Tender	September 5, 2025
ISSUED FOR	**DATE**

PROJECT MANUAL

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

		Tender	September 5, 2025
Issued For	Date	Issued For	Date

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DIVISION 00 — PROCUREMENT AND CONTRACTING REQUIREMENTS

INTRODUCTORY INFORMATION
00 01 01- Project Tracking Page
00 01 07 - Professional Seals Page
00 01 10 - Table of Contents
00 01 15 - List of Drawing Packages

DIVISION 01 — GENERAL REQUIREMENTS
01 10 00 - General Requirements
01 11 00 - Summary of Work
01 11 01 - Construction Schedule
01 18 11 - Commissioning General Requirements
01 33 00 - Submittal Procedures
01 33 00A - Standard Submittal Form
01 35 44 - Environmental Protection
01 41 13 - Pre-Start Health and Safety Review Requirements
01 62 00 - Equivalents and Substitutions
01 62 01 - Substitution Request Form
01 66 15 - Material Equipment and Workmanship
01 74 19 - Construction Waste Management
01 74 19A - City of Toronto - A Guide to Waste Audits and Waste Management
01 74 19B - City of Toronto - Completed Waste Audit Form Sample
01 74 19C - Completed Waste Audit Form Sample
01 74 19D- Completed Waste Reduction Work Plan Sample

DIVISION 02 — EXISTING CONDITIONS
02 41 19 - Selective Structure Demolition
02 82 00 - ACM and LCM Abatement Specification
02 82 00.01- City of Toronto Asbestos Management Policy
02 82 00.02 – City of Toronto Asbestos Management Plan

DIVISION 03 — CONCRETE
03 11 00 - Concrete Forming
03 20 00 - Concrete Reinforcing
03 30 00 - Cast-In-Place Concrete

DIVISION 04 — MASONRY
04 22 00 - Unit Masonry

DIVISION 05 — METALS
05 20 00 - Metal Joists
05 30 00 - Metal Decking
05 50 00 - Metal Fabrications

DIVISION 06 — WOOD, PLASTICS, AND COMPOSITES
06 10 00 - Rough Carpentry
06 20 00 - Finish Carpentry
06 41 00 - Custom Cabinets

DIVISION 07 — THERMAL AND MOISTURE PROTECTION
07 13 00 - Waterproofing
07 21 00 - Thermal Insulation
07 21 29 - Sprayed Insulation
07 27 00 - Sheet Air Vapour Barriers
07 53 23 - EPDM Roofing-Fully Adhered
07 81 50 - Intumescent Fireproofing
07 84 00 - Firestopping and Smoke Seals

07 92 00 - Joint Sealants

DIVISION 08 — OPENINGS
08 11 13 - Hollow Metal Doors and Frames
08 14 10 - Wood Doors
08 31 00 - Access Doors and Panels
08 34 56 - Security Fence and Gate
08 40 00 - Aluminum Entrances and Windows
08 41 23 - Fire Rated Glass and Framing Systems
08 71 00 - Finish Hardware
08 71 00.1 - Hardware Schedule - 160 Rivalda Rd
08 71 05 - Installation of Doors and Finish Hardware
Automatic Door Operators (ADO)- Refer to Appendix C1-C3
08 80 00 - Glazing
08 87 00 - Glazing Surface Films

DIVISION 09 — FINISHES
09 29 00 - Gypsum Board
09 30 00 - Tiling
09 51 00 - Acoustical Ceilings
09 60 10 - General Requirements for Floor Finishes
09 61 13 - Tactile Attention Indicators
09 65 13 - Resilient Base and Accessories
09 68 00 - Carpet Tiles
09 91 00 - Painting

DIVISION 10 — SPECIALTIES
10 14 00 - Interior Signage
10 14 00.01 - City of Toronto Construction-Improvement Signs
10 14 37 - Exterior Signage
10 28 13 - Washroom and Shower Accessories
10 51 13 - Metal Lockers
10 91 00 - Miscellaneous Specialties

DIVISION 11 — EQUIPMENT
11 12 33 - Parking Gates

DIVISION 12 — FURNISHINGS
12 36 00 - Countertops
12 57 00 - Furniture

DIVISION 14 — CONVEYING EQUIPMENT
Elevators - Refer to Appendix B1 to B3

DIVISION 22 — PLUMBING
22 05 00 - Common Works for Plumbing
22 11 00 - Facility Water Distribution
22 11 23 - Potable Water Pumps
22 13 00 - Facility Sanitary Sewerage
22 13 29 - Sanitary Sewerage Pumps
22 14 00 - Facility Storm Drainage
22 33 00 - Electric Water Heaters - Potable Water
22 34 00 - Fuel Fired Domestic Water Heaters
22 42 00 - Commercial Plumbing Fixtures
22 45 00 - Emergency Plumbing Fixtures

DIVISION 23 — HEATING VENTILATING AND AIR CONDITIONING
23 05 01 - Basic Mechanical Requirements
23 05 13 - Motors and Wiring for Mechanical

23 05 19 - Meters
23 05 23 - Pipes, Fittings and Valves
- Piping Standards as listed in Section
23 05 24 - Piping Specialties
23 05 29 - Pipe Hangers and Supports
23 05 48 - Noise and Vibration Control
23 05 49 - Seismic Restraint
23 05 53 - Mechanical Identification
23 07 13 - Duct Insulation
23 07 19 - Piping Insulation
23 08 16 - Testing, Adjusting and Balancing
23 08 23 - Mechanical Commissioning
23 08 33 - Project Close-Out
23 21 13 - Hydronic Piping
23 21 23 - Hydronic Pumps
23 31 00 - HVAC Ducts and Casings
23 33 00 - HVAC Duct Accessories
23 34 00 - HVAC Fans
23 36 00 - Air Terminal Units
23 37 13 - Diffusers, Registers and Grilles
23 74 13 - Packaged Rooftop Air Conditioning Units
23 81 00 - Decentralized Unitary HVAC Equipment
23 82 40 - Electric Heaters
23 83 00 - Radiant Heating Units
23 84 00 - Humidity Control Equipment

DIVISION 25 — INTEGRATED AUTOMATION
25 05 00 - Building Automation System

DIVISION 26 — ELECTRICAL
26 05 01 - Common Work Results for Electrical
26 05 02 - Electrical Basic Materials and Methods
26 05 04 - Existing Building - Modifications
26 05 54 - Electrical Identification for Electrical Systems
26 08 06 - Field Testing and Commissioning Low Voltage
26 20 02 - Service and Distribution Equipment
26 50 00 - Lighting
- Lighting Schedule
26 50 05 - Digital Network Lighting Controls
- Lighting Control Sequence

DIVISION 27 — COMMUNICATIONS
27 05 00 - Common Work Results for Communications
27 05 53 - Identification for Communications
27 08 00 - Commissioning and Testing for Communications
27 10 00 - Communications Structured Cabling
27 20 00 - Data Communications
27 30 00 - Voice Communications
27 51 23 - Intercommunications and Program Systems

DIVISION 28 — ELECTRONIC SAFETY AND SECURITY
28 01 00 - City of Toronto Corporate Security Requirements
28 01 01 - City of Toronto Non-Disclosure Declaration Form
28 01 02 - CCURE 9000 Programming Standard
28 02 00 – City of Toronto Structured Cabling Standard
28 31 00 - Fire Detection and Alarm Systems

DIVISION 31 — EARTHWORK
31 10 00 - Site Preparation

DIVISION 32 — EXTERIOR IMPROVEMENTS
32 12 16 - Asphalt Paving
32 16 13 - Concrete Curbs and Sidewalks
32 17 23.23 - Pavement Markings
32 92 23 - Sodding

APPENDICES
Appendix A1 – DSS Report, issued April 20, 2022 by Fisher Environmental Ltd.
Appendix B1 - Part 3 of City RFQ for Elevators
Appendix B2 - Part 2 of City RFQ for Elevators
Appendix B3 - Elevator Pricing List
Appendix C1 - Part 3 of City RFQ for ADO's
Appendix C2 - Part 2 of City RFQ for ADO's
Appendix C3 - ADO Pricing List
Appendix D - Plumbing and Accessories Order Form
Appendix E- Environmental Soil Quality Investigation Report, prepared October 24, 2024, by GHD Limited.

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 Package

122260-TAU-21-86-160RVLDA-A-Tender

122260-TAU-21-86-160RVLDA-S-Tender

122260-TAU-21-86-160RVLDA-M-Tender

122260-TAU-21-86-160RVLDA-E-Tender

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INDEX

No.	Article
GR1	General
GR2	Environmental Protection
GR3	Project Coordination
GR4	Cutting and Patching
GR5	Field Engineering
GR6	Project Meetings
GR7	Submittals
GR8	Schedules
GR9	Quality Control
GR10	Temporary Construction Facilities and Controls
GR11	Fire and Life Safety
GR12	Material and Equipment
GR13	Systems Demonstrations
GR14	Contract Closeout

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.

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 The buildings included in the scope of work will require security services during construction.

.2 The Owner has existing contracts with Logix security companies. The Contractor is required to coordinate and engage with a security company as directed and specified by the Owner.

.1 Security company contact information will be provided as needed.

.2 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.

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.

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.

.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.

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 for required staging.

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 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.

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 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.

.11 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.

.12 Refinish surfaces to match adjacent finishes; for continuous surfaces refinish to nearest intersection; for an assembly, refinish entire unit.

.13 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.

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 Contactor 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:

.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 **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.

7.3 **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 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 .

.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 specified or directed. Restore all areas to conditions at start of Contract to the satisfaction of the Contract Administrator.

10.4 **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 exists 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. 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

10.5 **DUST TIGHT SCREENS**

.1 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.

10.6 **ACCESS AND CONSTRUCTION PARKING**

.1 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 ad provided prior to commencement of construction.

10.7 **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.

10.8 **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.

10.9 **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.

10.10 **WATER SUPPLY**

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

10.11 **TEMPORARY POWER AND LIGHTING**

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

10.12 **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.

10.13 **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.

10.14 **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.

10.15 **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 The Contractor shall conform to safe Work practices in accordance with regulations and authorities having jurisdiction.

.2 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.

.3 The Contractor shall provide at the Site, equipment to supply first aid service.

.4 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.

.5 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.

.6 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".

.7 The Contractor shall ensure that all personnel are adequately equipped to comply with safety regulations and that sufficient safety equipment is available.

.8 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 Contactor 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

City of Toronto

Method of Procedure (MOP) Template

Detailed Technical Method of Procedure
Isolation of Switchboard EB

Tile:	Isolation of Switchboard EB	**Activity Date:**	
Version:	2	**Estimated Duration:**	4:30
Project:		**Start Time:**	7:30
Site Address:		**End Time:**	11:30
Revision Date:		**Required Tech 1:**	
		Required Tech 2:	

Approved by:

Technical Details Approval by:	☐ -	☐ -	☐ COT - FM	☐ COT - Site Operations				
Impact/Schedule Approval by:	☐ T.P.S	☐ TPS - COMM	☐ PARAMEDICS	☐ COT - transportation	☐ COT - OEM	☐ COT – I & T	☐ COT – Security	☐ 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.

SAMPLE

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 emgergency 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)

SAMPLE

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				

SAMPLE

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		-	-		-	

SAMPLE

	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 torqueing and meggering of new feeders	15 min	10:27	10:42		-	-		-	
Step Sign Off (Initial):								-			
Contingency Plan/Comments:											

SAMPLE

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:											

SAMPLE

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											

SAMPLE

City of Toronto

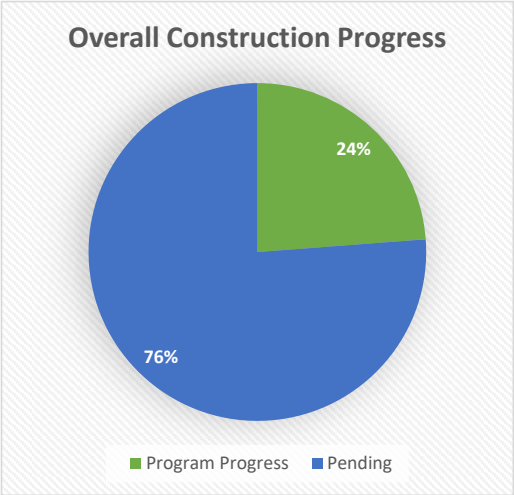
Construction Dashboard Template

GROUP XX

MONTH DAY, YEAR

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



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

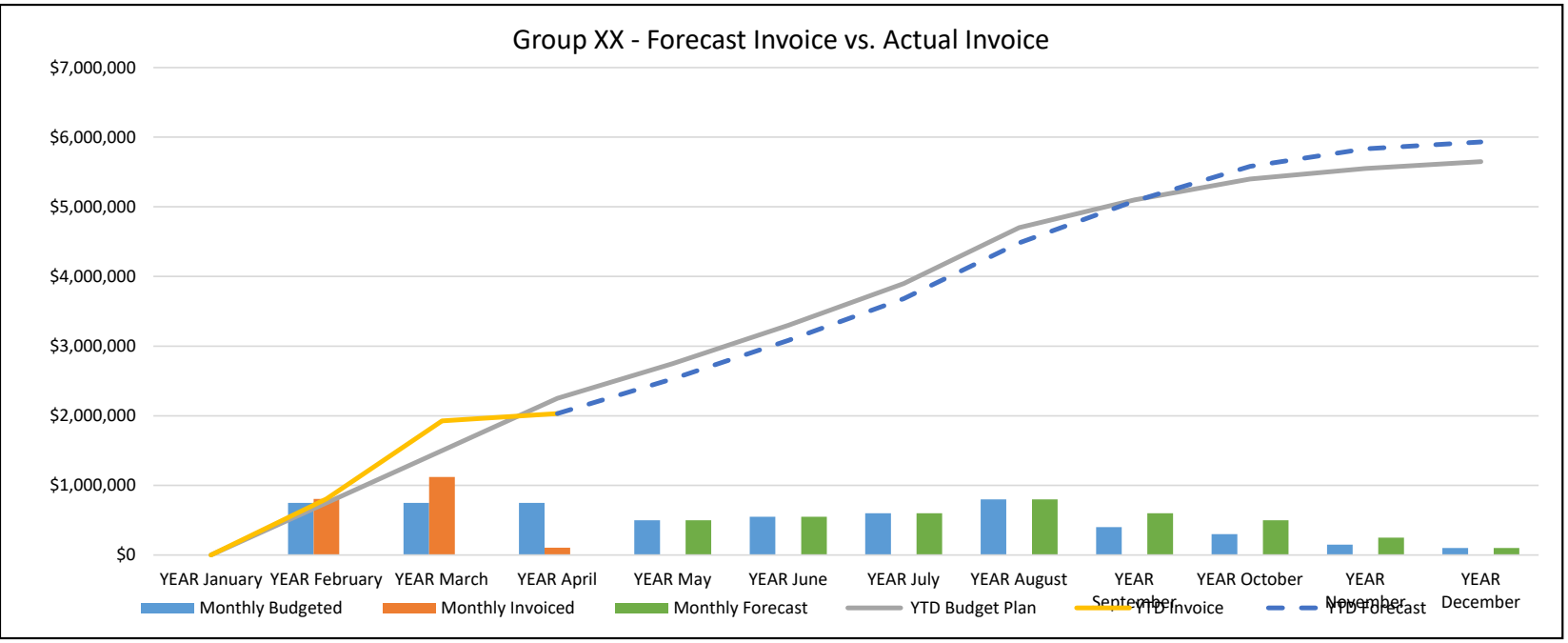
Key Achievements	
1	Achievement 1
2	Achievement 2
3	Achievement 3
4	Achievement 4

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

MONTH DAY, YEAR



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

FM-PMO PM **REQUIRED**	
Common Name/Building ID#:	
Address:	
Transit #	

Color Code & Instructions	Input all required cell information as indicated by the color coding. There are "optional information" columns as well as drop down menus in certain columns. The FM-PMO Project Manager to initiate the information gathering process and enter the CoT BuildingCode as the location identification information. The General Contractor will complete the input of their assigned cells and return the form to the FM-PMO Project Manager for review. The FM-PMO Project Manager will forward the completed form to the CoT assigned FM Opreations Manager for review and loading into the COT Asset Managemnet and Faciilites work order system. Equipment Codes provided on the third tab (Asset Type & Code)
FM- PMO Project Manager	
CoT Facility Manager Operations	
General Contractor	

St, City, Province \ State, Country FM-PMO PM**REQUIRED** Top level of location hierarchy - should be set up in Customer Location hierarchy	Building FM-PMO PM**REQUIRED** Building should be set up in Customer Location hierarchy	Equipment Floor General Contractor **REQUIRED** Indicate the "Floor" where the specified equipment is located	Equipment Room General Contractor **REQUIRED** Indicate the "Room "where the specified equipment is located	Service Insight Schedule (1) CoT Facility Manager **REQUIRED** Select (1) as follows; A-Preventative Maintenance, B-Not Applicable
Example	Example	Example	Example	Example

Automatic from Column F

Asset Description **General Contractor** **REQUIRED** Max Length = 25 Description of individual asset / equipment. Commonly used description for the specific asset at the site.	**Asset ID (Type Code)** **General Contractor** **REQUIRED** Equip. Code currently associated with the specific equipment as identified in Tag List provided in tab "3"	**Serial Number** **General Contractor** **REQUIRED** Serial number of the specified installed equipment	**Critical** **General Contractor** **REQUIRED** Indicate if the asset is critical to the operation of the specific facility (YES \ NO)	**Manufacturer** **General Contractor** **REQUIRED** List the Mfg.'s. name of the specified asset / equipment.	**Model Number** **General Contractor** **REQUIRED** List the Model # of the specified asset / equipment.
Example	Example	Example	Example	Example	Example

Part Description General Contractor **REQUIRED** List the equipment description. For instance, Air Handler, Generator, Fire Suppression, Elevator.	**Material Inventory (Belts, Filters, etc.)** General Contractor **Optional** materials needed on hand or to perform PMs if known	**Frequency** General Contractor **REQUIRED** Frequency - every X months or Quarterly, etc.	**Unit # \ Dates** General Contractor **REQUIRED** Schedule for the required PM work	**Annual PM Start Date** General Contractor **REQUIRED**	**PM Procedure Library** **CoT Facility Manager**
Example	Example	Example	Example	Example	Example

Assignment (list service provider(s)) **General Contractor** **REQUIRED** Assignment - Assigned vendor	**Date Installed** **General Contractor** **Optional** System will default to date entered xx/xx/xx	**Date Warranty Service Expires** **General Contractor** ****Optional**** System will default to date xx/xx/xx	**Warranty Expiration Date Parts (From)** **General Contractor** **REQUIRED**	**Warranty Expiration Date Parts (To)** **General Contractor** **REQUIRED**
Example	Example	Example	Example	Example

Warranty Expiration Date Labor (From) General Contractor **REQUIRED**	Warranty Expiration Date Labor (To) General Contractor **REQUIRED**	Warranty Assignment (Vendor) General Contractor **REQUIRED**
Example	Example	Example

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 one building located at the address below:

Building Address	Building Type
160 RIVALDA ROAD	NEW PARAMEDICS STATION

.3 The building 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.

.2 Simultaneous work in similar building is not allowed. For example, two Fire Halls or two Police Stations cannot be under construction at the same time.

4 PROJECT PHASING

.1 The phasing to implement the work in the building is indicated on the architectural drawings. The phasing plan 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 in writing 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 **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 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.

6 **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.

.1 Furcon Environmental Ltd

.2 The BearStar Group Inc.

.3 JMX Environmental

.2 Keying and Cylinder installation:

.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.

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

.3 Refer to Hardware Schedule.

.3 . Preferred Security Company / Vendor:

.1 The City of Toronto has an existing contract with Logixx Security. The General Contractor shall engage Logixx for any security guard services for this Contract.

.4 Preferred Corporate Security Subcontractors

.1 The General Contractor shall engage one of the following Subcontractors as their security subtrade for this Contract.

.2 All security subtrade must be certified in both CCURE 9000 and Milestone at time of bidding and maintain these certifications throughout the duration of the Contract. Submit evidence of compliance with this requirement upon request.

.3 Procurement of hardware or software shall be aligned with the project schedule to prevent technological obsolescence. Hardware shall not be purchased more than six months prior to deployment.

.4 Refer to Section 28 01 00 City of Toronto Corporate Security Deliverables document for additional requirements. The Contractor and security subtrade shall thoroughly review this document to ensure compliance with the contract requirements.

COMPANY	CONTACT
360 Advanced Security Corporation 31 Constellation Court Toronto, ON. M9W 1K4	Contact Name: Christopher Phillips Telephone: (416) 7982228 Main: (647)223-5570 E-mail: christopher.p@360asc.com
AC Technical Systems Limited 2100 Forbes Street, Units 8 – 10 Whitby, ON L1N 9T3	Contact Name: Dominic Burns Telephone: (905) 666-8676 Main: (905) 426.0388 E-mail: dburns@actechnical.com
Bond Securcom 41 Scarsdale Road, Unit 1 Toronto, ON M3B 2R2	Contact Name: Cesar Traverso Telephone: (416) 256-6666 Main: (416) 951-2494 E-mail: CTraverso@bondsecur.com

COMPANY	CONTACT
Chubb Security Systems 5716 Coopers Avenue Mississauga, ON L4Z 2E8	Contact Name: Ammar Alhussaini Telephone: (905) 629-2600 Main: (416) 951-2494 E-mail: Ammar.alhussaini@chubbfs.ca
Delco Security 7500 Hwy 27, Unit #9 Vaughan, ON L6H 5R7	Contact Name: Mark Peterson Telephone: (416) 346-8628 E-mail: mpeterson@delcosecurity.com
GTECK Advanced Technology 2400 Skymark Ave., Unit 7B Mississauga, ON L4W 5K5	Contact Name: Naeemul Ebad Telephone: 1.800.931.7107 E-mail: n.ebad@gtecktechnology.com
Hart-Well Electrical Company 1295 Morningside Ave., Unit #20 Scarborough, ON M1B 4Z4	Contact: Nuno Veiga Telephone: (905) 671-9414 Main: (416) 936-7854 Email: nveiga@hart-well.com
Johnson Controls L.P. 56 Leek Crescent Richmond Hill, ON L4B 1H1	Contact Name: Danny Zavaglia Telephone: (905) 731-2813 Main: (416) 629-3508 E-mail: danny.zavaglia@jci.com
Met-Scan 30 Kern Road, Suite 104 Toronto, ON M3B 1T1	Contact Name: Antoinette Modica Telephone: (416) 391-2200 E-mail: amodica@met-scan.com
Paladin Technologies 71 Barber Green Rd. Toronto, ON M3C 2A2	Contact Name: Marc Kingsbury Telephone: (416) 916-6767 Main: (647) 459-5691 E-mail: mkingsbury@paladintechnologies.com
Profile Security 110 - 5525 Eglinton Ave. W Toronto, ON M9C 5K5	Contact Name: Jason Caissie Telephone: (416) 695-1260 x 235 Main: (647) 221-3453 E-mail: jasonc@profileinc.com
Tyco Integrated Fire & Security 2400 Skymark Avenue Mississauga, ON L4W 5K5	Contact Name: Danny Zavaglia Telephone: (905) 212-4400 Main: (416) 629-3508 E-mail: danny.zavaglia@jci.com
Securitas Technology 2495 Meadowpine Blvd. Mississauga, ON L5N 6C3	Contact Name: Scott Jupp Telephone: (647) 458-8058 E-mail: scott.jupp@securitas.com
Siemens Canada Limited 1577 North Service Road East Oakville, ON L6H 0H6	Contact Name: Jerome Ferrie Telephone: (905) 799-9937 Fax: (647) 292-4013 E-mail: jerome. ferrie@siemens.com

COMPANY	CONTACT
Vipond Inc. 6200 Kenway Drive Mississauga, ON L5T 2N3	Contact Name: Sean Foy Telephone: (905) 564-7070 Main: (416) 427-9532 E-mail: sean.foy@vipond.ca

.5 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 the building.

.3 Proper decommissioning, removal and commissioning of all elements so as to prevent niusance 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 de-mobilizing from the site.

.6 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.

7 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 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 Automatic Door Operators (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.

.2 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 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.

.4 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

.5 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 Lift, shaft, and all associated accessories

.10 Doors and hardware

.11 Door operators and controls

.12 Floor finishes including tiles, 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

.6 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

.7 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

.8 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 Lift shaft roofing structure

.8 Concrete stairs

End of Section

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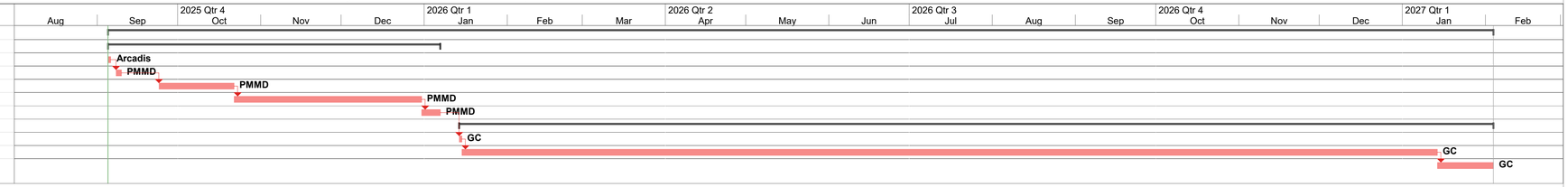
City of Toronto
Design, Program Management and Contract Administration Services for Accessibility Upgrades (358 Buildings, Various Locations)
Master Program Schedule Extended - Combined Groups & SSHA

March 10, 2023

ID	Resource Names	Task Name	Duration	Start	Finish	Predecessors
1		**160 Rivalda Rd - Tender & Construction**	**369 days**	**Fri 25-09-05**	**Wed 27-02-03**	
2		**Procurement**	**88 days**	**Fri 25-09-05**	**Tue 26-01-06**	
3	Arcadis	Submit Tender Drawings & Front End Documents	1 day	Fri 25-09-05	Fri 25-09-05	
4	PMMD	Tender Call and Preparation	2 days	Mon 25-09-08	Tue 25-09-09	3
5	PMMD	Tender Posting Period	20 days	Wed 25-09-24	Tue 25-10-21	4FS+10 days
6	PMMD	Bid Review & PO Issuance	50 days	Wed 25-10-22	Tue 25-12-30	5
7	PMMD	Issued for Construction Drawings	5 days	Wed 25-12-31	Tue 26-01-06	6
8		**Construction Administration**	**276 days**	**Wed 26-01-14**	**Wed 27-02-03**	
9	GC	Construction Kick-off meeting	1 day	Wed 26-01-14	Wed 26-01-14	7FS+5 days
10	GC	Substantial Completion	260 days	Thu 26-01-15	Wed 27-01-13	9
11	GC	Total Completion (Including deficiencies + occupancy)	15 days	Thu 27-01-14	Wed 27-02-03	10



Project: 2020 09 30 - TAU - Ma
Date: Fri 25-09-05

Task | Split | Milestone | Summary | Project Summary | Inactive Task | Inactive Milestone | Inactive Summary | Manual Task | Duration-only | Manual Summary Rollup | Manual Summary | Start-only | Finish-only | External Tasks | External Milestone | Deadline | Critical | Critical Split | Progress | Manual Progress

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 up-coming tests, a minimum of two weeks before the anticipated test date.

.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 paged 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 Login 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 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. Submittal Title:				
2. To: ATTN:	3. From: ATTN:	4. Project Title & Location:	5. Submittal Date	6. New ☐ Resubmittal ☐
			7. Submittal No.	
		8. Specification Section No:	9. Partial Submittal No.	10. Resubmittal 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 Print	Cat.	Samp	Other	Date: Received: Action Code #	Dept. File

18. Contractor's Remarks:

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.

Name of Contractor _____

Signature _____

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	☐
3.	Reviewed	Drawings reviewed without comments. Proceed with construction	☐
4.	Not Reviewed	Drawing does not require Consultant's review	☐

By _____
Date _____
IBI Group

Consultant Comment:

Route	Dept.	Ck'd by	Date	Action
	Civil			
	Arch.			
	Struc.			
	Mech.			
	Elect.			
	I &C			
	Process			
	PM			

Received

Tracking Number

Copies to:

Primary Dept. Checker

Control Administrator

Review completed on

Returned to Contractor on

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

1. Submittal Title:				
2. To: ATTN:	3. From: ATTN:	4. Project Title & Location:	5. Submittal Date	6. New ☐ Resubmittal ☐
			7. Submittal No.	
		8. Specification Section No:	9. Partial Submittal No.	10. Resubmittal No.
11. Contract		12. Project No:		ARCADIS/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 Print	Cat.	Samp	Other	Date: Received: Action Code #	Dept. File

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Name of Contractor _____

Signature _____

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	☐
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3.	Reviewed	Drawings reviewed without comments. Proceed with construction	☐
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By _____
Date _____
ARCADIS Group

Consultant Comment:

Route	Dept.	Ck'd by	Date	Action
	Civil			
	Arch.			
	Struc.			
	Mech.			
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    - 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
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    - 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

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.

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 four (two) 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

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.

.2 The sections listed below shall be read in conjunction with this section. If there are any conflicts, the sections below shall take precedence:

.1 Section 01 74 19A - City of Toronto - A Guide to Waste Audits and Waste Management

.2 Section 01 74 19B - City of Toronto - Completed Waste Audit Form Sample

.3 Section 01 74 19C - Completed Waste Audit Form Sample

.4 Section 01 74 19D- Completed Waste Reduction Work Plan Sample

1.2 **DEFINITIONS**

.1 CDL: Construction, Demolition and Landclearing.

.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

A Guide to Waste Audits and Waste Reduction Work Plans for Construction & Demolition Projects

A Guide to Waste Audits and Waste Reduction Work Plans For Construction & Demolition Projects

As Required under Ontario Regulation 102/94

Protecting our environment. Ontario

You can view and download the regulation titled *Waste Audits and Waste Reduction Work Plans* by going to www.e-laws.gov.on.ca and entering O. Reg. 102/94 into the search box.

Please direct any questions to the Ministry of the Environment's Public Information Centre at the number listed below.

You can download additional copies of this guide from the ministry's web site at www.ene.gov.on.ca/en/publications/forms/index.php#AuditandReduction or obtain hard copies by calling the Public Information Centre:
135 St. Clair Avenue West, 1st floor
Toronto, Ontario M4V 1P5
Tel: 1 (800) 565-4923
(416) 325-4000
Fax: (416) 325-3159
Email: picemail.moe@ontario.ca

Il existe une version française de se document.

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PREFACE

This guide will help you understand the requirements of Ontario Regulation 102/94 (O. Reg. 102/94 – Waste Audits and Waste Reduction Work Plans) as it applies to construction and demolition projects.

O. Reg. 102/94 is an integral part of Ontario's efforts to encourage businesses to reduce the amount of waste they produce, to reuse whatever waste they can and to recycle the rest. Businesses need to do this if Ontario is to meet its overall goal of reducing the amount of waste going to disposal.

This guide is intended to help you understand the minimum requirements for conducting waste audits and preparing waste reduction work plans for construction and demolition projects as required under O. Reg. 102/94. The regulation is part of Ontario's 3Rs Regulations (3Rs stand for reduce, reuse and recycle).

- Note that those who are subject to O. Reg. 102/94 must implement a source separation and recycling program in accordance with O. Reg. 103/94. See A Guide to Source Separation of Recyclable Materials for Industrial, Commercial and Institutional Sectors and Multi-Unit Residential Buildings as Required under Ontario Regulation 103/94, which is available from the ministry.

The other guides in the series are:

- A Guide to Source Separation of Recyclable Materials and Leaf and Yard Waste Systems for Municipalities as Required Under Ontario Regulation 101/94
- A Guide to Approvals for Recycling Sites, Leaf and Yard Waste Composting Sites and Compost Use as Required Under Ontario Regulation 101/94
- A Guide to Waste Audits and Waste Reduction Work Plans for Industrial, Commercial and Institutional Sectors as Required under Ontario Regulation 102/94
- A Guide to Source Separation of Recyclable Materials for Industrial, Commercial and Institutional Sectors and Multi-Unit Residential Buildings as Required under Ontario Regulation 103/94
- A Guide to Packaging Audits and Packaging Reduction Work Plans as Required under Ontario Regulation 104/94

Disclaimer: These guides are for informational purposes only and are not intended to provide specific advice or recommendations in any circumstances. Moreover, these guides are not, and should not be construed as, legal advice. Please review Ontario Regulations 101/94, 102/94, 103/94 and 104/94 and, if you have any questions about the application or interpretation of these regulations or have other legal questions, you should consult a lawyer.

TABLE OF CONTENTS

1.0 Introduction ……..…….. 1

2.0 General Requirements …….. 2
2.1 Conducting your waste audit ……... 2
2.2 Developing your waste reduction work plan …… 3
2.3 Implementing your waste reduction work plan …… 3
2.4 Documenting your waste reduction work plan …… 4

3.0 Who Is Affected? …… 5
3.1 Construction Projects ……... 5
3.2 Demolition Projects …….. 5
3.3 Definition of Floor area …… 5

Appendices

A – Links to Additional Information …….…….. 6

.

B – A Typical Waste Reduction Program ……... 7
Sample Waste Audit Report …….. 11
Sample Waste Reduction Work Plan ……. 20

C – Conversion Factors …… 25

D – Blank Waste Audit and Waste Reduction Work Plan Forms …… 27

1.0 INTRODUCTION

O. Reg. 102/94 applies to non-hazardous solid wastes from designated industrial, commercial and institutional (IC&I) sources. This guide focuses on the requirements for waste audits and waste reduction work plans specific to construction and demolition projects.

The implementation of waste audits and waste reduction work plans by those construction and demolition projects required to comply with O. Reg. 102/94 will contribute significantly to the efforts to promote the diversion of waste away from landfills and incinerators as the preferred approach to waste management. Construction and demolition (C&D) waste makes up a large component of the non-hazardous solid waste stream. Efforts to divert C&D waste stream, therefore, will have a large potential for reducing the quantity of materials destined for disposal and increasing the quantity put back into productive use.

Section 2.0 of this guide describes the general requirements for conducting the waste audit, preparing the waste reduction work plan and implementing it. Section 3.0 identifies the construction and demolition projects that must implement a waste reduction program and any special provisions that apply to these projects.

The appendices contain additional material to help affected parties meet regulatory requirements. Appendix B contains information on the steps you need to follow and checklists you may use for conducting the waste audit and preparing the waste reduction work plan. Examples of completed forms are also included here.

2.0 GENERAL REQUIREMENTS

This section outlines the general requirements for the steps needed to undertake all components of your waste audit, your waste reduction work plan and the reporting process to document your activities.

Construction and demolition projects must prepare a waste audit and waste reduction work plan before construction work begins at the site.

There are four basic steps to implementing a waste reduction program required under O. Reg. 102/94:

1. Conducting the waste audit
2. Developing the waste reduction work plan
3. Implementing the waste reduction work plan
4. Updating the waste audit and waste reduction work plan

Only certain construction and demolition projects must comply with O. Reg. 102/94 (see Section 3). To comply, the person undertaking the project (e.g., owner) or the person undertaking a project on someone else's behalf (e.g., contractor) must complete a waste audit and waste reduction work plan before construction work begins at the site.

2.1 Conducting Your Waste Audit

A waste audit is essentially a study relating to waste generated by all the normal activities at the site of the construction or demolition project. O. Reg. 102/94 is intended to ensure that a designated C&D waste generator takes a comprehensive approach to the study. The work you will need to complete as part of the waste audit will involve not only measuring the quantity of waste and identifying its composition, but also the manner by which the waste gets produced, including management decisions and policies that relate to the production of waste.

Under O. Reg. 102/94, all waste audits must address:

- The amount, nature and composition of the waste generated in all functional areas of the project
- How the waste is produced, including relevant management decisions and policies
- How the waste is managed

O. Reg. 102/94 requires that the waste audit be completed <u>before</u> construction work begins at the site. This means that a waste audit for a project will need to be done in conjunction with, and based on, other planning activities related to the project.

2.2 Developing Your Waste Reduction Work Plan

The information resulting from the waste audit forms the basis for developing the waste reduction work plan. The waste reduction work plan addresses 3Rs opportunities that you will pursue during the life of the project.

O. Reg. 102/94 requires that all completed waste reduction work plans include all reasonable actions that can be taken to reduce, reuse and recycle waste. These actions must be identified in a step-wise process that follows the 3Rs hierarchy:

- First - Reduce by developing actions that will stop waste from being produced in the first place.
- Next - Reuse any waste materials at your site or donate to others, e.g., a non-profit organization.
- Last - Recycle any waste materials through a recycling company.

The waste reduction work plan must encompass all administrative, warehousing or other ancillary activities or departments located on the same site and associated with the designated project.

The waste reduction work plan must also set out who will implement each part of the plan, when each part will be implemented and what the expected results are.

2.3 Implementing Your Waste Reduction Work Plan

O. Reg. 102/94 requires that a waste reduction work plan be developed before construction work begins at the site. The work plan must explicitly assign responsibilities and identify resources needed for its implementation and give an estimate of the expected results to be achieved. Your work plan may be structured so that some actions are given a higher priority than others. A number of factors may need to be considered to determine which actions will contribute most to meeting waste reduction objectives.

Note that those who are subject to O. Reg. 102/94 must implement a source separation and recycling program in accordance with O. Reg. 103/94. Further details are contained in A Guide to Source Separation of Recyclable Materials for Industrial, Commercial and Institutional Sectors and Multi-Unit Residential Buildings as Required under Ontario Regulation 103/94, which is available from the ministry.

2.4 Documenting Your Waste Reduction Program

A waste audit and waste reduction work plan must be documented in written reports as described below. In some cases, projects may have specific additional reporting requirements as specified in the regulation.

- A waste reduction work plan must set out who will implement each part of the plan, when each part will be implemented and the expected results.

- A report of a waste audit or a waste reduction work plan must be on a form provided by the ministry or another form as long as the same information is contained. Samples of completed forms are found in Appendix B of this guide. Blank forms are included at the end of the guide. The guides are available at: www.ene.gov.on.ca/en/publications/forms/index.php#AuditandReduction

- The report of the waste audit and the waste reduction work plan must be kept for at least five years after it was prepared.

- The waste reduction work plan or a summary of the work plan must be posted in places where employees will see it. An employee must also be allowed to see the entire plan where a summary of the plan has been posted.

- Note that O. Reg. 102/94 does not require automatic reporting to the ministry. The builder or demolisher subject to O. Reg. 102/94 must submit the most recent waste audit and waste reduction work plan to the Director within seven days of a request by a Director. For the purposes of the 3Rs Regulations, the "Director" is a Ministry of the Environment (MOE) Regional Director, Assistant Regional Director, District Manager, Director Waste Management Policy Branch (WMPB) or Assistant Director WMPB.

- The waste audit for a designated construction project must also address the extent to which materials or products used by the builder consist of recycled or reused materials or products.

3.0 WHO IS AFFECTED?

A project includes the operations normally associated with the construction or demolition of buildings. Types of projects include construction or demolition of residential, commercial, industrial and institutional buildings such as single-family housing, apartments, offices, factories and hospitals. O. Reg. 102/94 does not address renovation projects.

3. 1 Construction Projects

The builder of a "construction project" that consists of the construction of one or more buildings with a total floor area of at least 2,000 square metres is subject to O. Reg. 102/94 and must conduct a waste audit covering the waste generated in the construction project. The builder – a person who is undertaking the construction project on their own behalf or on behalf of another – must prepare and implement a waste reduction work plan.

For the purposes of determining when construction begins at the site, the ministry's position is that construction generally begins at the point foundations for the building(s) are being dug. Where, however, a building is going to be constructed in phases (e.g. one builder constructs the outer shell and another contractor constructs the inner shell), construction for the second phase begins when the builder begins construction on the second phase.

3.2 Demolition Projects

The demolisher of a "demolition project" that consists of the demolition of one or more buildings with a total floor area of at least 2,000 square metres is subject to O. Reg. 102/94. The demolisher – a person who is undertaking the demolition project on his/her own behalf or on the behalf of another – must conduct a waste audit covering the waste generated in the demolition project and must prepare and implement a waste reduction work plan.

3.3 Definition of Floor Area

Building floor area is to be calculated as "gross area" according to the Ontario Building Code: "the total area of all floors above grade measured between the outside surfaces of exterior walls or between the outside surfaces of exterior walls and the centre line of firewalls except that, in any other occupancy than a residential occupancy, where an access or a building service penetrates a firewall, measurements shall not be taken to the centre line of such firewall."

The total floor area should be calculated as the total area of the building. This is the area normally reported on Building Permits. Multi-story or underground parking lot areas must be included in the total building area. However, any outside areas, such as ground-level outdoor parking lots or recreation parks, are not part of the total area. For example, an apartment complex project consists of three buildings, with areas of 800, 500 and 600 m^2, and an outdoor ground level parking lot of 1,000 m^2. The sum of the three building areas, or 1,900 m^2, would be the total area of the project and, therefore, it would not need to comply with the regulation. However, if a building has an area of 1,700 m^2 and it has an underground parking area that is 400 m^2, it would have to comply with the regulations as the total floor area (2,100 m^2) would exceed 2,000 m^2.

APPENDIX A – Links to Additional Information

1. **e-laws:**

   You can view and download O. Reg. 102/94 by going to e-laws and entering O. Reg. 102/94 into the search function. You can find all four of the 3Rs regulations or other acts and regulations by entering their name: www.e-laws.gov.on.ca

2. **Copies of the 3Rs Guides:**

   Additional copies of the ministry's 3Rs guides are available at: www.ene.gov.on.ca/en/publications/forms/index.php#AuditandReduction

3. **Helpful guide:**

   "The Environmentally Responsible Construction and Renovation Handbook," ***Public Works and Government Services Canada.*** This Technical Guidebook has been prepared for portfolio and asset managers, project managers and building professionals, leasing agents, accommodation users and property managers to assist them in planning and undertaking renovations in an environmentally responsible manner, and to achieve Green Office Building Plan (GOBP) status. Building operators and property managers in the private sector will also find this document useful. Although the emphasis of the handbook is on environmentally responsible renovation, many of the principles and guidelines also apply to new construction projects. Available at: www.tpsgc-pwgsc.gc.ca/biens-property/gd-env-cnstrctn/index-eng.html

4. **Ontario Environment Business Directory:**

   The Ministry of the Environment (MOE) maintains a web site for Ontario companies that provide environmental goods and services at: www.envirodirectory.on.ca

Appendix B – A Typical Waste Reduction Program

Getting Started

Ideally, a person who is interested in resource conservation and has sound knowledge and experience of your company's operations should manage your waste reduction program. An effective Waste Reduction Coordinator will have the greatest impact when fully involved in all aspects of the waste audit and reduction work plan program.

For larger projects, you may wish to form a Waste Reduction Committee to set up and maintain your waste reduction program. The committee could consist of the coordinator, owner, general contractor and site supervisor, representatives of various sub-trades and a waste hauler. This will allow you to generate ideas collectively and ensure that the program is designed to provide opportunities for everyone to participate.

Examples of what role(s) the coordinator/committee could play to successfully undertake a waste audit and to implement a waste reduction work plan include the following:

- Identifying and interpreting government requirements and regulations
- Securing senior management support
- Conducting and/or overseeing the waste audit
- Establishing the waste reduction goals
- Identifying funding requirements and the costs and benefits of the program
- Developing a 3Rs program and implementation schedule
- Monitoring the waste reduction, reuse and recycling activities
- Promoting and communicating waste reduction activities.

Communicating Project Objectives

Before initiating a waste audit or waste reduction work plan, you should inform everyone involved of the objectives of the program and the importance of their cooperation. Sub-trades should be informed also. They will need to work cooperatively to characterize and measure waste streams and effectively implement waste reduction measures.

CONDUCTING A WASTE AUDIT

Introduction

An important factor in planning your waste audit is the level of audit detail you choose to use. The level of detail depends upon the size of the project, complexity of operations and accuracy you require for your reduction work plan.

The following waste audit process is one approach that will provide you with enough information to proceed with your waste reduction work plan and to meet the requirements of O. Reg. 102/94. This approach is intended to identify the major wastes and to provide a starting point for your waste diversion initiatives. Figure 1, Waste Audit Flowchart, provides an overview of the audit process.

Step 1: Assemble Basic Information

Review Operations

You should review and record the following basic information about your construction or demolition project:

- Building floor area or other indicators relevant to your projects
- Type and size of construction or demolition project
- Location
- Stages of project, e.g. excavation, structural, interior finishing
- Stages of the project that are sub-contracted to trades
- Purchasing policies.

It is also important to review all areas of your project so that you will not miss future opportunities for waste reduction. The scope of the review will include the traditional waste generation areas. This level of review, with waste reduction in mind, often leads to significant opportunities.

Here are the minimum points to review:

- Composition and quantity of all wastes directly generated within the project through all normal activities
- The extent to which materials or products used consist of recycled or reused materials
- Management decisions and policies that relate to the production of waste
- The way in which the waste is managed.

Review Existing Waste Reduction and Disposal Activities

You should review your current waste management activities to provide start-up information for your waste audit and for later efforts in waste reduction planning. Basic questions to be asked include:

- Who is responsible for waste management and reduction?
- What are the current waste separation and recycling activities?
- What are the timing and frequency of waste collections?
- What methods of waste collection will be employed, including internal and external waste handling?
- What quantities of waste and recyclables are to be collected?
- Who are the contractor(s) for waste collection and recycling services?
- What are the responsibilities of sub-trades for their own waste disposal?
- What is the gross cost of waste collection and disposal?
- Are there recycling companies in your area?

Step 2: Identify Wastes

The objective of this step is to estimate categories of wastes and places where they will be generated. During the review, you should note collection and storage practices and any other special considerations that should be taken into account later when you develop your waste reduction work plan.

It is your responsibility to ensure that the information that appears in the audit reflects the waste that will be generated by your project. Sources of information may include:

- Engineering estimates
- Material purchasing records
- Waste disposal invoices for similar projects
- Records of waste produced at generation points in daily operations of other projects
- Studies of similar projects.

You can identify your wastes by:

- Estimating wastes generated through each stage of a project based on building construction and demolition methods, materials and efficiencies. Staff and sub-trades may be required to submit information to the coordinator for summary.
- Conducting a walk-through review of operations on similar projects to ensure that all waste streams have been identified. Look inside waste containers, and, above all, ask questions.

Classify your wastes as follows:

- Materials that the Ministry of the Environment requires you to source separate for recycling (see "A Guide to Source Separation of Recyclable Material for Industrial, Commercial and Institutional Sectors and Multi-Unit Residential Buildings", *Appendix A for link*).
- Other materials identified within your project that could be source-separated for reuse or recycling.
- Residual material that would go for disposal.

Use **Figure 1**, Waste Sampling Record (next page) to summarize the results.

Step 3: Identify Recycled Content of Building Materials and Products

This step requires you to examine the current reduction activities at the front end of your operations. You should now examine purchasing specifications to identify the recycled content of purchased building products and raw materials. This will be useful for determining whether you can take steps to increase use of items with higher recycled content.

It is not necessary to examine all of your incoming materials and products. Look at your major material and product purchases and review the recycled content of each material. Approach your suppliers if the information needed is not readily available.

Figure 1: Waste Sampling Record

Location				Date
3777 Recycle St., Anytown, ON A1B 2C3				October 10, 2008
Sample Taken		Time Period		
Demolition Phase		Oct, Nov, Dec 2008		
Operation Characteristics				
Normal activities.				
Material	**Characteristics**	**Volume * (yd^3)**	**Weight (tonnes)**	**% of Total Sample ****
Wood	Lumber, pallets	60	9	16 %
Concrete & Masonry	Rubble from exterior walls	120	40	71%
Plaster	Broken pieces from walls	30	4	7%
Cardboard	Packaging	2	.25	.4%
Drywall	Clean drywall	2	.25	.4%
Misc		64	3	5.3%
Totals		278	56.5	100 %

* Please note if you measure your waste by volume, you must convert these figures to weights. See Appendix C for Conversion Table.

** If using purchasing records, calculation of % is not applicable.

Step 4: Complete a Waste Audit Report

You should maintain a record of the information reviewed, assumptions made, waste samples examined (including the sample dates) and the material weights and/or volumes calculated.

You are now ready to complete the Waste Audit Report, as required by O. Reg. 102/94. See a *sample* of a completed waste audit report on the next page. A blank Waste Audit Report form is provided at the end of this guide. A Microsoft Word version of the form is available from the ministry's website (see Appendix D). You can use your own forms as long as the same information is provided.

You may want to calculate the amount of waste generated per "unit of measure." For example, by calculating the total waste generated per 100 m^2 floor area of the project to that of other projects, you might observe whether a change in overall waste generation is due to project size, type or other factors.

Sample

Ministry of the Environment Waste Form

Report of a Waste Audit

Large Construction and Demolition Projects

As required by O. Reg. 102/94

This report must be prepared before construction or demolition begins at the site. The waste audit must be retained on file for at least five years after it is prepared, and be made available to the ministry upon request.

I. GENERAL INFORMATION

Name of Owner/Contractor Undertaking Project and Company Name: *Mr. Bricks, 1234 Ontario Ltd.*				
Name of Contact Person and Company: *Ms. Builder, 1234 Ontario Ltd.*	**Telephone #:** *416-123-4567*		**Email address:** *builder@1234Ontario.com*	
Project Type (Check One)*	**Construction Project**	√	**Demolition Project**	
Floor Area (square metres): *2500 m2*	**Number of Buildings:** *20 houses*			
Street Address of Project Site (if known): *123 Yellowbrick Road*				
Lot and Plan Number: *Lot 50; Plan Number 12345*	**Municipality:** *Anyplace*			
Estimated Start Date of Project: *June 30, 2008*	**Estimated Completion Date of Project:** *August 1, 2009*			

**** Separate reports must be made for construction and demolition projects regardless if they occur on the same site.***

II. DESCRIPTION OF PROJECT

Provide a brief overview of the construction or demolition project:
Construction of 20 new one storey luxury brick houses with rear garages on newly developed land. Some of the main construction materials that will be used for this project will include clay brick, concrete, vinyl windows, wooden framing, drywall, hardwood floors and asphalt shingles. There will be waste diversion depot areas for reusable or recyclable materials located throughout the project. In addition, a main waste collection area will be situated on site and will include a roll-off waste container. The project is located outside of the Anyplace main retail district near a ravine area.

III. CATEGORIES OF WASTE AND WASTE ITEMS

List the categories of waste the project will produce and the associated waste items for each category *(see part VI for examples of categories of waste):*

Categories of Waste	Waste Items
Blue Box Materials	*Glass, cans, newspaper, plastic bottles*
Brick and Concrete	*Cut offs, broken bricks; spilled concrete, cut or broken blocks*
Cardboard	*Boxes, sleeves on side of pallet loads*
Carpet	*Cuttings/remnants*
Drywall	*Cutoffs, broken or damaged pieces, cut outs for windows/doors*
Drywall Compound	*Compound that is contaminated, old or hardened.*
Insulation	*Cuttings, damaged pieces*
Metal	*Electrical, beams, light tracks, hangers, pipe, conduit, etc.*
Plastic	*Cuttings from plastic pipe, plastic film/wrap*
Roofing Shingles	*Cutoffs, damaged shingles*
Tile Flooring	*Cutoffs, damaged tiles*
Wood	*Lumber cut-offs, damaged studs, skids*

IV. PRODUCTION OF WASTE

For each category of waste listed in Part III of this form, explain how the waste at the construction or demolition project will be produced. Include references to how management decisions and policies will affect the production of waste:

How Waste Is Produced	Decisions/Policies Affecting Waste Produced
Blue Box - Glass, cans, newspaper, plastic bottles	*Cannot be avoided.*
Bricks - Cutoffs, broken bricks *Concrete – spilled; broken blocks/cutoffs*	*Brick waste cannot be avoided;* *Review how concrete is handled to reduce spillage. Cannot avoid broken blocks/cutoffs*
Cardboard - boxes, sleeves on side of pallet loads	*Will consider reusable shipping containers.*
Carpet – cuttings/remnants	*Cannot be avoided*
Drywall - cutoffs, broken or damaged pieces, cut outs for windows/doors	*Cannot be avoided.*
Drywall Compound – contaminated, old or hardened	*Will review how compound is stored to avoid contamination/hardening*
Insulation – cuttings, damaged pieces	*Will review how insulation is stored and how to protect it from becoming damaged*
Metal - Electrical, beams, light tracks, hangers, pipe, conduit, etc.	*Difficult to avoid scrap metal or cut offs from being generated. Will review reuse.*
Plastic – cut offs from piping; film wrap	*Plastic pipe cutoffs cannot be avoided; To review shipping of materials without plastic wrap.*
Roofing shingles - Cutoffs, damaged shingles	*Will try to ensure that shingles are not damaged during storage or movement on site. Will speak to supplier if damaged shingles are received.*
Tile Flooring	*Cut offs cannot be avoided. Damage is minimal.*
Wood - cut offs, damaged studs, skids	*Review how wood is purchased, including proper lengths required. Review how skids can be returned to company.*

V. MANAGEMENT OF WASTE

For each category of waste listed in Part III of this form, indicate which waste items will be disposed or reused/recycled and how each item will be managed at the project:		
Category	**Waste to be Disposed**	**Reused or Recycled Waste**
Blue Box Materials	*n/a*	*To be recycled in Blue Boxes and Carts*
Bricks - Cutoffs, broken bricks; Concrete - spilled concrete, cut or broken blocks	*Unusable pieces of brick will be disposed; Spilled concrete or unusable broken blocks will be dumped into roll off waste container.*	*Reusable pieces of brick will be used where possible. Will look into market for crushed brick for landscaping; Useable broken blocks will be reused where possible.*
Cardboard - boxes, sleeves on side of pallet loads	*Soiled Cardboard will be disposed in waste bin.*	*Strict policy that all cardboard that is not soiled must be recycled.*
Carpet	*Small pieces will be disposed in waste bin.*	*Reusable pieces will be reused.*
Drywall - cutoffs, broken or damaged pieces, cut outs for windows/doors	*Unusable pieces will be disposed in waste bin.*	*Any reusable pieces will be used.*
Drywall Compound – old/hardened	*Contaminated or hardened compound will be disposed in waste bin.*	*n/a*
Insulation – cuttings, damaged pieces	*Unusable pieces of insulation will be disposed in waste bin.*	*Reusable pieces of insulation will be reused as insulation.*
Metal - Electrical, beams, light tracks, hangers, pipe, conduit, etc.	*Small cuttings that end up in sweepings will be disposed in waste bin.*	*All larger pieces of metal will be recycled.*
Plastic – Cut offs from pipes; film wrap	*Unusable pieces of pipe/wrap will be disposed in waste bin.*	*Will reuse pipe cut offs where possible (e.g., to protect water turn off valves during construction), Film wrap will be reused during project where possible to cover materials.*
Roofing shingles - Cutoffs, damaged shingles	*Unusable shingles will be disposed in waste bin.*	*Reusable pieces of shingle will be used.*
Tile Flooring	*Small unusable pieces of tile will be disposed in waste bin.*	*Reusable pieces of tile will be used.*
Wood - cut offs, damaged studs, skids	*Unusable pieces will be disposed in waste bin.*	*Reusable pieces will be reused for bridging/blocking, etc.*

VI. ESTIMATED QUANTITY OF WASTE PRODUCED

Categories of Waste	Estimated Amount of Waste Produced (tonnes)	Categories of Waste (continued)	Estimated Amount of Waste Produced (tonnes)
Asphalt	*n/a*	Plastic (pipes, film, etc)	*50 kg*
Aluminum	*n/a*	Plaster *(Drywall compound)*	*50 kg*
Blue Box – Newspaper, cans, etc.	*25 kg*	Polystyrene Foam	*n/a*
Brick and Concrete	*1 tonne*	Porcelain Fixtures	*n/a*
Cardboard	*2 tonnes*	Roof Shingles	*200 kg*
Carpet	*100 kg*	Tile Flooring	*25 kg*
Drywall (unpainted)	*300 kg*	Wood (unpainted or untreated)	*1.5 tonne*
Drywall (painted)	*500 kg*	Wood (painted/treated)	*250 kg*
Glass	*n/a*	Other	*n/a*
Insulation	*10 kg*		
Metal	*200 kg*		
		TOTAL	**~ 6 tonnes**

VII. EXTENT TO WHICH MATERIALS OR PRODUCTS USED BY THE ENTITY CONSIST OF RECYCLED OR REUSED MATERIALS OR PRODUCTS

Please answer the following questions:

1. Do you have a management policy in place that promotes the purchasing and/or use of materials or products that consist of recycled and/or reused materials or products? If yes, please describe.

   Yes. Our construction company has a management policy in place to encourage the purchase of materials and products that contain recycled or reused materials. At this project we will be using aggregate/stone for constructing driveways that contains crushed concrete. The wood trim that will be used will be paint grade wood (made from finger joined scrap wood pieces). We will also be incorporating other recycled wood products in various applications. Most of the carpeting will have recycled content also.

2. Do you have plans to increase the extent to which materials or products used consist of recycled or reused materials or products? If yes, please describe.

   Yes, Our company does plan to increase the amount of recycled or reused material that is contained in the products or materials we use. We are currently considering a new floor tile that contains recycled material as well as paint that is recycled (remanufactured from old paint). In addition, we will be installing and testing roofing shingles that contain a high percentage of recycled material at this construction project.

