568-B.3 and its addendum
- ANSI/TIA/EIA-568-B.2-1 (category 6 addenda)
- ANSI/TIA/EIA-569-A and its addendum
- ANSI/TIA/EIA-606-A
- ANSI/TIA/EIA-J-STD-607
- ANSI/ICEA S-90-661
- ANSI/ICEA S-80-576
- ANSI/ICEA S-83-596
- ANSI/ICEA S-83-640
- ANSI/EIA/TIA-492AAAA
- ANSI/TIA/EIA-472CAAA
- ANSI/TIA/EIA-472DAAA
- ANSI/TIA/EIA-598
- ANSI/TIA/EIA-455
- ANSI/TIA/EIA-604
- ISO/IEC 11801 2nd edition
- CENELEC EN50173
- IEC 603-7

Commercial Building Standard for Telecommunications Pathways and Spaces

This is the American ANSI/EIA/TIA-569 standard that specifies the architectural requirements that support and enable the Commercial Building Wiring Standard.

Intelligent Building Distribution Network

Originally developed by Nortel, but now owned by Belden, the IBDN standard is a commercial implementation of the ANSI/CSA cabling specifications.

1.0 Building Area Network

1.1 Cabling Standards

These standards address specifications that comply with the conventions established by CCITT, IEEE, ISO, BICSI or other organizations with responsibilities for setting international standards. The City of Toronto has, where possible, selected international standards for the implementation of CITYNET. Building cabling must conform to the Intelligent Building Distribution Network (IBDN) standard which is, in turn, compliant with the Electronics Industry Association / Telecommunications Industry Association (EIA/TIA) Commercial Building Wiring Standard. The IBDN standard specifies the configuration of the cable distribution and termination within the building from the outlet in each office to the exit point from the building to the external carrier system.

- 1.1.1 Where fiber is being used within buildings to support 10baseFL 100BaseFX or Gigabit Ethernet and/or any other LAN technology,
 - a. Always determine with IT Network Services Fiber and type as part of the design. But the guidelines below can followed.
 - b. In existing buildings new fiber should be OM3 unless otherwise specified. All terminated in Patch panel with LC terminations. Patch cables are determined by what network equipment will terminate on the fiber.
 - c. In new buildings where installing new fiber, OM3 multimode fiber cable will be used with LC terminations on the fiber patch panels. OM4 Considered in computer room type applications or core locations.
 - d. Where there is a mixture of old and new terminations, the cable connectors and patch panels should be replaced with current standard at the time of major reconstruction.
 - e. Relocation of the fiber termination point, must include updating connectors and fiber patch panels.
 - f. Where a pathway is open or harsh environment armored cable should be used or conduit installed.
- 1.1.2 Unshielded Twisted Pair used between the workstations and the Hub Room or for vertical Hub Room to Hub Room service must be 4 pair unshielded twisted pair enclosed in Plenum rated jacket with a minimum of EIA/TIA Category 5E performance with RJ45 terminations. If there is category 6 existing in the renovated space, then the location must use the same rating or higher rating and must be the same series of cable i.e. Belden/CDT 2400 series or 4800 Series.
 - a. The UTP-based cabling system shall have minimum a 160 MHz Channel Bandwidth over a maximum distance of 100m (328 ft.) and a positive channel Power Sum Attenuation-to-Crosstalk Ratio (PSACR) at 160 MHz.
 - b. The UTP-based cabling system shall use matched components from a single manufacturer, and the cabling system shall be certified to deliver system

performance over the lifetime of the applications for which the cabling system was originally designed to support.

- c. All components used in the UTP-based cabling system shall be warranted for a period of 25 years from date of installation against defects in materials and/or workmanship.
- d. The UTP-based cabling system shall comply with the following standards:
Minimum Enhanced Category 5 – ANSI/TIA/EIA-568-B.1
Class D ISO/IEC 11801 2nd edition
Class D - CENELEC EN50173
- e. The UTP-based cabling system shall be capable of supporting the following applications:
Gigabit Ethernet (1000BASE-T)
Power over Ethernet (POE) 802.3af standard minimum
Fast Ethernet (100BASE-TX, 100BASE-T4)
Voice

IBDN System 1200 Parameters (cat 5e)