Please attach any additional page(s) as required to answer the above questions.

I hereby certify that the information provided in this Report of Waste Audit is complete and correct.		
Signature of authorized official: *Mr. Bricks*	**Title:** *President, 1234 Ontario Ltd.*	**Date:** *March 1, 2008*

CREATING A WASTE REDUCTION WORK PLAN

Introduction

Now you are ready to create your waste reduction work plan.

Step 1: Review Waste Audit Information

To begin the process, review your Waste Audit Report and assemble information relating to 3Rs actions currently in place, including:

- Waste reduction policies
- Current waste reduction, reuse, recycling and disposal activities
- Types and quantities of materials in each activity
- Achievement of current waste reduction targets
- Operating cost impacts as a result of 3Rs activities.

Step 2: Identify Areas of Greatest Waste Reduction Impact

A key factor in finding 3Rs opportunities for waste reduction involves examining those materials that make up a large part of the waste produced. Such a move to organize your waste audit data will highlight areas where your reduction efforts will have the greatest impact. Waste audit data can be organized in different ways by:

- Weight or volume
- Disposal cost
- Potential for source separation
- Potential to reduce, reuse or recycle
- Complexity of handling
- Current and potential regulatory requirements.

Material Type	Volume (m^3)	Weight (tonne)	Waste Cost ($/tonne)	Rank by Volume	Rank by Weight	Rank by Cost
Wood	60	9	110.00	2	2	3
Concrete & masonry	120	40	40.00	1	1	5
Cardboard	2	.25	Revenue	5	5	1
Drywall	2	.25	75.00	6	6	4
Roofing materials	25	2	150.00	3	3	2
Metal	10	.75	Revenue	4	4	1

Note: You should also consider issues you may face in implementing 3Rs programs, including: health and safety regulations, storage space at your project, availability of recycling markets and collection services and operating costs.

Step 3: Assess Waste Reduction Priorities

After identifying general areas for potential waste reduction, you should look at the possible impact of other priorities on your 3Rs options. You should consider at least the following items:

- Current and potential regulatory requirements
- Costs and benefits of each waste reduction opportunity.
- Be aware of planned or anticipated landfill closures or other disposal limitations that may affect your waste materials, including waste material bans or increased tipping fees.

Step 4: Determine Why Waste Is Generated

In assessing your waste reduction options, you should ask the following basic question at the start: Why is this material being used? Questions such as this can stimulate thought and help you develop many other ways of dealing with the material under review.

One approach to framing the questions you might ask yourself is to use the following matrix:

Purpose	Why is the material being used?	What else could be used?	What should be used?
Place	Where is it used?	Where else could it be used?	Where should it be used?
Sequence	When is it used?	When could it be used elsewhere?	When should it be used?
Person	Who uses it?	Who else could use it?	Who should use it?
Means	How is it used?	How else could it be used?	How should it be used?

Answers to these questions may show the way to various options for reducing, reusing, and/or recycling your wastes, including:

- Where waste can be reduced by eliminating the use of certain product materials or processes in your operations
- Where other materials can be used that, in turn, can be reused or recycled
- Where less wasteful/disposable materials can be used
- Where less material can be purchased (e.g. buying in bulk versus individually wrapped items)
- Where previously recycled materials can be used

Step 5: Identify Opportunities for Reducing, Reusing and Recycling Wastes

This section outlines some 3Rs opportunities that are in common use. Your own situation may differ, however, and not all these possibilities will apply. In many cases the ideas are very simple yet these can often lead to more significant initiatives.

Reducing Wastes

Workers on your project may already use various methods to reduce the quantity of waste being generated. For example, you may have replaced some disposable products with either reusable products or disposable products that can be recycled.

You should take a similar approach for each of the materials you use to support and maintain your construction/demolition projects. Focus on reducing the quantities of disposable supplies and equipment used, and on improving purchasing policies to reduce the amount of incoming packaging. You could also make changes to processes in your operation to decrease the quantity of material consumed (e.g., to reduce the amount of wood used in your project).

State expectations in trade contracts. Waste reduction policies and initiatives should be clearly stated in tendering and contract documents. Establish contracts with trades to supply both labour and materials. If trades supply materials, they will be fully committed regarding usage. Alternatively, establish policies that require contractors to remove and divert waste materials from disposal.

Produce more efficient construction designs where possible. Reducing material wastage begins at the design stage. Designers, architects, and builders should evaluate their plans for efficiency of material usage (e.g., consider standardizing room sizes and minimizing off-cuts).

Use more prefabricated products. Less waste may be generated on-site if more prefabricated or pre-cut products such as floor joists, trusses, and truss-joints are used.

Purchase selected materials in bulk containers. Purchase materials such as fasteners, paint, caulking and drywall mud in bulk containers. Stored in such containers, they are not as vulnerable to weather damage.

Reduce illegal dumping and contamination of recyclables. Protect waste bins and piles by covering them, securing them with locks and locating them in well-lit areas. Signs stating the company's commitment to waste reduction and dumping restrictions should be posted on-site and on bins.

Reusing Wastes

A reuse strategy to avoid waste is common on construction sites. Forms for pouring foundations, scaffolding and other systems all lead to less waste. Also consider using wastes from one application on other projects. For example, aluminum sheet off cuts from one job may provide the raw material input to another smaller job. Although you may already reuse certain materials, there may be others who can make beneficial use of your waste. This option can also help reduce your disposal costs.

Remove items carefully during demolition. Disassemble items carefully during demolition to minimize damage and salvage for reuse as many items as possible. Selected residual components of construction are often relatively simple to remove for reuse and will continue to have a useful lifespan.

Invite the public to reuse materials. Conduct a "strip-out sale" or advertise that certain items are free-for-the-taking by the public once they are removed from the building. Items of interest to the public may include bundles of wood off-cuts, doors, windows, decorative mouldings, cabinets, plumbing and electrical fixtures and older appliances.

Collect and store reusable materials. Space permitting, warehouse your unused materials and salvaged items for future use or re-assembly in another project. If not, direct your reusable materials to your local "reuse" facility or salvage yard. Join other companies to collect, re-distribute, and reuse waste materials. For example, excess brick from one or several projects can be reused as part of a fireplace or chimney on another project.

Reuse Items On-Site for Different Purposes. Many items have reuse potential on the job site. Reuse lumber off-cuts as bridging, blocking, or forming stakes. Recover plastic vapour barrier and wrappings and reuse as protection for tools and materials when not in use. Excess insulation from exterior walls can be added to interior walls or attics.

Recycling of Source Separated Wastes:

Most construction/demolition projects can take advantage of opportunities for external recycling of wastes. Markets exist for many recyclable materials such as steel, aluminum, corrugated cardboard, wood, drywall, concrete and glass.

The economics of recycling will vary with the material. For some materials you will receive direct revenue. For others, the cost of recycling may simply be less than the cost of landfill tipping fees.

Establish a recycling program. The ministry requires that the construction and demolition projects identified in this guide have a recycling program in place. See "A Guide to Source Separation of Recyclable Materials for the Industrial, Commercial and Institutional Sector and Multi-Unit Residential Buildings" *(refer to Appendix A for link).*

Source Separate Recyclables. Several alternatives exist to source separate recyclables. Several recycling containers and bins should be provided on every site to facilitate source separation.

Provide Adequate Training. Workers should be provided with training in source separation techniques and supplied with adequate means to perform this task efficiently.

Back-charge trades. Consider charging trades for the waste that they generate and the additional labour hours the general contractor takes to clean it up. Alternatively, all trades could be required to remove all waste off site.

Investigate waste handling techniques and equipment. Waste handling techniques and equipment such as split-bins and split-chutes are available. They can be useful on small sites as they help to maximize use of space.

Waste haulers or recycling companies: Set up contracts with waste haulers or recycling companies to provide reduced costs or revenue for source separated waste. Set up incentives (e.g., bonuses) to companies that assist with diverting the most waste and have them review the types of waste materials your project will generate before it starts.

Step 6: Assess Impact of Material Purchasing on Waste Reduction

Many of your waste reduction opportunities will involve your material purchasing practices. In some cases, you may develop a purchasing policy to buy materials that already have a recycled content. This action has the added benefit of improving the overall market for recycled materials.

Actions to change the material used in construction may involve discussions with your suppliers. For other products, you can work with your supplier to provide you with more environmentally sound materials. Replacing non-recyclable materials with reusable or recyclable materials gives economic benefits as well as greater waste diversion.

Another important waste reduction action with suppliers involves reducing packaging and containers. Many companies, as part of their purchasing and materials management policies, set up distribution systems with their suppliers to use returnable transportation/storage containers.

On a general basis, you should also review the materials and products currently purchased from your supplier to ensure optimum "environmental friendliness". This will increase your level of reliance on your suppliers to advise your company on the availability of previously recycled or more easily recyclable materials for your own use.

Step 7: Complete an Achievable Waste Reduction Work Plan

Your waste reduction work plan is a compilation of the waste reduction opportunities you have identified and the actions you intend to take in reducing your wastes. At this stage you should also set waste reduction targets. Try to set *realistic* reduction targets as it is important that your work plan is achievable.

Your targets will form the basis for waste reduction actions for each waste material. These decisions reflect the benefits of accurate waste audit information. Missed targets could have negative impacts on your workers attitudes and confidence in future waste reduction work plans.

The waste reduction work plan is designed to complement the waste audit report. The waste reduction work plan focuses on the wastes for which reduction actions have been identified and reduction targets set. The format allows actions on separate waste materials to be identified as well as the total amounts of waste reduced, reused and/or recycled.

See next page for a *sample* waste reduction work plan. A blank form is included at the back of the guide. A Microsoft Word version is available through the ministry's website (see Appendix D). You can use your own forms as long as the same information is provided.

Sample

Ministry of the Environment Waste Form

Report of a Waste Reduction Work Plan

Large Construction and Demolition Projects

As required by O. Reg. 102/94

This report must be prepared before construction or demolition begins at the site. The waste reduction work plan must be retained on file for at least five years after it is prepared, and be made available to the ministry upon request.

I. GENERAL INFORMATION

Owner/Contractor Undertaking Project and Company Name: *Mr. Bricks, 1234 Ontario Ltd.*				
Name of Contact Person and Company Name: *Ms. Builder, 1234 Ontario Ltd.*	**Telephone #:** *416-123-4567*	**Email Address:** *builder@1234Ontario.com*		
Project type (check one)*	**Construction Project**	√	**Demolition Project**	
Floor Area (square metres): *2500 m2*	**Number of Buildings:** *20 houses*			
Street Address of Project Site (if known): *123 Yellowbrick Road*				
Lot and Plan Number: *Lot 50; Plan Number 12345*	**Municipality:** *Anyplace*			
Estimated Start Date of Project: *June 30, 2008*	**Estimated Completion Date of Project:** *August 1, 2009*			

**** Separate reports must be made for construction and demolition projects regardless if they occur on the same site.***

II. DESCRIPTION of PROJECT

Provide a brief overview of the construction or demolition project:
Construction of 20 new one storey luxury brick houses with rear garages on newly developed land. Some of the main construction materials that will be used for this project will include clay brick, concrete, vinyl windows, wooden framing, drywall, hardwood floors and asphalt shingles. There will be waste diversion depot areas for reusable or recyclable materials located throughout the project. In addition, a main waste collection area will be situated on site and will include a roll-off waste container. The project is located outside of the Anyplace main retail district near a ravine area.

III. PLANS TO REDUCE, REUSE AND RECYCLE WASTE

For each category of waste described in Part III of "Report of a Waste Audit" (on which this plan is based), explain what your plans are to reduce, reuse and recycle the waste, including:
1) how the waste will be source separated at the project, and 2) the programs to reduce, reuse and recycle all source separated waste.

Waste Category	Source Separation and 3Rs Program
Blue Box Materials	*Blue Box Recycling Program: Blue boxes will be located throughout the site for the collection of materials such as plastic, metal and aluminum drink containers and newspapers. Materials will be source separated into recycling carts for collection by recycling company.*
Brick and Concrete	*(i) Brick Recycling Program: Any broken or non-reusable bricks will be source separated in piles beside each house. Front end loader will remove waste brick at end of the construction project and place into one pile so that it can be sent for recycling or as clean fill (e.g., Leslie St. Spit.), if possible.* *(ii) Concrete 3Rs Program: Source separate waste concrete, including dried spills, and recycle if quantities are significant via aggregate recycling company.*
Cardboard	*Cardboard Recycling: Will replace with reusable containers, where possible. Source separate cardboard into roll-off box for recycling company.*
Carpet	*Reuse cuttings where possible. Ensure that pieces of the same style/colour of carpet are reused in other houses/where required.*
Drywall	*Drywall 3Rs Program: Any unpainted drywall will be collected in wooden bunker. Will reuse cut pieces as much as possible. If waste drywall quantities are significant, will send for recycling through Gypsum Recycling Limited.*
Drywall Compound	*n/a*
Insulation	*Reusable pieces of insulation will be reused as insulation.*
Metal	*Metal Recycling Program: Scrap metal will be source separated and collected in box and saved for recycling by scrap metal company.*
Plastic	*Will reuse pipe cutoffs on site, e.g., to protect water shut off valves. Will reuse plastic wrap to cover materials during construction. Will look for company to recycle plastics and will recycle if possible (low quantities).*
Roofing Shingles	*Roofing Shingles 3Rs Program: Waste asphalt shingles, including cuttings, will be reused where possible. Attempts will be made to minimize waste, including minimizing the amount of overruns/unnecessary stock by accurately estimating the amount of shingles required. Will determine if recycling markets exist, if there are large quantities available.*
Tile Flooring	*Will reuse tile cuttings, where possible. Ensure that pieces of the same style/colour of tile are reused in other houses.*
Wood	*Wood Recycling Program: Reuse scrap wood where possible for bridging or blocking or any other application where it can be utilized.*

IV. RESPONSIBILITY FOR IMPLEMENTING THE WASTE REDUCTION WORK PLAN

Identify who is responsible for implementing the Waste Reduction Work Plan at the construction or demolition project. If more than one person is responsible for implementation, identify each person who is responsible and indicate the part of the Waste Reduction Work Plan that each person is responsible for implementing.

Name of Person	Responsibility	Telephone #
Jack Reduce	*Inform all workers and visitors to the site about the 3Rs program and provide information sheets where necessary.*	*416-123-4567*
Tim Reuse	*Ensure that only the required amount of construction material is ordered (to decrease overruns). Review and purchase materials that are reused or have recycled content.*	*416-123-4567*
Kim Recycle	*Oversee collection of recyclables by recycling companies, search for new markets for materials that are currently not recyclable.*	*416-123-4567*

V. TIMETABLE FOR IMPLEMENTING WASTE REDUCTION WORK PLAN

Provide a timetable indicating when each Source Separation and 3Rs program of the Waste Reduction Work Plan will be implemented.

Source Separation and 3Rs Program	Schedule for Completion
Blue Box Recycling Program	*Before project begins, (i) purchase blue boxes and recycling carts, and prepare signs. (ii) Instruct all workers to use the Blue Boxes. (iii) Set* up collection with recycling company.
Brick and Concrete Recycling Program	*(i) Before brick laying starts, instruct brick layers to place all unusable brick in piles beside each house. Determine area that will accept brick for recycling or as clean fill. Remove brick at end of project for recycling, if possible.* *(ii) Set up contract/pricing with concrete recycling company before construction. Inform all workers to minimize spillage of concrete. Set up area for all waste concrete to be stored before construction. Send waste concrete to recycling company at the end of the project – August 2009.*
Cardboard Recycling Program	*Before construction, set up signs, bins. Bring cardboard to recycling company during and/or at the end of the project.*
Drywall 3Rs Program	*Before the project starts, (i) instruct workers about using as much scrap drywall as possible during construction, (ii) set up bin to store waste drywall, (iii) find companies that recycle drywall. At the end of project, send all drywall to recycling company.*
Insulation Reuse Program	*During construction - insulation will be reused where possible in each house. Any additional pieces will be carried over and reused in other houses.*
Metal Recycling Program	*Before project starts, (i) instruct workers about program, (ii) set up collection bin, (iii) determine recycling company. During or at the end of the project have materials collected.*
Plastic Reuse Program	*During construction. Plastic pipe will be used for various purposes as will plastic film to protect materials.*
Roofing Shingles 3Rs Program	*Before roofing begins, instruct all workers about utilizing as much of the asphalt shingles as possible. Determine if any recycling companies exist. At end of the project, recycle shingles, if possible.*
Tile Flooring Reuse Program	*Set up during construction. Tile cuttings will be reused in each house and carried to other houses with similar tile pattern for reuse, where possible.*
Wood Reuse Program	*Before construction, inform all workers to reuse as much scrap wood as possible.*

VI. COMMUNICATION TO WORKERS

Explain how the Waste Reduction Work Plan will be communicated to workers at the site of the construction or demolition project:
Jack Reduce will hold a meeting with all workers prior to project commencement to discuss the waste diversion programs to be followed for the project. A one page hand out entitled "waste diversion summary" will be provide to each worker or visitor to the site. Signs will be developed for each waste source separation bin. If any of the source separation bins are used incorrectly, staff will be informed about this and given proper instruction. Input from all workers will be encouraged regarding how to improve the waste diversion program.

VII. ESTIMATED ANNUAL WASTE PRODUCED BY MATERIAL TYPE AND THE PROJECTED ANNUAL AMOUNT TO BE DIVERTED BY THE 3RS

Material Categories *(as stated in Part III)*	**Estimated Waste Produced/Yr.*** (kgs or tonnes)	**Name of Proposed 3Rs Program** *(as stated in Part III)*	**Projections to Reduce, Reuse or Recycle Waste/Yr.** (kgs or tonnes)			**Estimated Waste Diversion Rate** ** **(%)**
			Reduce	**Reuse**	**Recycle**	
Blue Box Materials	*50 kg*	***Blue Box Recycling***			*45 kg*	*90 %*
Brick and Concrete	*(i) 1.5 tonne (ii) 2 tonnes*	***Brick and Concrete Recycling***	*Concrete 300 kg*		*Bricks 1 tonne† Concrete 1 tonne†*	*66%*
Cardboard	*300 kg*	***Cardboard Recycling***			*220 kg*	*73%*
Drywall	*500 kg*	***Drywall 3Rs***		*50 kg*	*250 kg†*	*60%*
Insulation	*10 kg*	***Insulation Reuse***		*5 kg*		*50%*
Metal	*200 kg*	***Metal Recycling***			*170 kg*	*85%*
Plastic	*50 kg*	***Plastic Reuse***		*25 kg*		*50%*
Roofing Shingles	*250 kg*	***Roofing Shingles 3Rs***		*50 kg*	*150 kg†*	*80%*
Tile Flooring	*25 kg*	***Tile Flooring Reuse***		*10 kg*		*40%*
Wood	*1 tonne*	***Wood Reuse***		*600 kg*		*60%*

(† - depends on whether a company will recycle this material from our project)

* Estimated Waste Produced = Waste Diverted (3Rs) + Waste Disposed

** Estimated Waste Diversion Rate = Amount of Waste Diverted (3Rs) ÷ Estimated Waste Produced x 100%

I hereby certify that the information provided in this Waste Reduction Work Plan is complete and correct.		
Signature of authorized official: *Mr. Bricks*	**Title:** *1234 Ontario Ltd.*	**Date:** *March 1, 2008*

LAUNCHING THE WORK PLAN

Creating Awareness

Launching your waste reduction work plan needs several important actions to ensure success:

- Your Waste Reduction Coordinator/Committee should be clear about the goals and objectives of the work plan. They should assign responsibilities and authorities to appropriate personnel in all project areas.
- It is essential to make the right resources available. This may involve staff time to manage and operate your work plan and basic equipment to contain wastes. Consultation with end users or recycling service providers will help you identify what equipment is needed.
- At the same time, your coordinator/committee should develop awareness of your work plan among all staff and workers. Open display of the work plan, as required by the regulation, and explanation of its goals will help secure full participation.

Please note that the work plan must also be communicated to outside trades who come to work on the project. In these cases a short summary of the waste reduction work plan can be handed out with instructions and the locations of recycling bins.

Staying on Course

To ensure success, you should monitor waste reduction performance against the targets established. You may find that additional waste reduction opportunities will arise, or find that more action is needed or different methods become available. You may need to adjust operating procedures and amend reduction targets, ideally upwards.

You might compare the performance of similar projects to check your reduction achievements against your targets. You can then make changes to your waste diversion targets and planned actions.

APPENDIX C: Conversion Factors

Metric Conversions

1 metric ton (mt) = 1000 kilograms (kg)
1 kilogram (kg) = 2.2 pounds (lb)
1 cubic metre (m^3) = 1.3 cubic yards (yd^3)
1 metric ton (mt) = 2200 pounds (lb)

Typical Container Sizes

4 yd^3 = 3.1 m^3
6 yd^3 = 4.6 m^3
8 yd^3 = 6.2 m^3
14 yd^3 = 10.7 m^3
20 yd^3 =15.4 m^3
40 yd^3 =30.8 m^3

Typical Weights of Items (kg)

Pallet – Softwood = 9
Pallet – Hardwood = 13.6
Pallet - 1 cu. yd. (not compacted) = 45
Pallet - 1 cu. yd. (compacted) = 91
Drum - Steel, top = 18
Drum – Steel = 16
Drum - Fibre, top = 9
Drum – Fibre = 5.5
Drum - Plastic, top = 16
Drum – Plastic =14

Example Densities (kg/m^3)

Asphalt (milled, ripped) = 800-1000
Concrete, Brick & Block = 1200-2372
Mixed Demolition, noncombustible =1000-1600
Mixed Demolition, combustible = 300-400
Odd Plastic (loose) = 30
Odd Plastic (compacted) = 416
Glass (loose) = 300-357
Glass (compacted) = 595-1189
Corrugated Container (loose) = 24-27
Corrugated Container (compacted) = 241-342
Wood – pallets = 170
Wood - dimensional lumber =145
Wood - sawdust/shavings = 241-288
Wood - trimmings = 577
Wood - crates = 108
Metal Scrap – heavy = 2408
Metal scrap – light = 803
Mixed Residential Waste = 150-300

APPENDIX D: Ministry of the Environment Forms

- **Waste Audit Report**
- **Waste Reduction Work Plan**

The blank forms included here are in PDF format. Copies of the blank forms are also available as Microsoft Word documents. This will allow you to modify the size of the tables, including the number of rows or the width of columns. The forms are available from the ministry as Word documents at:

www.ene.gov.on.ca/en/publications/forms/index.php#AuditandReduction

Ministry of the Environment Waste Form

Report of a Waste Audit

Large Construction and Demolition Projects

As required by O. Reg. 102/94

This report must be prepared before construction or demolition begins at the site. The waste audit must be retained on file for at least five years after it is prepared, and be made available to the ministry upon request. (Revised July 2008)

I. GENERAL INFORMATION

Name of Person Undertaking Project and Company Name:				
Name of Contact Person and Company:		**Telephone #:**	**Email address:**	
Project Type (Check One)*	**Construction Project**		**Demolition Project**	
Floor Area (square metres):		**Number of Buildings:**		
Street Address of Project Site (if known):				
Lot and Plan Number:		**Municipality:**		
Estimated Start Date of Project:		**Estimated Completion Date of Project:**		

**** Separate reports must be made for construction and demolition projects regardless if they occur on the same site.***

II. DESCRIPTION OF PROJECT

Provide a brief overview of the construction or demolition project:

III. CATEGORIES OF WASTE AND WASTE ITEMS

List the categories of waste the project will produce and the associated waste items for each category *(see part VI for examples of categories of waste):*	
Categories of Waste	**Waste Items**
Example: Wood	*Lumber cut-offs, Old Window frames*

IV. PRODUCTION OF WASTE

For each category of waste listed in Part III of this form, explain how the waste at the construction or demolition project will be produced. Include references to how management decisions and policies will affect the production of waste:	
How Waste Is Produced	**Decisions/Policies Affecting Waste Produced**
Example: Cut-offs and over-runs of waste shingles are produced during roofing.	*Look at more accurate measurements for estimating amount of roofing shingles required*

V. MANAGEMENT OF WASTE

For each category of waste listed in Part III of this form, indicate which waste items will be disposed or reused/recycled and how each item will be managed at the project:		
Category	**Waste to be Disposed**	**Reused or Recycled Waste**
Example: Lumber cut-offs	*Small pieces into roll off waste bin.*	*Larger pieces saved in piles and later reused as bridging or blocking during construction.*

VI. ESTIMATED QUANTITY OF WASTE PRODUCED

Categories of Waste	**Estimated Amount of Waste Produced (tonnes)**	**Categories of Waste (continued)**	**Estimated Amount of Waste Produced (tonnes)**
Brick and Concrete		Tile Flooring	
Cardboard		Carpet	
Drywall (unpainted)		Glass	
Drywall (painted)		Plaster	
Steel		Blue Box – Newspaper, cans, etc.	
Wood (unpainted or untreated)		Other	
Wood (painted/treated)			
Plastic (pipes, film, etc)			
Polystyrene Foam			
Porcelain Fixtures			
Insulation			
Asphalt			
Aluminum			
Roof Shingles			
TOTAL		**TOTAL**	

Note: When completing this form, write “n/a” in the Estimated Amount of Waste Produced column where the project will not produce any waste for a category of waste.

…/4

VII. EXTENT TO WHICH MATERIALS OR PRODUCTS USED BY THE ENTITY CONSIST OF RECYCLED OR REUSED MATERIALS OR PRODUCTS

Please answer the following questions:

1. Do you have a management policy in place that promotes the purchasing and/or use of materials or products that consist of recycled and/or reused materials or products? If yes, please describe.

_____
_____
_____
_____
_____
_____

2. Do you have plans to increase the extent to which materials or products used consist of recycled or reused materials or products? If yes, please describe.

_____
_____
_____
_____
_____
_____

Please attach any additional page(s) as required to answer the above questions.

I hereby certify that the information provided in this Report of Waste Audit is complete and correct.		
Signature of authorized official:	**Title:**	**Date:**

Ministry of the Environment Waste Form

Report of a Waste Reduction Work Plan

Large Construction and Demolition Projects

As required by O. Reg. 102/94

This report must be prepared before construction or demolition begins at the site. The waste reduction work plan must be retained on file for at least five years after it is prepared, and be made available to the ministry upon request.

I. GENERAL INFORMATION

Name of Person Undertaking Project and Company Name:				
Name of Contact Person and Company Name:	**Telephone #:**	**Email Address:**		
Project type (check one)*	**Construction Project**		**Demolition Project**	
Floor Area (square metres):	**Number of Buildings:**			
Street Address of Project Site (if known):				
Lot and Plan Number:	**Municipality:**			
Estimated Start Date of Project:	**Estimated Completion Date of Project:**			

**** Separate reports must be made for construction and demolition projects regardless if they occur on the same site.***

II. DESCRIPTION of PROJECT

Provide a brief overview of the construction and/or demolition project:

…/2

III. PLANS TO REDUCE, REUSE AND RECYCLE WASTE

For each category of waste described in Part III of "Report of a Waste Audit" (on which this plan is based), explain what your plans are to reduce, reuse and recycle the waste, including:
1) how the waste will be source separated at the project, and 2) the programs to reduce, reuse and recycle all source separated waste.

Waste Category	Source Separation and 3Rs Program
Example: Wood waste	*Separate reusable pieces into special marked bins; non-reusable pieces into disposal bin. Larger pieces of wood will be reused for bridging or blocking.*

IV. RESPONSIBILITY FOR IMPLEMENTING THE WASTE REDUCTION WORK PLAN

Identify who is responsible for implementing the Waste Reduction Work Plan at the construction or demolition project. If more than one person is responsible for implementation, identify each person who is responsible and indicate the part of the Waste Reduction Work Plan that each person is responsible for implementing.

Name of Person	Responsibility	Telephone #

V. TIMETABLE FOR IMPLEMENTING WASTE REDUCTION WORK PLAN

Provide a timetable indicating when each Source Separation and 3Rs program of the Waste Reduction Work Plan will be implemented.	
Source Separation and 3Rs Program	**Schedule for Completion**
Example: Wood Reuse Program	*Set up before construction. Ongoing during project.*

VI. COMMUNICATION TO WORKERS

Explain how the Waste Reduction Work Plan will be communicated to workers at the site of the construction or demolition project:

VIII. ESTIMATED ANNUAL WASTE PRODUCED BY MATERIAL TYPE AND THE PROJECTED ANNUAL AMOUNT TO BE DIVERTED BY THE 3RS

Material Categories *(as shown in Part III)*	**Estimated Waste Produced/Yr.*** (kgs or tonnes)	**Name of Proposed 3Rs Program** *(as stated in Part III)*	**Projections to Reduce, Reuse or Recycle Waste/Yr.** (kgs or tonnes)			**Estimated Waste Diversion Rate** ** **(%)**
			Reduce	**Reuse**	**Recycle**	
Example: Wood (unpainted)	*600 kgs*	*Wood Reuse Program*		*~ 360 kg*		*60%*

* Estimated Waste Produced = Waste Diverted (3Rs) + Waste Disposed

** Estimated Waste Diversion Rate = Amount of Waste Diverted (3Rs) ÷ Estimated Waste Produced x 100%

Note: When completing this form, write "n/a" in the Estimated Waste Produced column where the project will not produce any waste from a material category.

I hereby certify that the information provided in this Waste Reduction Work Plan is complete and correct.		
Signature of authorized official:	**Title:**	**Date:**

CREM Construction and Demolition Non-Hazardous Waste Management

Project Management Office	**Construction and Demolition (CD) Non-Hazardous Waste Management** Mandatory Compliance with the Environmental Protection Act/ Ontario's 3Rs Regulations 102/94 and 103/94		
Process Owner:	PM, SPM, MNG, P.DIR	**Approver:**	N/A
Document #:	PMO-ENV-001		

Background

This document outlines CREM's waste management obligations when undertaking Construction and Demolition (C&D) projects over 2,000 sq. metres.

Part 1 – Compliance with Ontario Regulations 102/94 and 103/94
Part 2 – Obligatory Waste Tracking Report on completion of project (NEW)
Part 3 – Compliance with Toronto Green Standard v4 for new projects
Part 4 – City of Toronto's guidelines for Renovations by Divisions, Agencies and Corporations
Part 5 – Forms and Resources

Revision History

Version	Description of Change	Date	Approved By
1.1	N/A	N/A	N/A
1.0	Initial Release	2025/06/13	Environment Team

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Part 1 - Compliance with Ontario Regulations 102/94 and 103/94

Projects over 2,000 sq. metres

The successful bidder (General Contractor) for a project must comply with Ontario Regs 102/94 and 103/94 when dealing with Construction & Demolition (CD) waste.

The Project Manager (PM) must highlight this compliance in their RFT/RFQ under Terms and Conditions, "Compliance with Laws."

The RFT/RFQ must include the GC's obligation to submit a CREM Waste Tracking Report to the PM on completion of project. Details in Part 2.

At the PM's project's kick-off meeting, the above items should be discussed with the Consultant/Construction Administrator (CA) and General Contractor (GC).

The GC is responsible for conducting a Waste Audit, preparing a **Waste Audit Report** and a **Waste Reduction Work Plan** before the project commences. The reports should be kept on file, by the owner, for at least five years after they were prepared.

The GC is responsible to maintain regular tracking of the Waste Material as defined in the plan. A minimum monthly report is to be provided and upon Substantial Completion.

It is the Construction Administrator's (CA's) responsibility to ensure the GC is complying with these Regs.

Under O. Reg 102/94 the GC must:

- Conduct a Waste Audit
- Write a Waste Audit Report that *identifies* the materials to be generated by the project (Appendix 1)
- Prepare a report of a Waste Reduction Work Plan, based on the Waste Audit Report, showing *how* these materials will be diverted through reduction, reuse, and recycling (see Appendix 2).

Under O. Reg 103/94, the GC must:

- Separate wastes identified in the Schedule from each other and from other generated wastes on-site – see link below. Refer to SCHEDULE WASTES TO BE PROVIDED FOR IN SOURCE SEPARATION PROGRAMS in Part 111 and Part 1V.

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- The source separation program shall be implemented before the Work begins at the site.

  OR

- Provide for the removal of commingled wastes identified in the Schedule above from the building site, and the immediate separation of those identified wastes from each other at a waste disposal site operating under the authority of an environmental compliance approval.

Further details are available in the links below.
https://www.ontario.ca/laws/regulation/940102 - O. Reg 102/94 - see Part IV Large Construction Projects and Part V Large Demolition Projects

https://www.ontario.ca/laws/regulation/940103 – O. Reg 103/94 Source Separation Programs - #7 Large Construction Projects, #8 Large Demolition Projects.

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Revised: 20##/##/##
Developed: 2025/06/05

Appendix 1

Detailed Waste Audit and written Waste Audit Report
O. Reg 102/94

Before the project starts, to comply with O. Reg 102/94, the GC will conduct a *waste audit* that identifies the waste materials expected to be generated by the construction and/or demolition project.

The GC's *waste audit report*, based on the audit findings, will identify the materials that have to be source-separated to comply with Regulation 103/94 as well as other materials that can be source-separated for recycling, reuse, or salvage. It will identify the materials that cannot be diverted (residual waste) that will go to landfill.

See Part 5 of this document for the Ministry of the Environment, Conservation and Parks (MOECP) form.

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Developed: 2025/06/05

Appendix 2

Waste Reduction Work Plan O. Reg 102/94 & O. Reg 103/94

The Construction Administrator (CA) shall confirm the GC has completed the waste audit report before creating the waste reduction work plan.

Using the waste audit report results, the GC creates a *waste reduction work plan* which shows how the waste will be separated at the project site and what programs will reduce, reuse, and recycle the waste generated by the project.

Download the MOECP's Waste Reduction Work Plan form here.

See Part 5 of this document for the Ministry of the Environment, Conservation and Parks (MOECP) form.

End of Part 1

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Part 2 - CREM Obligatory Waste Tracking Report on completion of project (NEW)

To track the waste generated by large construction and demolition projects (2,000 sq. ft), the PMO is directing PMs to ensure GCs submit a waste tracking report at regular intervals and upon completion. It is essential the PMO has a record of the types of waste and how the wastes were managed by the GC in compliance with the Ontario Regulations 102/94 and 103/94.

Identifying how waste was recycled, salvaged, or landfilled can highlight project areas where waste reduction can be introduced with a view to salvaging materials for future reuse.

Once the project is completed, and as part of the project closure documents, the GC will sign and submit a Waste Tracking Report to the CM / PM.

The PM will acknowledge receipt of the Report and submit it to be filed in the project's closeout folder.

Signed and dated weigh tickets and receipts from all haulers and recycling facilities, salvage companies and landfill sites, must accompany the report.

The PM is responsible for acknowledging receipt of the Report and filing it with attachments in the project's closeout folder.

See Part 5 of this document for the CREM Waste Tracking Report template.

End of Part 2

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Part 3 - Toronto Green Standard v4

The following is taken from the TGS v4 website.
The Toronto Green Standard Version 4 consolidated Standard applies to **all new** City Agencies, Corporations & Division-Owned residential and non-residential development projects (including additions) that are greater than 100m2 GFA.

The TGS includes two requirements for waste management plans for your projects under the Solid Waste section, Construction Waste Management, SW 4.1 and 4.2 with detailed specifications outlining the requirements.

SW 4.1 Construction Waste Management
Manage construction and demolition waste in accordance with O. Reg. 103/94, of the Environmental Protection Act, which applies to large construction projects that contain one or more City buildings and have a total floor area greater than 2000m2, as amended: Industrial, Commercial and Institutional Source Separation Programs. 1,2

SW 4.2 Construction Waste Diversion ((Refer to Specifications & Resources 3,4,5)

Waste Management Plan and Report
All projects must develop and implement a construction and demolition waste management plan and divert at least 75 per cent of the total construction and demolition material from landfill: diverted materials must include at least four material streams.

OR

Generate less than 100 kg/m² of construction and demolition waste through reuse and source reduction design strategies. Salvage or recycle renovation and demolition debris and utilize waste minimizing design strategies for new construction elements. Track all materials generated by the project from start of construction through project completion to determine the project's total waste generation. Include all waste and diverted materials in the calculation of total project waste. Exclude hazardous materials and land-clearing debris from calculations.

Further specifications and resources available at

https://www.toronto.ca/city-government/planning-development/official-plan-guidelines/toronto-green-standard/toronto-green-standard-version-4/city-agency-corporation-division-owned-facilities-version-4/waste-and-the-circular-economy/

End of Part 3

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Part 4 - City of Toronto's guidelines for Renovations by Divisions, Agencies and Corporations

The City's Renovation Projects Guidelines provide a consistent approach when dealing with renovations in the City of Toronto to mitigate health and safety concerns associated with this work through enhanced communication, selection of products and recommended work practices**.**

Renovations are not covered by Regs 102/94 and 103/94.

CREM PMs are expected to follow 'best practices' regarding waste generated by renovation projects. There is no need for waste audit reports or waste reduction plans, but PMs should be aware of what is happening with the waste the project generates.

These are the City of Toronto Renovation Projects Guidelines for project managers doing office renovations.

https://www.toronto.ca/city-government/accountability-operations-customer-service/city-administration/corporate-policies/people-equity-policies/renovation-projects-guidelines/

End of Part 4

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Part 5 - Forms and Resources

Guides and Forms:

Document Name	
A Guide to Waste Audits and Waste Reduction Work Plans for Construction & Demolition Projects	2481e01-A Guide to Waste Audits and W
Completed Waste Audit Form Form Sample	CompletedWASample-CD.pdf
Completed Waste Reduction Work Plan Form Sample	CompletedWRWPSample-CD.pdf
Blank Waste Audit Form	WA-CD.doc
Blank Waste Reduction Work Plan Form	WRWP-CD.doc
CREM Waste Tracking Report	2025.06.05-Waster Tracking Report v1.0.c

End of Part 5

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Ministry of the Environment Waste Form

Report of a Waste Audit

Large Construction and Demolition Projects

As required by O. Reg. 102/94

This report must be prepared before construction or demolition begins at the site. The waste audit must be retained on file for at least five years after it is prepared, and be made available to the ministry upon request. **(revised July 2008)**

I. GENERAL INFORMATION

Name of Person Undertaking Project and Company Name:				
Name of Contact Person and Company:		**Telephone #:**		**Email address:**
Project Type (Check One)*	**Construction Project**		**Demolition Project**	
Floor Area (square metres):		**Number of Buildings:**		
Street Address of Project Site (if known):				
Lot and Plan Number:		**Municipality:**		
Estimated Start Date of Project:		**Estimated Completion Date of Project:**		

**** Separate reports must be made for construction and demolition projects regardless if they occur on the same site.***

II. DESCRIPTION OF PROJECT

Provide a brief overview of the construction or demolition project:

III. CATEGORIES OF WASTE AND WASTE ITEMS

List the categories of waste the project will produce and the associated waste items for each category *(see part VI for examples of categories of waste):*	
Categories of Waste	**Waste Items**
Example: Wood	*Lumber cut-offs, Old Window frames*

IV. PRODUCTION OF WASTE

For each category of waste listed in Part III of this form, explain how the waste at the construction or demolition project will be produced. Include references to how management decisions and policies will affect the production of waste:	
How Waste Is Produced	**Decisions/Policies Affecting Waste Produced**
Example: Cut-offs and over-runs of waste shingles are produced during roofing.	*Look at more accurate measurements for estimating amount of roofing shingles required*

V. MANAGEMENT OF WASTE

For each category of waste listed in Part III of this form, indicate which waste items will be disposed or reused/recycled and how each item will be managed at the project:		
Category	**Waste to be Disposed**	**Reused or Recycled Waste**
Example: Lumber cut-offs	*Small pieces into roll off waste bin.*	*Larger pieces saved in piles and later reused as bridging or blocking during construction.*

VI. ESTIMATED QUANTITY OF WASTE PRODUCED

Categories of Waste	Estimated Amount of Waste Produced (tonnes)	Categories of Waste (continued)	Estimated Amount of Waste Produced (tonnes)
Brick and Concrete		Tile Flooring	
Cardboard		Carpet	
Drywall (unpainted)		Glass	
Drywall (painted)		Plaster	
Steel		Blue Box – Newspaper, cans, etc.	
Wood (unpainted or untreated)		Other	
Wood (painted/treated)			
Plastic (pipes, film, etc)			
Polystyrene Foam			
Porcelain Fixtures			
Insulation			
Asphalt			
Aluminum			
Roof Shingles			
TOTAL		**TOTAL**	

Note: When completing this form, write "n/a" in the Estimated Amount of Waste Produced column where the project will not produce any waste for a category of waste.

…/4

VII. EXTENT TO WHICH MATERIALS OR PRODUCTS USED BY THE ENTITY CONSIST OF RECYCLED OR REUSED MATERIALS OR PRODUCTS

Please answer the following questions:

1. Do you have a management policy in place that promotes the purchasing and/or use of materials or products that consist of recycled and/or reused materials or products? If yes, please describe.

_____
_____
_____
_____
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2. Do you have plans to increase the extent to which materials or products used consist of recycled or reused materials or products? If yes, please describe.

_____
_____
_____
_____
_____
_____

Please attach any additional page(s) as required to answer the above questions.

I hereby certify that the information provided in this Report of Waste Audit is complete and correct.		
Signature of authorized official:	**Title:**	**Date:**

Ministry of the Environment Waste Form

Report of a Waste Reduction Work Plan

Large Construction and Demolition Projects

As required by O. Reg. 102/94

This report must be prepared before construction or demolition begins at the site. The waste reduction work plan must be retained on file for at least five years after it is prepared, and be made available to the ministry upon request.

I. GENERAL INFORMATION

Name of Person Undertaking Project and Company Name:				
Name of Contact Person and Company Name:	**Telephone #:**	**Email Address:**		
Project type (check one)*	**Construction Project**		**Demolition Project**	
Floor Area (square metres):	**Number of Buildings:**			
Street Address of Project Site (if known):				
Lot and Plan Number:	**Municipality:**			
Estimated Start Date of Project:	**Estimated Completion Date of Project:**			

**** Separate reports must be made for construction and demolition projects regardless if they occur on the same site.***

II. DESCRIPTION of PROJECT

Provide a brief overview of the construction and/or demolition project:

III. PLANS TO REDUCE, REUSE AND RECYCLE WASTE

For each category of waste described in Part III of "Report of a Waste Audit" (on which this plan is based), explain what your plans are to reduce, reuse and recycle the waste, including:
1) how the waste will be source separated at the project, and 2) the programs to reduce, reuse and recycle all source separated waste.

Waste Category	Source Separation and 3Rs Program
Example: Wood waste	*Separate reusable pieces into special marked bins; non-reusable pieces into disposal bin. Larger pieces of wood will be reused for bridging or blocking.*

IV. RESPONSIBILITY FOR IMPLEMENTING THE WASTE REDUCTION WORK PLAN

Identify who is responsible for implementing the Waste Reduction Work Plan at the construction or demolition project. If more than one person is responsible for implementation, identify each person who is responsible and indicate the part of the Waste Reduction Work Plan that each person is responsible for implementing.

Name of Person	Responsibility	Telephone #

V. TIMETABLE FOR IMPLEMENTING WASTE REDUCTION WORK PLAN

Provide a timetable indicating when each Source Separation and 3Rs program of the Waste Reduction Work Plan will be implemented.	
Source Separation and 3Rs Program	**Schedule for Completion**
Example: Wood Reuse Program	*Set up before construction. Ongoing during project.*

VI. COMMUNICATION TO WORKERS

Explain how the Waste Reduction Work Plan will be communicated to workers at the site of the construction or demolition project:

VII. Estimated Annual Waste Produced By Material Type And The Projected Annual Amount To Be Diverted By The 3Rs

Material Categories *(as shown in Part III)*	**Estimated Waste Produced/Yr.*** (kgs or tonnes)	**Name of Proposed 3Rs Program** *(as stated in Part III)*	**Projections to Reduce, Reuse or Recycle Waste/Yr.** (kgs or tonnes)			**Estimated Waste Diversion Rate** ** **(%)**
			Reduce	**Reuse**	**Recycle**	
Example: Wood (unpainted)	*600 kgs*	*Wood Reuse Program*		*~ 360 kg*		*60%*

* Estimated Waste Produced = Waste Diverted (3Rs) + Waste Disposed

** Estimated Waste Diversion Rate = Amount of Waste Diverted (3Rs) ÷ Estimated Waste Produced x 100%

Note: When completing this form, write "n/a" in the Estimated Waste Produced column where the project will not produce any waste from a material category.

I hereby certify that the information provided in this Waste Reduction Work Plan is complete and correct.		
Signature of authorized official:	**Title:**	**Date:**

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.

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, door widening 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 Disconnect and/or re-route electrical data, communication and telephone service lines entering structures to be demolished. Remove abandoned lines as indicated on Drawings. Post warning signs on electrical lines and equipment which is required to remain energized.

.5 Remove or relocate existing equipment and services unexpectedly encountered, not indicated on Drawings, and interferes with such Work.

.6 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 Demolition shall proceed safely in systematic manner from roof to grade and as necessary to accommodate remedial Work indicated. Work on each floor level shall be complete before commencing Work on supporting structure and safety of its supports are impaired. Parts of building which would otherwise collapse prematurely shall be securely shored. Walls and piers shall not be undermined.

.4 Do not overload floor or wall with accumulations of material or debris or by other loads.

.5 Remove existing equipment, services, and obstacles where required for refinishing or making good of existing surfaces, and replace as Work progresses.

.6 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.

.7 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.

.8 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.

.9 Concrete:

.1 Demolish concrete by methods which avoid impact loads on items which are not to be demolished.

.2 Where only part or parts of a concrete floor, wall, roof, foundation or other items are to be demolished, use saw cuts to isolate areas which are to be demolished except where existing reinforcing steel is to be left in place. Prior to such isolating, install suitable support to prevent premature movement of area(s) being isolated and undesirable transfer of loads as cutting progresses. If necessary remove area(s) to be demolished by successively isolating small sections.

.3 Where reinforcing steel is to be left in place, use saw cuts from surface of concrete reinforcing steel around perimeter(s) of area(s) to be demolished, chip concrete without damaging reinforcing steel. Retouch damaged epoxy coating of existing reinforcing steel.

.10 Masonry: Demolish block or brick walls in small sections of not more than 2 m^2. Where only part(s) of a wall is to be demolished, install adequate support for adjacent part(s). Do not permit masonry to fall in mass from one level to another

.11 Roofs

.1 Remove gravel to expose membrane. Cut back minimum of 230 mm outside line of new roofing to facilitate future flashing.

.2 Remove membrane, insulation and vapour barrier over area to be demolished. Cut roof decking along lines as indicated on Drawings with power tools to ensure straight edges. Leave free ends 300 mm maximum in length, unless adequately supported.

.3 Supply and install plywood catchboard immediately under areas to be cut, to protect structure interior from falling debris. Install catchboard in combination with dust/weather protection.

.4 Remove and recycle mill deck.

.12 Sheet metal flashings: Remove sheet metal flashings indicated on Drawings and recycle.

.13 Where doors are scheduled to be removed for disposal, include removal of door frames and door hardware.

.14 Remove interior partitions, fittings, fixtures and accessories as indicated on Drawings. Partitions and walls shall be removed full height to structure above.

.15 Ceiling

.1 Removal of existing ceilings shall include complete removal including bulkheads and suspension system.

.2 Where ceilings are to be removed to accommodate Work, and later reinstalled, carefully disassemble ceilings to the extent required.

.3 Where ceilings are to remain after wall or bulkheads are demolished, remove ceiling components as required to complete demolition work. Coordinate with trades doing new ceiling work, and confirm what components are to be retained for reuse. Cut tiles may not be used; new full or appropriately cut tiles will be required.

.16 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.

.17 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.

.18 Cutting

.1 Cut openings through existing walls, partitions, roofs and floors. Establish exact location of steel reinforcing in existing concrete slabs or walls before cutting. Be responsible for damage to existing steel reinforcing and be liable for structural failure. Make good surfaces disturbed with materials to match existing.

.2 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.

.3 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).

.4 Demolish masonry and concrete in small sections.

.5 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.

.19 Cutting of Precast Wall Panels

.1 Examine the Site to verify existing precast wall panel condition.

.2 Engage the original precast wall panel manufacturer or a licensed professional structural engineer to determine the extent of cutting and to design the structural support at the opening, unless design is noted on Drawings.

.3 Have cutting performed under the supervision of the above.

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 Upon completion, clean site(s) in areas disturbed by construction activities, including landscaped areas. Remove and dispose of rubbish, surplus materials, waste materials, tools and other equipment. Leave site(s) in a neat clean and safe condition acceptable to Consultant.

.2 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 **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.

.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.

.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 over lap 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 form 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 Dioctylphthalate (DOP) Test: A test method that uses Dioctylphthalate 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.

.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 Lechate 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 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 contactor 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.

.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.

.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 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.

.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.

.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.

.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 <u>Cleanup:</u>

.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.

.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 form 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.

.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 contactor 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 contactor 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.

.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.

.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 contactor 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 of 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.

.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 were 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.

.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

Asbestos Management

July 2007

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 heath 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 manufacturer 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.

<u>Management of all divisions that occupy buildings where asbestos is present will:</u>

- 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.

<u>The Occupational Health and Safety Co-ordinating Committee will:</u>

- 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 July 23, 2007**

City of Toronto

Asbestos Management Plan

ASBESTOS MANAGEMENT PLAN

Prepared by:

City of Toronto

TABLE OF CONTENTS

Section *Page*

GLOSSARY OF TERMS

SECTION 1.0

1.0 Introduction 1
1.1 Purpose and Scope 1
1.2 Program Statement 2
1.3 Program Elements 3
1.3.1 Asbestos Inventory 3
1.3.2 Administration 4
1.3.3 Operations and Maintenance 4
1.3.4 Work Procedures 5
1.4 Regulatory Requirements 6
1.4.1 Regulation Asbestos 6
1.4.2 EPA General 8
1.4.3 Dangerous Goods Transportation Act 8

SECTION 2.0 ADMINISTRATION

2.0 Use of this Manual 1
2.1 Administration of the Asbestos Management Plan 1
2.1.1 Personnel Involved in Acquisition or Leasing 1
2.1.2 Personnel Leasing to City of Toronto 2
2.1.3 Facility Manager 2
2.1.4 Project Manager 4
2.1.5 Facility Occupants and Tenant Representatives 5
2.2 Record Keeping and Documentation of AMP 7
2.3 Contractor Requirements 7
2.4 Janitorial Work 8
2.5 Location of ACM Documentation 8
2.5.1 Introduction 8
2.6 Asbestos Surveys 9
2.7 Bulk Sample Collection Procedures 9
2.8 Bulk Analysis 9
2.9 Overall Site Floor Plan 10
2.10 Tenant Summary Documentation 10
2.11 Master Locations Document 11
2.12 Distribution of Assessment Record and Reassessment 12

TABLE OF CONTENTS

Section		*Page*
SECTION 3.0	**OPERATIONS AND MAINTENANCE PROGRAM**	
3.0	Operations and Maintenance Program	1
3.1	Introduction	1
3.2	Periodic Building Inspection and Assessment of ACM	2
3.2.1	Routine Inspection	2
3.2.2	Formal Inspection	3
3.2.3	Pre-Renovation or Construction Inspection	3
3.3	Reassessment of ACM and Update of Survey Record	4
3.4	Distribution of Assessment Record and Reassessment	4
3.5	Pre-Construction Asbestos Survey	4
3.6	Notification	7
3.6.1	City of Toronto Staff	7
3.6.2	Notification to Tenants	8
3.6.3	Service Personnel and Maintenance Personnel or Contractors	8
3.7	Notification of Asbestos Abatement	8
3.8	Emergency Procedures and Contacts	9
3.8.1	Fallen Debris or Damaged Materials	9
3.9	Disturbance of Previously Unidentified Friable Material	11
3.9.1	Module 1: General Awareness Training	11
3.9.2	Module 2: Type 1 Work Training	12
3.9.3	Module 3: Type 2 Work Training	13
3.9.4	Module 4: Evaluating the Impact of Asbestos in a Facility	14
3.9.5	Module 5: Outside In-Depth Training	15
3.10	Training	15
3.11	Personal Protective Equipment Program	16
3.11.1	Respiratory Equipment	16
3.11.2	Requirement	16
3.11.3	Fit-Testing	18
3.11.4	Maintenance	19
3.11.5	Cleaning	19
3.11.6	Storage	20
3.11.7	Training	20
3.11.8	Protective Clothing	21
3.12	Medical Surveillance Program	21
3.12.1	Employee Exposure Records	22
3.13	Work Authorization	26
3.13.1	Maintenance/Renovation Permit System	26
3.13.2	Work Practices for Renovation and Remodelling	26
3.13.2.1	Renovation	26
3.13.2.2	Remodelling	27
3.13.2.3	Specialized Cleaning Procedures	27
3.13.2.4	Special Work Practices for Maintenance Activities	27
3.13.2.5	Emergency Response Procedures	27
3.13.2.6	Minor Episodes	28
3.13.2.7	Major Episodes	28

TABLE OF CONTENTS

Section		*Page*
3.14	Waste Disposal	28
3.15	Air Monitoring	31
3.15.1	Air Sampling Program	32
3.15.1.1	Occupied Building	32
3.15.1.2	Abatement Projects	32
3.16	Equipment	32
3.16.1	Asbestos Equipment Room	32
3.16.2	List of Equipment	33
3.16.3	Special Equipment – HEPA Vacuum Cleaners	34
3.16.4	Requirement for Use	35
3.16.5	Handling and Cleaning HEPA Vacuums	35
SECTION 4.0	**ASBESTOS WORK PROCEDURES**	
4.0	Asbestos Work Procedures	1
4.1	Classification of Scheduled Work	1

LIST OF FIGURES

SECTION 2.0		
Figure 2.1	Overview of Asbestos Management Plan	6
SECTION 3.0		
Figure 3.1	Periodic Inspection of Asbestos-Containing Materials	5
Figure 3.2	Asbestos Control Program Damage Report	6
Figure 3.3	Asbestos Emergency or Damage Reporting	10
Figure 3.4	Asbestos Work Report	24
Figure 3.5	Employee Exposure Record	25
Figure 3.6	Record of Waste Disposal	30
SECTION 4.0		
Figure 4.1	Major Project Protocols for Renovation or Demolition	4

TABLE OF CONTENTS

Section *Page*

LIST OF TABLES

SECTION 1.0
Table 1.1 Summary of Legislation 6

SECTION 3.0
Table 3.1 Asbestos Air Quality Criteria in Ontario 31

SECTION 4.0
Table 4.1 Classification of Asbestos Work Types 1

APPENDICES

APPENDIX A – Asbestos Fact Sheet

APPENDIX B – Reference Materials

APPENDIX C – Letter of Notification to Tenants Regarding Asbestos in Premises

APPENDIX D – Contractor Notification and Acknowledgement Form

APPENDIX E – Work Practices (Emergency Work)

APPENDIX F – Asbestos Project Work Record

APPENDIX G – Asbestos Work Procedures

APPENDIX H – Reassessment of ACM

ASBESTOS MANAGEMENT PLAN

Prepared by:

City of Toronto

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	In relation to specific work, means a worker who, • 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.

GLOSSARY OF TERMS

Enclosure	Enclosure of ACM means the construction of solid enclosure (walls, ceiling, bulkhead etc.) around ACM, or An Enclosure means the site isolation including hoarding walls, polyethylene sheeting and seals that isolates an Asbestos Work Area.
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	Material that: • 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	Joint Health and Safety Committee. ▪ 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 • *Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations* • 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 • *General – Waste Management* • 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 • *General* • 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 at though it contained a type of asbestos other then 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 title, 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 Good 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

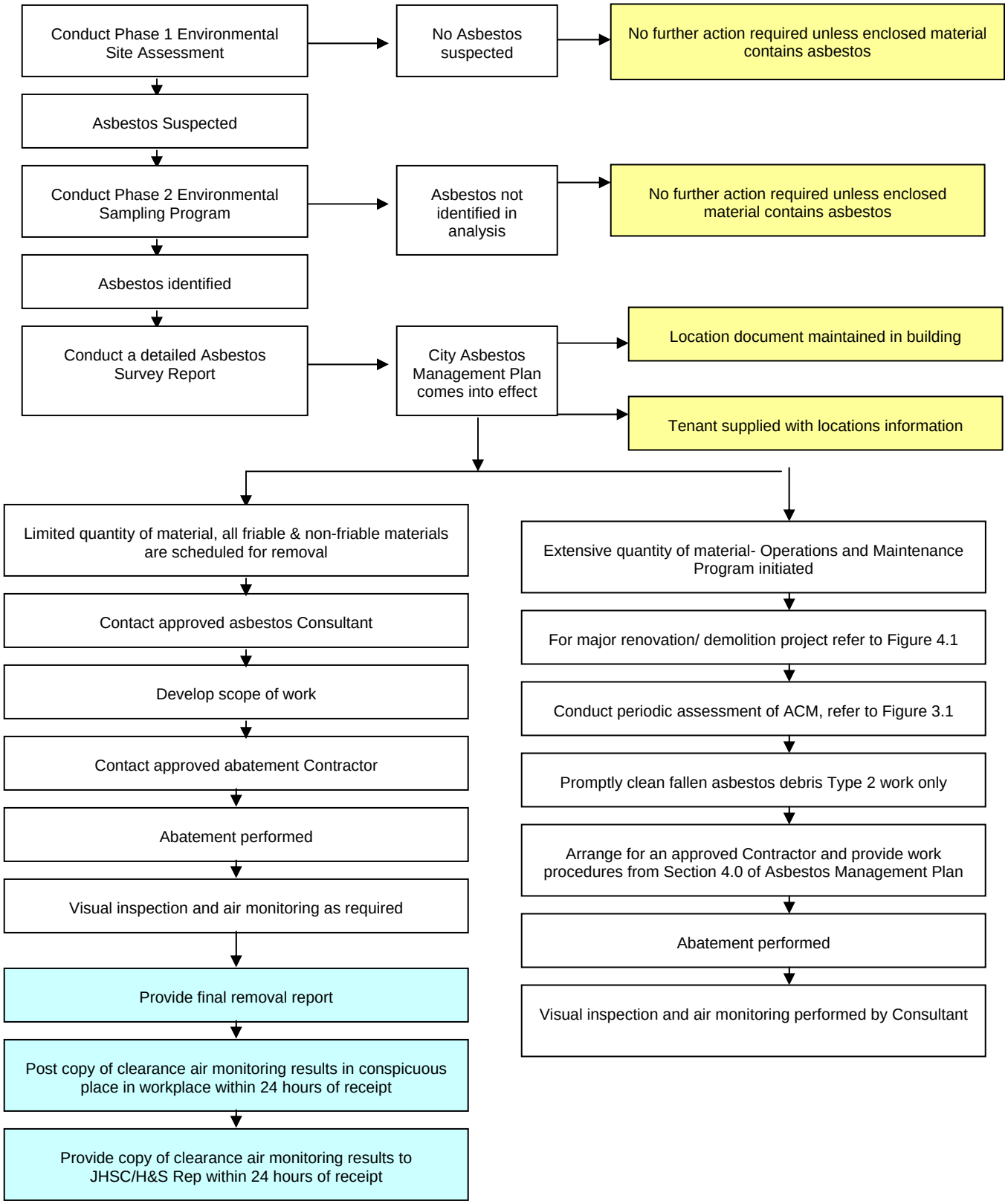
All persons in the Facility who may arrange for maintenance or alteration of the Facility are to be made aware of the presence of ACM and shall:

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

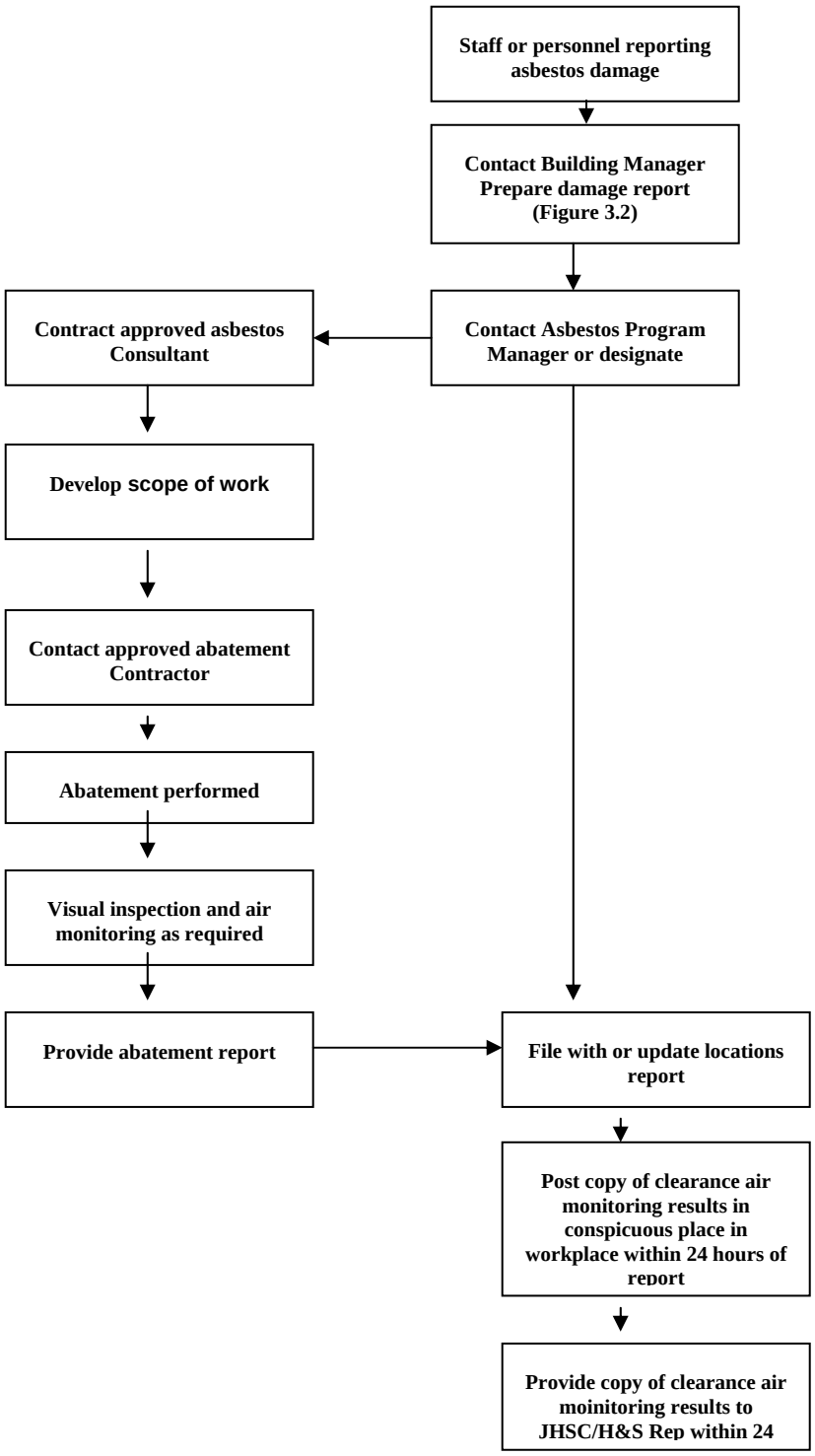


FIGURE 3.2 - ASBESTOS CONTROL PROGRAM DAMAGE REPORT

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.

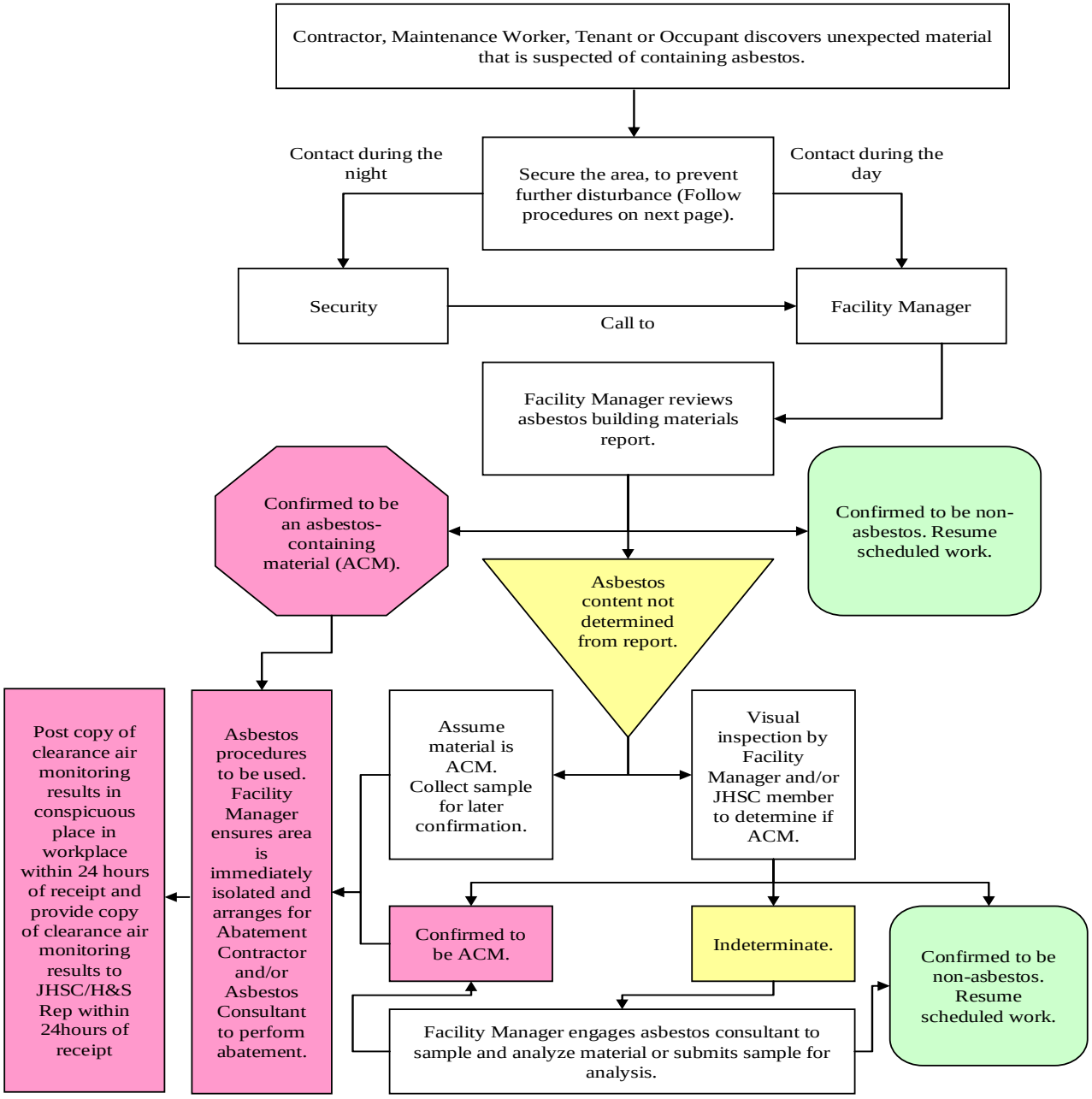
Facility Management shall follow the protocol "Emergency Reaction in the Event of a Suspected Asbestos Spill" (Appendix E).

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 preformed, 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 preformed, 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 Manger, 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 ua 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 réglement 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.			Family Physician's Name and Address/Nom et adresse du médecin de famile
	Y/A	M/M	D/J	

	Type 2	**Type 3**
Hours of Work/Heures de travail		

Return to: Provincial Physician Occupational Health & Safety Branch Ministry of Labour 655 Bay St 14th 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 14th 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

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 no 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:

(1) Ontario Regulation 278/05, as amended, – Designated Substance – Asbestos, made under the *Occupational Health and Safety Act.*

(2) *Summary of Point of Impingement Standards, Point of Impingement Guidelines and Ambient Air Quality Criteria* (AAQCs), Standards Development Branch, Ontario Ministry of the Environment, December, 2005.

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 24hours 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:

<u>Work Procedure:</u>

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

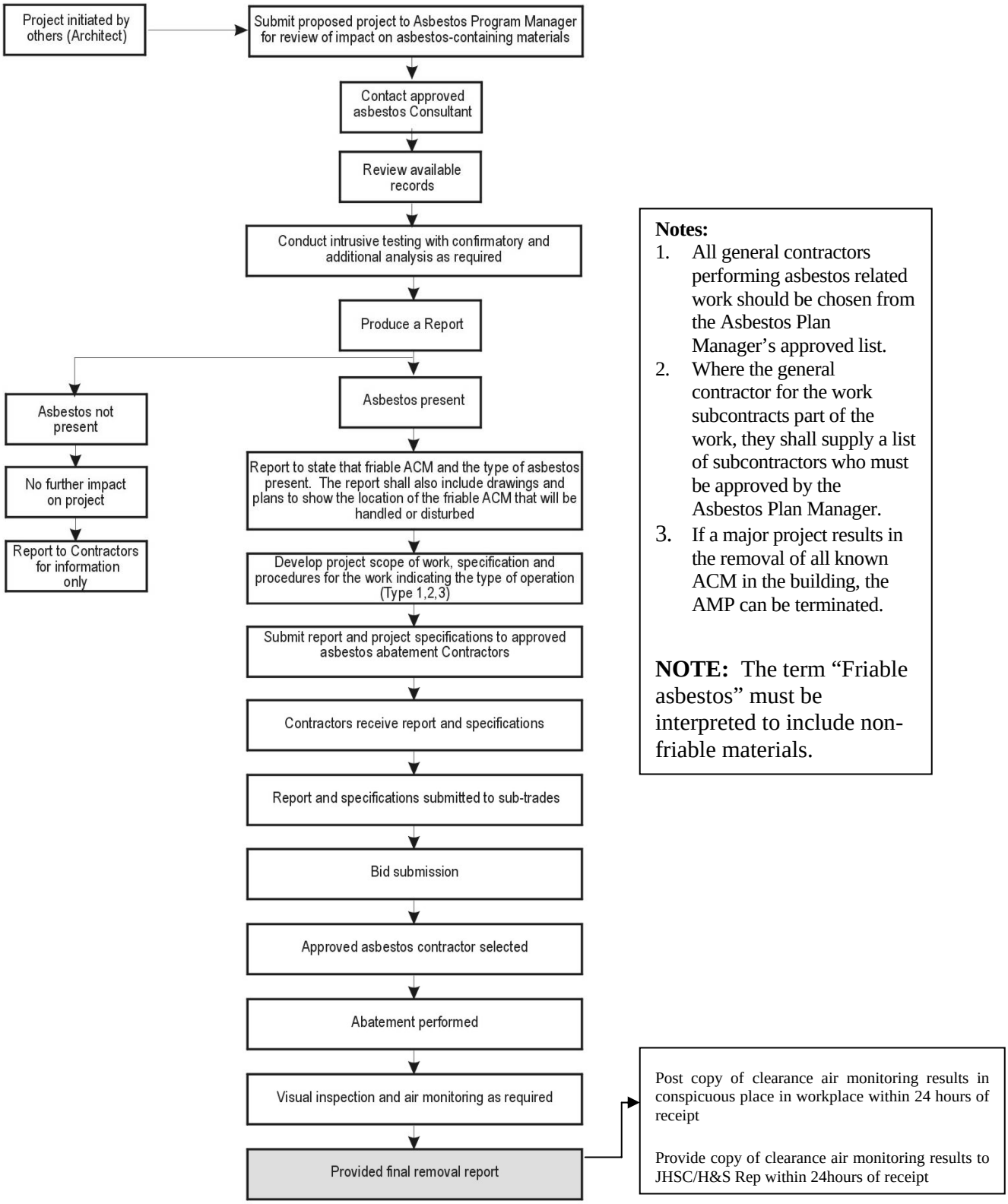
TABLE 4.1 – Classification of Asbestos Work Types

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, 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, 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, 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 CLASSIFICAION	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: 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



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 then 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/environ/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
G10	Cleaning out of HEPA Filtered Vacuum Cleaners, Asbestos Waste Storage and Disposal – Type 2 Work

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 (≤ 1 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).

Room or Location	Material	Comments regarding condition – Disturbed/Undisturbed (if other, explain)	Action Required

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.

.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.

.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.

.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:

.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 m^3 of concrete or for each 30 m^3 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.

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"

.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 Approved 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 Approved 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 Approved equal

.16 Workability-retaining admixture: Conforming to ASTM C494, Type S:

.1 Master Builders Solutions (Formerly BASF Corporation) "MasterSure Z 60”

.2 Approved 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/m^3 (15 litres/m^3) of concrete

.2 Grace "DCI" or "DCI-S" at the rate of 10 litres/m^3 (15 litres/m^3) of concrete

.3 Axim "Catexol 1000 CNCI" at the rate of 10 litres/m^3 (15 litres/m^3) of concrete

.4 Master Builders Solutions (Formerly BASF Corporation) “MasterLife CI 30" at the rate of 10 litres/m^3 (15 litres/m^3) 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 Approved 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 Approved equal.

.20 Viscosity-modifying admixture: Conforming to ASTM C 494:

.1 Master Builders Solutions (Formerly BASF Corporation) “MasterMatrix” Series

.2 Approved 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.

.1 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 Approved 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"

.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 "Epoxcrete (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 approved equivalent, 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: Dow 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.

.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 Stair nosings for concrete stairs: American Safety Tread Co./Safety Stair Products "FA-311D", IKG Industries “Mebac C-3E” or Wooster Products equivalent.

.40 Stair nosings for concrete filled steel pan stairs: American Safety Tread Co./Safety Stair Products, “FAL311”, IKG Industries Mebac “A-3E” or Wooster Products equivalent.

.41 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 approved equivalent. 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.

.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.

.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.

.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 coved 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.

.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 approved 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.

.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.

1.2 **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:

.1 Product data: Submit as Shop Drawings, manufacturer's specifications and other technical data for masonry.

.2 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

.3 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.

.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 **BRICK**

.1 Source (each type of) masonry unit from one manufacturer. Units to be of uniform texture and colour for each kind required.

.2 Brick Veneer (BR-1):

.1 Metric modular, hard burned clay brick masonry units, conforming to CSA A82.

.2 Finish exposed ends of brick at external corners, headers, control joints, expansion joints and openings same as the face.

.3 To match existing brick in all respects, modular size, with special shapes and sizes as detailed.

.4 Where brick veneer masonry type is not specified, provide Type X, exterior grade.

.5 Colour: Solstice Matt

.6 Size as indicated on Drawings.

.7 Manufacturer:

.1 Contemporary Series by Brampton Brick

.2 Or accepted equal

.8 Sills: in accordance with Contract Drawings. Colours to match existing or as selected by Consultant.

.3 Brick Veneer (BR-2):

.1 To match existing brick in all respects, modular size, with special shapes and sizes as detailed.

.2 Where brick veneer masonry type is not specified, provide Type X, exterior grade.

.3 Colour: Iceland White

.4 Manufacturer:

.1 “Finesse” by Brampton Brick

.2 Or accepted equal

2.2 CONCRETE BLOCK

.1 Concrete blocks: Normal weight, metric modular, moisture-controlled units conforming to CSA A165.1, Type H/15/A/M (and Type S/15/A/M).

.1 Exposed surfaces: Free of cracks, chips or other blemishes, and broken corners. Use sash blocks at control joints, solid block around openings for rolling steel doors or shutters and 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 and block at door jambs: Bullnosed type.

.3 Special shapes: Manufacture to shape shown; do not field cut stretcher units to make special shapes.

.2 Concrete blocks: Lightweight, metric modular moisture-controlled units conforming to CSA A165.1, Type H/15/C/M and Type S/15/C/M. Do not use for walls in contact with earth or where exposed to the weather. For the purpose of fire-resistance rating, conform to the requirements of $L_2$20S as specified in the National Building Code.

.1 Exposed surfaces: Free of cracks, chips or other blemishes and broken corners. Include required sash blocks for control joints, solid block around openings for rolling steel doors or shutters 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 and block at door jambs: Bullnosed type.

.3 Special shapes: Manufacture to shape shown; do not field cut stretcher units to make special shapes.

.4 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.

2.3 MORTAR AND GROUT

.1 Mortar: Conforming to CSA A179-M, Type "S".

.2 Mortar (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.

.3 Mortar (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.

.4 Grout: Conforming to CSA A179-M, coarse.

2.4 **REINFORCEMENT**

.1 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 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.

.2 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.

.3 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.

.4 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).

.5 Vertical reinforcement: Conforming to CAN/CSA G30.18-M, Grade 400.

2.5 **ACCESSORIES**

.1 Insulation adhesive: Synthetic rubber based compatible with insulation as recommended by insulation manufacturer.

.2 Concrete block cell insulation: "Zonolite" granular vermiculite by W.R. Grace.

.3 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 Fibreglass or 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.

.4 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.

.5 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.

.6 Brick Control Joints Material:

.1 Neoprene Sponge by Blok-Lok Limited.

.2 NS - Closed Cell Neoprene Sponge by Hohmann & Barnard Company

.7 Expansion joint flashings: Insulated Lexsuco "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.

.8 Dampproof course and through-wall flashings: "Blueskin SA" by Monsey Bakor, or "Sopraseal Stick" by Soprema, self-adhesive grade.

.9 Cavity wall ventilation inserts: Dur-O-Wal "Cell Vent Weep-Hole Ventilator". Colour as selected by the Consultant.

.10 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.

.11 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.

.12 Brick and block vents: Titus "Model OXL-77" complete with duct extension and birdscreen; exposed surfaces clear anodize finished.

.13 Anchor bolts: Minimum 9 mm diameter steel, in length shown on Drawings, hot-dip galvanized to CAN/CSA G164-M.

.14 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.

.15 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.

3.2 **GENERAL MASONRY CONSTRUCTION**

.1 Carefully and neatly lay masonry, truly vertical and horizontal, with joints of uniform size as required to suit requirements for design coursing and bonding.

.2 Tooth intersections of walls with alternating units, except as otherwise shown or where control joints and expansion joints occur.

.3 Lay blocks in running bond except where shown otherwise. Lay in full mortar beds with face shell vertical joints filled. Align block webs vertically and with thicker ends of face shells up.

.4 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.

.5 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.

.6 Lay ledge blocks in running bond in full mortar beds and with vertical joints filled with mortar. Tool joints flush.

.7 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.

.8 Lay brick in such a way that vertical joints in alternate brick courses are plumb from the top course to the bottom course.

.9 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.

.10 Match coursing, bonding (colour and texture) of new masonry work with existing Work where indicated.

.11 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.

.12 Coordinate building-in of anchors as required for the proper installation of the Work of other trades.

.13 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.

.14 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.

.15 Build recesses to receive items recessed in masonry.

.16 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".

3.3 **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.

3.4 **MODIFICATIONS TO EXISTING MASONRY**

.1 Match existing bond and coursing height of adjacent masonry to remain.

.2 Tooth new masonry into existing masonry in run of wall and at intersections with existing partitions.

.3 At new openings in masonry walls, remove units, clean and re-install rotated to conceal cut and expose finish surface.

.4 Clean bond areas of adjacent masonry to remain, remove loose material and prepare masonry to receive new masonry toothed in.

.5 Install reinforcement as necessary to provide continuity of reinforcing and stability between existing and new masonry work.

.6 Provide repair anchors as necessary to stabilize existing masonry adjacent to and affected by the Work.

3.5 **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.

3.6 **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.

3.7 **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.

3.8 **PARGING**

.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.

3.9 **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.

3.10 **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.

.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.

3.11 **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:

.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.

.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 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.

.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 (tee) 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.

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 "Galvafroid" 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.

.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 or roofing trade.

.4 Coordinate location and size of openings with mechanical trades (Contract) 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

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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 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	CAN3-S157-M	-	Strength Design in Aluminum
.15	CSA-G40.20/G40.21-M	-	General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel
.16	CAN/CSA-S16.1	-	Limit States Design of Steel Structures

.17	CAN/CGSB-1.181	-	Ready Mixed Organic Zinc Rich Coating
.18	CGSB 85-GP-16M	-	Painting Galvanized Steel
.19	CAN/CSA G164-M	-	Hot-Dip Galvanizing of Irregularly Shaped Articles
.20	CSA W47.1	-	Certification of Companies for Fusion Welding of Steel Structures
.21	CSA W47.2	-	Certification of Companies for Fusion Welding of Aluminum
.22	CSA W48 Series	-	Electrodes
.23	CSA W59-M	-	Welded Steel Construction (Metal Arc Welding)
.24	CSA-W117.2	-	Safety in Welding, Cutting and Allied Processes
.25	CISC/CPMA 2.75	-	Canadian Institute of Steel Construction/Canadian Paint Manufacturers Association “A Quick-Drying Primer for Use on Structural Steel”
.26	CISC	-	Canadian Institute of Steel Construction, "Code of Standard Practice"
.27	OPSS	-	Ontario Provincial Standard Specifications
.28	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 and handrails 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.

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 Welding materials: Conforming to CSA W48.1-M and CSA W59-M.

.5 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.

.6 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.

.7 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

.8 Galvanizing: Hot-dip galvanizing with minimum zinc coating of 600 g/m^2 to CAN/CSA G164-M.

.9 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. "Galvafroid" or Kerry Industries "Z.R.C." or Niagara Paint Inc. "PL052898" zinc rich coating.

.10 Handrails

.1 Steel pipe handrails: Conforming to ASTM A53, Type "S", Grade B steel pipe, powder coat finish. Colour to be selected by Consultant from manufacturer's standard colour range. Secure handrail to bracket with 2#10 FHMS through two countersunk holes in bracket.

.1 Handrail brackets: Julius Blum cast steel model 378 (377-flat handrail), powder coat finish, and with flanges tapped for bolting. Colour to match steel pipe handrails. Secure bracket to post with 2#10 FHMS through countersunk holes into threaded insets in the post.

.11 Steel pipe bumpers: Conforming to ASTM A500, cold rolled, bare, seamless steel pipe of sizes shown.

.12 Stainless steel pipe: To ASTM A312, Type 304, 180-grit finish.

.13 Pass Through Trays / Metal Liner: minimum 18 gauge stainless steel sheet to ASTM A167, type 304 to AISI No. 4 finish. Sheet to be levelled, free of buckles, warps and imperfections. Size and thickness as indicated on Drawings.

.14 Galvanized sheet steel: 0.0897 mm (13 ga) core thickness commercial quality to ASTM A653/A653M, Grade A, with Z275 zinc coating designation.

.15 Checkered plate: To ASTM A36, 6 mm thick, with raised diamond floor surface pattern.

.16 Grating treads and landings: As manufactured by Borden Metal Products, Armco Irving, Fisher & Ludlow or Ohio Gratings Inc. Furnish treads with 32 mm x 5 mm bearing bars incorporating 32 mm crosshatch abrasive nosing.

.17 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:

Diameter	Pullout kN	Shear kN
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

.18 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.

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/m^2.

.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 Stairs – General

.1 Fabricate stairs with necessary components and in sizes and manner to enable installation directly to structure. Provide cast-in anchor assemblies supporting pickets, balustrades and other stair railing members. Provide bracing and hangers including necessary adjustment capability. Where possible, fit and shop assemble various sections of Work and deliver to Site in largest practicable sections.

.2 Forming and bending of exposed materials for treads shall be crisp, smooth, and of smallest possible radii.

.3 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. Parts shall be secured in a rigid and substantial manner using concealed connections where practicable.

.4 Where necessary to secure Work to the structure by means of expansion bolts, cinch anchors, and similar connections, do the Work of laying out and installing such connections, installing the Work and bolting up, unless otherwise noted. Drill or core holes in concrete and masonry Work.

.14 Elevator Pit Access Ladder

.1 Provide with slip-resistant steel rungs, side rails, bent plate brackets, detailed in accordance with ASME A17.1/CSA B44, and Drawings.

.2 Ladder Anchorage: Use stainless steel Grade 304 mechanical anchors. Size of anchors as required by design but not less than indicated on Contract Drawings. Connect to elevator pit wall only.

.3 Ladder Electrical Device: Provide with latching switch reset

.4 Size: as indicated on Drawings

.5 Finish: prime and painted. Colour to be selected by Consultant.

.6 Retractable Type ladder: “Retracta Ladder” by Smart Elevator Tech or accepted equivalent.

.7 Nonretractable type ladder with weight-actuated sensor: “The Smart Ladder” by Smart Elevator Tech or accepted qual.

.15 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.

.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.

.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 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.

.20 Pipe Bumpers and Sleeves, Pipe Guardrails

.1 (Removable), constructed of steel pipe sizes shown, complete with lifting hole where bumper is to be removable, and 6 mm thick plate closure welded to bottom of guard post sleeves.

.2 Provide properly sized steel pipe sleeves to allow easy removal of pipe bumper.

.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 Metal Spandrel Panel

.1 Insulated aluminum infill spandrel panel. minimum 0.60 mm thick (24 ga) thick aluminum face sheet with rigid insulation core of thickness shown bonded to same, supplemented by mechanical fasteners as applicable.

.2 Finish: Painted Kynar, Colour as Charcoal Grey. Provide samples to Consultant for selection.

.3 Basis of Products: K-Roc HF by Kingspan or accepted equal.

.24 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.

.25 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.

.26 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 Erect fibre reinforced plastic (FRP) grating plumb, true, square, straight, level and accurate to size detailed, in accordance with manufacturer's printed instructions.

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

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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/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 accepted equal, 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, 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 Loose insulation: Loose type; fiberglass by Owens-Corning Canada, mineral wool by Roxul Inc., or basalt wool by Fibrex Insulations, Inc.

.6 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 1-60) (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	CAN3-O188.1-M	-	Interior Mat-Formed Wood Particleboard
.3	CSA O80 Series	-	Wood Preservation
.4	CSA O115-M	-	Hardwood and Decorative Plywood
.5	CSA O121-M	-	Douglas Fir Plywood
.6	CAN/ULC-S102	-	Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
.7	NEMA LD3	-	National Electrical Manufacturers Association, High Pressure Decorative Laminates
.8	AODA	-	Accessibility for Ontarians with Disabilities Act

1.3 **SUBMITTALS**

.1 Shop Drawings

.1 Submit in accordance with Section 01 33 00. Show on Shop Drawings, vanities, counters, cupboards, and other casework.

.2 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.

.3 Custom

.1 Contractor shall submit stamped Shop Drawings for miscellaneous metal framing, supports and other components used in the assembly.

.2 Shop Drawings shall bear the seal and signature of a Professional Structural Engineer licensed in Province of Ontario.

.2 Samples: Submit duplicate samples of plastic laminate 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.

.2 Execute plastic laminate Work to CAN3-A172-M, except as specified otherwise.

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 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.

1.6 **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 Kitchen countertop:

.1 Quartz: Refer to Section 09 30 00. Design and colour as indicated on Drawings.

.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 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.

.5 Plywood:

.1 Softwood to CSA O151

.2 Douglas fir conforming to CSA O121-M, G2S, sanded, and stain grade birch conforming to CSA O115-M, G1S and G2S, depending on exposure.

.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 0121, 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.

.6 Exterior wood benches, tables and bearers: Clear "All Heart" Grade California Redwood, free from all sapwood streaks.

.7 Shower and locker room seats: Premium Grade Maple or similar hardwood standard, shop finished with one coat of polyurethane varnish reduced 25% and 2 coats of polyurethane varnish.

.8 Rough hardware: 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.

.9 Wood veneer for natural finish: Species: Straight grain, to match approved sample, minimum 0.8 mm thick, architectural quality, premium grade selected for uniformity of colour, figure and grain. 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.

.10 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.

.11 Insulation: Refer to Section 07 21 00 Thermal Insulation.

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 Plastic Laminate Work

.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 Cut units for sinks in coordination with mechanical trade.

.11 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.

.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.

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.

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, countertops, cupboards, wardrobes, lockers, closets, shelving, desks, tables, benches, showcases, door jambs.

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	CAN3-A172-M	-	High Pressure, Paper Base, Decorative Laminates
.3	CAN3-O188.1-M	-	Interior Mat-Formed Wood Particleboard
.4	CSA O115-M	-	Hardwood and Decorative Plywood
.5	CSA O121-M	-	Douglas Fir Plywood
.6	CAN/ULC-S102	-	Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
.7	NEMA LD3	-	National Electrical Manufacturers Association, 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 countertops.

.2 Two 150 x 150 mm plastic laminate applied on 19 mm core showing finish for cupboard doors and adjustable shelves.

.3 One drawer unit (except hardware) constructed and finished as specified.

.6 Apply plastic laminate on sample materials on both faces and on three sides only of core, in thicknesses specified.

.7 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.

.8 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 **COORDINATION**

.1 Coordinate with other work having a direct bearing on work of this section.

.2 Coordinate the work with electrical rough-in, installation of associated and adjacent components, systems and finishes.

1.4 **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.

1.5 **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 **COMPONENT**

.1 Lumber: In accordance with the AWMAC Standard National Hardwood Association (NAAWS), air dried to maximum 6% to 8% moisture content.

.2 Veneers: As required by AWMAC's STANDARDS (NAAWS) for its use and Grade specified.

.3 Core:

.1 Particleboard meeting requirements of AWMAC's STANDARDS (NAAWS) of minimum 720 kg/m^3 density. Conforming to NEMA LD3.

.4 Plastic Laminate

.1 PLAM-1: Solid color through high pressure laminate. Melamine-impregnated decorative surface papers combined with specially formulated resin-treated kraft paper.

.1 Finish: Matte, or as indicated on Drawings

.2 Colour: North Sea, D90-60 (Medium Grey)

.3 Acceptable Manufacturer: Wilsonart or accepted equal

.2 PLAM-2: Solid color through high pressure laminate. Decorative surface papers impregnated with melamine resins and pressed over kraft paper core sheets impregnated with phenolic resin.

.1 Finish: Matte, or as indicated on Drawings

.2 Colour: Alabaster, D431-60 (off-white)

.3 Acceptable Manufacturer: Wilsonart or accepted equal

.3 Plastic laminate backing sheet: Backing Grade (BK) 0.511 mm, non-decorative, high pressure laminate, NEMA LD3, Grade, types and thickness to match face sheets and equalize pull. Sanded one face and manufactured by same manufacturer as facing sheet Product of manufacturer of face sheet used.

.5 Edgeband: PVC or High Pressure Decorative Laminate (HPDL)

.6 Adhesive: Thermosetting to suit laminate application without failure or as recommended by fabricator. Conforming to CSA 0112, formulated for use in decorative laminate fabrication and to suit the conditions of application without failure. Adhesive for countertops where sinks will be installed is to be water resistant.

.7 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.

2.2 **CASEWORK HARDWARE**

.1 Adjustable shelf hardware (janitors' shelves): 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 mm2'-0" o.c. maximum.

.2 Adjustable shelf hardware (cupboard shelves): Knape & Vogt No. 255 standards and No. 256 shelf brackets, or Richelieu equivalent, nickel plated (brass) (epoxy coated white) (epoxy coated almond), mortised into cabinet sides.

.3 Door and drawer pulls: Canadian Builders Hardware CBH 220, 88 mm3½" long aluminum (bronze) (brass) (stainless steel) or Hafele 116.05.922.

.4 Hinges: Blum "Clip 170" or Hettich "Euromat Topsafe 4955", 170 degree opening angle, concealed, self-closing, nickel plated.

.5 Drawer slides: Full extension, rated 100 lb. load, Knape & Vogt 1400 or Accuride 3832.

.6 Cabinet door and drawer lock: Knape & Vogt 986, nickel plated.

.7 Vanity brackets: Hebco table brackets.

2.3 **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 Tool marks on exposed surfaces is deemed sufficient cause for rejection.

.3 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.

.4 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.

.5 Ensure that mill assembled units are of sizes that can be transported through the building to their final location.

.6 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 particle board 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 Gables and shelving: All gables, divisions and shelving shall be as detailed. Where gables are over 1220 mm high, use 25 mm thick plywood unless otherwise detailed, with all exposed edges covered with wood edging.

.3 Plywood backs: No horizontal joints on exposed faces and vertical joints at vertical divisions only.

.4 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.

.5 Drawers: All drawers shall have 25 mm solid birch front (cut for lock hardware). Drawer sides shall be 13 mm thick solid birch with top edges rounded and attached to drawer front with carefully fitted glued dovetail joints. Mortised or nailed construction will not be accepted. Drawer backs shall be 13 mm solid birch attached to drawer sides with carefully fitted lock corner joints. Drawer bottoms shall be 6 mm plywood grooved into drawer sides, back and front making box construction. Install all hardware to drawers, doors and fitments.

.6 Laminated maple tops, aprons and splashbacks: Laminate maple tops and aprons and fabricate from 38 mm wide strip material with standard glue jointing, through-dowelled and matched for graining to prevent warping. Trench tops where shown. Join together tops, aprons and splashbacks with T and G joints and concealed bolts.

.7 Galvanized iron tops, aprons and splashbacks: Form G.I. work to tops, aprons and splashbacks of tables where shown. Cover all exposed edges, ends and faces. Solder all joints neatly. Clean down with acid-neutralizing cleanser.

.8 Stainless steel tops, aprons and splashbacks: Fabricate in accordance with details shown on the Drawings of type (302) (304) (316) (321) stainless steel with 2B finish. Weld, grind smooth all joints and brush to same finish as the finish of adjoining surfaces.

.9 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.

.10 Wood louvres: Form louvres of solid oak material at sill and head and oak veneered laminated core for blades. Conceal fastenings of blades to framing and framing to other construction.

.11 Oak work bench: Construct oak bench of solid material with all fastenings concealed by side grain plugs.

.7 Confirm base height with flooring subcontractor. Toe space to be designed to accommodate base height as indicated on Drawings.

.8 Coordinate with mechanical trades and cut fitments for sinks, services and wastes.

.9 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.

2.4 **FINISHES**

.1 Cover all exteriors of fitments, braces, shelves, countertops, aprons and splashbacks, 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.

.2 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 **FIELD MEASUREMENTS:**

.1 Verify actual measurements and openings by field measurements before fabrication; show recorded measurements on Shop Drawings.

.2 Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

3.3 **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 Make allowances around perimeter where fixed objects pass through or project into laminated plastic work to permit normal movement without restriction. Provide cutouts for inserts, grills and appliances and other penetrations. Round internal corners, chamfer edges and seal exposed core.

.3 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.

.4 Install all finish hardware supplied by the finishing hardware Supplier.

.5 Substrate Repairs: Restore damaged substrates with specified repair materials. Sand and clean all repaired areas prior to applying resurfacing laminate.

3.4 **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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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 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 approved alternative

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 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 accepted equal.

.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 Batt Insulation: 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/m^3.

.2 Thicknesses 65 mm and above Density: Outer layer: 100 kg/m^3; Inner layer: 60 kg/m^3

.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/ft^3

.1 Comfortboard 110 by Rockwool Inc.

.2 or accepted equal

.2 Density 11lb/ft^3

.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/m^3 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/m^3 = 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/m^3 = 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 kg/m^3 = 0.80/51 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, iIn 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 Extruded Polystyrene (XPS): Perimeter Foundation Insulation

.1 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 Extruded polystyrene (XPS): Under slab, footings, columns

.1 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 Expanded Polystyrene Insulation (EPS): Under slab insulation

.1 Closed-cell expanded polystyrene sheets in accordance with AST C518.

.2 Thickness as indicated on Drawings.

.3 Acceptable Manufacturers:

.1 Isolofoan XHD Series by Isolofoam Group

.2 Owens Corning Canada

.3 DuPont

.4 Alleguard

.5 Or accepted equal

.10 Acoustic insulation:

.1 Semi-rigid, spun wool, fibre mats insulation in accordance with ASTM C665

.2 Thickness as indicadted on Drawings

.3 Acceptable manufacturer

.1 QuietZone Acoustic Batt or SAFB by Owens Corning,

.2 “Sustainable Insulation Noise Reducer” by Certainteed,

.3 "Thermafiber Sound Attenuation Fire Blanket" by Thermafiber Inc.,

.4 "AFB" by Rockwool

.11 Loose insulation: Loose glass fibre by Owens Corning Canada, basalt wool by Fibrex Insulations Inc. or mineral wool by Roxul Inc.

.12 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.

.13 Adhesives

.1 Polystyrene foam insulation adhesive: Canadian Adhesive "Lepage PL Premium" or approved equivalent.

.2 Glass fibre or mineral wool insulation adhesive: Henry "200-02".

.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.

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.

.4 or accepted equal

.2 Primers: As recommended by manufacturer.

.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.

.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.

.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 (± 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.

.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 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.

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.

.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 (Manager and) 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 Contractor's 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 Roofing Membrane: Non-reinforced, black cured synthetic single-ply membrane composed of ethylene propylene diene monomer (EPDM), complying with ASTM D4637.

.1 Thickness: 60 mills (1.52 mm)

.2 Membrane attachment: fully adhered

.3 Manufacturer:

.1 Elevate (Formerly 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•m^2 maximum, when tested in accordance with ASTM E2178.

.5 Manufacturer:

.1 V-Force Vapor Barrier Membrane by Firestone

.2 Sopraseal Stick 1100T by Soprema

.3 JM Vapor Barrier SAR by Johns Manville

.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/m^3 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 and 1-90 windstorm classification and FM4450 approval requirements for Class 1 fire as a component in roof deck construction.

.1 Manufacturer:

.1 “E’NRG’Y 3 CGF” as supplied by Johns Manville Canada

.2 “Resista” by Elevate (Formerly 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 Tapered insulation: Of same material as roof insulation specified, factory tapered as required to provide slopes in areas shown. Minimum slope to be 2%.

.5 Membrane accessories

.1 Perimeter membrane fastening: Elevate (Formerly Firestone) "AP" fasteners, Carlisle "HP" or Johns Manville "Ultrafast", with corrosion coating.

.2 Perimeter edge flashing reinforcement strips: Elevate (Formerly Firestone) Reinforced Perimeter Fastening (RPF) strip with QuickSeam tape or approved equal.

.3 Flashing membrane: Minimum 1.5 mm thick, non-reinforced, Elevate (Formerly Firestone) "RubberGard EPDM FormFlash” or accepted equal by Carlisle or Johns Manville

.4 Seam Primer: for cleaning and priming of EPDM membranes. Elevate (Formerly Firestone) “QuickPrimee Plus” or approved equal.

.5 Splice tape: 100% solids rubber polymer tape, Elevate (Formerly Firestone) "Quickseam Splice Tape", Carlisle "Secur-Tape", Johns Manville "EPDM Seam Tape".

.6 Bonding adhesive (flashings): Elevate (Formerly Firestone) "RubberGard Bonding Adhesive", Carlisle "90-8-30A", Johns Manville "EPDM Bonding Cement".

.7 Lap sealant: Elevate (Formerly Firestone) "Lap Sealant LS-3029", Carlisle "Lap Sealant", Johns Manville "EPDM Lap Caulk".

.8 Water cut-off mastic: Elevate (Formerly Firestone) "Water Block Seal S-20", Carlisle "Water Cut-Off Mastic", Johns Manville "EPDM Nite Stop", to seal membrane terminations.

.9 Pourable sealer: Elevate (Formerly Firestone) "S-10", or Carlisle, Johns Manville "Pourable Sealer".

.6 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.

.3 Loose insulation: Loose fibreglass, basalt wool or mineral wool.

.4 Flexible flashing bottom support: Lexcor "FR40".

.7 Butyl tape: Tremco 440 II Tape, 3 mm thick x 25 mm wide.

.8 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.

.9 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: 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 13 mm thickness: 127 mm, minimum.

.5 Surface Burning Characteristics: Flame spread of 0, smoke developed of 0, when tested in accordance with ASTM E84.

.6 Combustibility: Non-combustible, when tested in accordance with ASTM E136.

.7 Factory Mutual approved for use with FM 1-60 and 1-90 rated roofing assemblies.

.8 Mold Growth Resistance: Zero growth, when tested in accordance with ASTM D3273 for minimum of 4 weeks.

.9 Pre-primed for better adhesion.

.10 Acceptable Product:

.1 Georgia-Pacific DensDeck Prime Roof Board

.2 DEXcell FA by John Manville

.3 Or approved equivalent.

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/m^2, "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.

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.

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.

.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.

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.

.5 Coordinate with metal deck and siding trade to maintain continuity of building air/vapour barrier system.

OR

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:

Location	Weight
Field:	50 kg/m²
Perimeter:	60 kg/m²

OR

3.16 **ROOF WALKWAYS**

.1 Apply two additional plies of 500 mm wide roofing membrane under each sleeper location. Lay membrane for the full length of sleepers and extending out by 150 mm at each end.

.2 Place wood sleepers centred to additional membrane.

.3 Install metal roof walkways on wood sleepers with galvanized mechanical fasteners in accordance with walkway manufacturer's directions.

3.17 **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.

3.18 **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 | Date Final Inspection and Approved

AGREED

THE ROOFING SUPPLIER
(REFERRED TO IN SECTION 07553
(_____) AS "ROOFING WARRANTOR")

By_____
Building Owner

By_____
Serial Number

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 Intumescent fireproofing system to provide fire resistance rating of structural steel members as indicated on Drawings, in accordance with ULC design number specified on the Drawings.

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 (41ºF) 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 fireproofing – exterior exposure: A/D Thermo Lag 3000 System including basecoat and protective decorative finish coat by A/D Fire Protection Systems Inc. or accepted equal.

.1 Primer: As recommended by fireproofing manufacturer.

.2 Intumescent coating: Water based, A/D Thermo Lag 3000.

.3 Topcoat: Carboguard 890 VOC epoxy.

.4 Colour: As selected by Consultant from manufacturer's standard colour palette.

.3 Intumescent coating - Water based, thin film, fire resistant intumescent coating with low VOC for interior wood floor. Coating shall be applied to achieve 2 hour fire rating.

.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.

.6 Pipe wrap strip: single component intumescent elastomeric strips, flexible firestop wrap strip at existing piping systems. The wrap strip shall be UL Certified and tested to the requirements of ASTM E814 (UL1479) and CAN/ULC-S115.

.1 “CP 648E/648S” by Hilti

.2 SpecSeal SSW Wrap Strip” by Specified Technologies, Inc. (STI)

.3 Fire Barrier Intumescent Wrap Strip by 3M

.4 or accepted equal

.7 Firestop Sealant: flexible, acrylic based firestop sealant, silicone free, for use in fire-rated joints and through penetrations. “CP 606” by Hilti or accepted equal. Size 200 mm x 127mm wide x 50 mm high. Firestop Block to be in accordance with ASTM E814.

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 joins, 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 windowalls, 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.

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

.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”.

.10 Acoustic Caulking: DAP “Sound Block”, Green Glue “Noise Proofing Sealant”, LePage “Draft and Acoustic Sealant - Green Series”, or accepted equal.

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 laitant 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.

.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.

.6 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 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 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.

3.3 **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

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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 (Galvanealed) 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.

.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

2.2 **MATERIALS**

.1 Sheet steel: Commercial grade sheet steel conforming to ASTM A653/A653M, with ZF75 zinc-iron alloy coating designation. Sheet steel thicknesses specified are base metal thicknesses prior to galvanizing.

.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: 18 Gauge skin thickness - Polystyrene Insulated - Tack Welded & Filled Edges.

.2 Doors in high security or sensitive facilities such as Police Stations where additional security is required:

.1 Exterior: 16 Gauge skin thickness - Steel Stiffened

.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.

.3 Adhesive for Steel Stiffened Core: water based neoprene or solvent based neoprene or two component epoxy or acceptable equal.

.5 Interior stiffeners: 0.91 mm thick (20 ga) steel.

.6 Sound deadening and insulating material: Semi-rigid fibreglass, 24 kg/m^3 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 or accepted equal.

.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.

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 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.

.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 galvanneal 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/m^3 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.

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 Perimeter Construction: solid lumber lock blocks, vertical stiles and top and bottom rials, bonded to core material.

.3 Glass stop: matching wood, flat bead types

.4 Cross banding: minimum 1.6 mm hardwood veneer.

.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 Blocking: Provide blocking with screw holding capability for doors to receive surface mounted hardware.

.8 Thickness: 45 mm (1 ¾ inch)

.9 Size: 560 mm x 2135 mm

.10 Hardware: Refer to hardware schedule.

.2 Adhesive: Hot pressed, water resistant type conforming to glue line requirements of CAN/CSA 0132.2 series.

.3 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

.4 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 **DOOR FACING**

.1 Wood Veneer

.1 Minimum 0.8 mm thick, architectural quality, premium grade selected for uniformity of colour, figure and grain. Piece veneers to be parallel dipped, jointed by tapeless splicer and edge glued. Face veneers with open joints, face depressions, glue stain, plastic repairs and other defects will not be accepted.

.1 Contractor to match existing stain and grains. Provide samples to Consultant for approval.

.2 Veneers for transparent finishes shall be centered slip matched, plain slice, minimum 0.8 mm thick, adhered to 1.6 mm, hardwood crossband, core, rails, and stiles by hot press method.

.3 Veneer for painted finish: hardwood veneer, minimum 1.5 mm thick after sanding.

.1 Species: Paint Grade Birch

.1 Cut: Rotary, unless shown otherwise.

.4 Plastic laminate facing: 1.6 mm thick "Arborite", "Formica", Durolam, Nevamar or "Wilsonart", in solid colour or woodgrain finish as selected by the Consultant from manufacturer's standard range.

2.4 **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 Frames in gypsum board partitions: Steel anchor clips and adjustable base anchors of suitable design securely welded inside each jamb.

2.5 **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.

2.6 **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.

2.7 **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.

2.8 **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.

2.9 **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 hardware in accordance with hardware supplier’s instructions.

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 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 Door:

.1 Door: 20 gauge door panel. Finish: White prime coated baked

.2 enamel finish

.3 Frame: 26 gauge galvanized steel flush to frame complete with galvanized integral perforated taping bead.

.4 Hinge: concealed

.5 Latch: Slotted Screwdriver Cam Latch.

.6 Finish: satin coat steek

.7 Panel Sizes: as indicated on Drawings.

.8 Acceptable Manufacturers

.1 “DW-5040 or DW-5015” by Acudor Products Ltd.

.2 Bauco equal

.3 or accepted equal

.2 Fire-rated Access Door:

.1 Door: 22 gauge recessed steel door panel

.2 Frame: 22 gauge steel frame complete with pre-punched flanges

.3 Hinge: concealed

.4 Latch: Self-latching bolt, operated by flush key

.5 Fire Rating: as indicated on Drawings

.6 Panel Sizes: as indicated on Drawings

.7 Acceptable Manufacturers

.1 “FW-5015” by Acudor Products Ltd.

.2 Bauco equal

.3 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.

.2 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.

.2 Remove drywall compound from hinge, frame and door leaf edge.

.3 Clean the frame and door with a damp cloth.

.4 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.

.2 Work of this section include but are not limited to:

.1 Interior Security welded wire mesh fence, gate and accessories.

1.2 **SUBMITTALS**

.1 Submit in accordance with Section 01 33 00.

.2 Show and describe in detail the wire mesh fence and gate assemblies including elevations, sections and details of fence, gate and hardware, and relationship of wire mesh fence components to adjacent construction, dimensions, gauges, thicknesses, descriptions of materials, finishes, and all other pertinent data and information.

1.3 **DELIVERY, STORAGE AND HANDLING**

.1 Deliver materials in sequence to meet construction schedule. Arrange ahead for strategic, off-the-ground, covered storage location.

.2 Handle and store materials in a manner to prevent damage thereto.

.3 Protect the Work of this section from damage. Protect work of other trades resulting from work of this section. Replace damaged Work which cannot be satisfactorily repaired, restored or cleaned, to the satisfaction of the Consultant at no cost to Owner.

2 Products

2.1 **MATERIALS**

.1 Fence Panels: Fabricated from 12 gauge diameter steel wire, welded into a 50 mm x 50 mm mesh and spot welded to 50 mm x 50 mm Post. Provide non-modular size panels as required to complete the Work.

.2 Posts: Hollow steel tubing, minimum 12 gauge, 50 mm x 50 mm square, welded construction, designed for fastening to structure.

.1 Post caps: Manufacturer's standard formed cap; finish to match other components.

.3 Swing Gate: Fabricated same as panels.

.4 Steel sections and plates: Cold rolled steel to ASTM A570.

.5 Miscellaneous: Provide miscellaneous hardware, latch, bolts, brackets, shields, cinch anchors as required for erection of fence and gate.

2.2 **FINISH**

.1 Fence, gate and post to be hot dip galvanized. Finish shall be manufacturer's standard colour as selected by Consultant. Field touch up any damaged paint Work on the job.

3 Execution

3.1 **ERECTION**

.1 Erect wire mesh fence and gate plumb and level and in accordance with reviewed Shop Drawings. Ensure erection is secure and rigid. Plumb system to a tolerance of 3 mm in 3 m.

.2 Hang gate and mount miscellaneous hardware supplied as part of Work. Align in correct position with ample clearances. Ensure correct fit; test and adjust hardware as required for ease of operation.

.3 Fix to masonry and concrete using lag bolts and shields; to steel supports with bolts in threaded holes or spot welds.

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/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 sample sections of all component parts of entrances, glass and spandrel panels, finished in specified colours. Sizes of samples as follows:

.1 250 mm samples of each type of extrusion and finish.

.2 250 x 200 mm samples of insulating glass unit.

.3 One complete corner detail of door frame, glazing, and finish for each door type.

.4 250 x 200 mm sample of aluminum panel.

.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 moldings (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 items.

.3 Restrict air infiltration/exfiltration through aluminum entrance assembly to 2.79 $m^3/h/m^{-1}$ at pressure differential of 75 Pa in accordance with ASTM E283.

.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 Sheet Steel: ASTM A653/A653M, zinc coated (galvanized) sheet steel with metallic designation Z275 (G90), 0.91 mm thickness.

.3 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, 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 Alumicor

.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 Alumicor

.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 Alumicor

.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 Insulated metal back pan: Minimum 0.76 mm thick (22 gauge) galvanized steel face sheet with rigid fibreglass or mineral wool insulation core of thickness shown.

.4 Stools, sills and cover plates: Extruded aluminum and brake formed sheet stock.

2.6 **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.

2.7 **GLASS AND GLAZING MATERIALS**

.1 Glass Component Types: Refer to Section 08 80 00.

.2 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.

.3 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 ±5, Shore A.

.4 Silicone spacer blocks: Durometer hardness of 55 ±5 Shore A.

.5 Gaskets: Extruded EPDM.

.4 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.

2.8 **DOOR HARDWARE:**

.1 Provide complete manufacturer’s standard door finish hardware.

.2 Supply of door hardware for aluminum doors as listed under Section 08 71 00 Finish Hardware and Door Hardware Schedules shall list all hardware items for aluminum doors to be shop prepped by this Section.

.3 Minimum automatic door operator weight requirements:

.1 Single Door Operator - Total weight of operator assembly is 46.90 lbs (21.273 kg).

.2 Dual / Pair Door Operator(s) - Total weight of operator assembly is 93.8 lbs (42.546 kg).

2.9 **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: Refer to Section 08 87 00 Glazing Surface Films.

.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.

2.10 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.

.13 Fabricate insulated closure panels of 1.3 mm thick precoated aluminum sheet, stretcher levelled and tension levelled, both sides, to match finish and colour of framing.

.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.

2.11 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

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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 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

.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 for 20, 45, 60 or 90 minutes.

.2 Window Assembly: Capable of providing a fire rating for 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 Member deflection: Limit deflection of the edge of the glass normal to the plane of the glass to flexure limit of glass, 1/175 of the glass edge length or ¾ inch, whichever is less of any framing member.

.3 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: [20, 45, 60 or 90] 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 fabricaton.

.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.

.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

1 General

1.1 **FINISH HARDWARE**

.1 Supply finish hardware, 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 is listed 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 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.

2.5 **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 (anodized)
.11	629	Polished Stainless Steel
.12	630	Satin Stainless Steel
.13	631	Flat Black Steel/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 (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
New Paramedic Station
160 Rivalda Road, Toronto, Ontario

ARCHITECT:

IBI GROUP
175 Galaxy Blvd, Unit 100
Toronto, Ontario

Prepared By: Alex Bekmansourov
Date: April 26, 2022
Revised: June 14, 2022
Revised: May 10, 2024

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

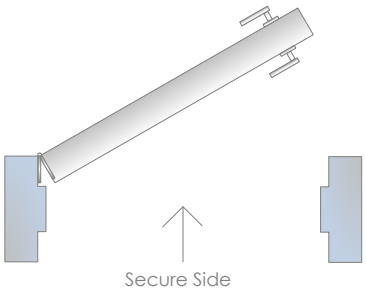
BP – Bi-Passing Slider

BF – Bi-Folding Slider

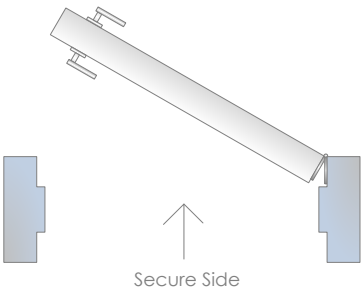
TS – Telescopic Slider

PKT – Pocket Slider

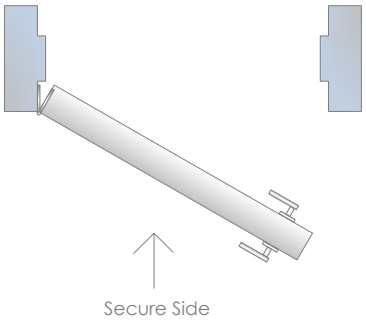
Note: The handing on a swing door is determined by placing yourself on the secure side or keyed side of the door.