Parameters	Frequency	Standards*	IBDN Performance
PSNEXT	100 MHz	27.1 dB	32.7 dB
	155 MHz		29.6 dB
	160 MHz		29.4 dB
Attenuation	100 MHz	24.0 dB	22.3 dB
	155 MHz		28.6 dB
	160 MHz		29.1 dB
PSACR	100 MHz	3.1 dB	10.4 dB
	155 MHz		1.0 dB
	160 MHz		0.3 dB**
PSELFEXT	100 MHz	14.4 dB	20.0 dB
	155 MHz		16.2 dB
	160 MHz		15.9 dB
Return Loss	100 MHz	10.0 dB	12.0 dB
	155 MHz		10.1 dB
	160 MHz		10.0 dB
Propagation Delay		555 ns	490 ns
Delay Skew		50 ns	25 ns
Available Bandwidth		100 MHz	160 MHz

Worst case scenario for four-connector topology

*Based on ANSI/TIA/EIA-568-B.1 (May 2002)
ISO/IEC 11801 2nd edition (September 2002)

** Positive PSACR @ 160 MHz

- 1.1.3 In large campus environments such as civic centers and Metro Hall, connections from hub room to hub room or vertical riser's connection should use fiber, unless otherwise stated by IT – Network Services.
- 1.1.4 100BaseTX and 1000baseT switches are used in each hub room or communications room. Cat5E / Cat6 patch cables are used to connect the switches to the building cabling system between the hub room and the servers / end user workstations. At the server/workstation, the appropriate Network Interface Cards (NICs) are incorporated in the workstations.
- 1.1.5 Servers in the main computer room will be connected to Cat6 patch panels within the cabinet. Cat6 cables will be run from these patch panels to patch panels specified by IT – Network Services Group or Gigabix Frame.

- a. Any new server cabling put should be located on a directly installed patch panel within the cabinet of the server.
 - b. New Cabling infrastructure for computer room environment or where GigE is required Cat 6 utilizing 4800LX series Belden cable should be considered mandatory, decision should be decided with direction from IT-network services.
- 1.1.6 Workstations in office areas will be connected to Cat5E/Cat6 wall jacks or to Cat5E/Cat6 jacks incorporated into modular furniture.
 - a. If the location is new, or a fully renovated floor or location Cat6 cable should be used
- 1.1.7 Data Jacks are to be identified with a separate colour, by default black for voice, white or blue for data, unless a different scheme is used at the location, or aesthetic reasons the jack is in furniture and is limited available colours. Any differences should be approved by IT - Network Services,
- 1.1.8 Every effort should be used to support the Belden IBDN product line, this will keep the parts standardized and are readily available to the current cabling supplier used by the City of Toronto. Any changes should be a provided by IT -Network Services. Also a proper end to end solution for Cat5e / Cat6 will be certified by one vendor using all the same components from one vendor.

1.2 Cabling Standards (COT – Information Technology (IT))

Corporate standards address the design aspects of CITYNET that comply with industry practices but may be unique to the corporation. These specifications deal with the current environment and the variety of methods used to accommodate the varied computing platforms of the corporation.

There are a variety of methods used to cable LAN's and terminal equipment. The City has adopted the following corporate standards that address the methods for the implementation of cabling to serve a variety of equipment:

- 1.2.1 A central hub room for each Civic location for the city of Toronto shall be established. This must be located within the City of Toronto space and should be monitored by Corporate security. Access arrangements through Corporate Security for IT must be available 7x24. If any location through this central hub room is monitored by security or any department use is required beyond normal business hours.
- 1.2.2 A main secure hub room will be established on each floor, this must be located in the City of Toronto Space, all voice and data cabling should terminate here. **This is important for UC environment and -911 Enhanced service.** For Small locations, the equipment will generate some heat and noise. The main hub room should not be in an office where people are occupying.
- 1.2.3 Where the floor area is extensive, multiple hub rooms will be created
- 1.2.4 All hub rooms to house voice connections, network patch panels, Network equipment, terminal servers and all other network termination equipment. All units will be rack mounted. Rack mounted shelves can be used for equipment that does not provide rack mounts. (For Rack details please see section 1.3.0 Cabinet / Rack Standards) See Appendix A for examples of configurations.