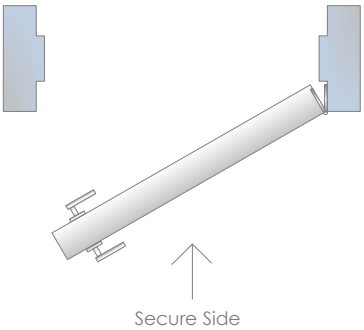
LH



RH

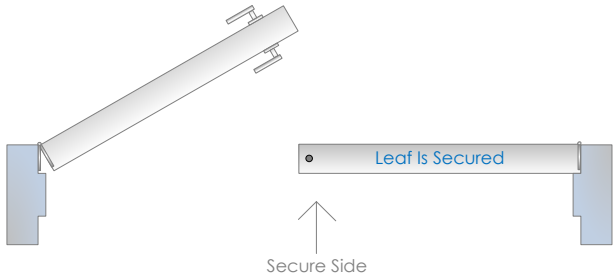


LHR

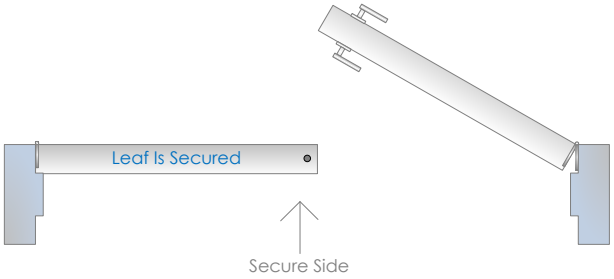


RHR

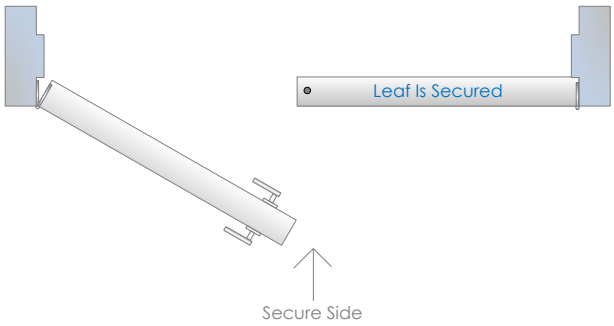
1



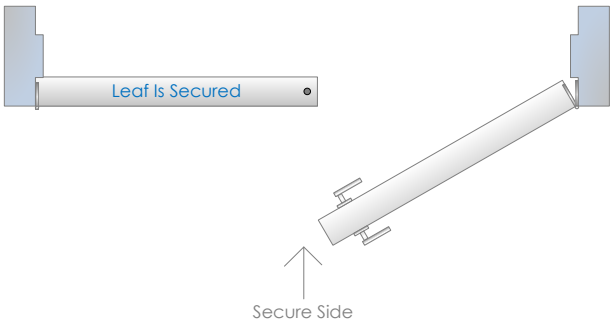
LHA



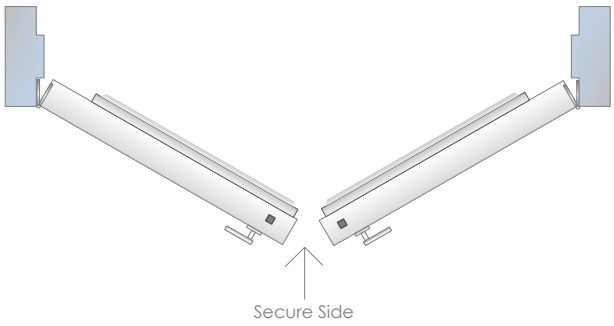
RHA



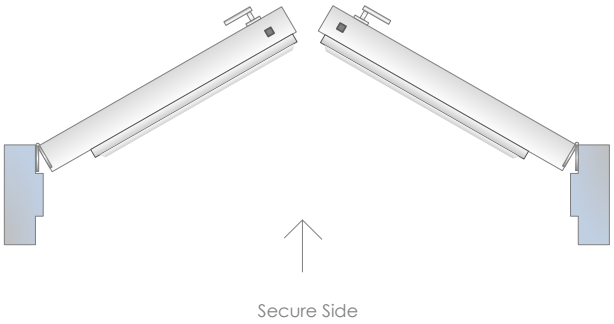
LHRA



RHRA

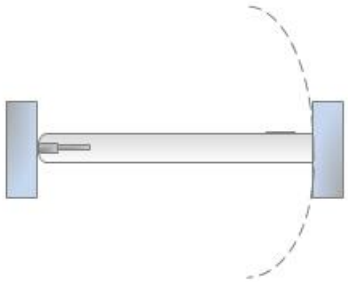


LHRA / RHRA



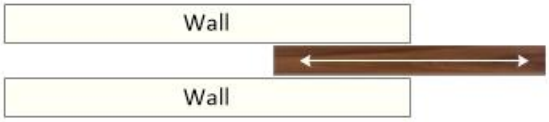
LHA / RHA

2



DA-DOUBLE ACTING

DE-DOUBLE EGRESS



PKT – POCKET SLIDER

SS – SINGLE SLIDER or BARN SLIDER

BP – BI-PARTING

BPS – BI-PASSING

3

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

Electrical Automatic

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-004A **Location:** Elevator Lobby 003 to Lunch Room 004 **Handing:** LH

					Web Link	Install Instructions	Site Verified	
By Hardware Supplier								
3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	652	Hager	X			☐
1	Passage Set	L9010 x 06B x 630	630	Schlage	X	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) – Door Screws	630	Gallery	X			☐
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			☐
1	Door Sweep	W-24S x 1067	CA	KN Crowder	X			☐
By Automatics Supplier – **PACKAGE #3**								
1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount - LH	628		X			☐
2	Push Button	CM60/4-WT	630	Camden	X			☐
2	Surface Mount Box	CM-79	630	Camden	X			☐

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

Electrical Card Access

Heading# 2

Opening Information					
Opening Type:	Single	**Opening Size:**	1067 x 2185 x 45	**STC Rating**	None
Door Material:	ALD	**Frame Material:**	ALF	**Fire Rating**	None

1 Total Openings

1 **Door#** N-004B **Location:** Exterior from Lunch Room 004 **Handing:** RHR

					Web Link	Install Instructions	Site Verified	
By Hardware Supplier								
1	Continuous Hinge	112XY x 2163	693	Ives	X	X		☐
1	Exit Device	CD-35A-NL-OP x 388NL x 4'0	622	Von Duprin	X	X		☐
1	Rim Cylinder	80-116	622	Schlage				☐
1	Mortise Cylinder	80-110	622	Schlage	X			☐
1	Electric Strike	6300 x 12/24VCD	622	Von Duprin	X	X		☐
1	Door Pull	GSH 165F x 1880 x #2 MTG	622	Gallery	X			☐
1	Closer	4021-LH	693	LCN	X	X		☐
1	Drop Plate	4020-18G	693	LCN	X	X		☐
1	Overhead Stop	105S	693	Glynn Johnson	X	X		☐
1	Weatherstrip	By Aluminum Door Supplier	622					☐
1	Door Sweep	By Aluminum Door Supplier	622					☐
1	Threshold	By Aluminum Door Supplier	622					☐
By Security Supplier								
1	Card Reader	To Suit Building System (12V)	BLK					☐
1	Door Contact	To Suit Building System						☐
1	Rex Sensor	To Suit Building System						☐
1	Access Controller	To Suit Building System						☐
1	Power Supply	Located in nearest IT Closet – By Security Provider						☐
By Locksmith								
2	Permanent Core	Permanent Medeco Core Provided by City Locksmith	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

- 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 2185 x 45	**STC Rating**	None
Door Material:	ALD	**Frame Material:**	ALF	**Fire Rating**	None

1 Total Openings

1 **Door#** N-004C **Location:** Exterior from Lunch Room 004 **Handing:** LHR

					Web Link	Install Instructions	Site Verified	
By Hardware Supplier								
1	Continuous Hinge	112XY x 2163	693	Ives	X	X		☐
1	Exit Device	CD-35A-NL-OP x 388NL x 4'0	622	Von Duprin	X	X		☐
1	Rim Cylinder	80-116	622	Schlage				☐
1	Mortise Cylinder	80-110	622	Schlage	X			☐
1	Electric Strike	6300 x 12/24VCD	622	Von Duprin	X	X		☐
1	Door Pull	GSH 165F x 1880 x #2 MTG	622	Gallery	X			☐
1	Overhead Stop	105S	622	Glynn Johnson	X	X		☐
1	Weatherstrip	By Aluminum Door Supplier	622					☐
1	Door Sweep	By Aluminum Door Supplier	622					☐
1	Threshold	By Aluminum Door Supplier	622					☐
By Automatics Supplier – **PACKAGE #1A**								
1	Auto Operator (SNG)	BESAM SW200i – Push Side Mount - RH	628		X			☐
2	Push Button	CM60/4-WT	630	Camden	X			☐
2	Surface Mount Box	CM-79	630	Camden	X			☐
1	Logic Relay	CX-33		Camden	X			☐
By Security Supplier								
1	Card Reader	To Suit Building System (12V)	BLK					☐

1	Door Contact	To Suit Building System						☐
1	Rex Sensor	To Suit Building System						☐
1	Access Controller	To Suit Building System						☐
1	Power Supply	Located in nearest IT Closet – By Security Provider						☐
By Locksmith								
2	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
- 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

Fire Rated

Heading# 4

Opening Information

Opening Type:	Single	**Opening Size:**	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-005 **Location:** Stair A 005 from Lunch Room 004 **Handing:** RHR

					Web Link	Install Instructions	Site Verified	
By Hardware Supplier								
3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	652	Hager	X			☐
1	Passage Set	L9010 x 06B x 630	630	Schlage	X	X		☐
1	Closer	4011-LH (LCN/ST 1544)	689	LCN	X	X		☐
1	Drop Plate	4020-18	689	LCN				☐

1	Overhead Stop	104S	630	Glynn Johnson	X	X		☐
1	Kickplate	GSH 80A – 203 x 876 (Rounded Corners) – Door Screws	630	Gallery	X			☐
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			☐
1	Auto Door Bottom	434APKL x 915	MIL	Pemko	X	X		☐

Notes:

- Refer to STC rating of the wall in Architectural layout G1002

End of Heading

Heading# 5

Opening Information

Opening Type:	Single	**Opening Size:**	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-007 **Location:** Corridor 006 to Mechanical Room 007 **Handing:** LH

						Web Link	Install Instructions	Site Verified	
By Hardware Supplier									
3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	652	Hager		X			☐
1	Storeroom Lockset	L9080BDC x 06B x 630	630	Schlage		X	X		☐
1	Closer	4011-LH (LCN/ST 1544)	689	LCN		X	X		☐
1	Drop Plate	4020-18	689	LCN					☐
1	Overhead Stop	104S	630	Glynn Johnson		X	X		☐
1	Kickplate	GSH 80A – 203 x 876 (Rounded Corners) – Door Screws	630	Gallery		X			☐
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder		X			☐
1	Auto Door Bottom	434APKL x 915	MIL	Pemko		X	X		☐
By Locksmith									
1	Permanent Core	Permanent Medeco Core Provided by City Locksmith	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

Fire Rated

Heading# 6

Opening Information					
Opening Type:	Single	**Opening Size:**	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-008 **Location:** Corridor 006 to Janitor's Closet 008 **Handing:** LH

					Web Link	Install Instructions	Site Verified	
By Hardware Supplier								
3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	652	Hager	X			☐
1	Storeroom Lockset	L9080BDC x 06B x 630	630	Schlage	X	X		☐
1	Closer	4011-LH	689	LCN	X	X		☐
1	Floor Stop	GSH 209	626	Gallery	X			☐
1	Kickplate	GSH 80A – 203 x 876 (Rounded Corners) – Door Screws	630	Gallery	X			☐
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			☐
1	Auto Door Bottom	434APKL x 915	MIL	Pemko	X	X		☐
By Locksmith								
1	Permanent Core	Permanent Medeco Core Provided by City Locksmith	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

Electrical Automatic

Heading# 7

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-009A **Location:** Elevator Lobby 003 to Change Room 009 **Handing:** RH

					Web Link	Install Instructions	Site Verified	
By Hardware Supplier								
3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	630	Hager	X			☐
1	Passage Set	L9010 x 06B x 630	630	Schlage	X	X		☐
1	Electric Strike	1500C	630	HES	X	X		☐
2	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – Door Screws	630	Gallery	X			☐
1	Overhead Stop	105S	630	Glynn Johnson	X	X		☐
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			☐
1	Door Sweep	W-24S x 1067	CA	KN Crowder	X			☐
By Automatics Supplier – **PACKAGE #3**								
1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount	628		X			☐
2	Push Button	CM60/4-WT	630	Camden	X			☐
2	Surface Mount Box	CM-79	630	Camden	X			☐

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
- During installation, centreline of Door Pulls must Be at 46-1/2" AFF.
- 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# 8

Opening Information					
Opening Type:	Single	**Opening Size:**	915 x 2135 x 45	**STC Rating**	None
Door Material:	HMD	**Frame Material:**	HMF	**Fire Rating**	None

1 Total Openings

1 **Door#** N-009B **Location:** Change Room 009 to Corridor 006 **Handing:** LH

					Web Link	Install Instructions	Site Verified	
By Hardware Supplier								
3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	630	Hager	X			☐
1	Classroom Lockset	L9070BDC x 06B x 630	630	Schlage	X	X		☐
2	Kickplate	GSH 80A – 203 x 876 (Rounded Corners) – Door Screws	630	Gallery	X			☐
1	Closer	4111-RH (LCN / ST 2779)	689	LCN	X	X		☐
1	Overhead Stop	105S	630	Glynn Johnson	X	X		☐
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			☐
1	Door Sweep	W-24S x 1067	CA	KN Crowder	X			☐
By Locksmith								
1	Permanent Core	Permanent Medeco Core Provided by City Locksmith	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# 9

Opening Information					
Opening Type:	Single	**Opening Size:**	915 x 2135 x 45	**STC Rating**	None
Door Material:	HMD	**Frame Material:**	HMF	**Fire Rating**	None

5 Total Openings

								Web Link	Install Instructions	Site Verified
1	**Door#**	N-010	**Location:**	Change Room 009 to WC Stall 010	**Handing:**	LH				
1	**Door#**	N-011	**Location:**	Change Room 009 to WC Stall 011	**Handing:**	RH				
1	**Door#**	N-015	**Location:**	Change Room 009 to WC Stall 015	**Handing:**	RH				
1	**Door#**	N-016	**Location:**	Change Room 009 to WC Stall 016	**Handing:**	LH				
1	**Door#**	N-017	**Location:**	Change Room 009 to WC Stall 016	**Handing:**	LH				

By Hardware Supplier

15	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	630	Hager	X			☐
5	Privacy Set	L9040 x 06B x 630 x L283-712 x L283-722	630	Schlage	X	X		☐
5	Closer	1461 x Rw/PA (Pull Side Mount)	689	LCN	X	X		☐
5	Floor Stop	GSH 209	626	Gallery	X			☐
5	Coat Hook	GSH 390	626	Gallery	X			☐
5	Kickplate	GSH 80A – 203 x 876 (Rounded Corners) – Door Screws	630	Gallery	X			☐
5	Smoke / Sound Seal	W-66 x 5300	BLK	KN Crowder	X			☐
5	Door Sweep	W-24S x 915	CA	KN Crowder	X			☐

Notes:

- Refer to STC rating of the wall in Architectural layout G1002

End of Heading

Electrical Automatic

Heading# 10

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-012 **Location:** Corridor to B/F Universal WR 108 **Handing:** RH

					Web Link	Install Instructions	Site Verified	
By Hardware Supplier								
3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	630	Hager	X			☐
1	Storeroom Lockset	L9080BDC x 06B x 630	630	Schlage	X	X		☐
1	Electric Strike	1500C	630	HES	X	X		☐
2	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – Door Screws	630	Gallery	X			☐
2	Coat Hook	GSH 390	626	Gallery	X			☐
1	Overhead Stop	105S	630	Glynn Johnson	X	X		☐
1	Smoke / Sound Seal	W-66 x 5500	BLK	KN Crowder	X			☐
1	Door Sweep	W-24S x 1067	CA	KN Crowder	X			☐
1	Emergency Key Cabinet	EB-02	RD	Canropa	X			☐
By Automatics Supplier – **PACKAGE #5**								
1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount - RH	628		X			☐
1	Push to Lock Kit	CX-WC13XFM	630	Camden	X			☐
1	Emergency Call Kit	CX-WEC10K2	630	Camden	X	X		☐
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.
- 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# 11

Opening Information					
Opening Type:	Single	**Opening Size:**	915 x 2135 x 45	**STC Rating**	None
Door Material:	HMD	**Frame Material:**	HMF	**Fire Rating**	None

1 Total Openings

1 **Door#** N-013 **Location:** Elevator Lobby 003 to Elevator Sump Pump Room 013 **Handing:** RH

					Web Link	Install Instructions	Site Verified	
By Hardware Supplier								
3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	652	Hager	X			☐
1	Storeroom Lockset	L9080BDC x 06B x 630	630	Schlage	X	X		☐
1	Closer	4011-RH	689	LCN	X	X		☐
1	Floor Stop	GSH 209	626	Gallery	X			☐
1	Kickplate	GSH 80A – 203 x 876 (Rounded Corners) – Door Screws	630	Gallery	X			☐
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			☐
1	Auto Door Bottom	434APKL x 915	MIL	Pemko	X	X		☐
By Locksmith								
1	Permanent Core	Permanent Medeco Core Provided by City Locksmith	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

Electrical Automatic

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**	None

1 Total Openings

1 **Door#** N-014A **Location:** Lunch Room from Vestibule 014 **Handing:** RHR

					Web Link	Install Instructions	Site Verified	
By Hardware Supplier								
3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	652	Hager	X			☐
1	Passage Set	L9010 x 06B x 630	630	Schlage	X	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) – Door Screws	630	Gallery	X			☐
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			☐
1	Door Sweep	W-24S x 1067	CA	KN Crowder	X			☐
By Automatics Supplier – **PACKAGE #3**								
1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount - LH	628		X			☐
2	Push Button	CM60/4-WT	630	Camden	X			☐
2	Surface Mount Box	CM-79	630	Camden	X			☐

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

Electrical Automatic

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**	None

1 Total Openings

1 **Door#** N-014B **Location:** Vestibule 014 from Change Room 009 **Handing:** LHR

					Web Link	Install Instructions	Site Verified	
By Hardware Supplier								
3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	652	Hager	X			☐
1	Passage Set	L9010 x 06B x 630	630	Schlage	X	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) – Door Screws	630	Gallery	X			☐
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			☐
1	Door Sweep	W-24S x 1067	CA	KN Crowder	X			☐
By Automatics Supplier – **PACKAGE #3**								
1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount - LH	628		X			☐
2	Push Button	CM60/4-WT	630	Camden	X			☐
2	Surface Mount Box	CM-79	630	Camden	X			☐

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

Electrical Card Access

Heading# 14

Opening Information					
Opening Type:	Single	**Opening Size:**	1067 x 2185 x 45	**STC Rating**	None
Door Material:	ALD	**Frame Material:**	ALF	**Fire Rating**	None

1 Total Openings

1 **Door#** 128A **Location:** Stair C from Workstations 133 **Handing:** RHR

					Web Link	Install Instructions	Site Verified	
By Hardware Supplier								
1	Continuous Hinge	112XY x 2163	671	Ives	X	X		☐
1	Exit Device	CD-35A-NL-OP x 388NL x 4'0	622	Von Duprin	X	X		☐
1	Rim Cylinder	80-116	622	Schlage				☐
1	Mortise Cylinder	80-110	622	Schlage	X			☐
1	Electric Strike	6300 x 12/24VCD	622	Von Duprin	X	X		☐
1	Door Pull	GSH 165F x 1880 x #2 MTG	622	Gallery	X			☐
1	Closer	4021-LH	693	LCN	X	X		☐
1	Drop Plate	4020-18G	693	LCN	X	X		☐
1	Overhead Stop	105S	693	Glynn Johnson	X	X		☐
1	Weatherstrip	By Aluminum Door Supplier	671					☐
1	Door Sweep	By Aluminum Door Supplier	671					☐
1	Threshold	By Aluminum Door Supplier	671					☐
By Security Supplier								
1	Card Reader	To Suit Building System (12V)	BLK					☐
1	Door Contact	To Suit Building System						☐
1	Rex Sensor	To Suit Building System						☐
1	Access Controller	To Suit Building System						☐
1	Power Supply	Located in nearest IT Closet – By Security Provider						☐
By Locksmith								
2	Permanent Core	Permanent Medeco Core Provided by City Locksmith	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
- 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# 15

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:	ALD	**Frame Material:**	ALF	**Fire Rating**	None

1 Total Openings

1 **Door#** N-100A **Location:** Exterior from Open Garage 100 **Handing:** RHRA

By Hardware Supplier					Web Link	Install Instructions		Site Verified
1	Continuous Hinges	112XY x 2108 x EPT	671	Ives	X	X		☐
1	Continuous Hinges	112XY x 2108	671	Ives	X	X		☐
1	Power Transfer	EPT-10	671	Von Duprin	X	X		☐
1	Exit Device	RX-QEL-LBR-3547A-NL-OP x 388NL x 4'0 x RHR	622	Von Duprin	X	X	X	☐
1	Mortise Cylinder	80-110	622	Schlage	X			☐
2	Flush Bolts	FB458-UL	622	Ives	X			☐
1	Dust Proof Strike	DP2	622	Ives	X			☐
1	Rim Cylinder	80-116	622	Schlage				☐
1	Door Pull	GSH 165F x 1830 x #2 MTG	622	Gallery	X			☐
1	Overhead Stop	105S	622	Glynn Johnson	X	X		☐
1	Overhead Stop	103S	622	Glynn Johnson	X	X		☐
1	Weatherstrip	By Aluminum Door Supplier	671					☐
1	Door Sweep	By Aluminum Door Supplier	671					☐
1	Threshold	By Aluminum Door Supplier	671					☐
1	Astragal	By Aluminum Door Supplier	671					☐
By Automatics Supplier – **PACKAGE #1A**								

1	Auto Operator (SNG)	BESAM SW200i – Push Side Mount - LH	671		X			☐
2	Push Button	CM60/4-WT	630	Camden	X			☐
2	Surface Mount Box	CM-79	630	Camden	X			☐
1	Logic Relay	CX-33		Camden	X			☐
By Security Supplier								
1	Card Reader	To Suit Building System (12V)	BLK					☐
1	Door Contact	To Suit Building System						☐
1	Rex Sensor	Provided in Exit Devices						☐
1	Access Controller	To Suit Building System						☐
1	Power Supply	Located in nearest IT Closet – By Security Provider						☐
By Locksmith								
2	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
- Security Provider must use electric dogging feature of exit device If doors are meant to be push/pull(non secure) during certain hours of operation.
- 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# 16

Opening Information

Opening Type:	Single	**Opening Size:**	1067 x 2125 x 45	**STC Rating**	None
Door Material:	ALD	**Frame Material:**	ALF	**Fire Rating**	None

1 Total Openings

1 **Door#** N-100B **Location:** Exterior from Open Garage 100 **Handing:** RHR

Web Link | Install Instructions | Site Verified

By Hardware Supplier								
1	Continuous Hinge	112XY x 2108	671	Ives	X	X		☐
1	Exit Device	CD-35A-NL-OP x 388NL x 4'0	622	Von Duprin	X	X		☐
1	Rim Cylinder	80-116	622	Schlage				☐
1	Mortise Cylinder	80-110	622	Schlage	X			☐
1	Electric Strike	6300 x 12/24VCD	622	Von Duprin	X	X		☐
1	Door Pull	GSH 165F x 1820 x #2 MTG	622	Gallery	X			☐
1	Overhead Stop	105S	622	Glynn Johnson	X	X		☐
1	Weatherstrip	By Aluminum Door Supplier	671					☐
1	Door Sweep	By Aluminum Door Supplier	671					☐
1	Threshold	By Aluminum Door Supplier	671					☐
By Automatics Supplier – **PACKAGE #1A**								
1	Auto Operator (SNG)	BESAM SW200i – Push Side Mount - LH	671		X			☐
2	Push Button	CM60/4-WT	630	Camden	X			☐
2	Surface Mount Box	CM-79	630	Camden	X			☐
1	Logic Relay	CX-33		Camden	X			☐
By Security Supplier								
1	Card Reader	To Suit Building System (12V)	BLK					☐
1	Door Contact	To Suit Building System						☐
1	Rex Sensor	To Suit Building System						☐
1	Access Controller	To Suit Building System						☐
1	Power Supply	Located in nearest IT Closet – By Security Provider						☐
By Locksmith								
2	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
- 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

Electrical Automatic Card Access

Heading# 17

Opening Information					
Opening Type:	Pair	**Opening Size:**	1 x 1067 x 2230 x 45 – 1 x 750 x 2230 x 45	**STC Rating**	None
Door Material:	ALD	**Frame Material:**	ALF	**Fire Rating**	None

1 Total Openings

1 **Door#** N-100C **Location:** Vestibule 140 from Open Garage 100 **Handing:** LHRA

					Web Link	Install Instructions	Site Verified	
By Hardware Supplier								
2	Continuous Hinges	112XY x 2230	671	Ives	X	X		☐
1	Door Pull Set	GSH 167F x 167F x 1925 x #5MTG (Back to Back)	622	Gallery	X			☐
2	Flush Bolts	FB458-UL	622	Ives	X			☐
1	Dust Proof Strike	DP2	622	Ives	X			☐
1	Overhead Stop	105S	622	Glynn Johnson	X	X		☐
1	Overhead Stop	103S	622	Glynn Johnson	X	X		☐
2	Door Sweep	By Aluminum Door Supplier	671					☐
By Automatics Supplier – **PACKAGE #1A**								
1	Auto Operator (SNG)	BESAM SW200i – Pull Side Mount – RH	628		X			☐
2	Push Button	CM60/4-WT	630	Camden	X			☐
2	Surface Mount Box	CM-79	630	Camden	X			☐

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

Electrical Automatic

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-103 **Location:** Room to B/F Universal WR 103 **Handing:** LH

					Web Link	Install Instructions	Site Verified	
By Hardware Supplier								
3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	630	Hager	X			☐
1	Storeroom Lockset	L9080BDC x 06B x 630	630	Schlage	X	X		☐
1	Electric Strike	1500C	630	HES	X	X		☐
2	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – Door Screws	630	Gallery	X			☐
2	Coat Hook	GSH 390	626	Gallery	X			☐
1	Overhead Stop	105S	630	Glynn Johnson	X	X		☐
1	Smoke / Sound Seal	W-66 x 5500	BLK	KN Crowder	X			☐
1	Auto Door Bottom	434APKL x 1067	MIL	Pemko	X	X		☐
1	Emergency Key Cabinet	EB-02	RD	Canropa	X			☐
By Automatics Supplier – **PACKAGE #5**								
1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount - LH	628		X			☐
1	Push to Lock Kit	CX-WC13XFM	630	Camden	X			☐
1	Emergency Call Kit	CX-WEC10K2	630	Camden	X	X		☐
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.
- 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# 19

Opening Information					
Opening Type:	Pair	**Opening Size:**	2 x 820 x 2135 x 45	**STC Rating**	None
Door Material:	HMD	**Frame Material:**	HMF	**Fire Rating**	None

1 Total Openings

1 **Door#** N-134 **Location:** Open Garage 100 from Sump Pit Room 134 **Handing:** RHA

					Web Link	Install Instructions	Site Verified	
By Hardware Supplier								
6	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	630	Hager	X			☐
1	Storeroom Lockset	L9080BDC x 06B x 630	630	Schlage	X	X		☐
2	Flush Bolts	FB458-UL	626	Ives	X			☐
1	Dust Proof Strike	DP2	626	Ives	X			☐
1	Closer	1461 x Rw/PA Push Side Mount	689	LCN	X	X		☐
2	Overhead Stop	103S	630	Glynn Johnson	X	X		☐
2	Kickplate	GSH 80A – 203 x 782 (Rounded Corners) – Door Screws	630	Gallery	X			☐
1	Smoke / Sound Seal	W-66 x 6300	BLK	KN Crowder	X			☐
2	Door Sweep	W-24S x 915	CA	KN Crowder	X			☐
1	Astragal	By HM Door Supplier						☐
By Locksmith								
1	Permanent Core	Permanent Medeco Core Provided by City Locksmith	626	Medeco				☐

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# 20

Opening Information					
Opening Type:	Single	**Opening Size:**	1170 x 2150 x 45	**STC Rating**	None
Door Material:	ALD	**Frame Material:**	ALF	**Fire Rating**	None

4	Total Openings					
1	**Door#**	N-122	**Location:**	Workstations 133 to Office 1 122	**Handing:**	SS
1	**Door#**	N-123	**Location:**	Workstations 133 to Office 2 123	**Handing:**	SS
1	**Door#**	N-124	**Location:**	Workstations 133 to Office 3 124	**Handing:**	SS
1	**Door#**	N-125	**Location:**	Workstations 133 to Office 4 125	**Handing:**	SS

Web Link | Install Instructions | Site Verified

By Hardware Supplier							
		ALL HARDWARE PROVIDED BY SLIDING DOOR SYSTEM PROVIDER					

***ALL HARDWARE PROVIDED BY SLIDING GLASS DOOR SYSTEM PROVIDER**

End of Heading

Heading# 21

Opening Information					
Opening Type:	Single	**Opening Size:**	1067 x 2135 x 45	**STC Rating**	None
Door Material:	SCWD	**Frame Material:**	HMF	**Fire Rating**	None

1 Total Openings

1 **Door#** N-126 **Location:** Workstations 133 to Office 5 126 **Handing:** RH

					Web Link	Install Instructions	Site Verified	
By Hardware Supplier								
3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	652	Hager	X			☐
1	Office Lockset	L9050BDC x 06B x 630	630	Schlage	X	X		☐
2	Coat Hook	GSH 390	626	Gallery	X			☐
1	Floor Stop	GSH 209	626	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 Locksmith								
1	Permanent Core	Permanent Medeco Core Provided by City Locksmith	626	Medeco				☐

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

Electrical Automatic

Heading# 22

Opening Information					
Opening Type:	Single	**Opening Size:**	1067 x 2135 x 45	**STC Rating**	None
Door Material:	SCWD	**Frame Material:**	HMF	**Fire Rating**	None

1 Total Openings

1 **Door#** N-127 **Location:** Workstations 133 to Office 6 127 **Handing:** RH

					Web Link	Install Instructions	Site Verified	
By Hardware Supplier								
3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	652	Hager	X			☐
1	Classroom Lockset	L9070BDC x 06B x 630	630	Schlage	X	X		☐
1	Mortise Cylinder	80-111	626	Schlage	X			☐
1	Electric Strike	1500C	630	HES	X	X		☐
1	Floor Stop	GSH 209	626	Gallery	X			☐
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – 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**								
1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount - RH	628		X			☐
2	Push Button	CM60/4-WT	630	Camden	X			☐
2	Surface Mount Box	CM-79	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	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
- Option to have Operators manually turned off and room closed during non working hours using classroom function of lockset.
- 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

Electrical Automatic

Heading# 23

Opening Information					
Opening Type:	Single	**Opening Size:**	1067 x 2135 x 45	**STC Rating**	None
Door Material:	SCWD	**Frame Material:**	HMF	**Fire Rating**	None

1 Total Openings

1 **Door#** N-129 **Location:** Workstations 133 to Meeting Room 129 **Handing:** LH

					Web Link	Install Instructions	Site Verified	
By Hardware Supplier								
3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	652	Hager	X			☐
1	Classroom Lockset	L9070BDC x 06B x 630	630	Schlage	X	X		☐
1	Mortise Cylinder	80-111	626	Schlage	X			☐
1	Electric Strike	1500C	630	HES	X	X		☐
1	Floor Stop	GSH 209	626	Gallery	X			☐
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – 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**								
1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount - LH	628		X			☐
2	Push Button	CM60/4-WT	630	Camden	X			☐
2	Surface Mount Box	CM-79	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	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
- Option to have Operators manually turned off and room closed during non working hours using classroom function of lockset.
- 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# 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-131A **Location:** Stair A 137 from Workstations 133 **Handing:** LHR

By Hardware Supplier					Web Link	Install Instructions	Site Verified	
3	Heavy Weight Hinge	BB1168 – 4 ½" x 4" NRP	652	Hager	X			☐
1	Exit Device	98L-NL-F x 996L-NL-R/V x 06 x 626/630 - 4'0	630	Von Duprin	X	X		☐
1	Rim Cylinder Housing	80-116	626	Schlage	X			☐
1	Electric Strike	6300 x 12/24VCD	630	Von Duprin	X	X		☐
1	Overhead Stop	105S	630	Glynn Johnson	X	X		☐
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – 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**								
2	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount - RH	628		X			☐
2	Push Button	CM60/4-WT	630	Camden	X			☐
2	Surface Mount Box	CM-79	630	Camden	X			☐
1	Logic Relay	CX-33		Camden	X			☐
By Security Supplier								
1	Card Reader	To Suit Building System (12V)	BLK					☐
1	Door Contact	To Suit Building System						☐
1	Rex Sensor	To Suit Building System						☐
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.

End of Heading

Electrical Automatic

Heading# 25

Opening Information					
Opening Type:	Single	**Opening Size:**	1067 x 2135 x 45	**STC Rating**	None
Door Material:	SCWD	**Frame Material:**	HMF	**Fire Rating**	None

1 Total Openings

1 **Door#** N-132 **Location:** Workstations 133 to Training Room 136 **Handing:** RH

					Web Link	Install Instructions	Site Verified	
By Hardware Supplier								
3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	652	Hager	X			☐
1	Classroom Lockset	L9070BDC x 06B x 630	630	Schlage	X	X		☐
1	Mortise Cylinder	80-111	626	Schlage	X			☐
1	Electric Strike	1500C	630	HES	X	X		☐
1	Floor Stop	GSH 209	626	Gallery	X			☐
1	Kickplate	GSH 80A – 203 x 1029 (Rounded Corners) – 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**								
1	Auto Operator (SNG)	BESAM SW100 – Pull Side Mount - RH	628		X			☐
2	Push Button	CM60/4-WT	630	Camden	X			☐
2	Surface Mount Box	CM-79	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	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
- Option to have Operators manually turned off and room closed during non working hours using classroom function of lockset.
- 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

Electrical | Card Access | Fire Rated

Heading# 26

Opening Information					
Opening Type:	Single	**Opening Size:**	900 x 2135 x 45	**STC Rating**	None
Door Material:	HMD	**Frame Material:**	HMF	**Fire Rating**	3/4 HR

1 Total Openings

1 **Door#** N-135 **Location:** Open Garage 100 to Lobby 138 **Handing:** LH

					Web Link	Install Instructions	Site Verified	
By Hardware Supplier								
3	Heavy Weight Hinge	BB1168 – 4 ½" x 4"	652	Hager	X			☐
1	Storeroom Lockset	L9080BDC x 06B x 630	630	Schlage	X	X		☐
1	Electric Strike	1500C	630	HES	X	X		☐
1	Closer	4011-LH (LCN/ST 1544)	689	LCN	X	X		☐
1	Drop Plate	4020-18	689	LCN				☐
1	Overhead Stop	104S	630	Glynn Johnson	X	X		☐
1	Kickplate	GSH 80A – 203 x 862 (Rounded Corners) – Door Screws	630	Gallery	X			☐
1	Smoke / Sound Seal	W-66 x 5400	BLK	KN Crowder	X			☐
1	Door Sweep	W-24S x 900	CA	KN Crowder	X			☐
By Security Supplier								
1	Card Reader/Keypad	To Suit Building System (12V)	BLK					☐
1	Door Contact	To Suit Building System						☐
1	Rex Sensor	To Suit Building System						☐
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:

- 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.

End of Heading

Fire Rated

Heading# 27

Opening Information

Opening Type:	Pair	**Opening Size:**	2 x 810 x 2135 x 45	**STC Rating**	None
Door Material:	HMD	**Frame Material:**	HMF	**Fire Rating**	3/4 HR

1 Total Openings

1 **Door#** N-018 **Location:** Change Room 009 from Elevator Closet 018 **Handing:** RHA

By Hardware Supplier					Web Link	Install Instructions	Site Verified	
6	Hinge	BB1279 – 4 ½" x 4"	652	Hager	X			☐
1	Storeroom Lockset	L9080BDC x 06B x 630	630	Schlage	X	X		☐
2	Flush Bolts	FB458-UL	626	Ives	X			☐
1	Dust Proof Strike	DP2	626	Ives	X			☐
1	Closer	1461 x Rw/PA (Push Side Mount)	689	LCN	X	X		☐
2	Overhead Stop	103S	630	Glynn Johnson	X	X		☐
2	Kickplate	GSH 80A – 203 x 772 (Rounded Corners) – Door Screws	630	Gallery	X			☐
1	Smoke / Sound Seal	W-66 x 6300	BLK	KN Crowder	X			☐
2	Door Sweep	W-24S x 915	CA	KN Crowder	X			☐
1	Astragal	By HM Door Supplier						☐

By Locksmith								
1	Permanent Core	Permanent Medeco Core Provided by City Locksmith	626	Medeco				☐

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

Electrical Card Access

Heading# 28

Opening Information					
Opening Type:	Single	**Opening Size:**	1220 x 2134	**STC Rating**	None
Door Material:	**Metal Mesh Gate**	**Frame Material:**	**Metal Gate Posts**	**Fire Rating**	None

1 Total Openings

1 **Door#** G-101 **Location:** Corridor from Lower Office 100 **Handing:** LHR

					Web Link	Install Instructions	Site Verified	
By Hardware Supplier								
1	Spring Gate Hinge Set	By Gate Provider.	630	Hager	X			☐
1	Electrical Door Loop or Power Transfer	By Gate Provider.	630	Hager	X			☐
1	Elec. Exit Device with Storeroom Lever Trim	RX-LX-QEL-98L-NL-F x 996L-NL-R/V x 06 x 626/630 - 4'0	630	Von Duprin	X	X		☐
1	Rim Cylinder Housing	80-116	626	Schlage	X			☐
By Security Supplier								
1	Card Reader/Keypad	To Suit Building System (12V)	BLK					☐
1	Door Contact	To Suit Building System						☐
1	Latch Bolt Monitor	Included in Exit Device – Security To Wire						☐
1	Rex Sensor	Included in Exit Device – Security To Wire						☐
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				☐

*BALANCE OF HARDWARE BY GATE PROVIDER.
*GATE PROVIDER MUST PROPERLY RE-ENFORCE AND PREP THE GATE TO RECEIVE ELEC RIM EXIT DEVICE WITH LEVER TRIM AND PROPER STRIKE BOX ON GATE POSTS.

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
- 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 **SECTION INCLUDES**

.1 Labour, products, equipment and services necessary to complete the work of this Section.

1.2 **REFERENCES**

.1 Standard hardware location dimensions in accordance with the Canadian Steel Door Manufacturer's Association (CSDMA) Canadian Metric Conversion Guide for Steel Doors and Frames

1.3 **DEFINITIONS**

.1 The word "portal" defines the opening and the immediate area around the door or doors as used to accommodate peripheral devices associated to the operational functionality of the door. By definition this may include key switch or push switch assemblies and/or audio visual alerts provided by this contractor and applied to electrical boxes installed by Divisions 26 or 28.

.2 The wording "Electrified Application" where it occurs as a line item within a hardware heading indicates an identified electrified application that is subject to all conditions associated to this specification for supply, installation and commissioning with complete 'as-built" documentation. The type identity is included to differentiate between the various configurations.

1.4 **REQUIREMENTS REGULATORY AGENCIES**

.1 Fire-rated and exit door hardware shall be certified by a Canadian Certification Organization accredited by the Standards Council of Canada. Ensure that all doors and hardware in fire-rated openings are tested as assemblies to maintain Listing requirements. Hardware items shall bear certification labels and be listed for use to the application.

.2 This Section must have in its employ Certified Electrical Applicators in the Province of Ontario with a minimum of two (2) years of experience with the type of work being performed and have previously supplied electrified hardware services to projects of this type and scale.

1.5 **DESCRIPTION OF WORK**

.1 This Section is based on the supply and installation of services to the electrified hardware and exit control equipment capable of supporting operations specified herein. Provide all system components specified herein, including access related peripheral hardware applications on the controlled portal where specified and install and commission as a working system each hardware heading with electrified devices to the intent of this specification. This does not include the supply of devices or services included for in Section 08 71 00 or Divisions 26 and 28.

1.6 **SUBMITTALS**

.1 This Section shall receive a digital copy of the Finish Hardware Schedule as prepared and submitted by Section 08 71 01 in an editable format in order to confirm identification of portal application that are relevant to the installation of electrified hardware devices or systems.

.2 This Section will in-turn apply electrified application information to the Finish Hardware Schedule and submit a digital copy in an editable format to the Contractor for distribution to the Finish Hardware supplier to confirm application devices are compatible to the total functionality.

.3 Electrified Applications: Provide six (6) copies of opening schematic documents that illustrates the same detail and includes suggested point-to-point conduit application necessary between devices associated to each configuration type.

.4 Opening Schematic documents shall provide a visual setup application for each portal type illustrating all electrified devices installed to the portal as provided by Section 08 71 00. Included in the document shall be a type specific overview of the sequence of operation for each portal type relating to the intended operational aspects of all electrified devices to be installed. Manufactures catalog sales sheets or technical application materials are not acceptable as content for this work. Each set shall provide a first page index as the first page to identify the content and project name. Provide each set ready for inclusion to a three ring binder so as to make each page available individually. All content is to be created from a CAD-PC software program. Printer output shall provide for colour definition. This work shall commence immediately upon award of this contract.

.5 Sequence of operation documentation shall be submitted to the Consultant in order that operational characteristics are provided for review before actual hookup is commenced.

1.7 **INSPECTION**

.1 Inspect the installation of electrified portal devices on an agreed upon frequency.

.2 Provide a written report to the Consultant of any work being performed which will prejudice the installation or correct operation of items of hardware.

1.8 **COORDINATION**

.1 Coordinate the Work of this Section to ensure information and material is promptly provided, to ensure orderly and expeditious progress of Work, and to comply with the schedule for completion.

.2 Convene a design review meeting within forty (40) days of Contract award. Prepare work plan, coordinate functional review of design documents, and resolve any conflicts between contract documents and actual requirements.

.3 Coordinate final conduit system requirements at the portal with Divisions 26 or 28. Confirm device locations, and electrical service allocations and requirements.

.4 Coordinate with aluminum door trade to ensure the proper preparation and fabrication of aluminum doors and frames. Ensure that doors have been prepared correctly for all electrical devices and that doors contain flexible conduit where required.

.5 Provide all manufactured system specific enclosures and back boxes to Division 26 for installation as part of the conduit system. Divisions 26 or 28 shall provide industry standard device and junction boxes and install substantial corrosion resistant pull strings in all conduit runs.

.6 This hardware supplier shall include for a qualified professional to attend regular site meetings when asked to coordinate scope of work with other trades.

1.9 **WARRANTY**

.1 Warrant the Work of this Section to be free of defects in materials and quality of work in accordance with the Contract requirements for a period of two (2) years.

.2 Further agree to promptly remove, replace and reinstall material, upon verification that defects in material, quality of work, or operation are in evidence.

.3 Further agree to be responsible for all service and labour associated to the warranty of the installation unless supplementary work or adjustments have been incorporated to the portal

system or devices connected, by others, who have by intervention caused the need for extended service, after commissioning and acceptance have occurred.

2 Products

2.1 **MATERIALS**

.1 Supply materials to be connected in accordance with the Finish Hardware Schedule. Electrified applications are identified as being part of Section 08 71 02 in the Finish Hardware Schedule provided in Section 08 71 01.

2.2 **HARDWARE PRODUCTS**

.1 Section 08 71 01 shall provide instruction to the door and frame supplier to locate and provide current transfer preparation cutouts where electric latch retraction systems are specified.

.2 Section 08 71 01 supplier shall provide “electric latch” retraction devices or latch releasing devices where interfacing is required for electrified access functionality or power operated doors are specified. Refer to Section 08 71 00 and 08 71 01 for more information regarding hardware requirements.

.3 Section 08 71 01 supplier will be required to ensure that all products applied to fire-rated doors are acceptable for use with labeled doors and carry the applicable certification label.

.4 Miscellaneous

.1 Ensure that the installation trades have installed associated equipment supplied into this section correctly and will report any incorrect installations to the contractor in a written report as required under 1.7.2 . Do not wire or commission equipment that has been incorrectly installed.

.2 It is the responsibility of the electrified application hardware installer to test all mechanical operation of electrified hardware after all connections have been completed and the portal is identified as ready for commissioning.

.3 The hardware applications listed in the latest revised hardware schedule will take precedence over all other documents for electrified hardware applications, unless specifically noted.

3 Execution

3.1 **GENERAL**

.1 Refer to contract Electrical drawings to ensure specific integration instruction for this scope of work are provided to the successful Electrical Contractor in a timely manner in order that systems provided by Divisions 26 or 28 are seamless in their integration, as a working application to the door control system.

.2 Scope of Portal Work Included

.1 This supplier shall include in its tender the cost for qualified technical services that provides specialized service and personnel equipped to implement the portal application as described in this section, in its entirety, including device hookup to a commissioned sign-off. Provide a commission sign-off document listing all functionality of the devices to the Contractor at the conclusion of the work and prior to other trades commencing implementation of the access or fire system to each portal.

.2 Provide a complete set of proposed device "point to point" hookup connections for each portal type with the suggested interface to remote systems as implemented by Divisions 26 or 28, to assist in their integration to the electrified portals.

.3 Provide a complete set of "as-built" schematic CAD drawings indicating "point to point" wire connections produced so as to include for all devices connected at the portal, as a group. Each specific type shall have a separate drawing and each drawing shall include the "sequence of operation" and where used" information. Drawing page size format to be tabloid 279 mm x 432 mm (11" x 17") with uniform title block and retain continuity of the applied device information.

.4 Provide terminal integration components or trays with terminal integration setups to suit each portal configuration that a SIP enclosure is provided for by the finish hardware supplier. Each terminal point shall be numbered an identified as necessary by name to support the incoming and outgoing wire distribution applied to the "as built" documentation.

.5 Provide for the cost of providing all low volt wire between the Portal System Integration Panel (SIP) enclosure and/or low volt power controller, power supply and all devices located at the portal. This scope of work covers all electrified devices included in this section, 08 71 00 and 08 71 01 that are connected into this portal system. All wire is to have colour coded jacketing so as to easily differentiate connection points between terminals.

.1 All systems provided by Divisions 26 and 28 will include for all connections.

.6 Provide connections at the device or a SIP enclosure, panel box, power controller or power supply. All inline or undocumented connections will be rejected. Specific attention is to be given to wire runs through aluminium door or frame channels – if the wire between the device and the exit point from the frame passes through a second channel from its mounting point, the wire(s) shall be encased in a flexible metal jacket. Where wires run through holes or conduit, they shall be protected by suitable grommets.

.7 Provide all low-volt power supplies as required to provide 24V power to all electrified devices provided by Section 08 71 00 and 08 71 01 that require power to activate as part of the portal system. Each power supply load connected shall not exceed 65% of the manufacturers rated output specification. Each power supply shall be provided with a terminal distribution board or boards as necessary to provide an individual fused circuit to each portal. Each power supply will incorporate a printed label identifying the portal circuit by name and terminal number. Each power supply will be ULC Listed for the intended use and incorporate a fire shut-down circuit.

.1 Power supplies that are related to specific hardware device functionality shall be provided by Section 08 71 01.

.2 Quantity and type to be provided for this work. To be determined.

.3 Power Supplies are to be RCI – Securitron or accepted equal.

.8 Provide a complete riser drawing that incorporates all electrified portal locations as connected to each power supply. Location of power supplies shall be positioned to the same equipment room as the access control system or as designated by the Electrical Engineer. This work shall commence immediately upon award of this contract.

3.2 **RELATED DIVISIONS**

.1 Divisions 26 or 28 shall retain responsibility for all fire system connections to portal systems as provided by this section, Sections 08 71 00 and 08 71 01. This Work shall include for all magnetic lock inspection by the commissioning authority to life safety, fire or monitoring systems as detailed for access related applications, including permits for magnetic lock application.

.2 Divisions 26 or 28 shall provide all access card reader, monitoring and asset monitoring power supplies as/if specified in other sections. This Work shall include for all components, including wire, necessary to interface these systems to the portal system for device management, as required to meet the functionality requirement defined for security and building code compliance.

.3 System Integration Panel (SIP) shall be provided by Section 08 71 00. This Section shall design and provide hookup back-pan trays or relay terminal applications with labeled terminal connections to suit enclosures being provided by the finish hardware supplier. Coordination is required to insure comparability.

.4 Divisions 26 or 28 shall provide all 120 Vac connections to related electrified products at the portal system including for power openers where specified.

.5 Divisions 26 or 28 shall provide all conduits to the power controller, power supply and system integration panel enclosure (SIP) as provided by this section or Section 08 71 00. Positioned all enclosures with consultation to ensure that all controllers are vertically mounted in accessible locations for future service. Under no circumstances are these enclosures to be mounted in the inverted position. All conduit (EMT) shall be provided with the actual wire required by this specification or an industry standard pull string for the use of this section.

.6 Divisions 26 or 28 shall include for installation and pulling of hook-up wire provided by this section between the portal devices and the portal system integration enclosure (SIP) located at the portal. All low volt wire supply and installation between the power controller or system integration enclosure (SIP) and /or the power supply will be the responsibility of Divisions 26 or 28. Reference 3.5.2 Wire and Cable.

.7 Section 08 71 00 shall ensure their specification includes for all Magnetic locks to be provided with a holding force (bond) sensor (dry contact type) to confirm lock status as secure or not secure to the security system. A power monitoring relay connected externally at the device is not acceptable to meet this requirement.

.1 Section 08 71 00 shall provide acceptable signing for doors to indicate “door unlocked by fire alarm” as local building codes dictate. Coordinate signs with the architect /or owner before ordering.

.8 Section 08 40 00 shall provide, where electrified applications occur, suitable raceway apertures for wire and connection points for all devices applied to aluminum doors and frames. Shop drawing and submittals will include profile details of doors and frames.

.9 Section 08 11 00 shall provide preparation for electrical connections to connect through steel frame sections as marked on templates provided by Section 08 71 00. Each pass-through point shall be provided with a continuous conduit or raceway coupling to enable a continuous wire run between the device location and the control point without exposure to the surrounding environment.

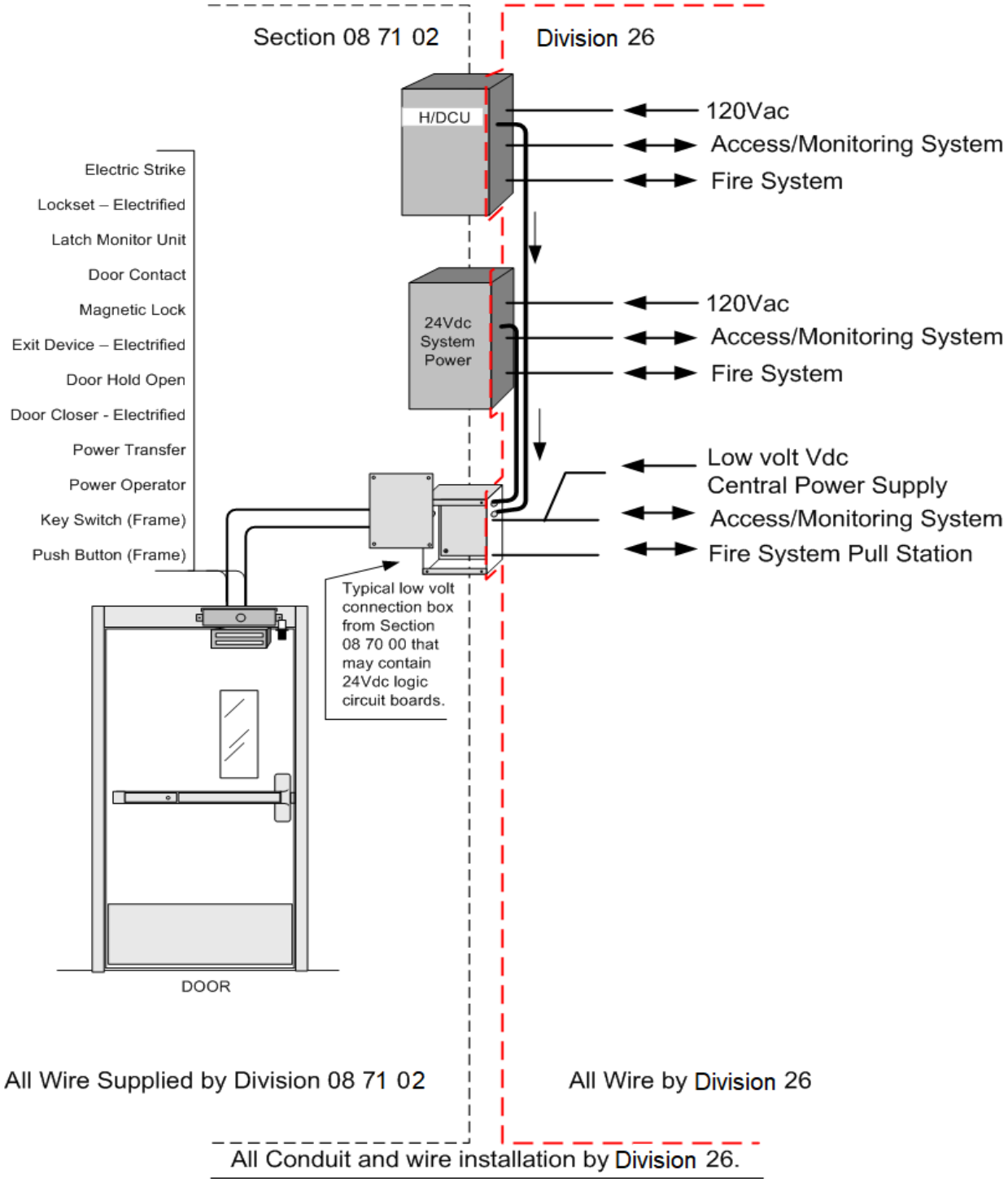
3.3 **WIRE AND CABLE**

.1 All hookup wiring shall be PVC insulated single or multi-conductor jacketed cable provided in this Division 08 71 02 and shall be installed by Divisions 26 or 28 in conduit or flexible

metal raceways as provided for in Divisions 26 or 28. Portal device hookup wire shall generally be #22 AWG stranded UL Listed between devices and the portal junction box, power supply or power controller. Very long wire runs or multiple operational doors at a portal location may exceed the capacity of the #22 wire size for power distribution. Confirm actual power draw requirements of devices attached to portal controllers and provide accordingly within acceptable industry standards for loading. All stranded wire termination will be by crimp connection or screw clamp with wire pad assemblies.

.2 All multi-conductor hook-up wire shall be provided to Divisions 26 or 28 contractor in bulk form to suit the requirement of the portal configuration device application between the portal collection box and the local electrified hardware devices. Divisions 26 or 28 shall include cost of installing wire in the conduit system. Wire type between remote low volt power supplies and the portal collection box is to be determined based on industry standards for power distribution over distance that maintains the integrity of the supplied volt output to be the same as the source at the collection box. Wire size and type is to be no less than 16 gauge stranded. Reference Section 3.2.5 Related work by other sections and Appendix “A” of this Section.

Section 08 71 02 – Appendix "A"
Divisional Portal Responsibility



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 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 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 Section 08 71 05.

.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 Tempered Glass (TGL): 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

.2 Laminated Tempered Glass: conforming to CAN/CGSB-12.1-M, Category II, consisting of two layers of 6 mm thick clear tempered glass, with 1.5 mm clear polyvinyl butyral (PVB) interlayer.

.1 Thickness: minimum 13 mm or as indicated on Drawings

.3 Insulating glass (ITGL): 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. (Panes to be float glass conforming to CAN/CGSB-12.3-M; tinted (grey) (bronze) exterior and clear interior, both 6 mm¼" 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.

.4 Fire-rated Glass: Refer to Section 08 41 23

.5 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.

.6 Mirrors: Conforming to ASTM C1503, normal use (high humidity use) 6 mm¼" 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 mm¼" 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.

.7 One way glass: 6 mm thick regular clear tempered glass with applied chrome alloy coating. Glass shall be transparent for one-way vision.

.8 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: 8 mils (203 µm)

.2 T ensile Strength: 32, 000 psi

.3 Breaking strength: 255 lbs/in

.4 Visible light transmittance: 87%

.5 Adhesive and sealant: as recommended by film manufacturer.

.6 Acceptable Product:

.1 “Scotchshield Ultra Series S800” by 3M Film

.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 **INSTALATION**

.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	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	AMPP (SSPC)	-	Association for Materials Protection and Performance
.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 Hangers: 5 mm diameter pencil rods or 32 mm x 3 mm galvanized steel flat bars to CSA A82.30-M.

.7 Tie wire: Not less than No. 18 gauge galvanized wire.

.8 Screw fasteners: in accordance with ASTM C1002, Type S, corrosion resistant.

.9 Wall Reinforcement:

.1 Provide fire retardant treated wood blocking and minimum 18 gauge sheet steel secured between studs for additional reinforcement and supports for wall mounted fixtures, equipment and accessories. The same requirements shall be applied to ceiling mounted items. Coordinate with General Contractor for weight of items to be supported and revise steel gauge accordingly to ensure proper support.

.2 Provide additional wall reinforcement to support future adult change table designed for a minimum load of 1.33 kN and baby change table designed to support a 0.22 KN load applied to it.

2.2 **GYPSUM BOARD**

.1 Standard Gypsum board:

.1 12.9 mm and 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.

.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)

.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 Etreme 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.

.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.

.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 accepted 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 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 or 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 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

.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.

3.3 **WALL REINFORCEMENT:**

.1 Provide and install backing and/or reinforcing within steel stud gypsum partitions for items being hung from or anchored to such partitions or furring.

.2 Verify location of supports within gypsum board and provide information in ample time to ensure supports are provided in the correct locations. Do not install gypsum board until

wood blocking or other reinforcements are installed. Remove and reinstall gypsum board at no extra cost to the Owner where this requirement is not complied with.