- 1.2.5 All hub rooms should connect back to the central hub room via a **direct** back bone fibre and/or Copper multi pair riser cable. If security requirements are required, then all backbone cabling shall be placed in conduit. No Daisy chaining fiber cables from floor to floor.
- 1.2.6 The room should be located in an area that is not obtrusive to staff and sufficient room to house the shelf or rack.
- 1.2.7 Hub rooms are for Voice/network and communications and related computer equipment only and should **not** be used for storage space. Especially chemicals for cleaning etc.
- 1.2.8 Floors should not be carpeted; a sealed concrete or vinyl floor is acceptable, anti-static flooring is preferred.
- 1.2.9 There must be sufficient room in the hub room to allow access around all the racks installed in the room. 10 Feet by 10feet minimum in room containing only one rack
- 1.2.10 Sufficient cooling / ventilation should be provided into the hub room for the expected equipment to be installed and also have room for adequate growth.
- 1.2.11 Water Valves or water dripping hazards etc. should not be above equipment.
- 1.2.12 Enough electrical should be installed to service the rack(s) power strip(s) as well as additional equipment required by the client (local servers – not sanctioned by Network services, expected to follow IT server standards)
- 1.2.13 Plywood for any other communications should be fire rated or painted with fire retardant paint.
- 1.2.14 If systems, terminals, printers, etc. require special cable an exception from standard must be requested before installation.
- 1.2.15 The unshielded twisted pair will be terminated on RJ45 Cat5e/Cat6 patch panels. The four pair cables will be terminated (ISDN format) on the patch panels, all excess will be trimmed and cables will be tied back appropriately. Cables will then be labeled on the cable at the connection point on the back of the patch panel and on the front of the patch panel above each port.
- 1.2.16 Patch cables running from the patch panel to the network equipment will adhere to the same UTP standard as above and will be labeled before installation.
- 1.2.17 Patch panel ports will be labeled following the corporate standard see section 1.4.0 Cabling Procedures (COT-IT)
- 1.2.18 All Hub room doors within Civic Centers or City owned Buildings should include an access card reader which will be controlled by City of Toronto Corp Security Division.

1.3 Cabinet / Rack Standards (COT-IT)

This standard specifies installation of racks and cabinets in the various buildings throughout the city. Each location has its uniqueness therefore local knowledge should be part of the design process for the layout of the cabinet and/or rack. Also larger locations or locations with a proper raised floor computer room environment have different standards than most other buildings. Most wiring locations, racks are adequate, but some locations, such raised floors areas and proper

computer rooms should contain cabinets.

- 1.3.1 All racks and cabinet Z-rails, must have threaded holes for 10/32 screws, no punch rails with separate bolt inserts.
- 1.3.2 All racks should have a 2 vertical cable managers at least 5" Wide and the height of the rack and should be attached to each side of the rack, the manger should be metal and have a hinged cover. If only one side can be attached or where two racks a placed in a row a 9" wide cable manger should be used.
- 1.3.3 All racks should be mounted securely to the floor.
- 1.3.4 Each rack should have a power strip (12 pos) attached to the side of the rack, with a minimum of a 15 foot cord attached to the strip, terminated with standard 125V 15A blade connector or Twist lock, this should be verified with IT – Network Services. If the cabinet is going on a raised floor. The power bar should have a twist lock on the end of the cable with the appropriate rated connector.
- 1.3.5 For some small wiring closets where there is no room for a rack or growth is not expected to be more than 24 ports, a wall mount 19" frame (11 RU) can be used in place of a rack. The frame should have a 2 RU metal hinged horizontal cable manager installed under the patch panel and room for at minimum 2RU switch and one shelf to hold non-rack mountable equipment and a 19" rack mountable 6 pos power bar. This rack should be installed at 48 – 60 inches above the floor so that it is accessible without a use of a ladder. IT staff are not certified via health and safety to be on ladders.
- 1.3.6 A duplex 125V 15A electrical outlet on an independent circuit should be installed within 10 feet of the rack, so that the power cord from the power strip will not cross any open areas. For the wall mounted racks the duplex outlet should be installed in the cabinet. For computer rooms in a raised floor environment a twist lock connector should be provided under the raised floor for the cabinet. Ensure the rating matches the power bar/strip. Within the city, currently there 15A 125V twist locks and 20A 125V twist Locks on cabinets. All power for cabinets and equipment should be verified in computer room environments with IT - Network Services.
- 1.3.7 If emergency power is available at the location then power for network equipment should be on the emergency power.
- 1.3.8 UPS requirements are based on the client's requirements. Not IT Network Services. Unless specified.
- 1.3.9 When a cabinet is used, the cabinet type and style should be specified by IT - Network Services, each location is different.
- 1.3.10 In general for cabinets the should be 30" wide cabinets with 19" Z rails front and back to allow for 19" rack mounted equipment. But should be confirmed depending on the location.
- 1.3.11 For cabinets, vertical cable managers should be used at the front corners, for every 48 patch ports a 2 RU horizontal cable manager should be used. All cable managers should be metal with hinged doors.
- 1.3.12 In the cabinets a 19" front mounted shelf should be installed in every cabinet.
- 1.3.13 For cabinets the patch panel layouts and locations must be approved by IT - Network Services.

- 1.3.14 For cabinets electrical requirements are specific to the location and equipment within the cabinets and should be specified by IT - Network Services.

1.4 Cabling Procedures (COT-IT)

These procedures will provide a common implementation method for all LAN installations and the appropriate relativity to the Cable/Configuration management system.

In an effort to have common cabling practices across CITYNET the following procedures have been developed to detail exact cable placement and installation procedures:

- 1.4.1 Cables will be labeled using the corporate standard. For horizontal data cables use Dxxxxyy. Where xxx is the building floor number and yyy is the cable number on that floor. For example cable 17 on floor 12 would be D012017. Where there is more than one Hub Room on a floor a direction indicator will be used (i.e. N, E, W, and S). For example, the first cable on the 3rd floor terminated in the north Hub Room will be labeled D03N001. If an existing cabling scheme exists, that is different, continue to follow the existing cabling scheme or contact IT -Network Services for clarification. Computer room wiring labeling should always be confirmed with IT - Network Services. Be aware of older exiting cabling and wire scheme so that numbering is not overlapped. If this occurs and is difficult to continue, then wiring can continue from next hundred higher , for example if the wires end at D021162 then continue d021200
- 1.4.2 The patch panel's ports will be labeled with the above standard numbering system.
- 1.4.3 For non- standard office devices on utilizing IP and cat5/6 cabling, patch panels should be grouped for services separately and identified jacks such as IP security cameras or intercom systems etc. Enough room should be allocated for expansion and layout of all patch panels included regular office jacks should be documented in a design and approved by IT - network services.
- 1.4.4 All cables should be terminated on the patch Panel then Patch cables will be utilized to connect into the switch, unless a Gigabix IDC type solution is used, Then Pigtailed from the switch to the IDC Block is acceptable.
- 1.4.5 Cables from the office terminated on the patch panel should be attached to the outside rear of the cable manager, not run inside the cable manager.
- 1.4.6 Any vertical backbone copper cables will be labeled aaa-bbb where aaa is the destination floor and bbb is a consecutive number within the group running to a given floor. For example, if you are looking at the patch panel on the 12th floor, the first vertical cable running to the 11th floor will be labeled 11-1 the second 11-2, the first cable running to the 13th floor will be labeled 13-1 and so on.
- 1.4.7 When there are more than 24 cables on the floor, additional patch panels will be added and manufacture's port numbering will begin again at 1 and continue consecutively. City standard labeling of these ports will continue consecutively from the panel above. For example port 4 on the second patch panel will have a cable number of D12028 and on the third patch panel port 3 will be cable number D12051. Always use the Dxxxxyy designation when referring to a port, or contact COR I&T – Network Services for clarification