.3 Provide galvanize stud reinforcements in moist areas. Do not use wood blocking for this purpose. Mount additional reinforcement horizontally or at an angle and secure between studs to support the load of and shear forces imposed by items installed upon the Work of this Section. Such items include, but not limited to the following:

.1 Washroom accessories

.2 Miscellaneous specialties

.3 Manufactured components

.4 Fitments and fixtures

.5 Architectural woodwork and other millwork components

.6 Minor mechanical and electrical work; heavy mechanical and electrical equipment shall be self-supporting.

.7 Adult and baby change table

.8 Fire hose cabinets

.9 Access panels

.10 Handrails

.11 Coat hooks

.12 Wall hung cabinets

.13 Shelving

.14 Owner supplied equipment

.4

3.4 **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.

.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.

3.5 **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.

3.6 **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.

3.7 **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.

3.8 **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.

3.9 **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.

.6 Remove control joint "V" groove tape.

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 Refer to Section 07 92 00 Joint Sealant.

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

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.

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 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: 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 Floor (PFT-1):

.1 Through body unglazed porcelain tile.

.2 Colour: Mica, Matte.

.3 Size (s):

.1 PFT-1: 300 x 600 mm x 9 mm

.2 PFT-1a: 150 mm x 150 mm x 9 mm

.3 PFT-1b: 300 mm x 300 mm x 9 mm

.4 Slip Resistance: DCOF- 0.50min. dry/wet in accordance with ANSI A137.1, when tested to BOT 3000 Digital Tribometer.

.5 Manufacturer: Emotion by Division 9 (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 x 5 mm

.4 Slip Resistance: DCOF- 0.50min. dry/wet in accordance with ANSI A137.1, when tested to BOT 3000 Digital Tribometer.

.5 Manufacturer: STI Mosaic by Stone Tile or accepted equal.

.3 Floor (PFT-3): Match existing. Provide samples for selection by Consultant.

.4 Washroom Floors (PFT-4):

.1 Through body unglazed porcelain tile.

.2 Colour: Cool porcelain white (200), Smooth (V)

.3 Size: 300 mm x 600 mm x 12 mm

.4 Slip Resistance: R10 in accordance with DIN 51130.

.5 Acceptable Manufacturer: Core Collection Terra by Mosa or accepted equal

.3 Wall (and ceiling) tiles: Glazed ceramic wall complete with trim fittings including integral coves, sanitary caps and beads. Types as follows:

.1 Washroom / Shower Walls (CWT-1):

.1 Collection: Colour & Dimension.

.2 Size: 100 mm x 400 mm

.3 Colour: Artic White, Matte

.4 Acceptable Manufacturer: Olympia Tile or accepted equal.

.2 Walls (CWT-2): Match existing. Provide samples for selection by Consultant.

.3 Washroom / Shower Accent:

.1 Collection: Colour & Dimension.

.2 Size: 100 mm x 400 mm

.3 Colour: Taupe, Matte (CWT-3); Dark Grey, Matte (CWT-4)

.4 Acceptable Manufacturer: Olympia Tile or accepted equal.

.4 Walls (CWT-5): Size: 600 mm x 600 mm, Provide samples for selection by Consultant.

.4 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

.5 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

.6 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

.7 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

.2 For tiles <u>over</u> 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

.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

.4 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

.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 equal.

.8 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.

.9 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 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 (TH-6a): Transition between floorings of different heights, smooth profile.

.1 Material and Finish: Polished Brass

.2 Height: for elevation differences of 7.8 mm to 13.5 mm. Select heigh as required to coordinate with tile selection and setting system selected.

.3 Ramp length: as required.

.4 Installation method: self adhesive

.5 Accepted Manufacturer: Profilitec “Leveltec RPR” or accepted equal.

.4 (TH-7a): Transition between floorings of different heights, smooth and grooved profile.

.1 Material and Finish: Stainless Steel Polished

.2 Height: for elevation differences of 3 mm to 14 mm. Select height as required to coordinate with tile.

.3 Length: as required.

.4 Installation method: pre-drilled with flathead screw

.5 Accepted Manufacturer: Profilitec “Leveltec RP” or accepted equal.

.5 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

.2 Accepted manufacturer: Schluter “RENO-T” or accepted equal.

.6 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: 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

.10 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.

.11 Use epoxy grout or approved group sealer for all tiled floors.

.12 Prefabricated control and expansion joints: Provide “Movement Joint Profiles” by Schluter or approved alternative 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.

.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 in accordance with waterproofing manufacturer's directions.

.2 Where tiles are to be installed in waterproofing system, apply system and tiles in accordance with manufacturer’s recommendation.

.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 Apply with a trowel on prepared substrate to a total dry film thickness of 635 microns (25 mils) in accordance with manufacturer's directions. Carry up walls to 100 mm high.

.7 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 ceramic 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 ceramic tile with thin set mortar in accordance with TTMAC Installation Manual, Detail 315C, latest edition.

.3 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.

.4 Tile on gypsum board walls in dry areas: Install ceramic tile and fittings with thin set mortar in accordance with TTMAC Installation Manual, Detail 304W, latest edition.

.5 Tile on cementitious board walls in wet areas: Install ceramic tile and fittings with thin set mortar in accordance with TTMAC Installation Manual, Detail 305W, 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 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.

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

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 **GRID SYSTEM**

.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”

.5 Or accepted equal

.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”

.5 Or accepted equal

.3 Seismic Grid System:

.1 Chicago Metallic “200 Snap Grid”, heavy duty

.2 Or accepted equal

.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”

.4 Or accepted equal

.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”

2.2 **ACOUSTIC CEILING TILES (ACT)**

.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”

.5 Or accepted equal

.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”.

.2 Or accepted equal

.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 Or accepted equal

.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 STC Rating 40: Use 1-layer plenum barrier board over walls with standard doors and large area of glass.

.2 STC Rating 50+: Use 2-layer plenum barrier board over walls without doors and glass.

.3 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.

.4 Acceptable Manufacturer

.1 “Plenum Barrier Board” by Rockfon.

.2 Or accepted equal.

2.3 **ACCESSORIES**

.1 Hangers: Soft-annealed, zinc coated steel wire minimum 2.64 mm (12 gauge), meeting "heavy-duty" classification of ASTM C635.

.2 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.

.3 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.

.4 Panel hold-down clips: Standard of grid manufacturer.

.5 Supplementary splines: Hard fiber or steel splines as standard with grid manufacturer.

.6 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.

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 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 sample 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 **MANUFACTURER'S INSPECTION**

.1 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.

.2 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 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.

1.7 **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 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 be limited to, loss of bond, breakage, deformation, fading and loosening of tiles.

1.8 **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. Domes to be installed in widths/depth of 610 mm

.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. Bars to be installed in widths/depth of 610 mm.

.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 Cast-in-place Tactile

.1 Install cast-in-place tactile surface tile system on full surface of barrier-free curb ramps.

.2 Retain factory-installed plastic sheeting in place during installation to protect the tile surface. Do not remove concrete from the area where the tiles are to be installed; avoid any air voids below the tile.

.3 Place tactile tiles in wet concrete, immediately after finishing concrete, using a rubber mallet and checking the slope electronic level. Tamp tiles into the concrete. Tiles to be set with the top of domes level to the adjacent concrete on the top and sides of ramp, to prevent damage by snow plows, with centre portion of the base/field level with concrete at the bottom of the ramp to allow water drainage. Ensure installation does not present a tripping hazard.

.4 While concrete is still workable, use an edging tool to create a finished edge, then a steel trowel to finish the concrete around the tile perimeter. After concrete has cured, remove protective plastic wrap from the tile.

3.4 **FIELD QUALITY CONTROL**

.1 Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant ad 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.

.4 Protect installed tactile warning indicator tiles from damage during construction by covering with plywood.

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.

.4 Comply with manufacturer's maintenance manual for cleaning and maintaining tile surface.

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

.2 ASTM F1861 - Standard Specifications for Resilient Wall Base

.3 ASTM - Standard Specifications for Resilient Stair Treads

1.3 **SUBMITTALS**

.1 Samples

.1 Submit in accordance with Section 01 33 00.

.2 Submit three samples of each type of resilient tile flooring and base, and treads and nosings.

.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 resilient tile 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 **PROJECT CONDITIONS**

.1 Maintain ambient temperature and substrate temperature at flooring in installation area as per manufacturer printed instructions.

.2 Do not install base and accessories in high humid conditions or where exposed to cold drafts. Protect from direct sunlight in hot weather.

.3 Provide adequate ventilation during installation.

1.6 **MAINTENANCE**

.1 Extra stock: Provide extra resilient base of colour and type for the project for maintenance use. Leave maintenance in quantity of two metres (10 feet) for every 100 linear meters (500 linear feet) installed. Include sufficient amount of adhesive and installation instructions.

2 Products

2.1 **ANTI-FATIGUE FLOORING (MAT-1)**

.1 Highly compressed homogeneous vinyl wear layer with a high-performance urethane topcoat, glass fiber interlayer and a calendared CDF backing. Flooring shall be flush with the existing flooring when installed.

.1 Size: as indicated on Drawings

.2 Colour: EC20, Texture Silver, unless indicated otherwise

.3 Acceptable Manufacturer:

.1 “Eternal Comfort” by Forbo

.2 or accepted equal.

2.2 **RUBBER WALL BASE**

.1 (RB-1): To match existing 100 mm high wall base.

.1 Acceptable manufacturer: “Johnsonite Baseworks” by Tarkett or approved equal.

.2 Colours: to match existing.

.2 (RB-2): Thermoplastic rubber (TP), in accordance with ASTM F1861. Provide samples for selection by the Consultant.

.1 Acceptable manufacturer: “Johnsonite Duracove” by Tarkett or approved equal.

.2 Colour(s): TA6 Bedrock

.3 Size: 152 mm high, 3.2 mm thick

.3 Epoxy adhesive and caulking compound: As required for surfaces involved recommended and supplied by manufacturer.

.4 Adhesive: of type as recommended by manufacturer.

.5 Sawcut and control joint filler: Latex-cement compound.

.6 Sub-floor filler: As recommended by manufacturer to meet site conditions.

2.3 **STAIR TREADS AND NOSING**

.1 One-piece homogeneous polyvinyl chloride (PVC) in accordance with ASTM F2169, Type TV, Class 2, Group 2, heavy duty square nose with contrasting visually impaired non-slip carborundum strip.

.1 Acceptable Manufacture:

.1 “Johnsonite Stair Treads” by Tarkett or accepted equal.

3 Execution

3.1 **EXAMINATION**

.1 Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for resilient base and accessories installation in accordance with manufacturer's written recommendations.

3.2 **PREPARATION**

.1 Remove pre-existing adhesives to prevent residual, pre-existing base adhesives from bleeding or telescoping through to new resilient base and accessories, or interfering with bonding of new adhesives.

3.3 **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.

.2 Before installing base, fill cracks and irregularities with a filler recommended by base manufacturer.

.3 Lay out base to keep number of joints to a minimum with no two joints closer than 450 mm apart. Make joints vertical and tight.

.4 Adhere resilient base to vertical surfaces. Ensure there are no gaps behind base, and front lip of base cove bears firmly and uniformly on floor surfaces. Ensure permanent bond between base and surface.

.5 Clean substrate and prime with adhesive

.6 Outside Corners: At external corners, 'V' cut back of base strip to 2/3 of its thickness and fold.

.7 Inside Corners: Mitre all inside corners.

.8 Provide floor mouldings, metal edge strips, transitions, and terminations, in full bed of adhesive, at interface of dissimilar floorings, where flooring terminates at concrete floors, at flooring exposed edges, and where indicated on Drawings.

3.4 **CLEANING AND PROTECTION**

.1 Remove adhesive from surfaces as work progresses.

.2 Remove excess adhesive from floor, base and wall surfaces without damage as work progresses

.3 Clean, seal and wax resilient base and accessories surfaces in accordance resilient base and accessories manufacturer's written recommendations.

.4 Protect resilient base and accessories from damage during construction period.

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 E648	-	Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source
.2	CAN/ULC S102.2-M	-	Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
.3	CGSB 4-GP-129	-	Carpets, Commercial
.4	NFPA-99	-	National Fire Protection Association, Health Care Facilities
.5	AODA	-	Accessibility for Ontarians with Disabilities Act

1.3 **SUBMITTALS**

.1 Samples

.1 Submit in accordance with Section 01 33 00.

.2 Submit two 300 mm x 300 mm samples of carpet, complete range of manufacturer's colour samples (for each type of carpet specified), specifications of adhesives and samples of base and trim, for review and colour selection.

.3 Samples to be prepared by manufacturers, after consultation with Consultant. Installed Product must match approved samples in every respect.

.2 Shop Drawings

.1 Submit in accordance with Section 01 33 00.

.2 Illustrate carpeted floor and wall areas, carpet selection, pile direction and seaming diagram (location and length). Arrange pile direction and seam location to suit pattern continuity and to provide a quality installation minimizing wastage. Include for appropriate amount of overage to suit particular pattern being installed.

.3 Submit adhesive Product data confirming specified requirement.

.3 Test reports: Submit a test report from an independent testing and inspection organization to substantiate conformity of carpet to be supplied for the Project, to test requirements specified.

1.4 **DELIVERY, STORAGE AND HANDLING**

.1 Deliver materials in original, factory sealed rolls, containers and wrappers. Handle and store and prevent damage, contamination and deterioration to Work of this section.

.2 Clearly mark carpet with register number and dye lot on each bale.

1.5 **PROJECT/SITE ENVIRONMENTAL REQUIREMENTS**

.1 Moisture: Ensure substrate is within moisture limits prescribed by manufacturer.

.2 Temperature: Maintain ambient temperature of not less than 18°C (64.4°F) from seventy-two hours before installation to at least seventy-two hours after completion of work.

.3 Relative humidity: Maintain relative humidity between 10% and 65% RH for forty-eight hours before, during and forty-eight hours after installation.

.4 Safety: Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.

.5 Ventilation: Provide continuous ventilation during and after carpet application. Run ventilation system twenty-four hours per day during installation; provide continuous ventilation for seven days after completion of carpet installation.

1.6 **MAINTENANCE**

.1 Upon completion of the Work, deliver a minimum of 10% (to the nearest full carton) of total amount of each type of tile as required for Owner's future maintenance purpose.

.2 Ensure such tiles are from same production run as tiles installed, and boxes are clearly labelled.

1.7 **TESTS**

.1 Carpet shall have been tested to, and passed the following test requirements:

.1 Flooring radiant panel test (ASTM E-648): mean average critical radiant flux of 0.45 w/sq.cm or higher.

.2 Flammability: The following aspect shall comply with requirements of CGSB 4-GP-129 and requirements of authorities having jurisdiction, when tested to CAN/ULC S102.2:

.1 Flame spread

.2 Fuel contribution

.3 Smoke developed

.3 Electrostatic propensity (AATCC 134): Not more than 2 kV.

.4 Surface resistivity (NFPA 99): Not more than 2 kV x 10^{10} ohms.

.5 Seconds (NFPA 99): 5000 - 500 V not more than 0.5; 5000 - 0 V not more than 2.0 V.

.6 Stain resistance (AATCC 175-05)

1.8 **WARRANTY**

.1 Warrant Work of this section against defects and deficiencies for the periods stated below from date Work is certified as substantially performed in accordance with the general conditions of the Contract.

.1 Manufacturer's Warranty: Ten years against unravelling, wear, colour fading and deterioration of backing materials, including materials and workmanship detrimental to appearance or performance.

.2 Installer's Warranty: Two years against loose fitting, breaking of seams or breaking away from sub-base.

.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 **MATERIALS**

.1 Carpet Tile: “Create Purpose 11769 collection” by Tarkett,

.1 Size: 600 mm x 600 mm

.2 Colour: Candid 32810

.3 Location: Training Room

.2 Product Characteristics:

.1 Primary Tufting Substrate: Synthetic Non-Woven

.2 Dye Method: 100% Solution Dyed

.3 Face mass: 508.5 g/m².

.4 Gauge: 50.4 rows per 10 cm.

.5 Stitches: 39.4 per 10 cm.

.6 Pile height: 4.7 mm.

.7 Pile thickness: 2.0 mm

.8 Flammability: ASTM D-2859.

.9 Density: 7.9 kilotex/cm^2.

.3 Adhesive: Solvent-free, non-toxic, odorless adhesive of type recommended by manufacturer.

.4 Rubber base: Refer to Section 09 65 13 Resilient Base and Accessories.

.5 Carpet base (for carpet tiles): Same type as carpet tiles but in roll quality, in the longest possible length available, and 100 mm high, unless indicated otherwise.

.6 Base gripper: Type as recommended by carpet manufacturer.

.7 Edge protection and transition strip:

.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 carpet 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 carpet 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, 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 selected by Consultant

.2 Accepted manufacturer: Schluter “RENO-T” or accepted equal.

.4 Vinyl threshold with homogeneous, PVC, exposed surface, 198.4 mm x 12.7 mm high or as indicated on Drawings. Acceptable manufacturer: “VT-XX-M2” by Tarkett or accepted equal.

.8 Carpet divider fire stops: K.N. Crowder No. CT 60 9.5 high x 100 mm wide.

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 Ensure floors are dry, completely cured, and free from dust, dirt, oil, paint, grease and other contaminants.

.4 Repair depressions and cracks with latex base compound. Sweep and vacuum surfaces before laying carpet.

.5 Grind ridges and high spots smooth and level.

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 **INSTALLATION - GENERAL**

.1 Install in accordance with manufacturer's printed directions.

.2 Commence installation after other trades have completed their work in areas to receive carpet Work.

.3 Apply adhesive by brush or roller. Do not spray.

.4 and ridges and slightly stretch. Anchor securely around projections and contours.

3.4 **INSTALLATION**

.1 Install in accordance with manufacturer's printed directions.

.2 Commence installation after other trades have completed their work in areas to receive carpet Work.

.3 Lay carpet with pile in same direction throughout a given floor area. A change in direction of pile will only be permitted in visually isolated areas which cannot be viewed simultaneously with other carpeted areas of same selection.

.4 Lay carpet by direct glue-down system according to printed instruction procedures of manufacturer of carpet being installed. Lay carpet tile without evidence of seams.

.5 Lay carpet with adhesive. Wait for glue to set before stretching carpet.

.6 Where carpet meets ceramic tile, double glue carpet 600 mm from the tile.

.7 Apply seam sealer to every edge of the total roll carpet installation around floor perimeter and around openings to prevent fraying and unravelling. Apply seam sealer along the trimmed edge where the face yarn enters the backing.

.8 Cut carpet to fit accurately around perimeter of room, into all recesses, and around fixtures.

.9 Keep seams to a minimum. When making seams, overlap the carpet by at least one row of tufts. Position seams so that where possible:

.1 The seams run the length of the area.

.2 Main traffic runs along rather than across the seam.

.3 Incident light does not strike across the seam.

.4 Avoid seams perpendicular to doorway openings.

.5 Seams are away from areas subject to pivoting traffic.

.10 Position edges of carpet in door reveals directly under door bottom.

.11 Extend floor carpet up at walls to specified height and into cap strip to form a coved carpet base.

.12 Roll down carpet into adhesive bed using 45 kg roller. Roll in both directions. Do not over-roll.

.13 Install edging strips at all openings or doorways, and where carpet abuts other floor coverings.

.14 Make cut-outs for all floor mounted items where they occur on carpet. Keep holes to an absolute minimum diameter to allow services involved to pass through, and diameter of holes shall be such that trim will completely hide hole when installed. Cooperate and coordinate with electrical trade to ensure correct location of outlets is obtained.

.15 Glue carpet to access box covers. Use glue recommended by carpet manufacturer.

.16 Apply wall carpet with specified adhesive and in accordance with ULC requirements.

.17 Install edge protection and transition strip at exposed carpet edges and where carpet terminates flush with other surfaces, or where transition is made to another material. Where carpet meets tile, leave carpet maximum 1.6 mm higher than the tile.

.18 Install rubber base. Provide coped internal corners and premoulded external corners.

.19 Install carpet divider fire stop at all fire doors over twenty minute rating where carpet occurs.

.20 Ensure entire carpet installation is level, flush across seams, continuous in texture, patterns and colour. Ensure joints are invisible and surface is free of wrinkles, bubbles and other defects.

3.5 **CLEANING**

.1 On completion, remove dirt, carpet scraps, etc., from surfaces of carpet.

.2 Clean carpet with beater-type vacuum cleaner.

.3 Remove any soiled spots or excessive adhesive with spot remover as recommended by carpet manufacturer.

.4 Remove loose pieces of face yarn by cutting with sharp scissors.

.5 Protect carpet areas with 6 mil polyethylene sheets. Tape joints to prevent shifting.

.6 On completion, permit Owner's Representative to inspect waste carpet scraps for possible retention for future repairs before removal from site. This is in addition to maintenance materials specified herein.

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 around PIV's

.7 Steel window sash, sub-frames, mountings, rod bars

.8 Sprayed masonry coating

.9 Concrete block walls

.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 Vertical lift door frames, counterweight enclosures and supplementary steel supports

.4 Hollow metal doors, frames and transom panels

.5 Fire doors and frames

.6 Borrowed light frames

.7 Glazed screen frames, mullions and closures

.8 Exposed steel items for the work of all trades

.9 Steel stairs, landings and railings

.10 Pipe bumpers

.11 Access panels and doors

.12 Screens

.13 Steel supports for wood benches

.14 Wood fitments unless plastic laminated as noted

.15 Natural gas piping

.16 Finish painting of prime painted diffusers, registers and grilles

.17 Conduit, piping, ductwork, lighting panels, etc. exposed to view in areas listed on the Room Finish Schedule

.3 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).

.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 before paining is required.

.1 Colours shall match those specified in the Finish Schedules as indicated on Drawings and in this section.

.2 Submit sample panels/drawdowns 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.

.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 (45°C to 86°F).

.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.

.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.

.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.

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.

2 Products

2.1 **MATERIALS**

.1 Refer to the Material and Finishes Schedule in the Drawings. It must be noted that the 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 acceptance of the Consultant.

.2 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.

.3 Only qualified Products with E2 or E3 "Environmentally Friendly" rating are acceptable for use on this Project.

.4 Conform to latest MPI requirements for exterior and interior painting Work including preparation and priming.

.5 Shellac and turpentine: Highest quality Product from approved manufacturer listed in MPI Architectural Painting Specification Manual, compatible with other coating materials as required.

.6 Provide paint Products meeting MPI "Environmentally Friendly" ratings based on VOC (EPA Method 24) content levels.

.7 Use MPI listed materials having minimum E2 or E3 rating where indoor air quality (odour) requirements exist.

.8 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.

.9 Formulate and manufacture water-borne surface coatings with no aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.

.10 All materials and paints shall be lead and mercury free and shall have low VOC content where possible.

.11 All paint materials shall have good flowing and brushing properties and shall dry or cure free of blemishes or sags.

.12 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 **COLOURS**

.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.

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	Maximum10	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 **EXTERIOR PAINTING SYSTEMS**

.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 **INTERIOR PAINTING SYSTEMS**

.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, flat for ceilings; semi-gloss for walls.

.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 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.

.5 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.

.6 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.

.7 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.

.8 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

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/m^2 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

All dimensions are in millimetres and inches.

Header:

Fixed Toronto Primary Logo (Corporate Identity Program 2.1) 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: www.toronto.ca/ecs-standards

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 accompanying sheet following this section.

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 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, stainless steel with satin finish, double roll type, non-controlled delivery, tumbler key locking mechanism, and wide viewing slot.

.1 Bradley, Model No. 5425 (Product No. 5425000000)

.2 Bobrick, Model 2892

.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 Bobrick, Model No. B-2890

.3 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 stainless steel 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 Type 304, 18 gauge stainless steel with all welded construction, satin finish door with full-length piano-hinge, stainless steel cable door-swing limiter, rounded towel tray with hemmed opening, multifold towel dispensing mechanism, and removable leak-proof plastic waste container.

.1 Bradley, Model No. 2442-11 (Product No. 2442110000)

.2 Bobrick, Model No. B-359039

.3 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 Bradley, Model No. 250-15

.3 Or accepted equal

.4 Surface mounted (PTD (PR)): Push-lever roll towel dispenser: translucent high impact plastic cover with heavy gauge powder coated back cover complete with fiberglass-reinforced plastic push lever.

.1 Bradley, Model 2497

.2 Or accepted equal

.5 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 Bradley, Model No. 238

.3 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 gal.

.1 Bobrick, Model No. 38032

.2 Or accepted equal

2.4 **SOAP DISPENSERS (SD)**

.1 Soap Dispenser

.1 Wall mounted (SD-1): automatic brushed stainless steel housing with satin finish, clear acrylic refill-indicator window and key lock, refillable plastic container, liquid type, 850 ml capacity container with no touch, sensor-activated valve.

.1 Bradley, Model No. 6A00-11 (Product No. 6A00110000)

.2 Bobrick, Model No. B-2012

.3 Or accepted equal

.4 Or accepted equal

.2 Wall mounted (SD-1A): automatic, brushed stainless steel housing with satin finish, reusable and refillable plastic container, foam type, 800 ml capacity, sensor-activated valve and battery operated.

.1 Bradley, Model No. Diplomat Series, 6A01-11

.2 Bobrick, Model No. B-2013

.3 Or accepted equal

.3 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 equal.

.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 equal.

.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 soap dish (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 soap dish (SDI-2): 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.

.1 Bradley, Model No. 781-1836,457 mm x 914 mm

.2 Bobrick, Model No. B-165 1836, 457 mm x 914 mm

.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 Folding grab bar with padded back rest (BR): Type 304, stainless steel, 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 BENCH - WOOD**

.1 Teak, Grade A solid wood, 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 (Change Room)

.1 Bench Seats

.1 Construct of laminated hard maple or clear vertical grain Douglas Fir slats, clear satin finish, standard with the manufacturer, 33 mm thick, with rounded exposed corners and edges, and smoothly sanded surfaces. Finish wood tops with two coats of clear polyurethane varnish or other clear finish system standard with the manufacturer.

.1 Size: minimum 510 mm wide x 2500 mm length

.2 Bench with 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 T-Leg or Tri-Leg: Provide steel pedestals for locker/change room benches, of minimum 33 mm O.D. steel pipe or tubing, with top and bottom steel flanges.

.1 Size: minimum 460 mm AFF, 760 mm AFF (with back support)

.2 Finish: Black powder coat

2.12 **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

2.13 **ADULT CHANGE TABLE (FOR FUTURE INSTALLATION)**

.1 Surface mounted, powder-coated steel frame. Foldable and height adjustable adult change table with wired hand control, safety rail, and water collection tray.

.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

2.14 **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

2.15 **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

2.16 **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

3 Execution

3.1 **INSTALLATION**

.1 Install miscellaneous washroom and shower room accessories as per manufacturer's printed installation instructions.

.2 Install grab bars to withstand minimum 1112 N (250 lb. pound-force) downward pull.

.3 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.

.4 Provide exposed screws of stainless steel or chrome plated steel to match units, with theft proof heads.

.5 Adjust accessories for proper operation and verify mechanisms function smoothly.

.6 Coordinate with Consultant and fill units with necessary supplies before final acceptance of building.

.7 Clean and polish exposed surfaces.

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 Shop Drawings

.1 Submit in accordance with Section 01 33 00.

.2 Show fabrication details including exact sizes and description of anchorage and hardware, trim, the nature of component parts and interface conditions with other Work.

.3 Cross-reference components on Shop Drawings to the Contract working Drawings indicating location, number required and name of unit.

.2 Locker and bench Drawings: Submit three copies of Drawings of each locker room showing locker and bench arrangement, numbering system (colour scheme) and number of lockers in the room, for Owner's control purposes. Drawings shall be on 215 x 280 mm sheets.

1.4 **DELIVERY, STORAGE AND HANDLING**

.1 Coordinate deliveries to comply with construction schedule and arrange for strategic off-the-ground, covered storage locations.

.2 Properly wrap units with protective covering and put in suitable crates to prevent distortion and damage. Carefully unload, handle, and store to prevent damage.

2 Products

2.1 **MATERIALS - LOCKERS**

.1 Sheet steel: Cold rolled carbon steel, stretcher levelled or temper rolled to stretcher levelled standard of flatness.

.2 Standard Lockers

.1 Single tier and double tier (Two-in-one) type, 300 x 375 mm x 1800 mm, ventilated, flat top and with metal bas).

.2 Acceptable Products: General Storage Systems "Decor", "Deluxe" by Shanahan's Manufacturing Limited, or "Emperor" by Hadrian Manufacturing Inc. or “Traditional Collection” by ASI/Watrous.

.3 Component Minimum Requirements

.1 Bodies: Minimum 0.61 mm thick (24 gauge) steel sheet with flanged backs and rib stiffeners on sides.

.2 Frames: Minimum 1.5 mm thick (16 gauge) steel sheet, box channel shape, welded and ground smooth, with two rubber door silencers on lock side of frame at approximately 38 mm from top and bottom of door.

.3 Doors: Rigid box construction, flush type consisting of minimum 0.91 mm thick (20 gauge) outer face and 0.61 mm thick (24 gauge) inner face. Exterior face shall incorporate a nickel plated lock pocket recess with matching pull and (padlock locking system; padlock by Owner) (cylinder locking system, master keyed) (built-in key controlled combination locking system, master keyed, and with combination change feature). Doors shall have number plates incorporating non-removable numerals, (one number designated for each locker) (one number per pair) (one number and suffix per locker pair.)

.4 Hang doors on pivot hinges, minimum two per door, or welded continuous piano hinge. Weld a one-piece fixed heavy hasp with plunger to frame for padlock locking system. Ensure plunger is integral with hasp and aligned with friction catch fixed in door. (A single hasp shall lock each pair of doors) (Doors shall be held in closed position with extra-strong steel keepers.)

.5 Ensure friction catch is complete with hidden fasteners and firmly holds plunger when door is in closed position.

.6 Accessories: Three single wall hooks.

.7 Trim, filler panels: Minimum 0.76 mm thick (22 gauge) steel sheet.

.8 Ventilation: Lockers shall have provision for ventilation at top and bottom of face. Ventilate multi-compartment lockers through face and back.

.4 Finish: Two coats of high grade alkyd baked enamel in one colour selected by Consultant from manufacturer's standard colour chart or baked urethane powder coating (in three separate colours for a) doors, b) trim/filler panels, frame, tops, including exposed sides, and c) interiors.) (Colours will be selected by Consultant from manufacturer's standard colour chart.) Finish paint shall have 60-65 percent minimum gloss and have successfully passed ASTM B117, four hundred hours of salt spray resistance.

.5 Ensure finished units are free from sharp metal edges, with welds ground smooth.

.6 Personalized Security Lockers

.1 Standard "Change-O-Matic" by Change-O-Matic of Canada Ltd., Type #12000, with each tier containing ten compartments, each compartment having a camlock locking system (built-in combination lock) (padlock locking system). Supply one key per compartment plus one spare lock and key, per compartment. Number all lockers. Each ten compartment unit shall be 450 x 450 x 1800 mm, sloping top.

.2 Finish: Standard baked enamel or baked urethane powder coating, grey. (Special colour(s) as selected by Consultant from manufacturer's custom colours.

2.2 MATERIALS - WOOD BENCHES

.1 Bench Seats

.1 Construct of laminated hard maple or similar hardwood standard with the manufacturer, 33 mm thick, of widths and lengths shown, with rounded exposed corners and edges, and smoothly sanded surfaces. Finish wood tops with two coats of clear polyurethane varnish or other clear finish system standard with the manufacturer.

.2 As an alternate, locker benches may be high density polyethylene solid plastic. Colour as selected by Consultant.

.2 Bench Supports

.1 Provide steel pedestals for locker room 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. Finish pedestals with baked enamel to match lockers.

3 Execution

3.1 **PREPARATION**

.1 Obtain and verify dimensions at the building Site before any locker fabrication takes place, and in ample time to prevent unnecessary delays in the Work.

3.2 **LOCKER INSTALLATION**

.1 Fabricate and install metal locker units in accordance with reviewed Shop Drawings.

.2 Install metal lockers on integral metal bases and to wood grounds where such lockers are alongside wall. Securely bolt lockers together in banks.

.3 For recessed lockers, install metal trim across the top and down each battery end and at junctions with other materials.

.4 Install end gables and similar trim material for sloping top lockers; install trim full height at battery end and at junctions with other materials. Where required, provide vertical full height filler panels.

.5 Upon completion, test doors and adjust for ease of operation.

3.3 **BENCH INSTALLATION**

.1 Anchor bench pedestals to floor with expansion bolts and secure wood bench tops of pedestals with wood screws applied from the underside. Provide a pedestal at each end of a bench and not over 1800 mm between end pedestals.

3.4 **CLEAN-UP**

.1 Polish units before final acceptance by 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 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 **DOORBELL**

.1 Commercial grade waterproof wireless doorbell and chime kit, long range and heavy-duty wireless push button transmitter complete with mounting hardware and battery, heavy-duty plug-in receiver, and AC adapter.

.1 Accepted Manufacturer: Warehouse Doorbell Kit by Milton Bells or accepted equal.

2.2 **CORNER GUARDS (CORRIDORS AND PUBLIC AREAS)**

.1 16 gauge Type 304 stainless steel, #4 satin finish, 50 mm wide wings with radiused edges and pre-drilled for countersunk screws (4 staggered long-life coated screws per 1200 mm lengths), supplied in longest lengths possible.

2.3 **REVEAL**

.1 Provides a straight, uniform reveal horizontally or vertically as indicated on Drawings (reception desks).

.2 Finish: brushed stainless steel.

.3 Dimensions: 12 mm x 12 mm

.4 Acceptable manufacturer: Fry Reglet or accepted equal

2.4 **SECURITY/TRAFFIC MIRRORS**

.1 Round Convex Mirror – Z Bracket

.1 Vandal and shatter resistant, acrylic, convex, circular mirror with hardboard backing, 26” diameter, 160° wide angle view, complete with metal “Z” mounting bracket and aluminum rim. Include all required mounting hardware.

.1 Use: Indoor

.2 Size: 26" H x 26" W

.3 Acceptable manufacturer: “W639226D” by Seton, PLXR by C.R. Laurence or approved equal by Global Industrial

.2 Round Convex Mirror – Telescopic Bracket

.1 Vandal and shatter resistant, acrylic, convex, circular mirror with hardboard backing, 36” diameter, 160° wide angle view, complete with adjustable “T” mounting bracket. Include all required mounting hardware.

.1 Use: Indoor

.2 Size: 36" H x 36" W

.3 Acceptable manufacturer: “W639336D” by Seton, PLXR by C.R. Laurence or approved equal by Global Industrial.

2.5 **PUSH PLATE SWITCH**

.1 Refer to ADO requirements in appendices, hardware schedules and Section 10 00 00.

2.6 **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

.2

.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”)

.4 Aluminum cover plate: 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. “814” by National Guard Products Inc or accepted equal

3 Execution

3.1 **INSTALLATION**

.1 Install miscellaneous specialties perfectly rigid in accordance with manufacturers' printed directions. 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.

1.2 **RELATED SECTIONS**

.1 Electrical Division

.1 Power wiring to line side of control panel

1.3 **REQUIREMENTS OF REGULATORY AGENCIES**

.1 Electrical equipment and installation thereof shall comply with all local and provincial laws, and with all other mandatory requirements. Be responsible to ensure an installation which is in compliance with all such laws and regulations, and all changes or alterations required by the authorized inspector of the authority having jurisdiction made without charge to the Owner.

1.4 **QUALITY ASSURANCE**

.1 Installation Work shall only be carried out by the unit manufacturer or by an approved installation specialist company properly licensed or franchised for installation Work.

1.5 **SUBMITTALS**

.1 Shop Drawings

.1 Submit Shop Drawings in accordance with Section 01 33 00.

.2 Show and describe gates in detail, assembly including operating components, dimensions, gauges, finishes and relationship to adjacent construction. Include detailed descriptions and catalog cuts of specified gate controls.

.3 Submit complete electrical schematics and wiring diagrams with Shop Drawings and sequence of gate operation.

.2 Operation and Maintenance Data: Submit printed operation instructions and maintenance data for the gates, in accordance with Contract Documents, as follows:

.1 "As built" straight line wiring diagrams showing electrical connections and control circuitry.

.2 Instructions explaining operation.

.3 Lubrication chart indicating lubrication points and type of lubricant recommended for equipment.

1.6 **HANDLING, STORAGE AND PROTECTION**

.1 Handle components with care. Protect against damage, dirt, disfigurement and weather.

.2 Store on site off the ground, and in a covered location.

1.7 **WARRANTY**

.1 Submit a two (2) year warranty for electrical and mechanical component, 10 years for frame and cover (cabinet), issued in the name of the Owner, and commencing from date of Substantial Performance. Warranty shall provide for replacement and/or repair of defective components.

2 Products

2.1 **MANUFACTURER**

.1 Basis of Design Products: “Model No. MATDCBB3” by LiftMaster or accepted equal

2.2 **COMPONENTS**

.1 High traffic DC powered barrier gate operator with battery backup for heavy-traffic applications, complete with fire department compliant to allow gate to auto open upon loss of power or battery depletion. Meet UL 325 and UL 991.

.1 Gate Arm:

.1 Aluminum, one-piece, internal counterbalanced, anti-tailgate breakaway mounting design.

.2 Operating Voltage: 12 VDC

.3 Power: 14.4 W/m

.4 Size: seventeen-foot 5,182 mm (17 feet) arm length, including 914 mm (3 feet) counterweight (MA117)

.5 Finish: Round, Reflective red and white stripes (MA116RDOT).

.2 Cabinet:

.1 Full aluminum cabinet, weather tight seams, tamper proof hardware, weather tight gaskets.

.2 Size (HxWxD): 1067 mm x 362 x 343 mm (42 x 14 ¼ x 13 ½ inch)

.3 Finish: Powder coated baked on enamel paint finish

.3 Gate Pedestal:

.1 50 mm (2 inch) thick steel tube continuous fillet welds construction with standard manufacturer base, cover and face plates complete with fasteners and anchors.

.4 Operator:

.1 High torque 24 volt magnet DC motor

.2 Operation: Gear reduced

.3 Opening time: 2.5 seconds (open and close)

.4 Controls: Sequenced access management system.

.5 Rated duty cycle: Maximum 6000 per day.

.6 Right or left-handed operation

.5 Mechanical

.1 Heavy duty 60:1 speed reducer in synthetic oil bath

.2 Chassis: Powder-coated 6 mm (¼ inch) aluminum alloy

.3 All machined parts and hardware plated for corrosion resistance.

.6 Electrical

.1 1/2 horsepower, 24 VDC continuous duty, prewired, high torque motor with built in thermal overload protection.

.2 Single 120V, required for power supply.

.3 24 VDC Low power loop detector.

.4 Remote Access control: Security+ 2.0® 3-channel receiver, rolling code technology remote controls and binary DIP switch remote controls.

.2 Pedestal

.1 1067 mm (42 inch) pedestal, 50 mm x 50 mm (2 x 2 inch) steel tube with base plate, continuous weld, complete with fasteners.

.1 Finish: Black

.2 Model 50-PED42 by Pedestal Pro.

3 Execution

3.1 **INSTALLATION**

.1 Install gate cabinets onto concrete base in accordance with manufacturer's instructions.

.2 Provide wiring, conduit and fittings and interconnect all electrical devices of the gates back to control panel. Refer to and comply with Electrical division and drawings.

3.2 **FIELD TOUCH-UP**

.1 Touch up all prepainted finishes disturbed during transport and installation using a spray formulation of the baked enamel paint supplied by security gate manufacturer.

3.3 **LUBRICATION**

.1 Upon completion of erection of gates lubricate all moving parts before operation, with lubricant recommended by gate manufacturer.

3.4 **DEMONSTRATION**

.1 Test gates and demonstrate the operation of same to the satisfaction of the Consultant at the time of acceptance of the completed 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 **SUBMITTALS**

.1 Samples:

.1 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.

1.5 **WARRANTY**

.1 Quartz countertop shall be warranted against warpage or manufacturing defects for a period of ten (10) years from the date the Work is certified as substantially performed.

.2 Promptly make good any 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 **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

2.2 **ACCESSORIES**

.1 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.

.2 Joint Sealant: manufacturer standard mildew-resistant silicone sealant recommended by manufacturer for application and conditions of use.

.3 Cleaning Agents: non-abrasive or as recommended by manufacturer.

2.3 **FABRICATION**

.1 Obtain and verify dimensions at the building before fabrication 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 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 Millwork

.1 Contractor shall submit stamped Shop Drawings for miscellaneous metal framing, supports and other components used in the assembly.

.2 Shop Drawings shall bear the seal and signature of a Professional Structural Engineer licensed in 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 **INDOOR FURNITURE**

.1 Furniture shall come with attachments, brackets, hardware, etc required to be fully assembled and functioning per the manufacturer's instructions.

.2 Colour chart and finishes for all items specified shall be submitted to the Consultant for selection in accordance with 1.3 Submittals.

.3 Reception Seating: Fixed base wall-mounted seat. Finish: Birch plywood with a fixed silver metal base. Fabric shall be anti-microbial vinyl, "Whisper Series WHI-2157 FOG" (light grey).

.1 Acceptable Manufacturer: "Jumpseat" or "Jumpseat 90" by Sedia Systems.

.2 Or accepted equal.

.4 Workstations – Option #1:

.1 Table: 29" d x 58" w 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 Lateral Screen: 10 mm tempered glass lateral screen attaching to the worksurface. 42" h x 29" d with frost finish.

.3 Desk Edge Screen: 10 mm etched tempered glass with frost finish, 13" h x 58" w. Total height of the screen is 19" and bracket shall be mounted so that 6" sits below the worksurface and 13" is above the worksurface.

.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.

.6 Pedestal: 2- drawer mobile solid storage cabinet with laminate finish, 18" d x 22" h. Pedestals shall be keyed alike.

.7 Task Chair: Dual upholstery tilt task chair, no headrest, width and height adjustable T-arms on caster wheels, fully assembled.

.5 Workstations – Option #2:

.1 Table: 29" d x 58" w 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 Lateral Screen: User-adjustable framed fabric lateral screen, 51" h x 29" d.

.3 Framed Desk Edge Screen: Upholstered framed fabric screen, to match the width of the worksurface. Partial modesty height of 23", datum height 51" and 58" wide.

.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.

.6 Pedestal: 2- drawer mobile solid storage cabinet with laminate finish, 18" d x 22" h. Pedestals shall be keyed alike.

.7 Task Chair: Dual upholstery tilt task chair, no headrest, width and height adjustable T-arms on caster wheels, fully assembled.

2.2 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 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

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

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, drafthood 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

.1 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 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

.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 relay 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.

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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 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

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: ±1% of full range

.9 Repeatability: ±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: ± 0.3°C (± 0.5°F)

.8 Temperature resolution: 0.1°C (± 0.1°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: ±1% of reading over a minimum of 10:1 turndown

.4 Repeatability: ±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: ±1% of reading over a minimum of 10:1 turndown

.4 Repeatability: °±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: ±1% of reading over a minimum of 10:1 turndown

.4 Repeatability: ±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

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.

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

.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.

.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
ASTM B61	Bronze valves - gate, globe and check - steam rated 200 and 350 psig
ASTM B283 C3770	Brass valves - ball valves
ASTM A126 Class B	Iron valves - gate, globe and check

.6 Markings

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
.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
.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 Worcester 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	Worcester 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.

.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 buttweld 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 handing 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).

.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.

.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 Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
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

Line Reference	Service
V(I)	Industrial Vacuum

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

1. Dieletric unions or couplings at connections to ferrous pipe or equipment
2. Sil-Fos solder

IBI Group

PIPING SPECIFICATION

Industrial Vacuum
Copper

Maximum Temperature
180°F

Maximum Pressure
125

Revised	5-30-00	Checked	PS
Rev:	1	Appr'd	PS

MPS-2060

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	AWWA (CSA)	Schedule , Class	Remarks
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								

Line Reference	Service
F	Fire Main

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								

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 adaptors for connection to buried PVC fire main

IBI Group

PIPING SPECIFICATION

Fire Protection
Buried - 4" and Larger
Ductile Iron

Maximum Temperature
100°F

Maximum Pressure
175 PSIG

Revised	########	Checked	RW
Rev:	1	Appr'd	CD

MPS-3010

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
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								

Line Reference	Service
F	Combined Fire Mains
SP	Standpipe
SPR	Sprinklers
FP	Fire Pump (discharge)
	Fire Pump (test line)
	Fire Pump (relief line)

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								

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

Revised	6-29-01	Checked	PS
Rev:	3	Appr'd	PS

MPS-3011

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
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	Combined Fire Mains
SP	Standpipe
SPR	Sprinklers
FP	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

Revised	7-7-03	Checked	PS
Rev:	3	Appr'd	PS

MPS-3012

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
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

Line Reference	Service
F	Combined Fire Mains
SP	Standpipe
SPR	Sprinklers

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								

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

IBI Group

PIPING SPECIFICATION

Fire Protection - Industrial
Carbon Steel
Welded, Roll Groove

Maximum Temperature
250°F

Maximum Pressure
175 PSIG

Revised	7-7-03	Checked	PS
Rev:	2	Appr'd	PS

MPS-3021

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
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

Line Reference	Service
F	Combined Fire Mains
SP	Standpipe
SPR	Sprinklers

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								

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

Revised	7-7-03	Checked	PS
Rev:	2	Appr'd	PS

MPS-3022

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
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								

Line Reference	Service
F	Combined Fire Mains
SP	Standpipe
SPR	Sprinklers

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								

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

Maximum Pressure
175 PSIG

Revised	7-7-03	Checked	PS
Rev:	2	Appr'd	PS

MPS-3023

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	AWWA (CSA)	Schedule Class	Remarks
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								

Line Reference	Service
F	Fire Mains (Buried)

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								

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

Revised	4-17-01	Checked	PS
Rev:	0	Appr'd	CD

MPS-3031

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
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								

Line Reference	Service
SAN	Sanitary
ST	Storm

Item	Size	End Treatment	Mat'l	Stem	Type	Approvals	Schedule Class	Remarks
Gate								
Globe								
Angle								
Butterfly								
Ball								
Check								
Strainers								

Notes

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

IBI Group

PIPING SPECIFICATION

Drainage and Vent
Buried
Cast Iron

Maximum Temperature
140°F

Maximum Pressure
-

Revised	########	Checked	PS
Rev:	1	Appr'd	CD

MPS-4011

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
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								

Line Reference	Service
SAN	Sanitary
ST	Storm

Item	Size	End Treatment	Mat'l	Stem	Type	Approvals	Schedule Class	Remarks
Gate								
Globe								
Angle								
Butterfly								
Ball								
Check								
Strainers								

Notes

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

IBI Group

PIPING SPECIFICATION

Drainage and Vent
Buried
PVC

Maximum Temperature
140°F

Maximum Pressure
-

Revised	#########	Checked	PS
Rev:	2	Appr'd	CD

MPS-4012

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
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

Line Reference	Service
PSW	Pumped Sanitary
PST	Pumped Storm

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								

Notes
1. Gaskets: 1/16" (1.6 mm) red rubber, full face type

IBI Group

PIPING SPECIFICATION

Pumped Sanitary
Pumped Storm
Above Ground

Revised	########	Checked	PS
Rev:	1	Appr'd	CD

Maximum Temperature
140°F

Maximum Pressure
-

MPS-4020

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
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								

Line Reference	Service
SAN	Sanitary Sanitary Vent

Item	Size	End Treatment	Mat'l	ASTM	ANSI	Spec Type	Schedule Class	Remarks
Gate								
Globe								
Angle								
Butterfly								
Ball								
Check								
Strainers								

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 **-**

Revised	########	Checked	PS
Rev:	1	Appr'd	CD

MPS-4031

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
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								

Line Reference	Service
SAN	Sanitary Drainage Sanitary Vent

Item	Size	End Treatment	Mat'l	ASTM	ANSI	Spec Type	Schedule Class	Remarks
Gate								
Globe								
Angle								
Butterfly								
Ball								
Check								
Strainers								

Notes
1. Solvent cement to CSA B181.11

IBI Group

PIPING SPECIFICATION

Sanitary Drainage and Vent
Above Ground
PVC

Maximum Temperature
140°F

Maximum Pressure
-

Revised	#########	Checked	PS
Rev:	2	Appr'd	CD

MPS-4032

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
Pipe	12" & DN	PE	Galv CS	A53	B		40	
Fittings	12" & DN	PE	Galv CI			B16.12		Drainage Fittings

Line Reference	Service
ST	Storm

Notes

IBI Group

PIPING SPECIFICATION

Storm Drainage
Above Ground
Steel - Drainage Fittings

Maximum Temperature
140°F

Maximum Pressure
-

Revised	########	Checked	PS
Rev:	1	Appr'd	CD

MPS-4041

Printed 2025-09-05

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
Pipe	10" & DN	GE	Galv CS	A53	B		40	
Fittings	10" & DN	GE	Galv MI	A47	32510 35018			
Pipe	12" & UP	GE	Galv CS	A53	B		30	
Fittings	12" & UP	GE	Galv CS	A234		(B242-M)	30	
Couplings	12" & UP	GE	MI	A47	32510 35018	(B242-M)		

Line Reference	Service
ST	Storm

Notes

IBI Group

PIPING SPECIFICATION

Storm Drainage
Above Ground
Steel - Grooved

Maximum Temperature
140°F

Maximum Pressure
-

Revised	########	Checked	PS
Rev:	1	Appr'd	CD

MPS-4042

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
Pipe	15" & DN	PE	CI			(B70-M)		
Fittings	15" & DN	PE	CI			(B70-M)		Note 1
Pipe	15" & DN	PE	CI			(B70-M)		
Fittings	15" & DN	B&S	CI			(B70-M)		Note 2

Line Reference	Service
ST	Storm

Notes
1. Neoprene sleeves with stainless steel gear type clamps (MJ joints)
2. Lead and oakum joints

IBI Group

PIPING SPECIFICATION

Storm Drainage
Above Ground
Cast Iron

Revised	########	Checked	PS
Rev:	1	Appr'd	CD

Maximum Temperature
140°F

Maximum Pressure
-

MPS-4043

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
Pipe	18" & DN	PE	PVC			(B181.2)		Note 1,2,3
Fittings	18" & DN	SWJ	PVC			(B181.2)		Note 1,2,3

Line Reference	Service
ST	Storm

Notes

1. Solvent cement to CSA B181.11
2. Use of PVC for aboveground piping requires Underwriter's acceptance
3. Alternate for storm drainage: CSA B182.1-M and CSA B182.2-M in PVC

IBI Group

PIPING SPECIFICATION

Storm Drainage
Above Ground
PVC

Maximum Temperature
140°F

Maximum Pressure
-

Revised	#########	Checked	PS
Rev:	2	Appr'd	CD

MPS-4044

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
Pipe	18" & DN	B&S	PVC			(B181.2-M)		
Fittings	18" & DN	SWJ	PVC			(B181.2-M)		Note 2
Flanges								
Unions								
Couplings								

Line Reference	Service
PW	Process Waste Process Vent

Item	Size	End Treatment	Mat'l	ASTM	ANSI	Spec Type	Schedule Class	Remarks
Gate								
Globe								
Angle								
Butterfly								
Ball								
Check								
Strainers								

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

Revised	#########	Checked	PS
Rev:	2	Appr'd	CD

MPS-4052

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
Pipe	8" & UP	PE	CI			(B70-M)		
Fittings	8" & UP	MJ	CI			(B70-M)		Note 2
Flanges								
Unions								
Couplings								

Line Reference	Service
PW	Process Waste Process Vent

Item	Size	End Treatment	Mat'l	ASTM	ANSI	Spec Type	Schedule Class	Remarks
Gate								
Globe								
Angle								
Butterfly								
Ball								
Check								
Strainers								

Notes
2. Neoprene sleeve and stainless steel gear type clamp (MJ joint)

IBI Group

PIPING SPECIFICATION

Process Drain and Vent
Above Ground
Cast Iron

Revised	########	Checked	PS
Rev:	1	Appr'd	CD

Maximum Temperature
140°F

Maximum Pressure

MPS-4053

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
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								

Line Reference	Service
PW	Process Waste Process Vent

Item	Size	End Treatment	Mat'l	ASTM	ANSI	Spec Type	Schedule Class	Remarks
Gate								
Globe								
Angle								
Butterfly								
Ball								
Check								
Strainers								

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

Revised	#########	Checked	PS
Rev:	2	Appr'd	CD

MPS-4054

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
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

Line Reference	Service
PW	Process Waste Process Vent

Item	Size	End Treatment	Mat'l	ASTM	ANSI	Spec Type	Schedule Class	Remarks
Gate								
Globe								
Angle								
Butterfly								
Ball								
Check								
Strainers								

Notes

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

IBI Group

PIPING SPECIFICATION

Process Drain and Vent
Above Ground
Acid Resistant

Maximum Temperature
140°F

Maximum Pressure

Revised	#########	Checked	PS
Rev:	1	Appr'd	CD

MPS-4055

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
Pipe	18" & DN	B&S	FRP	D2996				
Fittings	18" & DN	B&S	FRP					
Flanges						B16.5		
Unions								
Couplings								

Line Reference	Service
IW	Industrial Waste
EDW	Industrial Waste

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								

Notes

IBI Group

PIPING SPECIFICATION

Process Wastewater Piping Above & Below Ground FRP

Maximum Temperature **225ºF**

Maximum Pressure **150ºF**

Revised ######### Checked

Rev: 0 Appr'd

MPS-4056

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
Pipe	2" & DN	PE	CK	B88				
Fittings	2" & DN	SJ	WC					
Flanges								
Unions								
Couplings								

Line Reference	Service
CW	City Water

Item	Size	End Treatment	Mat'l	Stem	Type	Approvals	Schedule Class	Remarks
Gate								
Globe								
Angle								
Butterfly								
Ball								
Check								
Strainers								

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	#########	Checked	PS
Rev:	1	Appr'd	CD

MPS-4111

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
Pipe	2" & DN	PE	PET			(B137.1-M)		Note 2
Fittings	2" & DN	MJ-I	Nylon	D2609				
Flanges								
Unions								
Couplings								

Line Reference	Service
CW	City Water

Item	Size	End Treatment	Mat'l	Stem	Type	Approvals	Schedule Class	Remarks
Gate								
Globe								
Angle								
Butterfly								
Ball								
Check								
Strainers								

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

Revised	########	Checked	PS
Rev:	1	Appr'd	CD

MPS-4112

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	AWWA (CSA)	Schedule Class	Remarks
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								

Line Reference	Service
CW	City Water

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								

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

Revised	########	Checked	PS
Rev:	2	Appr'd	CD

MPS-4113

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
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								

Line Reference	Service
CW	City Water

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								

Notes

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

IBI Group

PIPING SPECIFICATION

City Water
Buried
PVC

Maximum Temperature
74°F

Maximum Pressure
150 PSIG

Revised	########	Checked	PS
Rev:	1	Appr'd	CD

MPS-4114

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
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

Line Reference	Service
DCW	Domestic Cold Water
DHW	Domestic Hot Water
DHWR	Dom Hot Water Recirc

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
1. Copper plated malleable iron couplings

IBI Group

PIPING SPECIFICATION

Domestic Water
Above Ground
Copper

Maximum Temperature
180°F

Maximum Pressure
125

Revised	#########	Checked	PS
Rev:	2	Appr'd	CD

MPS-4130

Printed 2025-09-05

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
Pipe	2 1/2"&DN	PE	CS	A53	B		40	
	3" to 10"	BW	CS	A53	B		40	
	12" & UP	BW	CS	A53	B		30	
Fittings	2 1/2"&DN	SE	MI	A197		B2.1	150	
	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
Plugs	2 1/2"&DN	SE	CS	A105	2		3000	Note 4

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

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

IBI Group

PIPING SPECIFICATION

Service Water
Carbon Steel
Threaded and Welded

Maximum Temperature
250°F

Maximum Pressure
150 PSIG

Revised	########	Checked	PS
Rev:	3	Appr'd	CD

MPS-5011

Printed 2025-09-05

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
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

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

IBI Group

PIPING SPECIFICATION

Service Water
Carbon Steel
Threaded and Grooved End

Maximum Temperature
250°F

Maximum Pressure
150 PSIG

Revised	#########	Checked	PS
Rev:	3	Appr'd	CD

MPS-5012

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
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

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 Welded

Maximum Temperature
250°F

Maximum Pressure
150 PSIG

Revised	########	Checked	PS
Rev:	3	Appr'd	CD

MPS-5013

Printed 2025-09-05

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
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 35018	B242-M	150	

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

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	

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

Maximum Pressure
150 PSIG

Revised	#########	Checked	PS
Rev:	3	Appr'd	CD

MPS-5014

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
Pipe	3" & DN	PE	CL	B88				
Fittings	3" & DN	SJ	WC					
Flanges								
Unions	3" & DN	SJ	CB					Note 2

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

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								

Notes

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

IBI Group

PIPING SPECIFICATION

Service Water
Copper

Maximum Temperature
250°F

Maximum Pressure
125 PSIG

Revised	#########	Checked	PS
Rev:	1	Appr'd	CD

MPS-5015

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
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

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

IBI Group

PIPING SPECIFICATION

Service Water
Carbon Steel
Buried

Revised ######## Checked PS
Rev: 3 Appr'd CD

Maximum Temperature
250°F

Maximum Pressure
150 PSIG

MPS-5021

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
Pipe	3" & DN	PE	CK	B88			40	Note 2,3
Fittings								
Flanges								
Unions								
Plugs								

Line Reference	Service
HS, HR	Constant Temp Heating
HTS, HTR	Scheduled Heating
GHS, GHR	Glycol Heating
GCS, GCR	Glycol Cooling
HCS, HCR	Heating/Cooling

Item	Size	End Treatment	Mat'l	ASTM	ANSI	Spec Type	Schedule Class	Remarks
Gate								
Globe								
Angle								
Butterfly								
Ball								
Check								
Strainers								

Notes

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

IBI Group

PIPING SPECIFICATION

Service Water
Copper
Buried

Maximum Temperature
250°F

Maximum Pressure
125 PSIG

Revised	########	Checked	Name
Rev:	1	Appr'd	

MPS-5022

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
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								

Line Reference	Service
G	Natural Gas
CNG	Compressed Natural Gas (125 psi max)

Item	Size	End Treatment	Mat'l	Stem	Type	Approvals	Schedule Class	Remarks
Gate								
Globe								
Angle								
Butterfly								
Ball								
Check								
Strainers								

Notes

1. Shaw "Yellow Jacket", 22 mil thick covering
2. Protect joints and sleeves with Shaw "Shrink Sleeves", refer to Specification

IBI Group

PIPING SPECIFICATION

Natural Gas
Buried
Carbon Steel

Maximum Temperature
140°F

Maximum Pressure
-

Revised	#########	Checked	PS
Rev:	1	Appr'd	CD

MPS-5211

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
Pipe	All	PE	PET			(CAN3-B137.4-M)	125	
Fittings	All	SW	PET			(CAN3-B137.4-M)	125	Note 1
Flanges								
Unions								
Couplings								

Line Reference	Service
G	Natural Gas

Item	Size	End Treatment	Mat'l	Stem	Type	Approvals	Schedule Class	Remarks
Gate								
Globe								
Angle								
Butterfly								
Ball								
Check								
Strainers								

Notes
1. Heat fusion joints

IBI Group

PIPING SPECIFICATION

Natural Gas
Buried
Polyethylene

Maximum Temperature
140°F

Maximum Pressure
-

Revised	########	Checked	PS
Rev:	1	Appr'd	CD

MPS-5212

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
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								

Line Reference	Service
G	Natural Gas
P	Propane

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								

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
-

Revised	#########	Checked	PS
Rev:	2	Appr'd	CD

MPS-5221

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
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								

Line Reference	Service
G	Natural Gas
P	Propane
CNG	Compressed Natural Gas (max 150 psig)

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

Natural Gas
Above Grade
Steel - Socket Weld

Maximum Temperature
140°F

Maximum Pressure
150

Revised	2000-10-16	Checked	PS
Rev:	1	Appr'd	CD

MPS-5222

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
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								

Line Reference	Service
FOS / R	Fuel Oil
FOF	Fuel Oil Fill
FOV	Fuel Oil Vent

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								

Notes

1. Cast iron fittings will not be accepted

IBI Group

PIPING SPECIFICATION

Fuel Oil
Above Grade
Socket Weld and Welded

Maximum Temperature
140°F

Maximum Pressure
-

Revised	#########	Checked	PS
Rev:	1	Appr'd	CD

MPS-5240

Item	Size	End Treatment	Mat'l	ASTM Spec	ASTM Grade	ANSI (CSA)	Schedule Class	Remarks
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								

Line Reference	Service
RL	Refrigerant Liquid
RS	Refrigerant Suction
HD	Halocarbon Discharge

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

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

IBI Group

PIPING SPECIFICATION

Refrigerant

Maximum Temperature
300°F

Maximum Pressure
400 PSIG

Issue	2002-12-18	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 ±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 ±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 Meuller

.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 Meuller

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

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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 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 figure167, 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

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
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

Pipe Size NPS	Rod Size mm	Spacing	
		Water Service m	Gas, Steam or Air m
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
½	10	1.2	1.2	1.2	1.2
¾	10	1.2	1.2	1.2	1.5

Pipe Size NPS	Rod Size mm	Pipe Schedule			
		PVC 40	CPVC 40	PVC 80	CPVC 80
1	10	1.2	1.5	1.5	1.8
1¼	10	1.2	1.5	1.5	1.8
1½	10	1.5	1.8	1.8	1.8
2	10	1.5	1.8	1.8	2.0
2½	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 m^2 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 m^2.