- 1.4.8 Patch cables will be labeled numbering from 1 to 999 within a single hub room. Straight through cables will have grey jacket colour.
- 1.4.9 Patch cables must be plugged to the patch panel port within the relative numbering system above. For example cable 9 in port 9 of the first patch panel, cable 34 in port 10 of the second patch panel, cable 55 in port 7 of the third patch panel etc.
- 1.4.10 Patch cables will be run through vertical and horizontal cable trays where available. Otherwise patch cables will be gathered in groups of 12 at the patch panel and tie wrapped, pulling the cables horizontally across the panel to clear the view of port numbers. Cables 1 through 12 will be gathered, tied and pulled to the left, then tie wrapped again to the rack. Cables 25 through 36 will be gathered, tied and pulled to the right then tie wrapped again to the rack.
- 1.4.11 Patch cables that are run vertically between patch panels and Network equipment, without cable management trays, will be grouped as above and tie wrapped periodically along the outside of the rack, neatly with sufficient tension to form a straight line of cable down the side of the rack.
- 1.4.12 Clusters of switches will be connected to a master switch. The master switch will be connected to the backbone network.
- 1.4.13 When daisy chaining is required, use the first port(s) of the master switch to connect to the other switches. Be sure to set the MDI/MDIX switch to MDI or use a cross over cable. Cross over cables will have orange or red jacket colour or proprietary stack cable can be used.
- 1.4.14 Complete all connectivity cabling of routers, connections between groups of Network equipment/switches, etc. before beginning the user equipment cabling.
- 1.4.15 All cables will be connected to the switches in order. For example patch cable 1 in the first available user port of first switch followed by cable 2 and so on.
- 1.4.16 Where cable mgt. trays are not used, cables will run down both sides of the cabinet or relay rack and Network equipment will be mounted directly below the patch panels. All cables must be connected to the Network equipment in order working from the left plugging the cables running down the left side of the rack ending at the middle of the Network equipment. Cables running down the right side of the rack will begin in the center port and plug across to the right of the concentrator. This process will be repeated on consecutive concentrators until all connections are completed.
- 1.4.17 All cables at the switches must be pulled and tied to provide a clear view of the port numbers on the switches.
- 1.4.18 Patch cable lengths,
- 1.4.19 For wall mount racks used in small site 2ft patch cord should be used.
- 1.4.20 For standard 2 post racks default should be 7ft. but should be verified with IT-network services staff assigned to project.
- 1.4.21 Other configuration should be designed as part of the project.
- 1.4.22 Cable tray should be utilized within all hub rooms when possible or required, Basket type cable tray should be used along with waterfalls.

2.1 Installation Procedures and Prerequisites.

Data cabling requests and services should be issued from an authorized person within the client department (preferred Telecom Coordinator or IT staff) or the project leader from Facilities and real estate, with the cost centre and site contact or alternative contact and/or numbers.

For Bell services for network connectivity to new locations, the call should be initiated from an authorized person from the client department to the IT Service desk.

This section for planning, please ensure that information is review before placing in a tender document.

2.2 Internal cabling.

- 2.2.1 The cable vendor (Currently Bell Canada under communications Tender ITI Agreement) should be a good standing member in BICSI. The product managers should be accredited RCDD, the technicians installing the cable should have training credits pertaining the product they are installing.
- 2.2.2 Current base costs of the cabling are for different types of buildings. Bell must follow the standard city pricing where applicable. This is based that all pathways are in place. For example Zone Conduit from the hub room and box and conduit on the wall from the ceiling space. Ceiling height is nominal 10ft.
- 2.2.3 Extra costs per tech/hr could be incurred for work not covered under the contract. All time and material work details have to be reviewed by network services, approval request from the account holder (i.e. department supervisor or telecom coordinator).
- 2.2.4 Extra high ceilings must be taken into special considerations for workplace safety reason, extra equipment such as sky lifts must be brought for the cable to be installed properly and provide a safe work area for the contractors. All this will cost will be funded from the department requesting the work.
- 2.2.5 Pathways **must be provided for the cable contractor** unless request for cable contractor to install /create the pathways. Extra charges will apply for this work. All conduits must have proper bend radius for type of cable used in the conduit, special consideration for fiber. Pull boxes should be placed after two 90 degree bends. No LB joints to be used. Pathways should be designed for installation of network cable standards.
- 2.2.6 For open areas, where there are no conduits, Cable tray should be utilized to allow installation of the cable and pathway back to the hub room.
- 2.2.7 Any Conduits from wall boxes, must extend up to the ceiling and flow into a cable tray.
- 2.2.8 Extensive pathways floor ducts should have pull strings and old cabling should be removed. Access points and pull boxes should accessible to ease in the installation, should not covered up with carpet and/or furniture. This will incur extra costs.
- 2.2.9 For general work on buildings the following practices must be used, or verified with the building supervisor.

All wiring to be installed in conduit 90 degrees to building grid fastened to the upper slab.

No free run wiring greater than 10' (should the free run be in a space deemed a plenum, the wiring shall be appropriately fire rated FT6).

All wiring made obsolete/ non-functional shall be removed as part of the installation process.

Cable tray systems can be used if appropriately sized & fire rated cabling is used, these are not preferred since they can eventually overflow and become unmanageable.

J-hooks can be used under the direction of the building supervisor and installation of the system recommended of the manufacturer and approved by IT-network services. Cable Tray is preferred.

- 2.2.10 Attachment to existing sprinklers, or duct work is not permitted.
- 2.2.11 Loop extra slack should be built in for relocation or re-termination of the cable.
- 2.2.12 Major renovations cabling should be brought up to current standard, it is easier to remove all the old cable and pull in new cable. Rerouting large quantities of existing cables and installing around existing cable can cause damage to the existing cable. Some locations are still at category/level 3 or level 4 communications cable.
- 2.2.13 Old cables that do not meet current standard and are removed should be removed back to the patch panel.
- 2.2.14 New cables should be terminated on patch panels, that are current cat 5e/Cat6 standard and match the current IBDN system in place (currently Belden IBDN)
- 2.2.15 System furniture where the data jack is integrated, if the jack cannot be placed in securely and reliably than a surface mount jack should be used secured on the surface in the furniture. The contractor is expected to replace this, if this identified as deficiency. Also is should also be confirmed the requirements with designer what is preferred.
- 2.2.16 Installation for Wall Jacks
 - a. If system furniture is being placed, then jacks are to be wired into the system furniture, walls jacks must not be covered up.
 - b. Any special requirements for the systems furniture jacks should be identified by the manufacturer/Furniture re back to the cable contractor.
 - c. For wall mount jacks the height of Voice/Data Jacks should be placed for accessible standards, such that a person in a wheel chair can access the phones. Must be verified by the client and/or Public Health or accessibility standards
 - d. All wall plates should have a covered plate with the Jack installed, if a UC phone is to be placed on this jack then a secure wall mount bracket with Key lock must be placed around this jack. Likewise for any other specialized device such as intercoms and wall clocks etc. Should also be identified any special mounting during the design and marked on the drawings.
- 2.2.17 Installation of Jacks for specialized devices
 - a. Wireless Access points Jacks should be install so that they can be moved in both directions to adjust the wireless access point

- b. Wireless access point should be mounted on the T-Bar ceiling with approved hardware. If not T-Bar then approved method must be agreed with IT Network Services.
- c. Other Devices, such as time clocks security cameras must be identified on any drawings and mounting must be agreed and to the manufacturers standards and department standards (i.e. Corporate Security or Toronto Water etc.)

2.3 External Cabling for Bell Services

- 2.3.1 For current data services via ITI/Bell Canada allow Minimum 45 to 85 business days for installation. Determine by presales check. Any escalation will result in extra fees
- 2.3.2 The move in date should be planned for 1 week after the Bell due date to ensure any issues with installation are accounted for.
- 2.3.3 All pathways from the street line must be provided by the City of Toronto (Department requesting the work) or General Contractor associated with the project with adequate space for the cabling required for the services and growth. Follows the same requirements as internal cable. If this is not provided extra fees could be charged.
- 2.3.4 For services required far from the main DMARC of the building extra charges may apply. This cannot be determined until after the order is placed and Bell performs site visits from the BND (Building Network Design) and access networks groups.
- 2.3.5 In order for data service to be on time and reduce billing charges due to an early installation. The custom must provide a date they want the activation of the service to happen. Otherwise the order will be placed and bell will provide due date. Please allow minimum times.
- 2.3.6 Under certain circumstances where a delay will be longer than anticipated, the install can be placed on hold, but will require at least 2 to 3 weeks to continue and reschedule the installation.
- 2.3.7 Any moves of an existing service within the building may be subject to a moving charge.
- 2.3.8 Any relocation of services from outside the build, charges may apply.
- 2.3.9 For extended runs of cable inside a building any outdoor cable that is not fire rated must be placed in conduit of fire rated inner duct.
- 2.3.10 Bell owns the cable to the DMARC point and must be Bell Canada owned fibre pulled in by their contractor (separate from local Voice and Data Contractor) Usually done by Expertech, Aecon and internal Cable Ready etc, but arranged by Bell Access networks. **Warning: These contractors attend unannounced before the due date. They may require clean dust free environment to complete fiber splicing reliably. Therefore trades may have to work somewhere else. The impact of not allowing them when they show up is that the installation of the service will more than likely be delay.**