.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”	¼”
¾” – 1¼”	½”
1 1/8” – 2 3/8”	¾”
2½” – 4½”	1¼”

.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 (°F

.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 (°F

.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	Application	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	38 (100)	D2	25

System	Application	Max. Op. Temp °C (°F)	Insulation Type	Insulation Thickness mm
	Concealed		D1	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
Exhaust duct serving washroom or shower, minimum 3 m long from exterior wall exhaust louvre or weather hood	Exposed Concealed	38 (100)	D2 D1	25 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

System	Maximum Op. Temp °C (°F)	Pipe Size NPS	Insulation Type	Insulation Thickness mm
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.

.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

.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 m^2

.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.

.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

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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 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

.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.

.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 comments 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 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 “snap-shots”

.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) - *if specified*	
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	☐ Reviewed ☐ 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 - *if specified*	
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	☐ Reviewed ☐ 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 ±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 convector-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.

.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 tappings

.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 convector-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 convector-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 tappings.

.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 tappings.

.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 ¼”=1’-0” 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 gasketted 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 gasketted 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.

.2 Balancing of Air Systems

.1 Balance air handling systems in accordance with Section 23 08 16.

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 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 ±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 x 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 ±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 ±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 ±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 gasketted 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 lose 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 lose 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

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.

.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

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.

.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 lose 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.

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 (194ºF) 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 (194ºF) 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 gasketted 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 Gasketted 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, grounding	-	Arrow Hart 6210
		-	Leviton 2320
		-	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 ±5%

.3 EMF readings near full load with 20% ±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

.1 C22.3 No. 1

.2 C22.2 No. 0.3-M

.3 C22.3 No. 2

.4 C22.2 No. 04-M

.5 C22.2. No. 41

.2 American Society for Testing and Materials: ASTM

.3 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 4th edition - Surge Protective Devices

.12 ANSI/UL 1283 5th edition - Electromagnetic Interference Filters

.13 ANSI/IEEE C62.41 - Surge Voltages in Low Voltage 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

.8 Sub-metering system

.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 lamacoid 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: ±1%

.2 Voltage regulation: ±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: ±0.5% output for ±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 ±10% maximum for a line voltage variation of ±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 ±10% maximum for a line voltage variation of ±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	dble twin	single end 2-pin	2700/4100	10,000	525	82
13	dble twin	single end 2-pin	2700/3000/3500/4100	10,000	810	82
13	dble twin	single end 4-pin	2700/3000/3500/4100	12,000	900	82
18	dble twin	single end 2-pin	2700/3000/3500/4100	10,000	1150	82
18	dble twin	single end 4-pin	2700/3000/3500/4100	12,000	1150	82
26	dble twin	single end 2-pin	2700/3000/3500/4100	10,000	1710	82
26	dble 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

watts	type*	base/burn pos.	clear/coated colour temp.	hrs life @ 10hrs per start	initial lumen s	CRI	protected*
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) base up	coated-3700K	20,000	30600	70	yes
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

watts	type*	base/burn pos.	clear/coated colour temp.	hrs life @ 10hrs per start	initial lumen s	CRI	protected*
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 condulet outlet boxes with a diameter larger than canopies.

.8 Attach boxes or hickeys 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, an 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
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
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 2700K, MINIMUM 80 CRI	6" LED Recessed Downlight. Wet Location. 780lm. 120V.	Lithonia WF6 Downlight or equivalent
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
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 plug, "Optimized power setup"	Vode ZipOne 707 or equivalent
L11	120	LED 3000K	2' x 4', Wet location, vandal-reistant lensed troffer. 6400lm.	GRW Wet Location and GRV Vandal LED Troffer or equivalent
L12	120	LED 3000K	Aluminium shade pendant LED. Ivory, matte chrome finish. Hung from ceiling box. Box to include decorative junction box cover. Hung at 2500 AFF	Bruck Classic LLED-30K-90-900-MC-PMC or equivalent
L13	120	LED 400K	Aluminium exterior lighting bollard, up 65, ik08 rating, black 2x12w	Ligman UFRE-10011 Freetown 2 Bollard or equivalent

265000_LUMINAIRE SCHEDULE

TYPE	VOLTS	LAMP (QTY)	DESCRIPTION	MFR.TYPE/SERIES
L14	120	LED3500K	3' 120v 3000k square vanity luminaire, 1300 lumen, wall mount, 26W	Lithonia Contemporary Square Vanity or equal
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	Lumacell LA Series Beghelli Micra RM 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 Seriers 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 01 33 00.

.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.

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:

.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.

.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.

.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 relay.

.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.

.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 proto¬col 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 artitioning: 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

.2 Execution

2.8 **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

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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

1 General 2
1.1 SUMMARY 2
1.2 ALTERNATE PRODUCTS 2
1.3 SYSTEM DESCRIPTION 2

2 Products 8
2.1 MANUFACTURERS 8
2.2 ACCEPTABLE MANUFACTURERS 8
2.3 PRODUCT VENDORS 8
2.4 COMMUNICATIONS GROUNDING AND BONDING 9
2.5 PATHWAYS FOR COMMUNICATIONS SYSTEMS 10
2.6 UNDERGROUND DUCTS AND RACEWAYS FOR COMMUNICATIONS 11

3 Execution 12
3.1 DIMENSIONS AND QUANTITIES 12
3.2 COMMUNICATIONS GROUNDING AND BONDING 13
3.3 ELECTRICAL SAFETY GROUND 14
3.4 PATHWAYS FOR COMMUNICATIONS SYSTEMS 14
3.5 UNDERGROUND DUCTS AND RACEWAYS 16
3.6 MANUFACTURER'S ATTENDANCE AND REPORT 17
3.7 FIELD INSPECTION 17

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 01.

.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 01.

.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 Underground and buried duct conduit and services to TIA 569.

.2 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 26 05 01 for rigid overhead cable tray.

.2 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 01.

.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 m 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 substations	10 m
.2	Power transformers enclosure (greater than 30 kVA)	10 m
.3	Transformers enclosures (up to 30 kVA)	1.2 m
.4	Motors casings (greater than 1 HP)	10 m
.5	Motors casings (up to 1 HP)	1.2 m
.6	Switch gear enclosures (greater than 600V)	10 m
.7	Feeder cable / conduit (600V and above)	1 m
.8	Distribution cable / conduit (less than 600V)	750 mm
.9	EMT conduit (enclosing 30A branch circuits)	300 mm
.10	ENT conduit (enclosing 30A branch circuits)	450 mm
.11	AC90 cable (enclosing 30A branch circuits)	450 mm
.12	EMT conduit (enclosing 20A branch circuits)	75 mm
.13	ENT conduit (enclosing 20A branch circuits)	150 mm
.14	AC90 cable (enclosing 20A branch circuits)	150 mm

.15	EMT conduit (enclosing 15A branch circuits)	65 mm
.16	ENT conduit (enclosing 15A branch circuits)	100 mm
.17	AC90 cable (enclosing 15A branch circuits)	100 mm
.18	Control cabling (in separate conduit)	zero
.19	Control cabling (exposed)	100 mm
.20	Class 2 wiring (in separate conduit)	zero
.21	Class 2 wiring (exposed)	100 mm
.22	Conduit (all others)	75 mm
.23	Fluorescent luminaires	600 mm
.24	Pipes (gas, oil, water, etc.)	300 mm
.25	HVAC (equipment, ducts, etc.)	150 mm

.2 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 mor 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

1 General 2
1.1 SUMMARY 2
1.2 SYSTEM DESCRIPTION 2
1.3 SUBMITTALS 3

2 Products 3
2.1 MANUFACTURERS 3
2.2 WRAP-AROUND COLOUR IDENTIFICATION MARKERS 3
2.3 LABELS 4
2.4 PAINT 5

3 Execution 5
3.1 COLOURS 5
3.2 LABELLING 5
3.3 LABELLING AND IDENTIFICATION SCHEMA 6
3.4 COMMUNICATIONS PATHWAY IDENTIFICATION 25

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.

.4 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-hhhhhH-FF-hhhhhH-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-hhhhhH-G-M-NNNN

.2 Typical usage

.1 hhhhhH-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.

.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.

.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.

.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

.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.

.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	1st stripe	2nd 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

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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 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, 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.

.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 ± 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 3
1.1 SUMMARY 3
.1 Section Includes 3
.2 Related Sections 3
1.2 REFERENCES 3
.1 Safety 3
.2 Performance 3
1.3 DEFINITIONS 4
1.4 ABBREVIATIONS 4
.1 Not specified 4
1.5 SYSTEM DESCRIPTIONS 4
.1 Structured Cabling – Outside Plant 4
.2 Structured Cabling – Architecture 4
.3 Communications Pathways 5
.4 Communications Equipment Room Fittings 5
.5 Communications Copper Backbone Cabling 7
.6 Communications Copper Backbone Terminations 7
.7 Communications Optical Fibre Cabling 7
.8 Communications Optical Fibre Terminations 8
.9 Communications Optical Fibre Termination Enclosures 8
.10 Communications Horizontal Distribution Cabling 8
.11 Work Area Faceplate 9
.12 Communications Connecting Cords, Devices, and Adapters 9
.13 Antennas Communications Horizontal Cabling 9
1.6 SHOP DRAWINGS SUBMITTALS 10
.1 General Instructions 10
.2 Shop Drawings 10
.3 Samples 10
.4 Manufacturer's Field Reports 10
.5 Close Out Submittals 11
1.7 QUALITY ASSURANCE 11
.1 Qualifications 11
.2 Certifications 11
.3 Field Samples 11
.4 Pre-Installation Meetings 11
.5 Site Meetings 11
1.8 DELIVERY, SHIPPING, HANDLING AND UNLOADING 11
1.9 WARRANTY 12
.1 General Terms 12
1.10 COMMISSIONING 12
1.11 MAINTENANCE 12

2 Products 12
2.1 MANUFACTURERS 12
.1 Manufacturers – General 12
.2 Communications Equipment Room Fittings 13
.3 Communications Optical Fiber Cabling 13
.4 Communications Copper Backbone Cabling 14
.5 Communications Coaxial Cabling 14
.6 Communications Coaxial Splicing and Terminations 14
.7 Audio-Video Communications Cabling 14
.8 Paging Communications Cabling 14
.9 Antennas Communications Cabling 14

.10 Communications Copper Distribution Cabling 15
.11 Communications Faceplates and Connectors 15
.12 Communications Connecting Cords, Devices, and Adapters 15
2.2 COMPONENTS 15
.1 Communications Equipment Room Fittings 15
.2 Communications Terminal Blocks, Terminations, Connectors and Patch Panels 20
.3 Communications Cable Management and Ladder Rack 27
.4 Rack Mounted Power Distribution Strip 28
.5 Communications Copper Backbone Cabling 29
.6 Communications Optical Fibre Backbone Cabling 30
.7 Communications Optical Fibre Trunk cabling: modular terminated 30
.8 Audio-Visual Communications Horizontal Cabling 31
.9 Paging Communications Horizontal Cabling 31
.10 Communications Horizontal Distribution Cabling 32
.11 Communications Faceplates and Connectors (Jacks) 33
.12 Communications Connecting Cords, Devices, and Adapters 34

3 Execution 34
3.1 PREPARATION 34
3.2 INSTALLATION 35
.1 Communications Equipment Room Fittings 35
.2 Communications Cabling 35
.3 Audio-Visual Communications Horizontal Cabling 38
.4 Paging Communications Horizontal Cabling 38
.5 Antennas Communications Horizontal Cabling 38
.6 Data Communications Horizontal Distribution Cabling 39
.7 Communications Faceplates and Connectors (Jacks) 39
.8 Communications Connecting Cords, Devices, and Adapters 40
3.3 RE-INSTALLATION 40
.1 General 40
3.4 FIELD QUALITY CONTROL 40
.1 General 40
3.5 SITE TESTS, INSPECTION 40
.1 Field Engineer Services 40
3.6 MANUFACTURERS' FIELD SERVICES 40
3.7 ADJUSTING 40
.1 Wireless Access Point Installation and Adjustment 40

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 shall be read in conjunction with Section 28 02 00 – City of Toronto Structured Cabling Standard and all other Divisions in order to comply with the requirements of the General Conditions of the Contract. Sections 28 02 00 shall take precedence where there is a conflict in 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 faciltities 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 occurances 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 enviroments 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 assembles 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 acreditied 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 telecommuications 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 specifed 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 nework 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	SSEDC			

.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						

Type ID					**Panduit**	
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	

Type ID	Belden	Panduit	Commscope
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 phase	KW	Branch Recept	Type	Branch Recept	Type	Feed Plug	Meter
PDI230SM	230	30	5.5	42	IEC C13			L6-30	Yes

.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 indicted 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 identied 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 saftey 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 - Mutlimode (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, saem 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 terminatison 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 metalic 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 Adminstration 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 constract drawigns 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

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 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 polycarbonyte handset and stainless steel hardware material. Provide pole mounting kit as required for the application.

.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.

.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.

.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

City of Toronto

Corporate Security

Security Deliverables Requirements

Corporate Security – Security Deliverables Requirements

Track Changes Form

Change Date	Change Author	Section Change	Change Description	Reason For Change
07/25/2024	Gary Mendonca	25.0	Milestone licenses are not to be purchased without expressed consent from the City of Toronto Corporate Security.	Restrict vendors' access to purchase Milestone camera licenses. This will help reduce the City of Toronto's surplus of camera licenses.
07/26/2024	Gary Mendonca	25.1	Milestone Licenses cannot be purchased until the cameras are installed or until 3 months before the system goes live.	Restrict vendors from purchasing the camera license until camera installation is within 3 months.
01/08/2025	Gary Mendonca	14	Updated Section 14 to reflect the new Husky IVO Series NVR	We are no longer using DELL or Ionodes servers.
01/09/2025	Gary Mendonca	15	Removed SAN requirements	No longer required.

Scope of Work and Associated Deliverables

1.0 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.

1.1 The Successful Bidder shall be the single point of contact and shall be responsible for all Work pertaining to the Systems, as well as all required coordination and communications between Personnel and the City.

1.2 The Successful Bidder shall be in good standing with all manufacturers referenced in this RFQ (including but not limited to American Dynamics, Dedicated Micros, Milestones, and Axis) and must have and maintain all up-to-date certifications.

2.0 Literature

Bidders, where applicable, should submit complete literature on all products included in their quotation, including, but not limited to, standard manufacturer's warranties, model numbers, part numbers, and other relevant documentation.

3.0 Bidder Qualifications

3.1 Bidders must be authorized sellers or resellers for the Products listed in section 33.0 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 before the Award. Failure to submit written verification of authorization that is satisfactory to the City within a time frame specified by the City will result in the Quotation being declared Non-Compliant.

3.2 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 RFQ. 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 a copy of each person's resume and certifications within five (5) business days of such a request as 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.

3.3 All Certificates must be valid at the time of submission and throughout the duration of this contract.

3.4 Mandatory Criteria 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

- 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.

3.4.0 All systems components and installation shall conform to the following standards and codes where appropriate:

- Manufacturing: ISO 9003
- Design: MIL 275E
- Communications: IEEE RS232C and RS485
- EMI emissions: FCC part 15
- Electrostatic immunity: IEC 801.2 level 4
- AC transients UL 964
- National Building Code
- Ontario Fire Code
- Electrical Standards Authority
- Process Control System Implementation Manual
- NFPA 730 & 731
- ULC 319/S304
- UL 1981 Central Station Automation System
- UL 681 Installation and Classification of Burglar and Hold up Alarm Systems
- UL1635 Digital Alarm Communicator System Units

4.0 Security Clearance Requirements

4.1 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 the RCMP maintains. 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.

4.2 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 regarding the protection of its assets.

4.3 Unless authorized in writing by the Project Manager, only Personnel who provided a Clearance Letter to the Project Manager shall be permitted to Work under this contract.

4.4 The Successful Bidder shall provide an original recent (obtained within the past 3 months) Clearance Letter only. No copies will be accepted.

4.5 The cost for each Clearance Letter shall be the complete responsibility of the Successful Bidder.

4.6 Refer to the Supplementary Forms and Policies section.

5.0 Specifications

5.1 Meeting

5.1.0 Upon award, the Project Manager will schedule a kick-off meeting with the Successful Bidder to review the city and bidder's roles and responsibilities.

5.1.1 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.

5.1.2 The Successful Bidder's Project Coordinator (or designate) shall coordinate, plan, and schedule as many subsequent meetings as necessary throughout the contract term to ensure effective project stakeholder communication.

5.1.3 All meetings shall be held within the City of Toronto. The Successful Bidder is responsible for all costs for consultation and project/subsequent meetings.

5.1.4 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

5.2.0 The Successful Bidder is the Design/Builder on Record and must continue to meet all of the requirements of Systems certifications and qualifications concerning 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.

5.2.1 The Successful Bidder must continue to meet all of the mandatory conditions of the Warranty throughout the Term of the Contract and Warranty periods.

5.2.2 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 contract term 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 contract.

5.2.3 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.

5.2.4 Only Personnel listed and registered with the City will be permitted to access and Work on City of Toronto sites.

5.3 Cleaning

5.3.0 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.

5.3.1 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.

5.3.2 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.

5.3.3 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

5.4.0 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.

5.4.1 Finishes and graphics for all equipment in public areas shall be submitted to, and approved by the City.

5.4.2 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.

5.4.3 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.

5.4.4 The Successful Bidder shall protect existing furnishings by providing and maintaining adequate temporary protective coverings.

5.4.5 The Successful Bidder shall provide and maintain adequate fire safety in accordance with applicable fire code and Regulations.

5.4.6 The Successful Bidder shall be responsible for any damage to existing structure or contents arising from a lack of adequate protection.

5.4.7 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.

5.4.8 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.

5.4.9 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

5.5.0 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.

5.5.1 All Work shall be performed in compliance with all applicable Regulations, Building Codes and Local By-laws.

5.5.2 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.

5.5.3 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 the RFQ document.

5.5.4 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.

5.5.5 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.

5.5.6 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 his/her directions in making good all deficiencies and defects, and in ensuring the proper execution of the Work.

5.5.7 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

5.6.0 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.

5.6.1 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.

5.6.2 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

5.7.0 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.

5.7.1 The Successful Bidder shall co-ordinate all Work with the City's representative to ensure minimum disruption of service.

5.7.2 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 Operations

5.8.0 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 inservice.

5.8.1 The Successful Bidder shallperform the Work in a manner to prevent disruption of normalCity of Toronto operations. Any task that may cause disruption of operations shall be approved in advance by City of Toronto Corporate Security.

5.9 Inspection of Work

5.9.0 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.

5.9.1 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.

5.9.2 The Successful Bidder shall correct within a maximum of one week (7 calendar days) any Work deemed not satisfactory by the City of Toronto.

5.9.3 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

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

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

5.12.0 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.

5.12.1 All placements of security devices are subject to approval by Corporate Security before final acceptance is granted.

5.12.2 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

5.13.0 The Successful Bidder is responsible to provide a fully functional system meeting the City's standards as required by this RFQ.

5.13.1 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, component wiring, terminations, connections, labelling, programming, integration, testing, commissioning and as-built drawings of all Systems.

5.13.2 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 RFQ.

5.13.3 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.

5.13.4 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.

5.13.5 As part of this RFQ 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.

5.13.6 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.

5.13.7 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.

5.13.8 Any required expansion boards/nodes and ancillary equipment needed for a full operation of the system are the responsibility of the Successful Bidder.

5.13.9 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.

5.13.10 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.

5.13.11 The Successful Bidder is responsible for all final wiring and terminations of all Systems.

5.13.12 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.

5.13.13 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.

5.13.14 The Successful Bidder shall maintain integration to existing security systems to the maximum level supported by the systems manufacturers.

5.13.15 Test and commission according to the 32.0 Compliance with Standards.

5.13.16 The Successful Bidder shall review the current site conditions and existing system configurations.

5.13.17 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.

5.13.18 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.

5.13.19 Equipment shall be installed as per the manufacturer's recommendations, programmed and integrated to City Standards and the City Project Manager.

5.13.20 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.

5.13.21 The Successful Bidder shall coordinate all network provisioning with City of Toronto ITServices.

5.13.22 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.

5.13.23 The Successful Bidder shall maintain the System in compliance with manufacturer's specified Preventative Maintenance schedule during the project installation period.

5.13.24 The Successful Bidder is responsible for all System decommissioning and removal ofequipment in this RFQ, at no additional cost to the City. Including all cable removal as per ESA requirements.

5.13.25 The Successful Bidder shall be responsible to investigate, design and integrate to new and existing Systems.

5.13.26 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.

5.13.27 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.

7.0 Supply and Installation Project Submission Requirements

7.1 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 RFQ.

7.2 All electronic documents submitted to COT must be named by purchase order, site name, document type, date, and Service Request Portal Number.

7.3 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.

8.0 Detailed Project Schedule

8.1 Detailed Project Schedules are to be free from error and submitted.

8.2 The detailed project schedule shall include, but not be limited to the following information:

- Commencement date for each major activity;
- The duration of eachactivity;
- The proposed sequence ofactivities;
- Dependencies between internal activities and milestone;
- Dependencies between external activities and milestone; and,

8.3 The schedule shall be progressively updated as the project progresses, which enables the Project Manager to readily identify activities by location and resources.

8.4 The schedule information shall be sufficiently detailed to enable integration of all interface activities by the Project Manager.

8.5 The schedule shall be presented in daily segments and shall include the following at a minimum:

- Site surveys (as required);
- Service Request Portal Number;
- Submission and approval of Shop drawings;
- Shipping confirmation date;
- Material delivery and installation;
- Conduit and wire pulls completed;
- Progress photographs (only of concealed work);
- Panels and power supplies installed and programmed;
- Field equipment terminated, mounted and tested;
- Security testing complete;
- Acceptance testing complete;
- As-built documents;

- Equipment integration and dry-run;
- Monitoring period (minimum one week);
- Commissioning and hand-over.

8.6 The schedule shall be clearly identified with the following:

- Site name, if applicable and address;
- CRO number;
- Start date of the project with time;
- Project Coordinator name with detailed contact information; and,
- Subcontractor name; and
- Project completion date.

8.7 Distribute copies of any revised schedule to:

- Project Manager; and,
- Security Project Lead
- Other Stakeholders as indicated by the Project Manager.

8.8 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.

9.0 Shop Drawings

9.1 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.

9.2 Shop Drawings shall include:

- Date and revision number;
- Project title and number;
- Service Request Portal Number;
- Contract Drawing / Specification Reference;
- Name and address of:
  - Subcontractor;

- Supplier, Manufacturer; and,
- Wiring diagrams for each location (including distances);
- Details of types of wire and conduit type and sizes;
- Particular model number of hardware;
- Dedicated circuit in electrical panel to be used (for new installations);
- Progress photographs (only of areas with concealed work);
- Panels and power supplies (location to be installed);
- Field equipment (location of mounting);
- All device programming names;
- Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.

9.3 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.

10.0 Project Commencement

10.1 Prior to the commencement of installation the successful bidder will submit the following:

10.1.0 The Security Contractor shall submit to the Corporate Security Lead the required Active and Passive network equipment specifications for all locations in scope

10.1.1 The specifications and active network equipment shall be in compliance with the City Networking standard and based on Cisco active networking equipment.

10.1.2 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

10.2 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:

- Draft test results of device and components installed
- Draft test result of cable inspection, testing and verification
- 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

11.0 As-Built Documentation

11.1 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.

11.2 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 viae-mail.

11.3 Drawings shall include:

- Shop drawing submittals;
- Wiring diagrams for each location (include distances);
- Details of types of wire and conduit (include type and size);
- Particular model number of hardware (to match Summary of Security Devices Table to be provided by COT);
- Approval of drawing submittals;
- Beneficial occupancy date;
- Project Completion date;
- Equipment manufactures;
- Factory Acceptance Tests;
- Installation procedure;
- O&M manuals; and,
- Manufacturer's specification sheet.

11.4 Architectural: site plans, building plans, and floor plans showing all locations for every security device both new as well as any effected existing device.

11.5 All security devices depicted in the drawings must be individually labelled according to the programming on the security system to ensure tagging consistency.

11.6 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).

11.7 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.

11.8 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.

11.9 Construction Typical for all security applications.

11.9.0 As-built shall include all information required in the prefabrication submittals revised to reflect "as installed" conditions.

11.9.1 As-built shall also include one (1) sets of complete and current operation and Maintenance manuals for all devices and equipment.

11.9.2 The Successful Bidder is solely responsible to include engineered stamped drawings when required by the City.

11.9.3 As-builts may not have any written notes on them all entries must beelectronic.

12.0 Installation Standards and Requirements

12.1 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.

12.2 The Successful Bidder must deliver the specified Products and/or Services as per their Quotation without substitution or deviation.

12.3 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.

12.4 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.

12.5 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).

12.6 The Successful Bidder is responsible for all final wiring, integration and terminations of all systems.

12.7 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).

12.8 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.

12.9 Any back boxes / junction boxes must be installed on secure side (if applicable).

12.10 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.

12.11 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.

12.12 All card readers must be ordered and programmed to City Standard/format and as directed by the City Corporate Security Lead.

12.13 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.

12.14 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.

12.15 Each facility covered under this contract shall be handed over to the City by the Successful Bidder as a turnkey operation.

12.16 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 allconditions.

12.17 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.

12.18 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.

12.19 All device conditions and alarms shall be individually enunciated on the relevant system, as required for each specific project scope.

12.20 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.

12.21 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.

12.22 The Successful Bidder shall be responsible for all required trenching, civil work, and any associated costs.

12.23 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.

12.24 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.

12.25 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.

12.26 All existing devices that will be re-used by the Successful Bidder shall be commissioned to the new systems as defined by the COT.

12.27 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:

- Electric Strike
- DVRs, NVRs
- Servers
- Security Network Switches
- Cameras
- Camera Mounts
- Encoders

- UPS
- Request to Exit Buttons
- Intercoms
- Wall mounted duress buttons
- Sirens
- Communication Boards/Panels
- Long Range Motion Sensors
- Maglocks

12.28 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.

12.29 All costs and expenses associated with returning old equipment shall be the responsibility of the Successful Bidder.

12.30 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.

12.31 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.

12.32 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.

12.33 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.

12.34 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 11.7".

12.35 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.

12.36 Connect equipment to the closest approved available panel/switch/computer with available inputs and outputs.

12.37 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 asdirected

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.

12.38 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.

12.39 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.

12.40 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.

12.41 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:

- Site Address-NVR/Controller Number/Name
- NVR's shall be numbered sequentially as added
- Device numbers shall match port number on attached switch or controller
- Ex: 1008YNG-NVR9-CAM3

12.42 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.

- Typical Camera/device short FORM name on Milestone system would be: 1008YNG-F3-NW STAIR-3

12.43 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.

13.0 VSS Design Criteria

13.1 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. Thisadministration

shall be redundant providing seamless failover capabilities and continuous operation in the event of failure of one of the main IP VMS services.

13.2 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.

13.3 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.

13.4 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.

13.5 The following will be supplied by the City of Toronto:

- Microsoft SQL Software and Licenses
- Physical Servers required for Milestone VMS Management Services including Microsoft Windows Server 2008/2012 Licenses:
  - Management Server
  - Event Server
  - SQL Server
  - Mobile Server
- Client (user) Workstations
- VSS Core Network Switches (Cisco Switches)
- VSS Access Layer Switches (Cisco Switches)
- SAN Network Switches (Cisco Switches)
- Ethernet Cat6A Patch Panels
- Fiber Patch Panels in VSS Racks
- Fiber connectivity between existing telecom rooms, entrance facilities and equipment rooms.

13.6 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.

13.6.0 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.…

13.6.1 The only acceptable video compression (digital encoding) method shall be non-proprietary H.264 and H.265 encoding (Baseline and/or Main Profile)

13.6.2 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.

13.6.3 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.

13.6.4 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.

13.6.5 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.

Section 14: Milestone NVR IVO Series Specifications

This section provides a detailed specification for the Milestone NVR IVO series, supporting configurations ranging from 1 camera to over 128 cameras. These specifications ensure compatibility with the City of Toronto Corporate Security standards and requirements.

14.1 General Requirements

All NVRs in the Milestone IVO series (350R, 700R, 1000R) must:

- Be compatible with Milestone XProtect® VMS.
- Support H.264, H.265, and MJPEG video compression standards.
- Be designed for continuous recording with RAID-protected storage.
- Minium storage 8 TB to 128 TB
- Include built-in failover and redundant power supplies for resilience. Note:350R will not have this
- Ensure seamless integration with the City's centralized management system.
- Include remote management capabilities. idrac interface for secure local and remote server management.
- Be equipped with enterprise-grade hardware.
- Recording specifications:
    - Resolution: 1920x1080p.
    - Frame rate: 15fps.

    - Bandwidth: 2400Kbps/stream.
- Dual network ports for recording and viewing streams idrac interface for secure local and remote server management.
- Hot-swappable hard drives and redundant power supply.
- 37-day storage retention at maximum capacity.

To mitigate the risk of technological obsolescence, equipment procurement should align with project timelines. Hardware purchases must occur no more than six months prior to deployment. Technology contingency amounts, equating to at least 10% of the total project cost, should be allocated to address unforeseen upgrades or compatibility issues that arise due to advancements in hardware or software.

14.2 Integration and Network Requirements

- All NVRs must connect seamlessly to the Corporate Security Lead's centralized Milestone Management System.
- VLAN configuration for separate recording and viewing streams.
- Compatible with Cisco network switches and must support QoS and secure VLAN tagging.
- IP cameras and NVRs must support 128-bit AES encryption for data transmission.

14.3 Additional Specifications

- Power Requirements:
    - All NVRs must operate on a UPS-backed power supply.
    - Devices must comply with UL and CSA standards.
- Environmental Requirements:
    - Operating temperature: 10°C to 35°C.
    - Humidity: 20% to 80% (non-condensing).
- Compliance:
    - ONVIF Profile S and G compliant.
    - Must adhere to NFPA 731 standards for physical security systems.

14.4 Testing and Commissioning

- All NVRs must pass functional testing by the Corporate Security Lead.
- Devices must be configured for optimal performance, including frame rate, resolution, and retention settings.
- Backup configurations and as-built documentation must be submitted to the Corporate Security Lead.

14.5 Warranty and Support

- Minimum 5-year warranty on all hardware components.
- Vendors must provide 24/7 technical support and next-business-day on-site replacement services.
- Firmware updates must be provided free of charge during the warranty period.

15.0 Removed.

16.0 Cameras

16.0.1 Install dome cameras in flush surface or drop ceiling with concealed cabling

16.0.2 Configure cameras internal access with a new Username/Password credentials and remove default logins

16.0.3 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

16.0.4 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

16.0.5 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

16.0.6 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

16.0.7 Ensure Cameras are operating the latest firmware version or as recommended by the manufacturer at time of installation.

16.0.8 Backup all camera settings/configurations in addition to the VMS configurations to a CD/DVD and submit to Corporate Security Lead.

16.0.9 Ensure outdoor cameras and their heater are properly powered to operate normally in all environmental conditions referenced in this section.

16.0.10 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:

- Motion in full or designated field of view zones
- Video Masking
- Video Loss/Gain
- Network Loss
- Device I/O's

16.0.11 Configure logging and network troubleshooting capabilities on each IP cameras in coordination with the Corporate Security Lead.

16.0.12 Configure Network Security features and settings on each camera in coordination withthe

Corporate Security Lead.

16.0.13 For PTZ cameras configure Masks, home position, pre-sets, control sensitivity, image mode and other related settings in coordination with the Corporate Security Lead.

16.0.14 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:

- General Observation: >20ppf on farthermost desired target
- Forensic Review (General Identification) : >40ppf on farthermost desired target

- Recognition including Facial, vehicle license plate, color, pattern, and cross-line recognition: > 80ppf on farthermost desired target
- All camera views, resolution and image color and quality, shall pass the approval of the Corporate Security Lead.

16.1 IR Illuminators

All IR illuminators specified for specific camera installation projects are to be:

- Mounted and calibrated not to over expose the image quality during night time operation.
- All IR accessories shall be POE Powered unless otherwise approved by the Corporate Security Lead.
- 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.

17.0 Video Encoders

17.1 The following are the minimum performance specifications for Video Encoders to be specified by the successful bidder:

17.1.0 Rack mounted

17.1.1 Flexible and Expandable allowing for hot swappable blades (applies to encoders for 1 channels or more)

17.1.2 Equipped with redundant hot swappable power supply and fans (applies to encoders where more than 8 channels are required)

17.1.3 Each encoder channel shall support H.264 and H.265 video compression, a minimum of two simultaneous streams at 720 (horizontal) × 486 (vertical) NTSC analogue video resolution and 30fps.

17.1.4 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 connectedPTZ analogue cameras

17.1.5 Each encoder shall support the following analytics for each video channel and shall trigger an alarm on Milestone Systems XProtect Corporate® VMS:

i. Camera repositioning
ii. Camera lens is masked, sprayed, covered or blocked
iii. Motion detection in defined zones of the camera view, minimum five [5] zones

17.1.6 Each Encoder shall support the following alarms and shall be annunciated on the Milestone monitoring interface:

i. .1 Video Signal loss /gained per channel
ii. .2 Network loss/gained

17.1.7 Encoder shall be ONVIF compliant and supports (Profile S)

17.1.8 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.

17.1.9 Shall support remote firmware upgrade.

17.2 All Encoders shall be rack mounted in a proper cabinet.

17.3 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 connectedto the Corporate Security Lead's Network.

17.4 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

17.5 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

17.6 Ensure Encoders are operating the latest firmware version

17.7 Backup all Encoders settings/configurations in addition to the VMS configurations to a CD/DVD and submit to Corporate Security Lead.

17.8 Ensure Encoder chassis is powered through a UPS and backup power to operate normally in all environmental conditions referenced in this section

17.9 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:

i. Motion in full or designated field of view zones
ii. Video Masking
iii. Video Loss/Gain
iv. Network Loss
v. Device I/O's

17.10 Configure logging and network troubleshooting capabilities on each channel and encoder chassisin coordination with the Corporate Security Lead.

17.11 Connect and configure PTZ Data control protocols and settings on channels that are connected to analogue PTZ.

18.0 Ethernet Media Extenders

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

18.1 POWER AND ETHERNET OVER COAX

The following are the minimum performance specifications for Power and Ethernet over Coax devices that are to be specified by the successful bidder:

18.1.0 Proposed IP and PoE/PoE+ over Coax solution shall, as a minimum, meet the following requirements:

a. 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)

b. 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

c. Has minimal end-to-end Latency of ≤3ms that shall not affect the Video/Ethernet transmissionover Coax

d. 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 anextra power source to operate.

e. Provide transient overvoltage and electrostatic discharge protection and immunity to a minimum of: 5x20µS 3,000A 6,000V; ESD protection for 200pF 20KV.

f. Provide an encrypted Coax link with a minimum of 128Bit AES encryption.

g. 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).

18.2 VSS POWER COMPONENT

The following are the minimum performance specifications of VSS Power Components that are to be specified by the successful bidder.

18.2.0 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.

18.2.1 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.

18.2.2 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.

18.2.3 In addition to the above requirement the following shall apply for UPS selection andsizing:

- Securely rack mounted in a secure lockable cabinet
- Sized to allow for a minimum of 40% extra power for future expansion
- cUL listed and meets the following standards: UL 1449, UL 1778, CAN/CSA-C22.2 NO. 60950-1-07 (R2012)
- Provides surge protection and filtering
- 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
- Alarms when on battery and c/w status LED indicators for normal operating mode, alerts and battery backup mode
- 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
- Resettable circuit breaker and automated recovery, ensures protection of connected loads from surges, spikes, lightning and other power disturbances
- 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

18.2.4 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.

18.2.5 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.

18.2.6 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.

19.0 Equipment Cabinets/Racks

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.

The following are the minimum performance specifications of various cabinets and enclosures that are to be specified by the successful bidder:

19.1 NEMA 12 – Rack Cabinets W/ Self-Contained Cooling Unit

- Pre-assembled before delivery
- Fully gasketed openings including gland plate in base
- 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
- M6 Rail Type
- Plexi or Solid Doors
- Key Lockable secure doors and side panels
- Include casters and levelers
- Compatible vertical mounted PDU's
- 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
- Include grounding kit and ground appropriately
- Cabinet Size and Cooling Requirements shall be approved by Corporate Security Lead

19.2 NEMA 12 - Wall Mount Cabinets

- Pre-assembled
- Double hinged allowing access to the front and back side of cabinet
- NEMA 12 Fan Assembly
- Independent Key lockable from and back side
- Lifetime Warranty
- M6 Rail type
- 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
- Cable management trays, and arms
- Include grounding kit and ground appropriately

19.3 Standard Rack Cabinets

- 42 U, Pre-assembled before delivery
- Vented Side Panels, with key locks
- Casters and levelers
- M6 Rails
- Split doors back and front side, with key locks

- 6 x 4” fans top panel
- Include grounding kit and ground appropriately
- Include Vertical PDUs
- 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
- Cable management trays, and arms

20.0 Real-Time Environmental Monitoring Component

- Provide real-time, Ethernet (IP) based environmental monitoring solution at each in of the existing and new VSS designated racks.
- The monitoring unit shall be rack mounted
- Shall have a dual temperature/humidity sensor, intelligent water temperature sensor and door contact sensors for each cabinet door
- The monitoring component shall be connected to the City corporate network
- Capable to notify the Owner of any changes or detections by the sensors in a variety of ways including e-mail and SNMP
- Supports SNMP v1, v2,v3
- Manageable through an intuitive web interface

20.1 RACK KVM TRAY

The following are the minimum performance specifications of Rack KVM Trays that are to be specified by the successful bidder.

- Integral KVM Switch with keyboard, LCD monitor, and touch pad in 1U FORM .2 Allows remote network user access through KVMoIP over WAN & LAN
- Full Sized 105-Key keyboard
- Ergonomic hand rest
- Includes Universal Rear Rail Kit
- CE, RoHS approved
- 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
- Control via on-screen display (OSD) menu, push buttons Selection Buttons on monitor bezel, hotkeys, or mouse.
- Connects to servers through CATx patch cables and required server access modules
- 16-Port CATx KVM
- Provide BIOS Level Access

21.0 Labelling

21.1 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.

21.2 All terminals shall be permanently tagged and shall agree with record drawings.

21.3 All system power supplies shall be labelled with their feed source and breaker number.

21.4 All connectors shall be marked with common designations for mating connectors. The connector designations shall be indicated on the record drawings.

21.5 All visible panel and control labels shall be silk-screened, engraved and filled, or engraved plastic laminate. Labels shall be permanently attached.

21.6 Labelled Doors and Frames in no instance shall any labelled fire door or frame be cut, penetrated, drilled or modified in any way.

21.8 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.

22.0 Conformity of Work with Plans and Specifications

22.1 The Successful Bidder shall perform all Work and furnish all materials and complete the whole of the Work in conformance with the requirements.

22.2 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.

22.3 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.

22.4 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.

23.0 Supply and Install Project Procedures

23.0.0 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.

23.0.1 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.

23.1 General Specifications

23.1.0 The Deliverables being supplied in this RFQ must be new and certified by the Vendor, and free of encumbrance. Refurbished, rebuilt, or used Products will not be acceptable.

23.1.1 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.

24.0 IT Coordination

24.1 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

24.2 All security equipment configurations shall be performed by the Corporate Security Lead IT Team in coordination, and support from the Security Contractor

24.3 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.

24.4 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 successful bidder for deliveries to required sites for programming shall be at no charge to the COT.

25.0 Licensing

(**** Milestone Licensing not to be purchased without expressed consent from the City of Toronto Corporate Security ****)

25.1 Milestone Licenses cannot be purchased until the cameras are installed or until 3 months before the system goes live.

25.2 The City prefers any net new licenses required to be a onetime purchase. Support and maintenance agreements should be independent of the software license.

25.3 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.

25.4 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:

i. 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;

ii. 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;

iii. 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;

25.5 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.

25.6 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.

25.7 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 another individual at any time or times without notice to the Vendor and without any fee or other charges being due to the Vendor.

25.8 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;

25.9 Each licensed software and the Documentation should be free from all encumbrances, should not, and will not contain any Disabling Code.

25.10 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.

25.11 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.

25.12 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.

25.13 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

25.14 The Warranty Period of licensed software shall commence on the Initial Install Date of such licensed software.

25.15 Each software license granted pursuant to the Agreement should survive any expiry or termination of the Agreement.

26.0 Software Updates

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.

The Successful Bidder is responsible to maintain 100% functionality of the CCTV and AV Systems prior to and after scheduled updates are performed.
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.

27.0 Upgrades and Updates

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.

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.

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.).

28.0 Future System Expansion

The City reserves the right to have other qualified firms expand and/or add to the systems at any time.

The City reserves the right to make changes, alterations, additions, or deletions to any of the City's equipment.

29.0 Delivery and Installation

The Vendor must deliver the specified Deliverables as per their Quotation without substitution or deviation. All items shall be delivered F.O.B. Destination.

The Successful Bidder must deliver the specified Products and/or Services as per their Quotation without substitution or deviation.

The Successful Bidder shall provide staff who are qualified to undertake the installation Services required under the Terms of this RFQ. 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.

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.

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).

29.1 Return of Products

29.1.0 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.

29.1.1 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.

29.1.2 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 exceed the current specifications at the same price.

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.

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.

29.1.3 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.

30.0 Warranty

30.1 The Successful Bidder shall include a two (2) year Warranty for all parts and labour as per the Warranty conditions of this RFQ.

30.2 Warranty shall include all Preventive Maintenance for two (2) full year periods. This entails two site visits per warranty year.

30.3 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.

30.4 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 theCity.

30.5 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.

30.6 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.

30.7 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.

30.8 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.

30.9 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.

30.10 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.

30.11 In the event of any breach of this Warranty and representation, the remedies available to the City shall include but not be limitedto:

- The Successful Bidder restoring the deliverable to the same level of performance as represented and warranted herein;

- The Successful Bidder repairing or replacing the deliverable with a deliverable conforming with this representation and Warranty;

- 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

- 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 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.

30.12 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.

30.13 This Warranty shall survive cancellation or other termination of this contract.

30.14 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.

30.15 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.

30.16 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.

30.17 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.

31.0 Warranty Service

31.0.1 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.

31.0.2 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.

1.0.3 The Successful Bidder must also maintain an email address for warranty service requests. Automated email responses are not acceptable.

6.0.4 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.

32.0 Service Calls

32.1.0 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.

32.1.1 Upon arrival at the location, the technician must notify the Corporate Security Control Centre by phone at 416-397-0000;

32.1.2 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.

32.2 Service Call Resolution Times

Warranty Service Call Priority	Resolution Time
(1) Urgent	48 HOURS
(2) High	Five (5) Business Days

33.0 Pass-Through Warranties.

33.1 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.

33.2 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.

33.3 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.

34.0 Compliance with Standards

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

30. Canadian Standards Association (CSA International)

    - CSA C22.1-[98], Canadian Electrical Code, Part 1 (18th edition) Safety Standard for Electrical Installations.

    - 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®)

    - NFPA® pamphlet 51B

    - NFPA® 70, National Electric Code.

- NFPA® 730, Guide for Premises Security 2008 or latest edition
- NFPA® 731, Standard for the Installation of Electronic Premises Security Systems, 2008 or latestedition

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

- CAN/ULC-S302-M91 - Standard for Installation and Classification of Burglar Alarm Systems for Financial and Commercial Premises, safes and Vaults
- CAN/ULC-S304-06, Signal Receiving Centre and Premise Burglar Alarm Control Units.
- CAN/ULC-S317-[1996], Installation and Classification of Closed Circuit Video Equipment (CCVE) Systems for Institutional and Commercial Security Systems.
- CAN/ULC-S319-05 Electronic Access Control Systems
- CAN/ULC-S3-1-M88 Standard for Central and Monitoring Station Burglar Alarm systems.
- CAN/ULC-S524-06 – Installation of Fire Alarm Systems
- CAN/ULC-S559-04 – Equipment for Fire Signal Receiving Centres and Systems
- CAN/ULC-S561-03 – Installation and Services for Fire Receiving Centres and Systems
- UL 1076-[1995], Standard for Safety for Proprietary Burglar Alarm Units and Systems.
- UL 1635 Digital Alarm Communicator System Units
- UL 1981 Central Station Automation Systems
- UL 294-[1999], Standard for Safety for Access Control System Units.
- UL 681 Installation and Classification of Burglar and Holdup Alarm Systems
- UL Testing Bulletin
- Underwriters Laboratories (UL) Cable Certification and Follow Up Program

35.0 Manufactures List

- Aegis
- ADI
- ADT Canada
- Aiphone Corporation
- Alarm Saf
- Altronix Corporation
- Alpha Technologies
- American Dynamics
- Amseco
- Ameta International Co. Ltd.
- APC by Schneider Electric
- Arecont Vision
- Asterix Security Hardware International Inc.
- Anixer
- ASSA ABLOY Canada
- AutoGate Inc.
- Automatic Systems America Inc.
- Avigilon
- AWID
- Axis Communications, Inc.
- Berk-Tek
- Black Box Network Services
- Boon Edam, Inc.
- Bogen Communication, Inc.
- Bosch Security Systems
- Camden Door Controls
- Cansec Systems Ltd.
- CCTV Direct
- CDVI Americas Ltd.
- CDW
- Cisco Systems
- Commend Inc.
- Computar
- D-Link Canada Inc.
- Dahua Technology
- Dedicated Micros
- Detex
- Digital Watchdog
- DIRAK Inc.
- DITEK Corporation
- DoorKing Inc.

- DSC
- DWG Distribution
- Eyesonic Enterprises Inc.
- FLIR Fibre Technologies
- GAI-Tronics
- RBH Access Technologies Inc.
- RBtec Inc.
- Rofu Security Internation Group
- Rutherford Controls Int'l. Corp.
- Safety Technology International Inc. (STI)
- Samsung Techwin America
- Santeri Industries
- Schlage
- Schneider Electric
- Senstar Corporation
- Sentrol Inc
- Sennetech Inc.
- Sentry Security Systems
- Smart Vision Direct Inc.
- Software House
- Sony of Canada Ltd.
- Southern Folger
- Southwest Microwave, Inc.
- SPECO Technologies
- Spectris Canada Inc.
- Systech Corporation
- Talk-A-Phone
- TOA Canada Corporation
- Toppan
- Tri-Ed, an Anixter Company
- Tri Tech
- Turnstile Security Systems Inc.
- Tyco Security Products
- Ultratech
- United Security Products
- Visonic
- Von Duprin
- WatchNET Inc.
- Weiser
- Winbo International Ltd.
- Zebra

City of Toronto

Corporate Security

Confidentiality and Non-Disclosure Declaration (NDA) Form

TORONTO
Corporate Security

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.

City of Toronto
Corporate Security

C•CURE 9000
Programming Standards

TORONTO
Corporate Security

Corporate Security

C•CURE 9000 ® Programming Standards

Version History	
Subject:	Version No.
C•CURE 9000 ® Programming Standards	5.00
Effective Date:	Issued By:
2024-11-01	Corporate Security – City of Toronto
Supersedes:	Approved By:
All previous or existing internal Corporate Security C-Cure 9000® system Programming Standards	Andrew Robinson Manager, Corporate Security, Systems & Technology Andrew.Robinson@toronto.ca
Contact Information	
Femi Ajayi, CSPM, ICPS, PSP Supervisor, Corporate Security, Systems & Technology Femi.Ajayi@toronto.ca	

CONFIDENTIAL

Document Classification

The information contained in this document is confidential and proprietary to Corporate Security, City of Toronto; and is protected by provincial and federal legislation.

The City of Toronto submits this document with the understanding that it will be held in strict confidence and will not be used for any purpose other than reference for the specification, design, maintenance and implementation of C•CURE 9000 ® card access and event management systems.

No part of the document may be circulated or reproduced for distribution outside Corporate Security without prior written approval from the Director, Corporate Security (or his/her designates).

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Contents

PREFACE 6
C•CURE 9000 ® NEW INSTALLATION PROGRAM VERIFICATION CHECK LIST 7
NAMING CONVENTIONS & GENERAL STANDARDS 8
LOCATION CONVENTIONS 10
HARDWARE CONFIGURATION 11
GENERAL STANDARDS 11
DEVICE NAMING CONVENTIONS 11
iSTAR CLUSTERS - GENERAL SETTINGS 13
iSTAR CONTROLLERS - GENERAL SETTINGS 14
TRIGGERS 14
DOORS - GENERAL SETTINGS 15
- **Hardware** 15
- **Reader** 15
- **Request To Exit** 15
- **Settings** 15

TIMING 16
- **Timers** 16
- **Options** 16

TRIGGERS 16
GROUPS 16
READERS - General Settings 17
iSTAR INPUTS – GENERAL SETTINGS 18
OUTPUT - General Settings 18
ELEVATORS / FLOORS - General Settings 19
GENERAL 19
BUTTONS 19
SYSTEM CONFIGURATION 20
AREA / ANTI-PASSBACK 20
CARD FORMATS 21
HOLIDAYS 22

CONFIDENTIAL

HOLIDAY OVERRIDE 22
EVENTS 22
CLEARANCES 25
SCHEDULES 25
HOLIDAY OVERRIDE 26
iSTAR INTRUSION ZONE 26
LEGACY MAPS 27
READER CARD FORMATS 28
GROUPS 28
SUPERVISION ERRORS 28
TAMPER DEVICES & SIGNALS 29
COMMUNICATION FAILURES (COMM FAIL) 29
SUMMARY 30

CONFIDENTIAL

PREFACE

The City of Toronto owns/operates a C•CURE 9000 ® access control and alarm management system with eight SAS, linked to a single card database through the C•CURE 9000 ® MAS. This unique enterprise solution was so chosen to curtail risk and moderate the impact of system failures - given the nature and criticality of Security system database to the City of Toronto.

This document is intended to highlight security best principles & practices and to serve as a guideline for the configuration of City of Toronto C•CURE 9000 ® systems.

In accordance with industry standards and practices, alarm display and communications should be designed to provide prompt and accurate reporting of all signals and events to a human operator. This is best accomplished when the displayed data is concise, consistent, and clear.

To ensure a quality approach, all system programming must be done with the following objectives in mind:

- Efficiency of use
- Ease of Operator understanding
- Effectiveness of data tracking, collection, and reporting
- Optimal effect with minimal system load

Although standards are devised for the purpose of ensuring conformity and continuity, pre-packaged “Cookie Cutter” solutions do not always fulfill the protection needs of the facility or the client. In addition, any protective system must be designed, implemented, and operated to counter current and emerging threats.

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C•CURE 9000 ® NEW INSTALLATION PROGRAM VERIFICATION CHECK LIST

Program Verification Check List	Completed
iSTAR Controller and iSTAR Cluster creation requested for new install sent to Security Access Team providing the valid SAS and partition for the install on C•CURE 9000 ® system.	Choose an item.
PMO provides C•CURE 9000 ® Programming Standards to the Integrator.	Choose an item.
PMO confirms site acceptance walkthrough has been completed with the Integrator.	Choose an item.
PMO ensures that the iSTAR cluster, iSTAR Controller, Devices and Events are created on the valid SAS on the right Partition in the C•CURE 9000 ® system.	Choose an item.
PMO confirmed the new installations has been tested and working.	Choose an item.
Security Access Team sends project verification update within 5 business days from the day of receiving confirmation of system testing from PMO.	Choose an item.
Security Access Team create clearance and add appropriate doors and schedules to clearances. Confirmation should be sent by PMO to add the doors to Security Clearances.	Choose an item.
PMO to send Designated Access Approver list to Security Access Team.	Choose an item.
System tested by PMO and Integrator and advise Integrator to ensure all devices and programming are in maintenance mode.	Choose an item.
PMO send request to Security Access Team to remove system from maintenance mode.	Choose an item.
Security Access Team and PMO check 3 to 6 days of journal records to determine installation is free of nuisance alarms and programmed according to C•CURE 9000 ® Programming Standards.	Choose an item.

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NAMING CONVENTIONS & GENERAL STANDARDS

The following general standards apply to C•CURE 9000 ® programming.

With a few exceptions, all system entries (i.e., names, descriptions, card record entries, etc.) will be made in Uppercase (Capitals). Exceptions will be listed in this document.

The System Programmer will need to balance the device name lengths. Names that are too long will exceed the available screen space.

Device names that are too abbreviated however will not provide sufficient information to facilitate accurate assessment and response.

FIG. 1 – ADMITTED CARD

All programmed devices, doors, elevators, etc., must include a detailed description with the following information:

For Example (locations and names will vary):

Site name: CITY HALL

Location of device: GROUND FLOOR, SUITE 202 NORTHWEST CORNER

Orientation of device: HUB ROOM ENTRANCE CARD READER

Additional Device Data: INSTALLED WITH FAIL-SECURE ELECTRIC STRIKE

Vendor: JOHNSON CONTROLS INC.

Date of installation: INSTALLED MARCH 2024

Date of warranty expiration: WARRANTY EXPIRES MARCH 2026

Facilities door number: (If applicable) DOOR B5-207

<u>Put together, it should display like this</u>:

CITY HALL: GROUND FLOOR, SUITE 202 NORTHWEST CORNER HUB ROOM ENTRANCE CARD READER. DOOR B5-207

INSTALLED WITH FAIL-SECURE ELECTRIC STRIKE

JOHNSON CONTROLS INC.