2.4 External Cabling - Private Cable and Property

- 2.4.1 Cabling between buildings on City of Toronto property where there are no issues with right of way crossing of streets etc. This is private cable that the City of Toronto owns and will and the department that requests will be responsible for all installations and future repair costs not associated with warranty on materials or workmanship. There are no guaranteed service levels for repair of this cable and is best effort.
- 2.4.2 All pathways must be defined, either Conduit underground, trenching or above ground on along a series of poles.
- 2.4.3 Similar rules for pathways for section 2.2 and 2.1 apply, Pathways can be supplied by outside source which is preferred, otherwise cable installers will have additional costs and subject to review by IT network services against the cabling agreement.
- 2.4.4 Safety devices utilized for environmental protections such as lightening should be used.
- 2.4.5 Tracing wire must be placed for cables installed in the ground.
- 2.4.6 For aerial cable ensure the height is adequate for any vehicles traveling below the cable.

3.0 Working with GC/Landlords and Clarification of Projects and Timelines.

3.1 Summary.

- 3.1.1 City current standard is cat 5e based on Belden 1200 series cable and former CDT/NORDX IBDN standards
- 3.1.2 Current the cabling Vendor of record is to be used for Voice and Data cabling and associated racks, contact to be provided by IT Voice or Data group.
- 3.1.3 All pathways are to be provided for communication services and voice and data cabling.
 - a. These are considered construction expect to be completed, by Facilities or the landlord, or the department. The cabling vendor of record can do these as requested, but this should follow standard purchasing policies, since conduit work and electrical work is not included in the ITI agreement.
- 3.1.4 For orders as part of tenders/landlord agreements, a scope of work/requirements (SOW) must to be stated clearly to the cabling vendor, this should include in the front any cabling specification, and/or indicated clearly in the drawings the expectations from the cabling vendor. A sign-off of the SOW between the GC/Landlord and cabling vendor of record must be included in the response package.
- 3.1.5 For service installations, voice or data, the department is responsible for this cost, the order must be placed through COT- Information technology (IT) processes and procedures.

Clarification and permissions can be exempted, but must be approved at supervisor level in IT. Cabling infrastructure for these services required to be installed in parallel with the construction, since the cabling is a service, the installation is the responsibility of the vendor, but all pathways as per the service provider specification must be provided by COT, GC/Landlord contracted to do this.

- 3.1.6 Service orders, especially for data services can be a lengthy process, since outside infrastructure may require building. For typical office buildings where there are tenants, a minimum of 8 weeks is required and should be sufficient, where the locations are new city property or city leased property in obscure areas, longer timelines may be required for the fibre build. This can only be determined at the time of order.
- 3.1.7 GC/Landlords must allow access for service providers and COT- IT Staff during the construction phase to implement the service for time of completion as requested by the department. A local contact/Supervisor cell phone and email must be provided. City IT staff and the service provider are expected to follow health and safety requirements and direction from the GC/Landlord during the construction.

3.2 Project related scheduling.

- 3.2.1 A GANTT chart or time line must be provided and update accordingly, This must be provided and reviewed by IT Voice and Data groups to ensure the site is prepared for the service provider implementation and IT change management processed to interface to the new location.
- 3.2.2 Certain milestones are required for the service provider to implement service on time as required by the client and/or COT (i.e. security). This includes the communications racks and associated power.
- 3.2.3 Site meetings, the IT Voice and Data rep should receive minutes of the site meetings and be allowed to attend when required pertaining any issues to IT communication requirements. All communication for changes and issues should be communicated through the COT project manager assigned to this project through Facilities Management.

Appendix A

Examples of rack configurations

Small Locations with HDSL



Currently the HDSL was not moved over from other location. This is the High Park supervisor's house. Issue here, rack was larger than expected by the client, so it should have been placed in the basement out of the way. That is why the closet now has doors. Rack is 11U Rack. There is about 12 connections in Total.



The HDSL circuit installed in this rack at the Fire Hall, 280 Burnhamthorpe. This is a little smaller than above. Only issue Patch cords should have been smaller, 2ft to hide in the cable manager. Almost 22 Connections. This room has enough space for a 2-post rack if required.

Larger sites

Typically Fibre locations, where there is more than 1 switch or multiple buildings connecting into the main building.

Below is new location Public Health 44 Victoria, with a 2 post rack, to vertical cable managers and 12 port power strip. Total 3 switches, Issues with this is the room, it was nice size but the air conditioning unit took up more space than anticipated. Therefore only room for growth is the one rack. This floor is at maximum capacity. The rack can be passed to maintain the AC unit.