INSTALLED BY JCI MARCH 2024

WARRANTY EXPIRES MARCH 2026

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C•CURE 9000 ® does not allow duplicate names of any device, clearance, schedule, event, or any other user-defined entry on the same partition (i.e., SAS).

This rule does not include data entered onto a card record except for Credential, which does not allow a duplicate card digit.

C•CURE 9000 ® will allow you to name both a card reader, a door contact, event, and schedule with the same name (i.e., 100QUE-SEC OFFICE), but this is not the best practice and may lead to confusion for technicians, Security Operations Centre and Security Access Staff working on C•CURE 9000 ®.

Installed devices which operate as single entity (such as a door) must have similar names to ensure continuity and ease of search. For example, Door 1008YONGE-01FL-WORKS-ENT DR will have the following components:

- Reader: **1008YONGE-01FL-WORKS-ENT DR ®**
- Door Switch Monitor: **1008YONGE-01FL-WORKS-ENT DR DSM**
- Door Contact: **1008YONGE-01FL-WORKS-ENT DR D/C**
- Door Latch Bolt Monitor: **1008YONGE-01FL-WORKS-ENT DR LBM**
- Request to Exit: **1008YONGE-01FL-WORKS-ENT DR RTE**
- Electric Strike: **1008YONGE-01FL-WORKS-ENT DR STK**
- Forced Open Alarm: **1008YONGE-01FL-WORKS-ENT DR – FORCED [E]**
- Held Open Alarm: **1008YONGE-01FL-WORKS-ENT DR – HELD [E]**
- Door Open Event: **1008YONGE-01FL-WORKS-ENT DR – DOOR OPEN [E]** (to be used with doors with Door Contacts Only)

Programmed events which operate with a schedule will have similar names to ensure continuity and ease of search.

For example, Event **1530MAR- UNLOCK MAIN DRS [E]** is controlled by schedule **1530MAR- UNLOCK MAIN DRS [TS]**.

Note: Do not use the system generated schedules for any door unlock events. A custom schedule must be created for door unlocking events. Using the system created schedules can lead to other devices being impacted by scheduling changes.

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LOCATION CONVENTIONS

Location prefixes must be used in the configuration of all device and sub-system names:

The location prefix will precede any other information contained within a device, clearance, and time spec or event name.

A hyphen (-) will separate the location prefix from the remainder of the device, clearance, schedule, or event name.

Location prefixes must include the full address minus the street suffix. (i.e.,

1530 Markham Road would become **1530MARKHAM**)

Location prefixes must allow a prompt recognition of the location that the device, clearance, schedule, or event is affiliated with or a quick search of the configured names in C•CURE 9000 ®.

Most locations will follow the same naming convention as above except for the Civic Centres, Metro Hall and City Hall.

Metro Hall, City Hall and Civic Centres will retain their common abbreviations as follows:

- METRO HALL = **MH**
- CITY HALL = **CH**
- SCARBOROUGH CIVIC CENTRE = **SCC**
- NORTH YORK CIVIC CENTRE = **NYCC**
- YORK CIVIC CENTRE = **YCC**
- EAST YORK CIVIC CENTRE = **EYCC**
- ETOBICOKE CIVIC CENTRE = **ECC**

All Toronto Water location naming conventions will follow the same general naming convention apart from the Water Treatment and Filtration Plants.

For example, Horgan Filtration Plant would become **HORGAN**, whereas the Wastewater Quality Enforcement and Laboratory located at 30 Dee Avenue would become **30DEE**.

Tanks, Reservoirs and Pumping stations will follow the regular location naming convention (**ADDRESS>NAME i.e., Rosehill Reservoir would be named 75ROSEHILL**)

All location naming conventions are subject to review and approved by the Security Access Team.

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HARDWARE CONFIGURATION

The following standards should apply to C•CURE 9000 ® hardware configuration and programming.

GENERAL STANDARDS

All device programming must meet the recommended specifications as outlined by Software House. Unique or 'one-off' programming may only be employed if written authorization is given by the Security Access Team.

All device names, descriptions, instructions or notations will be entered in capital letters.

DEVICE NAMING CONVENTIONS

Device names should provide sufficient detail as to the type of device and location of installation.

All device names are subject to review and approved by Security Access Team.

The following conventions must be used with device names:

CONFIDENTIAL

HARDWARE	
DOOR:	**DR**
DOUBLE DOORS:	**D/D**
DOOR CONTACT:	**D/C**
LATCH BOLT MONITOR:	**LBM**
DOOR SWITCH MONITOR:	**DSM**
REQUEST TO EXIT:	**RTE**
ELECTRIC STRIKE:	**STK**
DOOR HANDLE LOCK:	**DHL**
GLASS BREAK:	**G/B**
MAGLOCK	**MAG**
CARD READER (ONE-WAY):	**®**
CARD READER (ENTERING):	**[IN] ®**
CARD READER (EXITING):	**[OUT] ®**
DIRECTIONAL	
NORTH:	**N**
SOUTH:	**S**
EAST:	**E**
WEST:	**W**
NORTH/WEST:	**N/W**
NORTH/EAST:	**N/E**
SOUTH/WEST:	**S/W**
SOUTH/EAST:	**S/E**

DESCRIPTOR	
INTERIOR / INNER:	**INT**
EXTERIOR:	**EXT**
ENTRANCE:	**ENT**
ROOM:	**RM**
PARKING:	**PKG**
EMPLOYEE:	**EMP**
RECEIVING:	**RECV**
SHIPPING:	**SHIP**
LOADING DOCK:	**LOADING DOCK**
ADMINISTRATION:	**ADMIN**
MEZZANINE:	**MEZZ**
STORAGE:	**STOR**
FLOOR:	**FL**
CORRIDOR:	**CORR**
STAIR:	**STAIR**
OFFICE:	**OFF**
ELEVATOR:	**ELEV**
HALLWAY	**HALL**
EVENTS [E]	
FORCED ALARM	**FORCED [E]**
HELD ALARM	**HELD [E]**
DOOR OPEN EVENT	**DOOR OPEN [E]**
SUPERVISION ERROR ALARM	**SUPERVISION ERROR [E]**
REJECTED CARD ALARM	**CARD REJECTED [E]**

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iSTAR CLUSTERS - GENERAL SETTINGS

The iSTAR Cluster Name should be entered in the following manner:

Example:

9LESLIE-ISTAR CLUSTER # 1 (Location prefix, hyphen, and iSTAR Cluster)

For new iSTAR Clusters awaiting verifications should have the prefix of (:) at the beginning of the cluster name and all associated devices should be set to Maintenance Mode.

Example:

(:)9LESLIE-ISTAR CLUSTER # 1

iSTAR Clusters should not be placed online unless ready to be used and monitored.

A cluster placed online must be placed into maintenance mode until verified and approved by the Security Access Team.

Encryption Setting: All iSTAR Controllers should be created with encryption selected.

SNMP Enabled should be disabled for all created iSTAR Controllers before placing online.

Only one iSTAR should be added to a cluster.

Communications: Leave at default settings

Cluster: Leave at default settings

Miscellaneous: Leave at default settings

Area: Leave at default settings

Encryption: Leave at default settings

Triggers: Leave at default settings

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iSTAR CONTROLLERS - GENERAL SETTINGS

The iSTAR Controller Name should be entered in the following manner:

Example:

9LESLIE-ISTAR # 1 (Location prefix, hyphen, and iSTAR number)

For new iSTAR Controllers awaiting verifications should have the prefix of (:) at the beginning of the controller's name and all associated devices should be set to Maintenance Mode.

Example:

(:)9LESLIE-ISTAR # 1

iSTAR Controller should not be placed online unless verified by the Security Access Team and ready to be used and monitored.

A controller placed online must be placed into maintenance mode until verified and approved by the Security Access Team.

Controller-Type should be configured with up-to-date firmware and compatible with the City of Toronto C•CURE 9000 ® systems utilizing current hardware. Further consultation may be carried out with Software House.

Technicians must confirm that the right type of Controller and ACM Board is selected before programming.

Adapter #1 MAC Address: Should be the iSTAR MAC Address

Time Zone: GMT -05:00 Eastern Time (US & Canada)

Onboard Ethernet Adapter: Defaults when you enter IP Address.

TRIGGERS

Triggers: COMM FAIL Event.

Click Add and set the following:

- Property: Online Status
- Value: Offline
- Action: Activate Event
- Details: Populates when you assign the event to the controller.
- Event: Click … to select an existing event or click "v" arrow box to select edit an existing event or select new to create the event.

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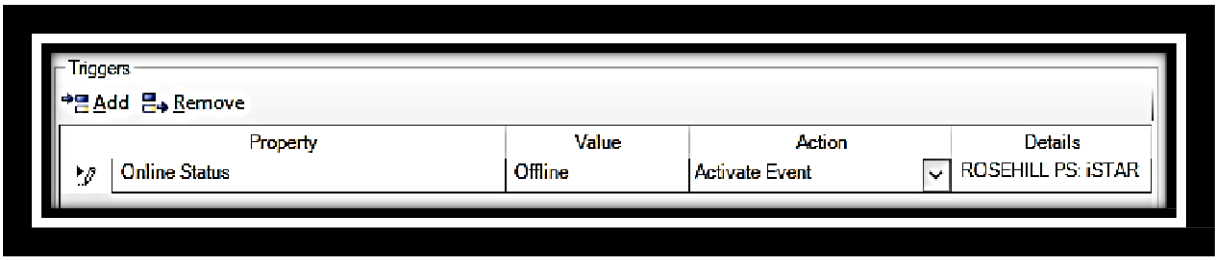

FIG.2 – TRIGGERS FIELD

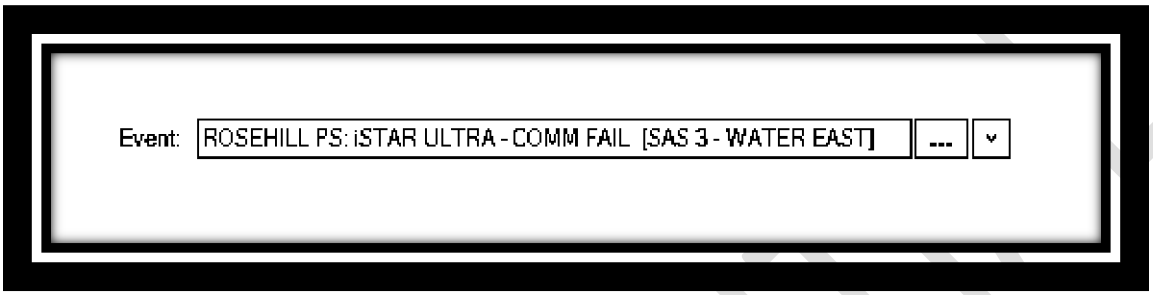

FIG. 3 – TRIGGERS FIELD: EVENT SELECTION

DOORS - GENERAL SETTINGS

These are the settings currently used on City of Toronto Doors.

Hardware

- Door Switch Monitor: DSM, D/C, LBM
- Door Lock Relay: STK, MAG

Reader

- Inbound Reader
- Outbound Reader
- Readers are continuously active: Box should be checked.

Request To Exit

- Request To Exit Input: Should be selected (RTE).
- Unlock Door on RTE: Should be checked on MAG Doors.
- Shunt DSM while RTE is active: Should be checked for both STK and MAG doors.

Settings

- Send non-alarms input status to the host: Should not be checked as this will overload the journal.

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TIMING

Timers

Delay Relock (seconds): default setting, to be amended as needed.

Shunt Time: default setting, to be amended as needed.

Unlock Time: default setting, to be amended as needed. Timing can be adjusted by the Security Access Team via request through CMR.

Door Close Debounce Time: Should be configured for vehicle gates, as needed depending on the forced open alarm received.

Door Grace Time: default setting, to be amended as needed.

Door Unlock Grace Time: default setting, to be amended as needed.

Options

Always use Shunt Expire Output: default setting, to be amended by Security Access Team depending on alarm being received.

Delay Relock while Door open after valid access: default setting, to be amended by Security Access Team depending on alarm being received.

Shunt Door for full Shunt Time: default setting, to be amended by Security Access Team depending on alarm being received.

TRIGGERS

FORCED [E], HELD [E] and SUPERVISION ERROR [E] events should be configured for all doors; except for vehicle gates and arm/disarm readers.

****INDIVIDUAL UNIQUE EVENTS PROGRAMMED. NO GENERIC/SHARED EVENTS. (I.E., EACH DOOR WILL HAVE THEIR OWN FORCED, HELD AND SUPERVISION ERROR EVENT).**

GROUPS

Doors can be added to door groups through Configuration Menu in C•CURE 9000 ®.

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READERS - General Settings

Readers should **not** be placed online unless ready to be used and monitored.

Readers that will be placed online and monitored should be on maintenance mode. The Security Access Team will remove maintenance mode.

Reader Technology: should be configured as appropriate to the type of reader employed.

Reader Type: should be configured as appropriate to the type of reader employed.

Card Formats: All relevant City card formats must be entered.

Supervised Inputs: should be configured with manufacturer-recommended devices only.

Outputs: should be configured with manufacturer-recommended devices only.

Keypad PIN: options should be configured as needed.

Keypad Commands: options should be configured as needed.

Allow Card Numbers to be Entered via Keypad: options should be configured as needed.

Activate this Output During Communication Failures: options should be configured as needed.

Activate this Event During Communication Failures options should be configured as needed.

Activate this Event While Tampered: options should be configured as needed and is recommended for all exterior readers.

Status: default settings.

Reader LED light flashing (RED and GREEN) when door is in Held Open status.

Reader arm/disarm LED light changing and accepting valid swipe cards. When armed, the LED should show RED, when disarmed, the LED should show GREEN.

Reader LED light changing and accepting valid swipe cards. The LED should change from RED to GREEN with a valid card swipe.

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iSTAR INPUTS – GENERAL SETTINGS

Inputs should **not** be placed online unless ready to be used and monitored.

Inputs that will be placed online and monitored should be on maintenance mode. The Security Access Team will remove maintenance mode.

Default State: Default state of the input should be armed.

Reverse Sense of Input: Should remain deactivated unless the device configuration needs to be inverted.

Activate on Supervision Error: Check box should be unchecked.

Send State Changes to Monitoring Station: Check box should be checked off for inputs not attached to doors.

Send State Changes to Journal: should be activated for inputs not attached to a door.

Triggers: All inputs need to trigger their own Supervision Error event. The event should be named the same as the input itself with – SUPERVISION ERROR [E] at the end.

Example:

1008YONGE-01FL-N/E WORKS RTE – SUPERVISION ERROR [E]

OUTPUT - General Settings

Outputs should **not** be placed online unless ready to be used and monitored.

Outputs that will be placed online and monitored should be on maintenance mode. The Security Access Team will remove maintenance mode.

Pulse Duration: should be configured as needed. Where output pulsing is not required, it should remain at the default setting of 0/10th second.

Send State Changes to Monitoring Station: should activated on outputs that are not door related.

Send State Changes to Journal: options should be configured as needed.

Normally Energized: should be configured as needed; but used sparingly. Outputs that are normally kept energized typically experience more wear and tear.

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ELEVATORS / FLOORS - General Settings

GENERAL

Elevators should **not** be placed online unless ready to be used and monitored.

Elevators that will be placed online and monitored should be on maintenance mode. The Security Access Team will remove maintenance mode.

Floors should **not** be placed online unless ready to be used and monitored.

Floors that will be placed online and monitored should be on maintenance mode. The Security Access Team will remove maintenance mode.

C•CURE 9000 ® controls elevator floor access by means of outputs attached directly to the elevator control board.

Elevator Time Schedule must be downloaded to the Controller as specified below paragraph.

Elevators will be set to **Controlled** status by default. If an elevator requires a period in **Uncontrolled** status, **INDIVIDUAL EVENTS** need to be created for each elevator cab and set to download to the assigned iSTAR Controller.

Each floor for each cab must be equipped with its own output. Pressing the floor button in an uncontrolled elevator signals the control board on where to move the elevator cab.

On Controlled Elevator Access, a valid card read must be received first, or C•CURE 9000 ® will restrict the control board from receiving the floor button activation.

An additional feature of C•CURE 9000 ® allows the use of inputs to monitor which floor button was activated by a cardholder.

No Input Selection, One Input Selection, or Multiple Input Selection buttons should be configured according to what input design has been chosen for the installation.

BUTTONS

Elevator buttons should be configured in accordance with Software House recommended methods.

Floors must be configured with the correct Elevator Cab + Floor Output to work properly.

Elevator **Admitted**, **Rejected** or **Duress** Access events may be configured as specified by the Project Manager.

Button Activation Time should be configured to 10 seconds as recommended by Software House.

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SYSTEM CONFIGURATION

The following standards should apply to C•CURE 9000 ® system configuration and programming.

AREA / ANTI-PASSBACK

Area/ Anti-Passback is not currently used on C•CURE 9000 ® System.

Configuring Areas enables anti-passback checking and specifies events to activate when various area-related situations occur.

Doors/readers can be configured to control ingress and egress from a passback-controlled area.

Areas can be defined within a single or iSTAR, or across iSTAR Clusters.

Only Enforce Regular Anti-Passback and Enforce Timed Anti-Passback may be used by the City of Toronto.

Regular Anti-Passback will only permit cardholders to enter an Area an exit swipe was previously registered.

Timed Anti-Passback will reject cardholder entry into an Area if the entry attempt was made within a certain time limit. Once the timed rejection has elapsed, entry into the Area will be permitted once again.

Mustering is used primarily for counting personnel during emergency evacuations.

The Access In and Access Out tabs should be configured to accurately reflect those relevant doors/readers that will be used for Area entry or exit.

The Asset In and Asset Out tabs are not currently being used by the city.

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CARD FORMATS

The city currently uses proprietary 27-bit Wigand card format and 35-bit proximity iClass Corp 1000 card format:

CITY HALL1	(No longer used by the city except for SSLTC)	27-bit
CITY HALL2	(Not needed in SSLTC)	27-bit
CITY HALL3	In Use	27-bit
CITY HALL4	In Use	27-bit
CITY HALL5	In Use	27-bit
CITY HALL6	In Use	27-bit
CITY HALL7	In Use	27-bit
CITY HALL8	In Use	27-bit
CITY HALL10	In Use	27-bit
CITY HALL11	In Use	27-bit
CITY HALL 12	In Use	27-bit
HID CORPORATE 1000	In Use	35-bit

The City of Toronto Bicycle Infrastructure program utilizes a different 35-bit card format which allows Union Station access cards to work on the City of Toronto system using a higher credential number. This credential number must be programmed specifically by the Security Access Team.

BIKE STORAGE CARD FORMAT	In Use	35-bit
BIKE STORAGE CARD FORMAT - EGLINTON CROSS TOWN	In Use	35-bit

All specifications under the Card Format should not be changed without **the expressed authorization of the Security Access Team**.

These sections hold the card mechanism of operations and how the system reads the card in C•CURE 9000 ® System.

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HOLIDAYS

Holidays are to be programmed by Security Access Team.

There are a maximum of 24 Holiday Lists on iSTAR-equipped C•CURE 9000 ® systems. However, there is no practical limit to iSTAR-equipped systems. In a mixed-panel environment, the lowest maximum limit applies.

Only Statutory Holidays are entered into C•CURE 9000 ®. The name should accurately reflect the holiday it represents (i.e., New Year's Day).

The Duration (In Days) should be configured to 1.

The Recurrence feature should be configured to reflect the nature of the holiday date most accurately.

HOLIDAY OVERRIDE

If the building needs to remain open despite the holiday, HOLIDAY OVERRIDE must be configured to override the holiday schedule.

EVENTS

An event is a C•CURE 9000 ® system definition that allows users to link actions, annunciations, and time activations into one component.

Events are used for a wide variety of purposes and thus must be properly named to ensure that any trained Operator can identify it immediately.

Events should **not** be placed online or armed unless ready to be used and monitored.

Events that will be placed online and monitored should be on maintenance mode. The Security Access Team will remove maintenance mode.

All acknowledgeable events must have specific instructions entered in the "**Instructions to Display on Event Monitor**".

These instructions should provide the Operator with the following information:

Example:

Type of event: **MOTION ALARM**)

Location of event: **1115 QUEEN STREET WEST**)

Response instructions: **DISPATCH POLICE IMMEDIATELY**), (**CALL A SITE NUMBER**)

Any relevant information: **LOCATION CONTAINS HAZARDOUS CHEMICALS**)

Some important events should have pertinent information entered in the "**Display this Line when Activated**": **MOTION DETECTOR HAS BEEN ACTIVATED IN VAULT**)

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The Integrator should consult with the Project Management Office on what to display under the Message Instructions "Instructions to display on Event Details screen".

All acknowledgeable alarm events must be assigned a priority of **75-150** (**depending on the sensitivity of the event)**.

All non-acknowledgeable events should be assigned a priority of **75-150** (**depending on level of importance**). The event should only report to Journal. No other acknowledgments required.

Acknowledgement Tab must have the following checkboxes selected for acknowledgeable alarms:

- Send state changes to Journal
- Send state changes to Monitoring Station
- This event requires acknowledgement
- Allow acknowledgement while causes are active

The Security Access Team will program all other exceptional events.

Unacknowledged/Un-cleared Events may be configured as needed and appropriate by Security Access Team.

Sounds should be configured to Play Sound Once. Sensitive alarms, such as **DURESS [E], GLASS BREAK [E], etc.,** will be programmed as Play Sound Instead of Beep (which will be a continuous alert).

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The following sounds may be used for alarm activations:

DOOR ALARMS	ALERT
SINGLE SENSOR ALARMS	ALERT
INTRUSION VIOLATIONS	SIREN
DURESS ALARMS	BUZZER
COMM FAIL	BUZZER
A/C POWER FAIL	BUZZER
P/S LOW BATTERY	BUZZER
TAMPER ALARM	BUZZER
AED REMOVAL ALARM	GLASS
GLASS BREAK ALARM	GLASS
ARM CHECK	LASER
ALARM TO INTERCON	SIREN
DISARM	CHIMES
FIRE ALARM	SIREN 1
PIR MOTION ALARM	ALARM

The Dialup feature is not currently being used by the city.

The General, and Overdue Timing features will be configured as needed and as deemed appropriate by the Security Access Team.

The Event Is Downloaded to Controller: feature is currently being used by the city on specific events for Schedules.

The Integrator may consult the Security Access Team for further details regarding event configurations.

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CLEARANCES

Clearances are created by the Security Access Team after receiving a detailed Security Application Change Request (SACR, previously known as CMR) from the Project Management Office group.

Clearance names should provide trained Operator reasonably good information as to the clearance timing and location of access.

All clearance names are subject to review by the Security Access Team.

Most clearance names will have the following conventions:

- [DAY] = Daytime Access: Monday to Friday during Business Hours (variable)
- [24HR] = 24 Hour Access, seven days a week. (Also known as "Always").
- [EXT] = Extended Access: Used mostly for access beyond the standard business hours.

Some clearances may be unique in nature and may require more specific names (i.e., **35S-7 DAYS 0600-2030 for 7 days a week clearance**)

A custom schedule must be created for clearances. Using the system created schedules can lead to other devices/configurations being impacted by changes.

Use Activation Date and Time may be used with temporary clearances (i.e., ones being used by contractors and during labour disruption)

Use Expiration Date and Time may be used with temporary clearances (i.e., ones being used by contractors and during labour disruption)

When configuring elevators, no more than 48 Triplicate Pairs (items, actions, etc. in a clearance), should be used in a single clearance. A Triplicate Pair is a combination of Elevator/Elevator Group, Floor/Floor Group, and a Time Specification.

If more than 48 Pairs are needed, another clearance must be created (i.e., **COUNCILLOR** and **COUNCILLOR1**) >>> Not necessary but it is better not to have too many Triplicate Pairs in a single clearance.

SCHEDULES

Schedules are used to provide chronological control over clearances and event activations.

Where possible, Schedules should not be configured to span across a full 24 hours.

The name should match the naming convention of the location and should be entered to closely match the event or clearance with which it is configured.

Exceptions to this standard include generic names, such as: **MON-FRI 0700-1900**, which may be used by multiple clearances.

Generic Names must not be used for C•CURE 9000 ® Events and Clearances.

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HOLIDAY OVERRIDE

Holiday will override the regular schedule and secure the building. However, if the building needs to remain open despite the holiday, HOLIDAY OVERRIDE must be configured. This will override the holiday schedule.

iSTAR INTRUSION ZONE

An Intrusion Zone is a user-defined group of doors, inputs, outputs, and actions that delineates a physical area monitored for alarms.

Devices within an Intrusion Zone reacts as one when one of its components is affected.

Special-purpose inputs cannot be assigned to an intrusion zone. These include:

- Request to Exit
- Any Power Fail Alarm
- Card Reader Arm/Disarm Input Point
- Any Tamper Alarm

Controller: Select the iSTAR Controller that will have the Intrusion Zone.

Entrance & Exit Doors: Add building doors. It is extremely important to add all exterior and affected doors. Every door must be secured apart from the Arm/Disarm door (which has to be in a locked state), and card control box checked to allow arming and disarming of the building.

Inputs: Add all Controlled Inputs

All Controlled Inputs must have individual events configured. No generic/shared events are to be used.

Example of unique event is "**1530MARKHAM-S/W EXT DR PIR – MOTION [E]**" This should be configured.

Arm – Disarm: Arming and Disarming fields should have Card Method to Arm Zone should be configured to "Active Input and Credential".

Arming Input must be selected for Arming and Disarming.

Under the Arm tab, the Readers Sounds during Exit Delay field should be configured as needed and mostly used for Parks & Recreation locations.

Under the Disarm tab, the Readers Sounds during Entrance Delay field should be configured according to site and client needs. The default time is 0 seconds.

Allow Disarm While Violated: check box should be **checked off**.

In iSTAR Intrusion Zones, the door schedule must not activate until the building is disarmed. The schedule should also deactivate anytime the building is armed, regardless of programmed scheduled start time of the event.

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The arming and disarming controls the activation of the schedule of the facility.

All other features of City Intrusion Zones may be configured in accordance with direction from the Security Access Team.

Arm/Disarm readers must have the LED lights change state Supervision Error event must be programmed on all devices.

All Events, Doors and devices naming must comply with the established Naming Convention. Please consult with the Security Access Team for further clarification.

Communication Failure, Tamper, AC power Fail, Low battery must be programmed on all iSTARs.

LEGACY MAPS

LEGACY MAPS WILL NO LONGER BE AVAILABLE IN THE NEXT C•CURE 9000 ® VERSION AND WILL BE REPLACED WITH AN ACTUAL MAP. ANY REQUESTS FROM THE CITY OF TORONTO THAT REQUIRE A MAP, SHOULD BE PROGRAMMED USING THE NEW MAP MENU.

Legacy Maps are Windows Bitmap files (*.bmp) or PNG files (*.png) which can be associated with C•CURE 9000 ® to display floor plans of devices and events.

Bitmap/png files should be large enough to recognize map details but not so large that it requires additional time to load onto the screen or the operator to scroll to find relevant devices.

A good size is **9000x600** dpi. If the floor plan is too big to shrink into something legible, it should be broken up into two separate files (i.e., **1530MARKHAM-05FL North** and **1530MARKHAM-05FL South**)

Bitmap/png file names must be clear enough to identify them with a facility and specific location.

C•CURE 9000 ® Icons should **not** be placed so that it overlaps other devices on the map. Where more than one device is installed at one point, the icons should be placed in a circle or square around that location.

C•CURE 9000 ® Map must be clear enough to identify them with a facility and specific location.

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READER CARD FORMATS

The following Card Formats must be added to all City of Toronto Card Readers, under Reader Card Formats field.

CITY HALL1	(No longer used by the city except for SSLTC)	27-bit
CITY HALL2	(Not needed in SSLTC)	27-bit
CITY HALL3	In Use	27-bit
CITY HALL4	In Use	27-bit
CITY HALL5	In Use	27-bit
CITY HALL6	In Use	27-bit
CITY HALL7	In Use	27-bit
CITY HALL8	In Use	27-bit
CITY HALL10	In Use	27-bit
CITY HALL11	In Use	27-bit
CITY HALL 12	In Use	27-bit
HID CORPORATE 1000	In Use	35-bit
BIKE STORAGE CARD FORMAT	In Use (at Bike Stations)	35-bit
BIKE STORAGE CARD FORMAT - EGLINTON CROSS TOWN	In Use (at Bike Stations)	35-bit

GROUPS

Groups are used to manage related clearances, doors, events, input/output, personnel, elevators, areas, readers and floors to optimize system configuration.

Group Names must be simple and clear.

Group names must include a location prefix, followed by a hyphen and then a simple descriptor (i.e., **1530MARKHAM-DOOR GROUP**)

SUPERVISION ERRORS

Supervision Error reports on the status of communication of C•CURE 9000 ® and the device. It may mean the device has become faulty, or a sign of tampering.

An error message is sent to the iSTAR Controller if a Supervision Error is detected, and a message should be displayed at the C•CURE 9000 ® Monitoring Station and logged on the historical journal.

All Input devices must be configured with its own unique Supervision Error Alarm event. (i.e., **1530MARKHAM-05FL-ENT DR DSM – SUPERVISION ERROR [E]**) This is vitally important for diagnosing faulty devices.

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TAMPER DEVICES & SIGNALS

Tamper input switches can provide notification of unexpected or unauthorized access into an iSTAR or card reader. This notification can best be displayed at the C•CURE 9000 ® Monitoring Station and logged on the historical journal by means of a Tamper alarm event.

All iSTARs and card readers (especially exterior card readers) should be equipped with Tamper input switches and configured with Tamper alarm events.

Separate Tamper alarms can be configured for each device.

COMMUNICATION FAILURES (COMM FAIL)

C•CURE 9000 ® always maintains bi-directional communications between the host or (server) and its controller and devices.

When communications are lost, C•CURE 9000 ® will report this condition in accordance with user-defined specifications.

This notification can best be displayed at the C•CURE 9000 ® Monitoring Station and logged on the historical journal by means of a **COMM FAIL [E]** alarm event.

COMM FAIL alarm events should be programmed with a unique individual event on all Controllers. (i.e., **1530MARKHAM-01FL-ISTAR #1 – COMM FAIL [E]**)

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SUMMARY

- All door schedules should be programmed and activates\deactivates only when the building is Armed or Disarmed. **The Arming must override the building Unlock schedules**.
- Arm/Disarm readers must have the LED lights change state.
- Each Input not attached to a door configuration must have its own unique events (i.e., Door Open Alarm, Supervision Error, etc.).
- Inputs that are part of a door configuration (DSM, RTE) must have its own unique Supervision Error with the matching naming convention that helps easily identify the device.
- All doors must have its own unique Forced or Held alarm but also may have a Rejected Card alarm when requested by the Project Management Office or the Security Access Team.
- All Elevator Floors must be programmed with a Scheduled Event which must be downloaded to each controller. Under no circumstances, should uncontrolled elevator buttons be programmed as a group and must have their own unique Time Spec/Event.
- All Controllers must have unique individual COMM FAIL events programmed with matching naming convention.
- Naming Conventions listed in this manual must be adhered to strictly.
- All iSTARs must be encrypted.

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City of Toronto

Commercial Facilities

Structured Cabling Standard System

Design Guide for Consulting Engineers, Architects, Designers & Contractors

City of Toronto - Commercial Facilities

Structured Cabling Systems

Design Guide For

Consulting Engineers, Architects, Designers

& Contractors

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Standards & Procedures

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CONTENTS

SECTION-1: INTRODUCTION 7
DOCUMENT INTENT AND LIFE CYCLE 7
TYPES OF CONSTRUCTION 8
A- NEW CONSTRUCTION 8
B- OVERBUILD CONSTRUCTION 8
C- BASIC CONSTRUCTION 8
CITY OF TORONTO AGREEMENT WITH BELL CANADA FOR COMMERCIAL FACILITIES 9
CITY OF TORONTO TENDER DRAWINGS 9
SERVICES NOT PROVIDED BY THE CITY OF TORONTO 10
MANDATORY DESIGNERS' QUALIFICATION REQUIREMENTS 11
MANUFACTURERS 11
ANSI/TIA RELATIONSHIP DIAGRAM 12
DESIGN AND REFERENCE STANDARDS 13
DEVIATION FROM STANDARDS 15
GENERIC TOPOLOGY 15
TORONTO WATER STRUCTURED CABLING SYSTEM - DESIGN CONSIDERATIONS 16
TORONTO WATER COMMERCIAL BUILDING CABLING TOPOLOGY 16
DESIGN SUMMARY 16
DESIGN DETAILS OF HORIZONTAL CABLING SYSTEM (CABLING SUBSYSTEM – 1) 18
DESIGN DETAILS OF BACKBONE CABLING SYSTEM (CABLING SUBSYSTEM – 2 AND 3) 20
CABLING DIRECTLY BETWEEN TELECOMMUNICATIONS ROOMS / TELECOMMUNICATIONS ENCLOSURES 22
DESIGN CONSIDERATIONS FOR SPACES, ENCLOSURES AND ROOMS 22
DESIGN GUIDE OF EQUIPMENT ROOM / NETWORK / SERVER ROOM (ER) 23
DESIGN GUIDE OF TELECOMMUNICATIONS ROOM (TR) 27
ENTRANCE FACILITY REQUIREMENTS (EF) | SHARED LAN/NETWORK ROOMS 28
WORK AREA OUTLET (WAO) 30
WORK AREA OUTLET (WAO) FOR OFFICE AREAS 30
UTP PATCH CORD FOR WAO IN OFFICE AREAS 31

WORK AREA OUTLET (WAO) FOR WIRELESS ACCESS POINT (WAP) 31
UTP PATCH CORD FOR TE/TR/ER 32
DESIGN CONSIDERATION OF PATHWAYS AND CONTAINMENT SYSTEM 32
DESIGN GUIDE OF CABLE TRAY SYSTEM 32
DESIGN GUIDE OF CONDUIT SYSTEM 34
DESIGN GUIDE OF PULL BOX 36
DESIGN GUIDE OF TELECOMMUNICATIONS BONDING & GROUNDING SYSTEM 37
SEPARATIONS FROM EMI 40
DESIGN GUIDE OF TAGGING CONVENTION (IDENTIFICATION AND LABELING) 40
EQUIPMENT / NETWORK / SERVER ROOM CABINETS IDENTIFICATION AND LABELING 40
COPPER PATCH PANEL (CP) & WORK AREA OUTLET (WA) IDENTIFICATION AND LABELING 43
FIBREOPTICS PATCH PANEL (FPP) IDENTIFICATION AND LABELING 45
WORK AREA OUTLET (WAO) IDENTIFICATION AND LABELING 46
CABLE IDENTIFICATION AND LABELING 46
FIBREOPTICS BACKBONE CABLE IDENTIFICATION AND LABELING 47
HORIZONTAL COPPER CABLE IDENTIFICATION AND LABELING 47
VOICE BACKBONE COPPER CABLE IDENTIFICATION AND LABELING 48
PATCH CORD IDENTIFICATION AND LABELING 48
CABLE PATHWAYS IDENTIFICATION AND LABELING 49
FIRE STOPPING 49
SUBMITTALS 49
END OF SECTION 50

SECTION -2: PRODUCTS 52
APPROVED MANUFACTURERS 52
ENTRANCE FACILITY PROTECTION 53
FIRE RATED BACKBOARD PLYWOOD 53
NETWORK CABINETS (CORE AND SERVER CLOSETS) 53
TELECOMMUNICATIONS ENCLOSURE (TE) 55
WORK AREA OUTLETS FOR OFFICE AREA 57

FACEPLATES 59
WORKSTATION FACEPLATES AND ADAPTERS - CUBICLES 59
RJ45 CAT6/6A JACKS 60
COPPER PATCH PANEL (CPP) 60
COPPER CAT6/6A HORIZONTAL CABLE (U/UTP) 60
COPPER CAT6/6A PATCH CORD (U/UTP) 61
BACKBONE CABLE FOR VOICE CENTREX ONLY - ISP (CAT3/5E) 62
TELEPHONE PATCH PANEL FOR VOICE (TPP) 62
VOICE CROSS CONNECT AT ENTRANCE FACILITY (EF) 63
FIBREOPTIC CABLES 64
INDOOR BACKBONE MULTIMODE OM4 FIBREOPTIC CABLE 64
FIBREOPTICS PATCH PANEL (FPP) 64
FIBREOPTICS LC CONNECTOR FOR FIELD TERMINATION OF OM4 CABLE 65
FIBREOPTICS LC PIGTAIL FOR FIELD TERMINATION OF OM4 CABLE 66
FIBREOPTICS MULTIMODE LC-LC DUPLEX PATCH CORDS – OM4 66
PATHWAY SYSTEM – CONDUIT AND CABLE TRAY 67
ELECTRICAL METALLIC TUBING CONDUIT - EMT 67
FITTINGS 67
EXPANSION FITTINGS 68
WATER PROOFING SEALS 68
WIRE BASKET TRAY 68
VENTILATED CABLE TRAYS 69
JUNCTION BOX 70
POKE THROUGH FLOOR BOX 70
GROUNDING AND BONDING 71
PRIMARY BONDING BACKBONE (PBB) / TELECOMMUNICATIONS MAIN GROUNDING BUSBAR (TMGB) 71
SECONDARY BONDING BACKBONE (SBB) / TELECOMMUNICATIONS GROUNDING BUSBAR (TGB) 72
TELECOMMUNICATIONS BONDING BACKBONE (TBB) 72
TELECOMMUNICATIONS BONDING CONDUCTOR (TBC) 73
WARNING LABELS 73

FIRE-STOPPING 73
END OF SECTION 73

SECTION – 3: EXECUTION 74
GENERAL 74
HORIZONTAL CABLE INSTALLATION 74
FIBREOPTIC CABLE INSTALLATION 75
CABLE ACCEPTANCE TESTING 75
COPPER PERMANENT LINK TESTING – HORIZONTAL CABLING 76
COPPER TEST EQUIPMENT 76
HORIZONTAL CABLE TESTING DOCUMENTATION - COPPER 78
BACKBONE FIBREOPTIC TESTING 79
BACKBONE FIBREOPTICS TESTING DOCUMENTATION 80
FIBREOPTIC TEST EQUIPMENT 80
CABLE TEST RESULTS MANUAL 81
TEST COMPLIANCE SHEET 82
SITE ACCEPTANCE TEST (SAT) 82
FIELD SUPPORT 84
MAINTENANCE 84
WARRANTY 84
QUALIFICATIONS AND TRAINING 86
AS-BUILT DRAWINGS 87
FINAL ACCEPTANCE 88
APPENDIX-A: SAMPLE OF CABLE ACCEPTANCE TEST (CAT) 89
APPENDIX-B: SAMPLE OF SITE ACCEPTANCE TEST (SAT) DOCUMENTS 93
APPENDIX-C: SAMPLE OF TELECOM WIRING DIAGRAMS|DRAWINGS|PHOTOGRAPHS 100
END OF DOCUMENT 107

SECTION-1: INTRODUCTION

This design guide is to provide consulting engineers, architects and designers working for the City of Toronto (CoT) with a document for the design of commercial facilities (owned, controlled, or leased buildings) communications distribution and structured cabling systems that accurately reflects the City of Toronto (CoT) and industry standards in effect as of this publication. This document shall be referenced to develop project specification and tender documents, specifically extra costs, and Bell standard pricing.

Therefore, it is obligatory for consulting engineers, architects, and designers of telecommunications systems of City of Toronto (CoT) to follow and practice the most updated revision to reflect the methods, materials and standards that have been used for providing telecommunications services to the existing facilities. The updated document also reflects changes in industry practice as of this publication.

In general, it is the responsibility of the building communications distribution designer to coordinate with the other designers on a project (architect, structural, electrical, mechanical, etc.) to ensure that other systems are both compatible with and complementary to the communications cabling system. The City of Toronto (CoT) design philosophy is that it is critical to coordinate between disciplines during the design phase of a project, rather than attempting to make adjustments in the field during construction.

Communications distribution systems designed for the City of Toronto (CoT) commercial facilities are expected to support and integrate voice, data and video communications with common media (fiber optic and unshielded twisted pair copper cable).

DOCUMENT INTENT AND LIFE CYCLE

The purpose of this standard is to define the general guidelines and standards for the design, specification, installation, testing, troubleshooting, documentation and handing over of the commercial facilities (owned, controlled, or leased) communications distribution and structured cabling systems. This standard follows published industry standards and best practices applicable to the commercial buildings of City of Toronto (CoT). The life cycle of this document version is from January to December every year from 2023. Always consult City of Toronto (CoT) Network Services (IT) Division for the latest version of this standard guide.

This document addresses commercial buildings communications distribution and structured cabling system design as it relates to:

- Design guide, topology and methodology
- Communications Media – fibreoptics and copper unshielded twisted pair (UTP)
- Pathway System – cable trays, conduits, etc.
- Products

- Execution (installation)
- Testing and Commissioning
- Handing over (final acceptance)

This document should serve as a guide for making standards compliant project specification which, in due course, will be reflected in a master tender specification document. In addition to specifications for a telecommunications project, plan drawings and schematic diagrams will also need to be produced by the designer. The drawings should conform to the guidelines contained in this document. This document is to be used in conjunction with the latest edition of BICSI TDMM.

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 communications specifications must be reviewed and approved by these groups within the City of Toronto (CoT).

TYPES OF CONSTRUCTION

Throughout this document, reference will be made to three types of construction as defined below: new, overbuild and basic construction. These definitions are applicable to the purposes of this document only. A new commercial building communications distribution and structured cabling system as well as the addition to and/or modification of existing cabling system is included in these construction projects. Tradeoffs between design standards and practicality will many times be dependent upon the type of construction. Different design approaches may be warranted for differing types of construction.

A- NEW CONSTRUCTION

New construction is defined as construction that results in a new (or new portion of an existing) commercial buildings communications distribution and structured cabling systems. For the most part, new pathway will be constructed, and new cabling will be installed in the pathway.

B- OVERBUILD CONSTRUCTION

Overbuild construction is defined as construction which may include demolition and/or abandonment of existing pathway and cabling, reuse of existing pathway for installation of new cabling and/or the addition of new pathway and/or cabling to existing pathway and/or cabling. Common terms referring to this type of construction include expansion, renovation, remodel, addition and retrofit, among others.

C- BASIC CONSTRUCTION

Basic construction is defined as construction that includes reuse of existing distribution pathway for the installation of new cabling. Demolition of existing cabling may be involved as well. Basic construction is focused on the installation of new cabling with no (minor) modifications to the existing pathway system.

CITY OF TORONTO AGREEMENT WITH BELL CANADA FOR COMMERCIAL FACILITIES

Effective January 10, 2010, the City of Toronto (CoT) has entered into 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 buildings of the City of Toronto.

A pricing table of services regarding this agreement having unit cost is available to share from CoT-IT with the permission to only authorized recipients.

Based on the agreement, current cabling vendor of record (VOR) shall be used. The cabling VOR shall be verified by CoT-IT Network Services at the time of proposed work or RFP.

Analog devices such as fax, POS (dialup), modems and other specialized monitoring lines are using Centrex. 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.

Please contact CoT-IT-Telecommunications Services, voice infrastructure group for more details.

CITY OF TORONTO TENDER DRAWINGS

This standard guide should be read in conjunction with the City of Toronto (CoT) standard drawings. The drawings shall typically be produced by the consulting engineers / designers and shall consist of (if applicable to the project) the followings but not be limited to:

1. Title Page and Drawing Index
2. Symbols (legends) and Notes General
3. Campus / Building Layout – Fibreoptics Backbone Network Layout (if applicable)
4. Fibreoptics Patch Panel Port Assignment (if applicable)
5. Campus / Building Layout – Voice (copper) Backbone Network Layout (if applicable)
6. Copper Patch Panel / BIX Blocks Port Assignment
7. Building Floor Plan
8. Serving Zone Floor Plan
9. Wireless Heatmap Plan
10. Entrance Facility Layout
11. Equipment Room Layout

12. Telecom Room Layout
13. Building Riser Layout – Horizontal / Backbone
14. Ceiling / Wall / Furniture / Floor Mounted Work Area Outlet Details and Bill of Materials
15. Telecom Enclosure Elevation and Bill of Materials
16. Telecom Enclosure Power Distribution Diagram
17. Telecom Enclosure UPS Panel Layout
18. Entrance Facility Backboard Elevation and Bill of Materials
19. Telecom Pathways (Cable Trays / Conduits) Layout
20. Typical Details of Cable Tray, Conduit / Sleeve, Fire-stopping, Horizontal/Backbone Labeling
21. Telecom Grounding and Bonding Layout (Riser and Floor Plan)
22. HVAC – Mechanical System Layout for Equipment Room / Telecom Room
23. Electrical / Power Layout for Equipment Room / Telecom Room / Work Areas
24. Demolition Drawings (all applicable drawings / layouts – if applicable)

SERVICES NOT PROVIDED BY THE CITY OF TORONTO

- The voice system technology (Bell Centrex etc.) shall be supplied and installed by Bell Canada.
- Entrance Facility and demarcation point shall be outlined in the specific design drawings. Service providers shall terminate the incoming copper cables on BIX and BIX cross-connect between the ISP and the OSP cabling at the Entrance Facility.
- Service providers shall terminate the incoming fibre cables in either wall mount or rack mount fibre enclosures between the ISP and the OSP cabling at the Entrance Facility.
- Witnessing field cable testing at site is NOT CoT's responsibility. The Contractor shall submit the test results to Consultant for their review, validation, witnessing and comment. Consultant shall forward the test results to CoT-IT/Network Services for further review (only if approved by the Consultant after their review). If there is no Consultant on the project, the contractor/cabling installer shall submit the test results to CoT's IT/Network Services for their review.
- BOQs/BOMs, layouts, elevations, drawings and schematics shall be prepared/reviewed by the Consultant.

MANDATORY DESIGNERS' QUALIFICATION REQUIREMENTS

- The standard is to be observed by the City of Toronto - IT Network Services Staff and Consultants involved with the design and implementation of structured cabling systems for data networks which include data networks, security networks, VoIP networks and any other networks that require a structured cabling system that is unified and connected to the City of Toronto network.
- The preparation and review of any network cabling system design, drawings and specification documents shall be conducted by a **Registered Communications Distribution Designer (RCDD).** The credential holder shall be in good standing who have demonstrated knowledge in the design, integration and implementation of telecommunications and data communications transport systems and related infrastructure.
- All consultant design drawings and specification document shall be sealed / stamped by RCDD.
- All cabling is to be provided from the manufacturers noted with the following sections. Cabling provided by alternate manufacturers is not acceptable.

In addition, the RCDD shall have the following qualifications:

- The RCDD shall demonstrate a minimum of 5 years of experience in the design of commercial buildings communications distribution systems. Experience not directly related to the design and installation of commercial buildings communications distribution systems, such as sales and/or marketing, is not acceptable.
- The RCDD shall demonstrate that he/she has designed or has had personal design oversight of a minimum of five projects similar in size and construction cost to the current CoT project.
- The RCDD consultant must have verifiable design experience with products and solutions from **Belden.**

Before commencing any work for or on behalf of the City of Toronto, the RCDD shall provide a copy of their RCDD certificate showing up to date registration in accordance with the **Building Industry Consultant Services International (BICSI)** policies and guidelines.

MANUFACTURERS

In addition to the standards listed below, the City of Toronto has selected **Belden** as a manufacturer of communications cabling infrastructure products for commercial buildings. The manufacturer is identified in the Product Section. The commercial building communications distribution designer is required to incorporate only this manufacturer into the design and to design a communications distribution structured cabling system that will be suitable for the use of products from the manufacturer.

ANSI/TIA RELATIONSHIP DIAGRAM

Relationships between ANSI/TIA Standard Documents

DESIGN AND REFERENCE STANDARDS

It is required that the designer be thoroughly familiar with the content and intent of these references, standards, and codes and that the designer be capable of applying the content and intent of these references, standards, and codes to all commercial communications system designs executed on behalf of the City of Toronto.

Listed in the table below are references, standards, and codes applicable to commercial communications systems design. If questions arise as to which reference, standard, or code should apply in a given situation, the more stringent shall prevail. As each of these documents is modified over time, the latest edition and addenda to each of these documents is considered to be definitive.

Standard	Title	Date
TIA-568.0-E	Generic telecommunications cabling for customer premises	2020
TIA-568.1-E	Commercial Building Telecommunications Cabling Standard	2020
TIA-568.2-D	Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted- Pair Cabling Components	2018
TIA-568.3-E	Optical Fibre Cabling Components Standard	2022
TIA-568.4-E	Broadband Coaxial Cabling and Components Standard	2022
TIA-568.5	Balanced Single Twisted-pair Telecommunications Cabling and Components Standard	2022
TIA 606-D	Administration standard for telecommunications infrastructure	2021
TIA- 607-D	Generic telecommunications bonding and grounding (earthing) for customer premises	2019
TIA-569-E	Telecommunications Pathways and Spaces	2019
TIA-758-B	Customer-Owned Outside Plant Telecommunications Infrastructure Standard	2012
TIA-942-B	Telecommunications Infrastructure Standard for Data Centers	2017
TIA-598-D	Optical Fibre Cabling Coding	2014

Standard	Title	Date
TIA-862-C	Structured Cabling Infrastructure Standard for Intelligent Building Systems	2022
TIA-1152-A	Requirements for field test instruments and measurements for balanced twisted-pair cabling	2016
TIA-1005-A	Telecommunications infrastructure standard for industrial premises	2012
TIA-526-14-C	Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant; Modification of IEC 61280-4-1 edition 2, Fiber-Optic Communications Subsystem Test Procedures-Part 4-1: Installed Cable Plant-Multimode Attenuation Measurement	2015
TIA-526-7-A	Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant, Adoption of IEC 61280-4-2 edition 2: Fibre-Optic Communications Subsystem Test Procedures – Part 4-2: Installed Cable Plant – Single-Mode Attenuation and Optical Return Loss Measurement	2015
TIA-TSB-162-B	Telecommunications Cabling Guidelines for Wireless Access Points	2021
TIA-TSB-184-A	Guidelines for Supporting Power Delivery Over Balanced Twisted-Pair Cabling	2017
TIA-604-10-C	FOCIS 10 Fiber Optic Connector Intermateability Standard- Type LC	2021
BICSI TDMM	Telecommunications Distribution Methods Manual, 14th Edition	2020
ANSI/BICSI 002-2019	Data Center Design and Implementation Best Practices	2019
ANSI/BICSI 007-2020	Information Communication Technology Design and Implementation Practices for Intelligent Buildings and Premises	2020
ANSI/BICSI 008-2018	Wireless Local Area Network (WLAN) Systems Design and Implementation Best Practices	2018

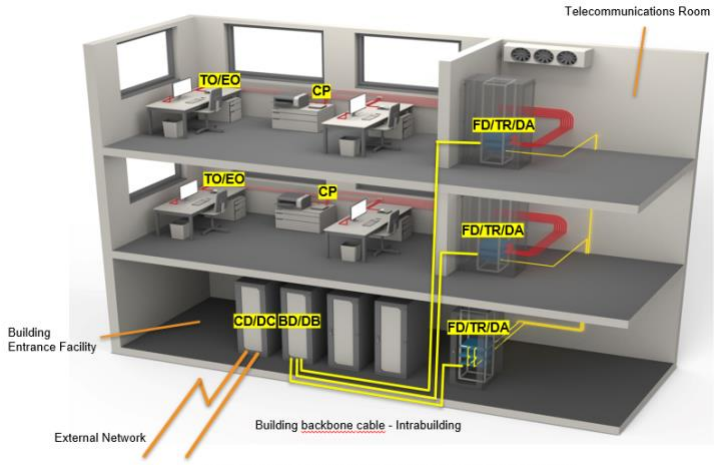
DEVIATION FROM STANDARDS

It is the intent of City of Toronto (CoT) to rigidly impose standards on every aspect of a commercial building communications system design. However, each design is unique and may be subject to situations in which deviations from the standards are warranted.

If the designer feels that deviation from a given standard is warranted, the designer shall submit a written deviation request to City of Toronto (CoT–IT). The request will, at a minimum, indicate the standard from which there is a proposed deviation, the substitution being proposed in place of the standard, the reason of the request being made, and an explanation of the justifications (economic, technical or otherwise) for the deviation. The designer may, upon written approval from CoT-IT, incorporate the design deviation into the overall design. The City of Toronto (CoT) approval is required on a project-by-project basis. The designer should not assume that a deviation approval for one project means that the deviation will necessarily be approved for a subsequent project.

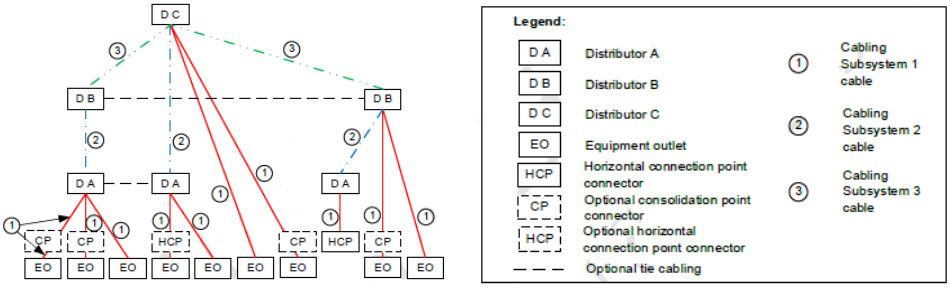
GENERIC TOPOLOGY

The figure below is an illustration of a generic cabling topology for Cabling Subsystem 1, Cabling Subsystem 2, Cabling Subsystem 3, Distributor A, Distributor B, Distributor C, an optional consolidation point and the equipment outlet. Elements of Generic Cabling Topology in both Standards are as below:



Example for the arrangement of functional elements in a building

ANSI/TIA-568.0 Terminologies

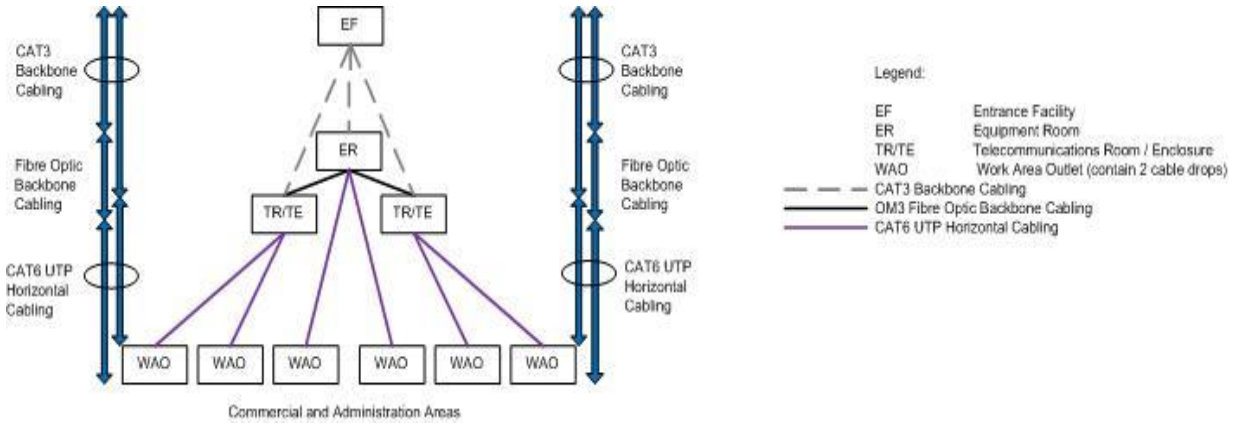


CITY OF TORONTO - STRUCTURED CABLING SYSTEM - DESIGN CONSIDERATIONS

This section highlights design considerations of particular importance to City of Toronto (CoT). It also discusses different CoT construction arrangements (new, overbuild, or basic) for a particular project.

CITY OF TORONTO - COMMERCIAL BUILDING CABLING TOPOLOGY

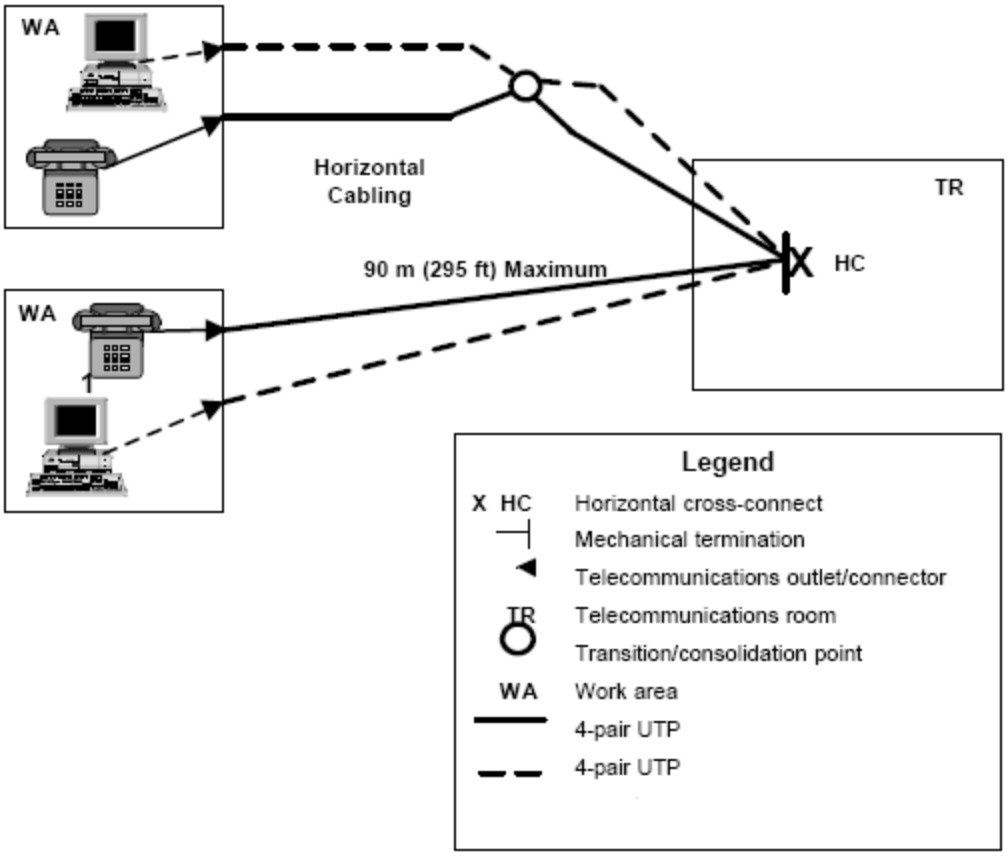
The figure below is an illustration of the City of Toronto commercial building cabling topology. Some of the cabling system such as CAT3/5e backbone, may or may not be applicable to the project.



Elements of the City of Toronto Standard Topology for Commercial Facilities

DESIGN SUMMARY

- The network shall be a distributed star topology network.
- All horizontal copper cables shall connect to the TE/TR from the WAO and fibre backbone cable shall connect to the ER (Server Room) from the TR/TE. The CAT3/5e backbone cabling from the TR/TE to the ER, may or may not be applicable to all the CoT projects.
- The specified copper network cables for all commercial buildings shall be Belden.
- The horizontal copper cable shall be U/UTP Category 6/6A and shall be in accordance to this specification.
- Length of the patch cables from WAO to the end device shall be in compliance to the Ethernet and structured cabling applicable standards.



- The backbone copper multi-pair (minimum 25 pairs) cable shall be U/UTP Category 3/5e and shall be in accordance to this specification. The multipair backbone, may or may not be applicable to all the CoT projects.
- The containment system for the voice and data network shall be as per the specified material mentioned in this document, unless specified otherwise on the design drawings/project scope. The approved conduit system is EMT type, appropriately sized as per TIA-569 standard. The cable tray shall be basket wire mesh type, corrosion resistant, standard sized as per TIA-569.
- The horizontal copper cables shall be permanently terminated at the patch panel in the Telecommunications Enclosure (TE) on one end, to a work-area outlet on the other end located on the walls of a commercial building.
- Horizontal cables in the commercial buildings shall always be collated of two (2) cables per work area outlet (WAO) located on the wall/furniture of the closed office or a cubicle.
- Office cubicles shall contain 1 WAO with 4 ports (1 Voice/VoIP, 1 Data and 2 Blank ports).

- Closed offices shall contain 1 WAO with 4 ports (1 Voice/VoIP, 1 Data and 2 Blank ports), shall be provided to every 10m^2 (100ft^2) of office space (i.e. if the office is 10m^2 then it shall have 1 WAO). If the office is larger than 10m^2 (100ft^2), then 2 WAOs shall be provided (with 2 Data and 2 Blank ports for the 2nd WAO).
- Each group of horizontal cables shall be associated with a single 4-port, work-area outlet on the wall/furniture and a 4-port, snap-in faceplate in the Telecommunication Enclosure patch panel.
- Approval for additional ports per cubicle or office must be granted by CoT IT/Network Services Technical Representative before proceeding with this work.
- Containment pathways shall be designed and sized for a minimum of four (4) horizontal cables, unless otherwise mentioned differently in the design drawings.
- The Fibre Optic Backbone is defined as the fibre optic segments radiating out from the Network Core Closet to the Telecommunications Enclosure/Room.
- The fibre allocation within the fibre optic backbone cable is as follows:
    - 12 Core fibre backbone: Multimode (OM4) and/or Singlemode (OS2)
    - City of Toronto LAN — 4 fibre strands active (2 primary, 2 redundant and 8 reserved)
    - All fibre cables shall be terminated and tested bi-directionally to the appropriate wavelengths (850/1300nm | 1310/1550nm) using calibrated certified testing equipment
- All passive network components shall be from a single manufacturer (Belden).
- The term "free-issue" refers to equipment supplied by the City. All the Network Switching and Routing Equipment will be freely issued by the City. The network equipment will be configured, tested and installed by City of Toronto IT/Network Services group.

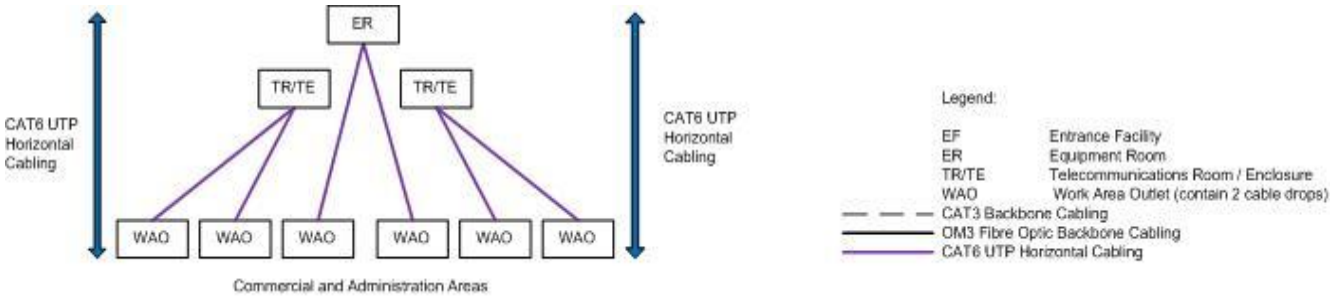
DESIGN DETAILS OF HORIZONTAL CABLING SYSTEM (CABLING SUBSYSTEM – 1)

Horizontal cabling includes installation cable, telecommunications connector/jack/module at the work area outlet (WAO), and mechanical terminations at both ends. Patch cords are required at WAO and TR/TE. Horizontal cabling length limitation requirements as specified in the ANSI/TIA-568.0-E and ANSI/TIA-568.1-E standards apply unless otherwise specified in this Standard.

TOPOLOGY

The horizontal cabling shall meet the star topology requirements of ANSI/TIA-568.0 and ANSI/TIA-568.1. Each telecommunication work area outlet (WAO)/connector/module shall be connected to the

horizontal cross-connect (HC) located at the TE/TR as shown in figure below. The horizontal installation cable shall be terminated on a jack/module (balanced twisted pair) at one or both ends.



Horizontal Cabling Topology

LENGTH

The horizontal cable length extends from the termination of the media on a patch panel at the TE/TR to the telecommunications connector/jack/module at the work area outlet (WAO). For balanced twisted-pair cabling the max permanent link length in the office/administration areas shall be 90m (295ft).

The length of the cross-connect/inter-connect jumper or patch cord at the cross-connect facility, including TE/TR, shall not exceed 5m (16ft) in the office/admin work area and 5m (16ft) in the TE/TR.

RECOGNIZED MEDIA

The recognized media, which shall be used individually or in combination, are:

- Minimum 4-pair 100 ohm balanced twisted-pair cabling, category 6 or higher
- 4-pair 100 ohm balanced twisted-pair cabling, category 6A (as per ANSI/TIA-568.2-D, preferred)

The Recognized media and associated connecting hardware, jumper, patch cord, equipment cord, and work area cord shall meet the requirements specified in this document.

CHOOSING MEDIA

Cabling specified by this Standard is applicable to different requirements within the commercial premises. Depending upon the characteristics of the individual application, choices with respect to transmission media should be made. In making this choice, factors to be considered include:

- Environmental classifications;
- Mitigation such as separation, protection or isolation;

- Cabling performance enhancements in accordance with performance test requirements;
- Applications to be supported by the cabling system;
- Equipment vendor recommendations or specifications;
- Configuration of cabling components;

The recognized cable has individual characteristics that make it suitable for a myriad of applications such as voice, data, video, automation and building controls, security, fire alarm, HVAC and audio visual (AV).

DESIGN DETAILS OF BACKBONE CABLING SYSTEM (CABLING SUBSYSTEM – 2 AND 3)

Backbone cabling is the portion of the commercial building telecommunications cabling system that provides interconnections between Entrance Facility (EF), Equipment Room/Server Room (ER) and Telecommunications Room/Enclosure (TR/TE). Primary and redundant, 12 strands in each cable shall run between the equipment room and the telecom room. Total of 2 x 12 strands shall run with diverse pathways between the equipment and telecom rooms. As such, the backbone cabling shall meet the requirements of ANSI/TIA-568.0, ANSI/TIA-568.2 and ANSI/TIA-568.3 for Cabling Subsystem 2 and Cabling Subsystem 3.

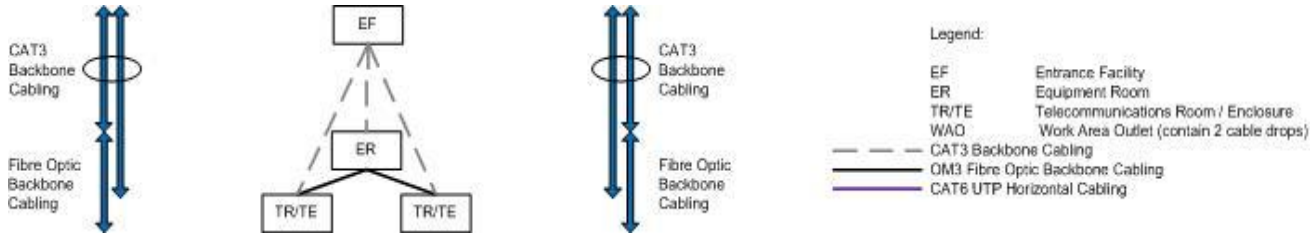
Backbone cabling consists of the multipair copper/fibre cable(s), intermediate and main cross-connect mechanical terminations and patch cords or jumpers used for backbone-to-backbone inter-connection. The cabling should be planned to accommodate future equipment needs, diverse user applications, ongoing maintenance, service changes and relocation.

TOPOLOGY

The backbone cabling shall meet the hierarchal star topology requirements of ANSI/TIA-568.0, unless otherwise specified by this Standard.

There shall be no more than two hierarchical levels of cross-connect in the backbone cabling. From the Horizontal Cross-Connect (HC) or Telecommunications Enclosure/Room (TE/TR), no more than one cross-connect shall be passed through to reach the Main Cross-Connect (MC) or Equipment Room (ER) depending on configuration. Therefore, connections between any two HCs shall pass through three or fewer cross-connect facilities.

NOTE – The topology required by this specification has been selected because of its acceptance and flexibility in meeting a variety of application requirements. The limitation to two levels of cross-connects is imposed to limit signal degradation for passive systems and to simplify moves, adds and changes. This limitation may not be suitable for facilities that have a large number of buildings or those that cover a large geographical area.



Backbone Cabling Topology

COMMERCIAL FACILITIES

The incoming fibre cable from the service provider enters the building Entrance Facility (EF) and spliced to ISP fibre at EF if the distance from the EF to the ER exceeds 15m (50ft). The ISP service provider cable runs from EF and terminates at Equipment Room (ER).

The multipair copper cable (if applicable to the project) for centrex voice runs from the ER/TR/TE to EF.

SMALL COMMERCIAL SITES

In small commercial buildings of City of Toronto, there is no ER. The TE/TR acts as an ER. The incoming fibre cable from the service providers enters the facility and spliced to ISP fibre if the distance from the facility entrance to the TE/TR exceeds 15m (50ft). The ISP service provider cable runs from entrance point and terminates at Telecom Enclosure (TE)/Telecom Room (TR)/Equipment Room (ER).

LENGTH

The backbone cable length extends from the termination of the media at the EF (Entrance Facility) to an IC (Equipment Room) or HC (Telecommunications Enclosure/Room). To minimize cabling distances, it is often advantageous to locate the EF near the center of the premises. Cabling installations may be divided into areas, which can be supported by backbone cabling within the scope of this Standard.

Cabling length is dependent upon the application and upon the specific media chosen (see ANSI/TIA-568.0 and the specific application standard). The backbone length includes the backbone cable, patch cords and cross-connect/inter-connect jumpers.

The length of the cross-connect/interconnect jumpers and patch cords in the EF or IC should not exceed 20m (66ft). The length of the cord used to connect telecommunications equipment directly to the EF or IC should not exceed 30m (98ft). For backbone link length less than 150m (492ft), OM4 multimode fibreoptics cable shall be used. More than 150m (492ft), OS2 singlemode fibreoptics cable shall be used.

BACKBONE RECOGNIZED MEDIA

Recognized cables with associated connecting hardware, jumpers, patch cords, and equipment cords shall meet the requirements specified in this document. The recognized media of backbone shall be:

- For Data, the fibre allocation within the fibre optic backbone cable is as follows:
    - 12 Core fibre backbone: Multimode (OM4) and/or Singlemode (OS2) as per backbone cable link length requirements mentioned above
- For Centrex Voice:
    - CAT3/5e multipair U/UTP cabling (if applicable), 25 pair (or higher pair count)

CHOOSING MEDIA

Backbone cabling specified by this Standard is applicable to a wide range of different user requirements. Depending upon the characteristics of the individual application, choices with respect to transmission media have to be made. In making this choice, factors to be considered include:

- Link length [≤ 150m (492ft) is OM4 multimode, > 150m (492ft) is OS2 singlemode]
- Useful life of backbone cabling
- Site size, user population and environmental conditions

Each recognized cable has individual characteristics that make it useful in a variety of situations. A single cable type may not satisfy all user requirements. It is then necessary to use more than one media in the backbone cabling. In those instances, the different media shall support the same facility architecture.

CABLING DIRECTLY BETWEEN TELECOMMUNICATIONS ROOMS / TELECOMMUNICATIONS ENCLOSURES

Cabling directly between HCs (Telecommunication Enclosures/Rooms) is not permitted. All backbone cabling must follow the star topology specified in ANSI/TIA-568.0 by connecting back to the IC (Equipment Room/Server Room).

DESIGN CONSIDERATIONS FOR SPACES, ENCLOSURES AND ROOMS

SPACES

- Spaces in commercial premises shall meet the requirements of ANSI/TIA-569-E.
- Spaces shall comply with local codes and regulations.

- Spaces should be designed to be compatible with the worst-case environment to which they will be exposed (see ANSI/TIA-568.0 and TIA/TSB-185 for information on environmental classifications).
- Temperature and humidity shall meet the requirements for Class 4 as per ANSI/TIA-569-E, unless stated otherwise.
- Perform additions and modifications to the existing Local Area Network as shown on the Contract Drawings.

DESIGN GUIDE OF EQUIPMENT ROOM / NETWORK / SERVER ROOM (ER)

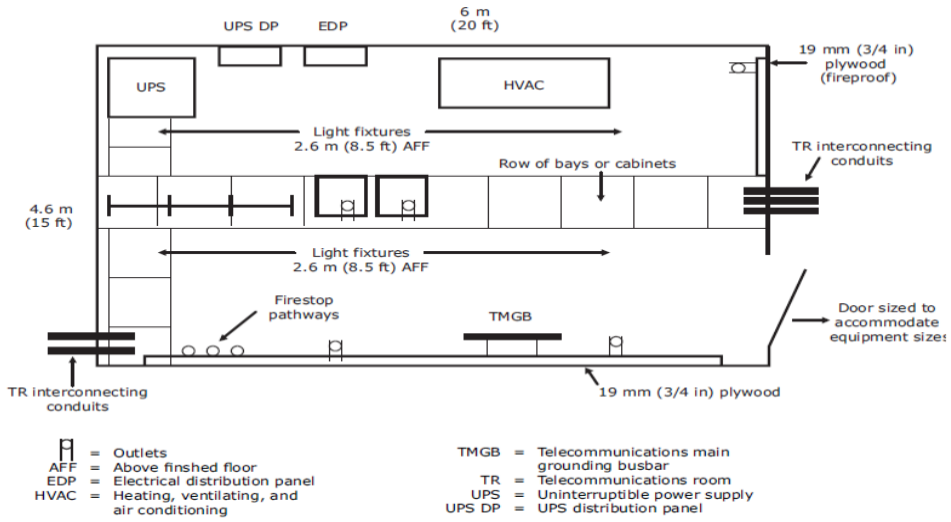
- If designing ER, consult this standard as a reference guide for Equipment Room (ER). Follow architectural/engineering drawings and project specifications as a design guide.
- The ER shall be strategically located to minimize the size and length of the backbone, especially in multiple-backbone situations.
- The ER shall accommodate the delivery of large equipment.
- The doors and hallways shall be sized appropriately for the movement of large equipment.
- Elevator or hoist and loading docks shall be available for large equipment movement.
- The weight capacity of the floors must be rated for large equipment.
- Any potential difficulties in scheduling and use of access routes and facilities for moving large equipment during installation and future changes shall be considered.
- Present and future needs shall be considered in properly locating and designing the ER.
- The ER telecommunications infrastructure shall be sized as required and capable of supporting a broad range of telecommunications applications required by the building or campus.
- Infrastructure shall be present for a large volume of cable between main distribution equipment and server racks.
- The ER telecommunications infrastructure shall be capable of supporting existing telecommunications equipment and/or cabling.
- The length of electrical power feeds from the electrical service entrance to the ER shall be minimized to aid in an optimal bonding and grounding arrangement.
- Access Card Reader should be added to access ER. Refer to CoT CORP SEC Standard for ACR/Sys.

- The distance (no closer than 3m [10ft]) to potential EMI and RFI sources shall be considered. These include transformers, motors, generators, radio transmitters, induction heating devices, photocopier, arc welding equipment, etc.
- The ER shall not be located in any place that may be subject to:
    - Water infiltration
    - Steam infiltration
    - Humidity from nearby water or steam
    - Heat (e.g. direct sunlight)
    - Corrosive atmospheric or adverse environmental conditions
    - Locations below water level unless infiltration preventive measures are employed.
- The ER shall not be located in any space in or adjacent to:
    - Mechanical rooms
    - Washrooms
    - Custodial closets
    - Storage rooms
    - Loading docks
    - Any area that contains sources of excessive EMI, hydraulic equipment, heavy vibration, steam pipes, plumbing, and cleanouts
- The ER must provide space for all planned equipment and access to all equipment for maintenance, administration and growth.
- The ER must meet the space requirements specified by equipment providers. Space and layout requirements for different telecommunications applications (e.g. voice, data) must be taken into account.
- For voice and data, provide $0.07m^2$ ($0.75ft^2$) of ER space for every $10m^2$ ($100ft^2$) of usable work area space.
- The minimum ER size shall be based on the known number of work areas as shown on the table below and not on usable floor area:

Equipment outlets served	Minimum floor space m^2 (ft^2)	Typical dimensions m (ft)
Up to 100	9 (100)	3 X 3 (10 X 10)
101 to 200	13.5 (150)	3 X 4.5 (10 X 15)
201 to 800	36 (400)	6 X 6 (20 X 20)
801 to 1600	72 (800)	6 X 12 (20 X 40)
1601 to 2400	108 (1200)	9 X 12 (30 X 40)

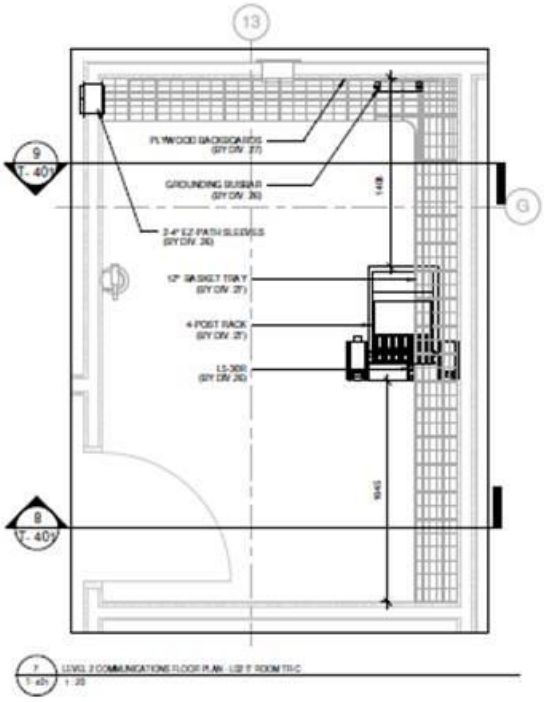
- The guidelines for other support equipment, such as power distribution, conditioner systems, and UPS up to 100kVA shall be permitted in the ER. UPS larger than 100kVA should be located in a separate room.
- The ER layout and floor plan shall comply with TIA-568, TIA-569 and BICSI TDMM latest edition.
- A minimum ER space of 3m (10ft) by 4.5m (15ft) shall be allocated.
- The ER shall include adequate space to support equipment changes with minimal disruption. Sizing shall include projected future as well as present requirements.
- Equipment not related to the support of the ER (e.g. piping, ductwork, pneumatic tubing, etc.) shall not be installed within, pass through, or enter the ER.

Typical equipment room layout



- The ER shall include space for environmental control equipment, power distribution/conditioners, and uninterruptible power supply (UPS) systems that may be installed.
- The ER shall be designed and comply with the City of Toronto (CoT) Security requirements.

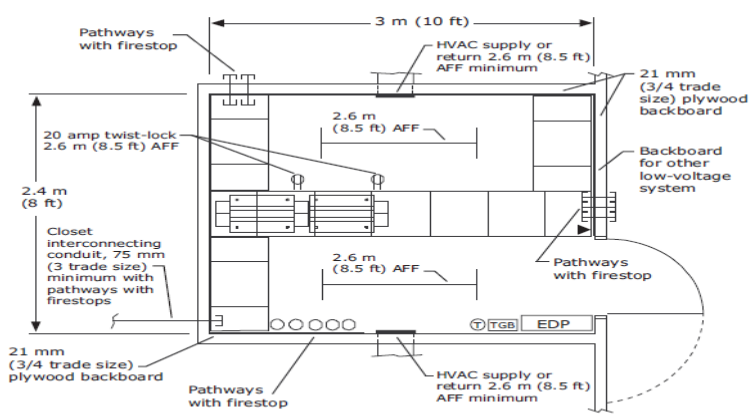
- The ER shall include barriers to protect sensitive network equipment from dust including door seals and air filtration.
- The ER shall include equipment and systems (grounding straps) to protect sensitive network equipment from static electricity.
- The ER shall be designed to comply with local zoning requirements for earthquakes and other natural disasters.
- The ER shall be designed to comply with NFPA-75 and include a pre-action fire protection system and hand-held fire extinguishers.
- The ER shall be designed for flood prevention and include a minimum of one floor drain for every 100m^2 (1075.84ft^2).
- The ER shall attenuate ambient room noise to acceptable Acoustic Noise level limits in accordance with applicable standards.
- There shall be no attachment of pull boxes or any type of panel/enclosure onto the surface of the Telecom Enclosure/Cabinet/Rack. It is strictly prohibited and shall not be allowed in any circumstances to have a box or enclosure attached/fixed on the surface of a Telecom Enclosure/Cabinet/Rack.



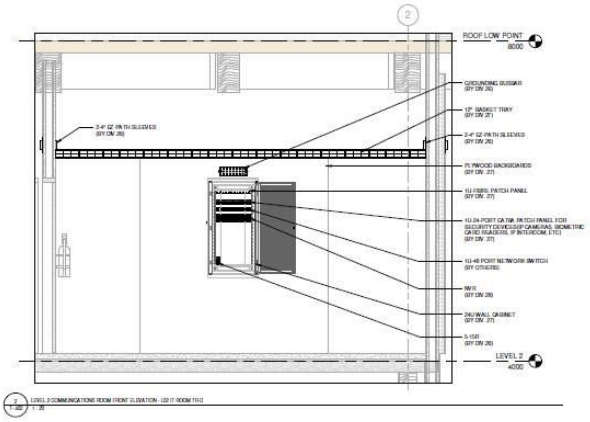
DESIGN GUIDE OF TELECOMMUNICATIONS ROOM (TR)

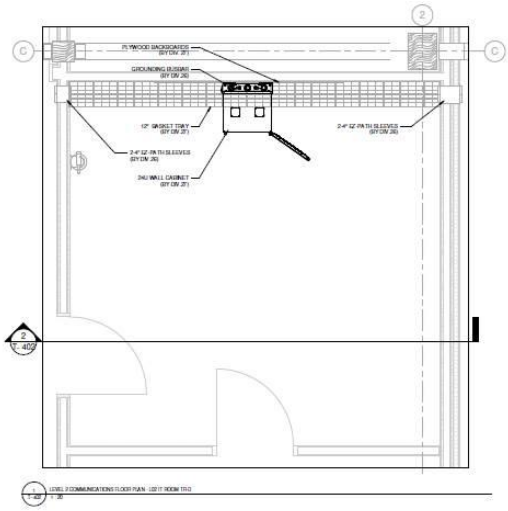
- If designing TR, consult this standard as a reference guide for Telecommunications Room (TR). Follow architectural/engineering drawings and project specifications as a design guide.
- A properly designed TR includes an HC (FD) that provides a floor-serving distribution facility for horizontal cabling. This cross-connect is capable of providing horizontal cabling connections to floor-serving telecommunications equipment and backbone cables from other TRs|TEs|ERs|EFs.
- Access Card Reader should be added to access ER. Refer to CoT CORP SEC Standard for ACR/Sys.
- The TR should be provisioned to house telecommunications equipment. In some cases, it may be necessary to combine the building and floor-serving functions of the ER and TR in one room. Instances where the two may be combined include smaller buildings (i.e., less than 500 m^2 [5400 ft^2]) and those with limited space for distribution facilities.
- There must be at least one TR per floor. Multiple rooms are required if the cable length between the HC (FD) and the telecommunications outlet location, including slack, exceeds 90m (295ft) or if the usable floor space to be served exceeds 929m^2 (10,000ft^2). For TRs that serve areas with an office density of less than one work area per 9.3m^2 (100ft^2) of usable floor space, a TR may serve larger areas, provided the horizontal cable length requirements are met.
- Figure below shows a typical layout of a full-size TR, suitable for a maximum of 480, 4 twisted-pair cable terminations. The drawing illustrates architectural, mechanical, electrical, and telecommunications requirements on a single plan view perspective for purposes of showing coordination issues. Actual design documents will typically separate requirements by discipline.

Typical telecommunications room layout



▼ = Telecommunications outlet/connector
Ⓣ = Thermostat
AFF = Above finished floor
EDP = Electrical distribution panel
HVAC = Heating, ventilating, and air conditioning
TGB = Telecommunications grounding busbar

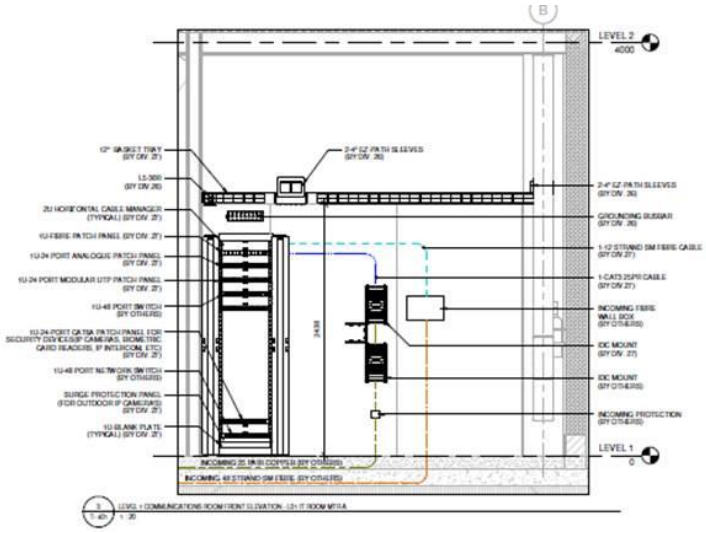




ENTRANCE FACILITY REQUIREMENTS (EF) | SHARED LAN/NETWORK ROOMS

- If designing EF, follow architectural/engineering drawings and project specifications as a design guide.
- Where functions of an entrance facility (EF) are combined with functions of the ER in the same space, the ER may house equipment dedicated to the Access Provider (AP). Requirements specified by the AP must be considered.

- As per ANSI/TIA-569-E, in shared LAN/Network Rooms between CoT-IT and other Agency/Third Party, individual spaces should be segregated by means of partitions using full size lockable cabinets or collocate cabinets. In extreme conditions, partitions may be comprised of cages, architectural assemblies or wire mesh walls.
- Where access providers and service providers share space (shared LAN/Network Rooms), individual spaces should be segregated by means of partitions. Partitions may be comprised of wire mesh walls or architectural assemblies.
- If separate AP space is required, it shall be adjacent to the EF. The design may require a mesh partition or locked cabinet. Space size at least 1.2m x 1.83m (4ft x 6ft) should be allocated for each AP.

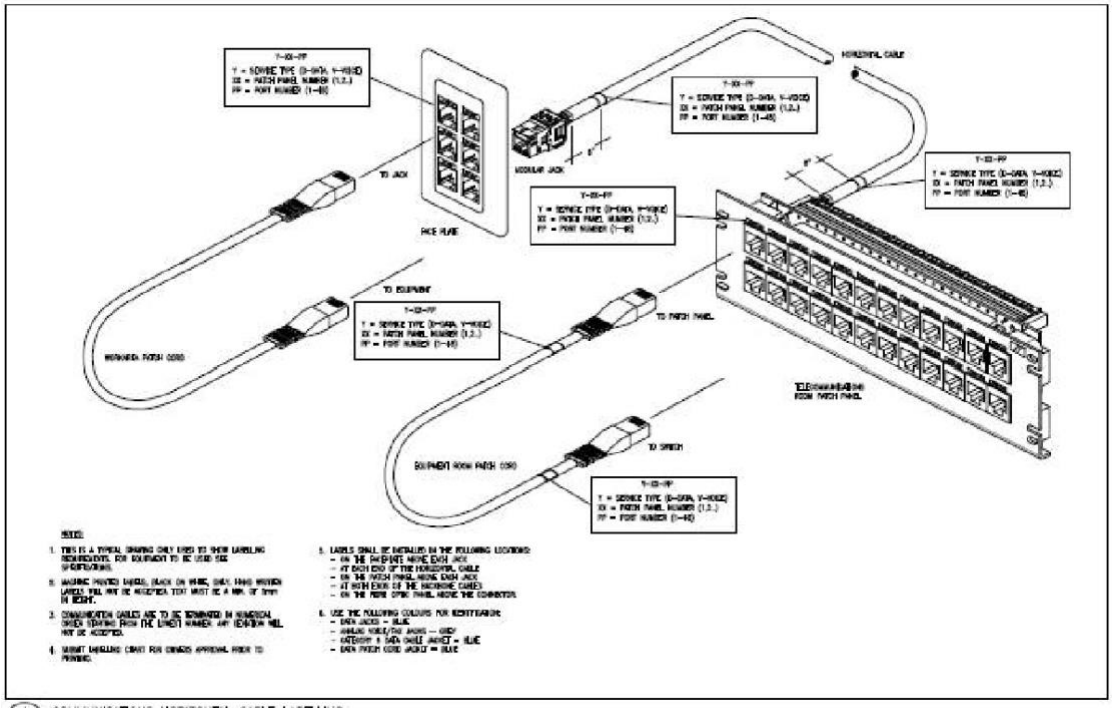


WORK AREA OUTLET (WAO)

- The work area outlet (WAO) components extend from the telecommunications outlet/connector end of the horizontal cabling system to the work area equipment. The telecommunications outlet/connector shall meet the requirements of this Standard. To simplify relocations, consider a single style of outlet/connector for all work area outlets of the same media type.

WORK AREA OUTLET (WAO) FOR OFFICE AREAS

- Provide one 4-ports, single-gang, work area outlet in each work area for termination of the horizontal CAT6/6A cables. Faceplate or decora module frame shall be from Belden.
- One 4-port, work-area outlet shall be associated with as many ports necessary (in groups of 2 or 4) on the snap-in faceplate installed in the patch panel of the Telecommunication Enclosure.
- In the majority of cases the 4-port, work-area outlet shall be installed within the cubical partitions. In some situations, the work-area outlet shall be installed directly on the wall in office areas.
- All UTP connectors in the office area shall be unshielded modular jacks and wired for a T586A wire-map.



1 COMMUNICATIONS HORIZONTAL CABLE LABELLING
N.T.S.

U/UTP PATCH CORD FOR WAO IN OFFICE AREAS

- Patch cords used in the WAO shall meet the requirements of ANSI/TIA-568.2. WAO cabling may vary in form depending on the application. When application-specific adaptations are needed at the WAO, it shall be external to the telecommunications outlet/connector.
- Supply two (2) 5-metres or less, CAT6/6A U/UTP patch cords for each work area outlet.
- The contractor is responsible for certifying that the supplied patch cords shall meet or exceed the requirements for U/UTP patch cords as described in the ANSI/TIA-568.0 standard.

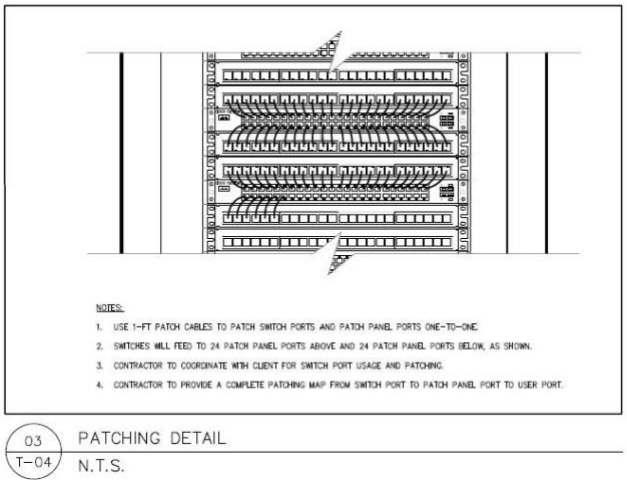
WORK AREA OUTLET (WAO) FOR WIRELESS ACCESS POINT (WAP)

- Provide one (1) 4-port, single-gang, work-area outlet, connectors and accessories for termination of the horizontal UTP cables (2 for each WAP) dedicated for Wireless Access Point (WAP). Where ever, it is possible to connect to the closest TR, additional and separate WAO may not be required.
- CAT6/6A modular jacks shall populate two (2) modules/jacks in a 4-port WAO for each WAP.
- Each 4-port, work-area outlet shall be associated with a 4-port, snap-in faceplate installed in the Telecommunication Enclosure patch panel.

- WAP Heatmaps are required for accurate location of WAOs. Sample heatmaps are in Appx-C.

UTP PATCH CORD FOR TE/TR/ER

- Supply minimum of 0.5 metre (2ft) CAT6/6A U/UTP patch cord for each data/VoIP drop (jack/module) to patch at TE/TR/ER.



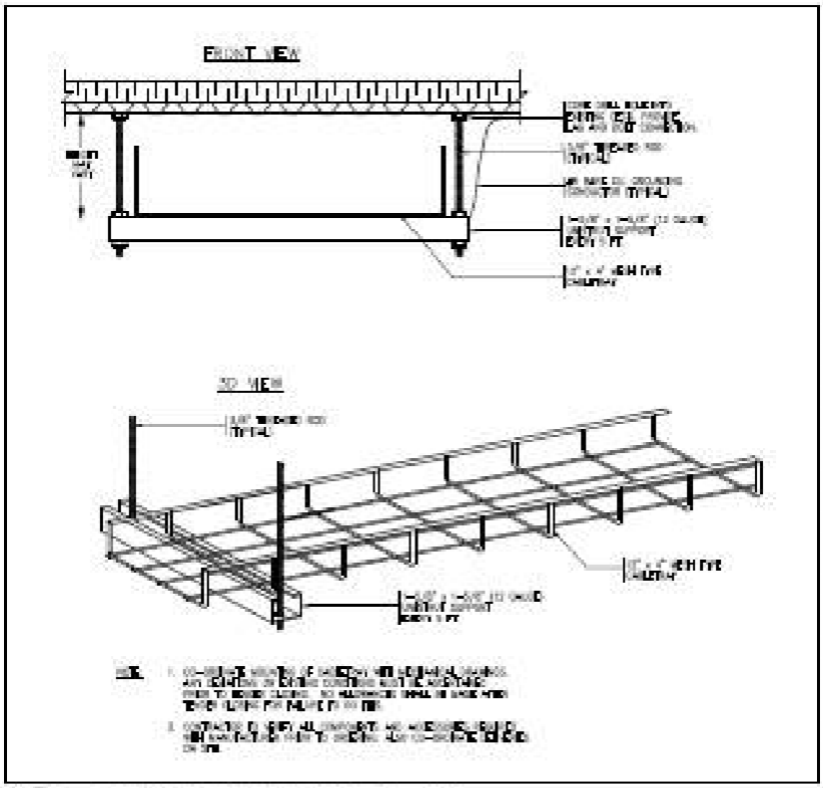
DESIGN CONSIDERATION OF PATHWAYS AND CONTAINMENT SYSTEM

- Pathways in commercial premises shall meet the requirements of latest ANSI/TIA-569 standard.
- Pathways should be designed to be compatible with the worst-case environment to which they will be exposed (see ANSI/TIA-568.0 for information on environmental classifications).
- Pathways in commercial premises shall comply with local codes and regulations.

DESIGN GUIDE OF CABLE TRAY SYSTEM

- All cable trays shall be either a ventilated trough, wire-mesh or ladder-rack type, pre-fabricated structure 300mm (12 inches) in width or greater.
- Ventilated trays shall be equipped with two side rails with a maximum height of 150mm (6 inches) and consisting of a light, rugged and tubular steel or aluminum construction.
- Should aluminum trays be specified (CoT approval is mandatory), the engineer is to ensure that, during the grounding or bonding aspects of the installation, the contractor uses tin plated or zinc coated ground connectors.

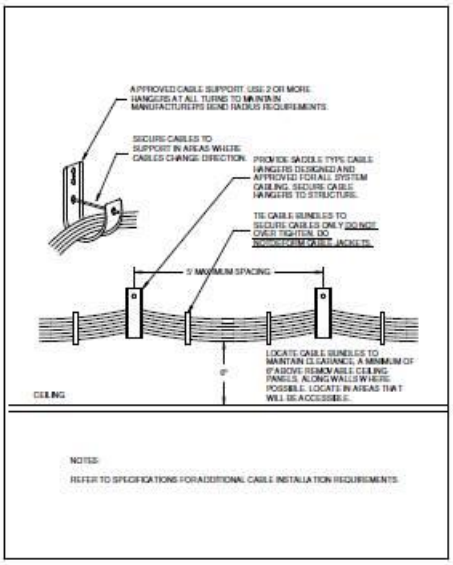
- Install the ventilated cable tray in the horizontal cable distribution system such as hallways and under floor.
- A cable ladder rack system is to be installed within the Equipment/Server Room (ER) and Telecom Rooms (TR). Refer to the project specifications/drawings or reference in this document for the type of ladder rack to be used in the horizontal cable distribution system and within the applicable ER/TR's. Spine type and improperly centre hung cable trays will not be accepted.
- All metal cable trays shall be bonded together to the TMGB/PBB or a TGB/SBB.
- All metal cable trays shall be coated to prevent rust or galvanic action.
- Accessories and fittings such as elbows and reducers shall be manufactured by the cable tray manufacturer.
- Install cable trays at least 300mm (12in) away from fluorescent luminaries and cross power cables at right angles.
- The minimum clearances for cable trays shall be in accordance with Canadian Electrical Code C22.1-09.
- Allow 300mm (12in) vertical clearance excluding the depth of cable trays, between cable trays installed in tiers.
- 300mm (12in) vertical clearance from the top of cable trays to all ceilings, heating ducts and heating equipment.
- 600mm (24in) horizontal clearance on one side of cable tray mounted adjacent to one another or to walls or other obstructions.
- All cable trays/ladders shall be labeled at regular intervals. The distance separating labels shall not exceed 15 metres (50ft).
- The design fill ratio of a cable tray is 25% to a maximum fill ratio of 50% as per ANSI/TIA-569 standard.



05 T-R5 CABLE TRAY MOUNTING DETAIL
N.T.S.

DESIGN GUIDE OF CONDUIT SYSTEM

- All telecommunications cables shall be installed in home run EMT conduits originating from the outlet to the cable tray system, Telecommunications Enclosure, or Telecommunications Room. The use of J-hooks, brackets and other attachments are not preferred but acceptable. Only Velcro ties are allowed. Plastic cable ties are not allowed in any condition.



5 / S-501 J-HOOK - INSTALLATION W/ CABLE HANGERS
N.T.S.

- The inside radius of a bend in a conduit shall be not less than six times the internal diameter when the conduit is less than 50mm (2in) in diameter and ten times the internal diameter when conduit is 50mm (2in) in diameter or larger.
- All zone conduits shall be identified and labeled at both ends and at regular intervals not to exceed 10 metres (32.8ft). Tags shall identify start and finish of conduit runs. Pull boxes shall be labeled on the exposed exterior.
- All conduits shall originate and be physically connected to the telecom backboards in the Equipment Room, Telecommunications Room, cable tray and pull box.
- All metallic parts of the cable distribution supporting system shall be bonded together mechanically inclusive of all transition points (i.e. cable tray and distribution conduit not mechanically connected) using a 6 AWG green jacketed stranded copper ground wire. The metallic components of the cable distribution system shall be bonded together at the ER and TRs and then bonded to their respective telecom ground busbars.
- All fittings, connectors and couplings shall be of the same material as the conduit used on site.
- All conduits/sleeves that enter the ER or any TR shall be fitted with an approved ground bushing with ground lug and bonded together mechanically (one continuous piece preferred). This shall be connected to the approved building ground by means of a No. 6 AWG to the grounding busbar.

- Cable fill capacities of conduit shall not be greater than 40%.
- All conduits entering or existing through the ceiling or walls of the ER or TR shall protrude into the room 25-50mm (1-2in).
- Riser sleeves in the Equipment Room/Server Room and Telecommunication Rooms shall protrude through the floor 50-75mm (2-3in) above finished floor (AFF).
- All conduit runs shall follow building grid lines and shall be concealed where possible.
- All conduits shall be EMT, reamed and bushed at both ends and bonded to the distribution system unless installed in areas deemed chemically hazardous in which cases PVC coated or Aluminum conduit shall be used. Approval from the City of Toronto is required in such instances.
- All conduit runs shall be a maximum of 30 meters (100ft) in length with a maximum of two 90 degree bends between pull points, unless otherwise specified.
- Conduits ending in the vicinity of a cable tray shall be terminated at a height of no less than 100mm (4in) and no more than 150mm (6in) from the top of the cable tray. Conduit runs shall not be punched through the side of the tray. Conduit ends shall be bonded to the cable tray.
- The use of LB, LL, LR, C and T type fittings are not permitted. Only LBs designed and manufactured for communications systems are allowed where applicable.
- Conduit fittings shall not be used in place of pull boxes or bends.

DESIGN GUIDE OF PULL BOX

- A pull box shall be placed in conduit runs where the sum of the bends exceeds 180 degrees, where the overall length of the conduit run is more than 30m (100ft), or if there is a reverse bend in the run.
- Pull boxes shall be constructed and sized in accordance with Canadian Electrical Code, TIA and BICSI standards of code gauge steel and shall have a rust resistant finish.
- In all instances pull boxes shall be placed in straight sections of conduit run and shall not be used in lieu of a bend. Corresponding ends of the conduit are to be aligned with each other. Conduit fittings shall not be used in place of pull boxes or bends.
- Conduit must enter the outlet boxes from the top or bottom.
- Pull boxes shall be installed at a reasonable height, in an exposed location and such that access for installation of cables is not prohibited. Pull boxes shall not be placed in a fixed false ceiling

space, unless immediately above a suitably marked and hinged access panel. Provide indicator decals on ceiling T-bar rail or ceiling tiles showing location of pull box or splice box.

- All conduits shall be installed in accordance with Canadian Electrical Code, Part 1 Section 12, applicable building codes and ANSI/TIA 569.
- The minimum size (inside diameter) for conduit running between the Equipment Room or a Telecommunications Room and the Telecommunications outlet at an outlet location is 25mm (1in).
- The maximum horizontal cable run distance shall not exceed 90 metres (295ft).
- The cable length from the mechanical termination in the TR and ER to the telecommunications outlet, where the horizontal distance exceeds 90m (295') provided additional rooms as required.
- Future requirements for additional cables to each outlet shall be considered.
- A pull cord shall be installed in all conduits.
- The telecommunications outlet conduit system shall be labeled green.
- Place pull boxes in readily accessible locations only.
- The use of LB, LL, LR, C and T type fittings are not permitted. Only LBs designed and manufactured for communications systems are allowed where applicable.
- There shall be no attachment of pull boxes or any type of panel/enclosure onto the surface of the Telecom Enclosure/Cabinet/Rack. It is strictly prohibited and shall not be allowed in any circumstances to have a box or enclosure attached/fixed on the surface of a Telecom Enclosure/ Cabinet/Rack.

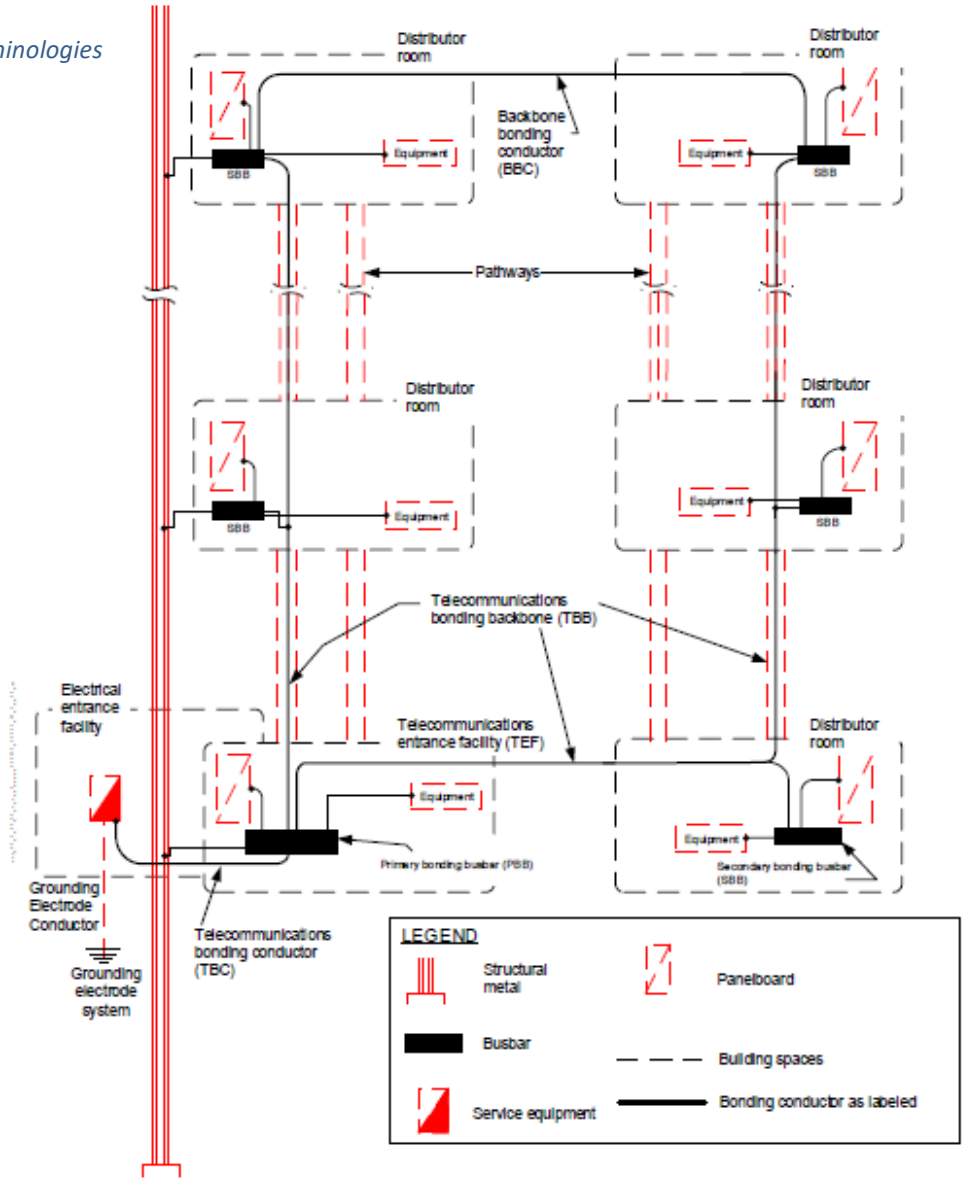
DESIGN GUIDE OF TELECOMMUNICATIONS BONDING AND GROUNDING SYSTEM

In general, a telecommunications grounding system contains the following components:

- Primary Bonding Busbar (PBB) or Telecommunications Main Grounding Busbar (TMGB)
- Telecommunications Bonding Backbone (TBB)
- Secondary Bonding Busbar (SBB) or Telecommunications Grounding Busbar (TGB)
- Telecommunications Bonding Conductor (TBC)

- The Telecommunications Bonding Backbone (TBB) consists of green jacketed stranded copper conductors and insulated copper busbars. The system extends from the Building Grounding Electrode Conductor through the ER to the TR's, within the building. The construction of the TBB is a requirement of the latest version of the ANSI/TIA-607. This standard shall be used in the design, installation, management and administration of the TBB systems in CoT facilities.

TIA--607-Terminologies



- All metallic parts shall be bonded together mechanically and attached to the approved building ground in accordance with applicable CEC, TIA and CSA standards. In all cases, the CEC shall be met or exceeded.

- Bonding conductors shall be continuous and routed in the shortest possible straight-line path. Any bends placed in the conductor shall be sweeping bends.
- Aluminium wires, clamps or terminal connectors are not acceptable for grounding and bonding.
- The following general requirements shall apply when constructing the TBB system:
    - An insulated pre-drilled, electro tin plated copper busbar, minimum dimensions of 6mm thick x 100mm wide and variable in length, shall be installed on the wall of the ER/EF adjacent to the cable entrance conduits, 150mm from the corner of the ER/EF and 150mm AFF. This busbar is known as the Primary Bonding Busbar (PBB) or Telecommunications Main Grounding Busbar (TMGB) and shall be insulated from its support by a minimum of 50mm.
    - An insulated pre-drilled, electro tin plated copper busbar, minimum dimensions of 6mm thick x 50mm wide and variable in length shall be installed on the wall of each TR (formally known as a Telecom Closet - TC), adjacent to the cable entrance sleeves, 150mm from the corner of the TR and 300mm AFF. These busbars are known as the Secondary Bonding Busbar (SBB) or Telecommunications Grounding Busbars (TGBs) and shall be insulated from its support by a minimum of 50mm.
    - A green jacketed stranded copper ground wire sized to maintain a voltage drop of less than 40 Volts under maximum short time rating. This wire shall be sized no smaller than No. 6 AWG nor larger than a 3/0 and shall be installed from the service equipment ground (main building ground) to the PBB/TMGB in the ER/EF. This ground wire is known as the Telecommunications Bonding Conductor (TBC). The Telecommunications Bonding Conductor (TBC) may be secured to the surface of the building if not subject to physical and mechanical damage, or installed in non-ferrous conduit. If ferrous conduit, such as EMT is used, the conductors shall be bonded to each end of the conduit with a conductor minimum sized as a No. 6 AWG green jacketed stranded copper ground wire.
    - The TBC shall be connected to the Primary Bonding Busbar (PBB)/Telecommunications Main Grounding Busbar (TMGB). The connection to the PBB/TMGB shall be done using a 2-hole electro tin plated compression lug. All joints to the TBC shall be done using irreversible compression-type connectors, exothermic welding, or equivalent.
    - The Telecommunications Bonding Conductor (TBC) shall be connected to the service equipment ground (main building ground) by qualified personnel and in accordance with the CEC and ANSI/TIA-607.
    - A green jacketed stranded copper ground wire sized the same as the Bonding Conductor for Telecommunications, shall be installed from the farthest TR, through each TR to the

Bonding Conductor for Telecommunications located in the ER/EF. This ground wire is known as the Telecommunications Bonding Backbone (TBB). The TBB may be fastened to the underside of open cable tray or installed in non-ferrous conduit. If ferrous conduit, such as EMT is used, the conductors shall be bonded to each end of the conduit with a conductor sized as a No. 6 AWG minimum.

- The TBB in each TR shall be connected to the SBB/TGB. All joints to the grounding wires shall be done using irreversible compression-type connectors, exothermic welding, or equivalent. The connection to the SBB/TGB shall be done using 2-hole compression connectors.
- The PBB/TMGB in the ER/EF and the SBB/TGB in the TR/TE(s) shall be bonded to the closest electrical panel using a No. 6 AWG green jacketed stranded copper ground wire.
- The metallic components of the horizontal distribution supporting infrastructure (conduits, cable trays and ducts) shall be bonded to the to the telecommunications busbars of the ER/EF or TR/TE in which they originate using a No. 6 AWG green jacketed stranded copper ground wire.

- A No. 6 AWG green-jacketed stranded copper ground wire shall be installed from each telecommunications busbar to the metal frame (structural steel) of buildings that are effectively grounded and whose structural steel is accessible.

SEPARATIONS FROM EMI

- Copper cables shall not be installed at a distance less than 300mm from lighting ballasts, less than 1 meter from electric motors or at a separation distance from source of 480V or less.
- Where electric power cable is not installed in EMT conduit, telecommunications cable shall not be run in parallel with it for more than 10 meters if the separation is less than 300mm.
- Electrical protection must be provided for copper cables entering the building. Protection shall be in accordance with the Canadian Electrical Code CSA C22.1-2006 and BICSI practices.

DESIGN GUIDE OF TAGGING CONVENTION (IDENTIFICATION AND LABELING)

- The requirements of this section shall take precedence over other sections.
- The labeling of the City of Toronto network components, structured cabling and cable routing/containment shall comply with the ANSI/TIA-606 standard

- The codification of network components, cables and cable routing shall follow the identification standards detailed in this standard.
- For example:
  - Building Location: YDE – 30 Dee Ave
  - Floor and Room Location: ER – Equipment Room / Server Room / Main Communications Room

    TRA – Telecom Room - A

    TRB – Telecom Room – B

    EF - Entrance Facility
  - Service Provider / Network Cabinet Label in ER: COT-IT-YDE-0100

    Network Closet
  - Network Cabinet Label in ER: COT-IT-YDE-0200

    Network Closet
  - Server Cabinet Label in ER: COT-IT-YDE-0300

    Server Closet
  - Patch Panel: A – Data Patch Panel A (A,B,C, etc …)

    FP01 – Fibre Optic Patch Panel

    TP01 – Telephone/Voice Patch Panel
  - Patch Panel Port: 01 – Patch Panel Port (01, 02, 03, …, 24)
  - Work Area Number: 125 – Work Area number associated in the admin/office areas of the facility
  - Work Area Outlet: WA01 – Work area outlet (01, 02, 03, etc…)

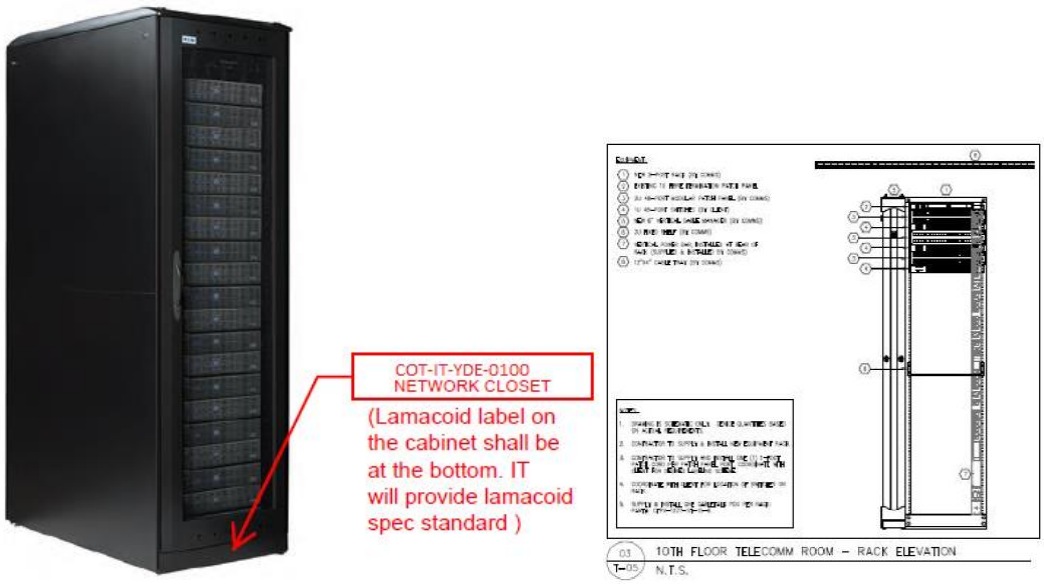
    1 – Port number (1, 2, 3, 4)

EQUIPMENT / NETWORK / SERVER ROOM CABINETS IDENTIFICATION AND LABELING

- Equipment Room/Server Room network enclosure contains active network components, including: Network Core Closet, Server Closet and Telecommunications Enclosure.
- All Network Closets/Cabinets related to the Equipment Room (ER) shall be tagged as follows.

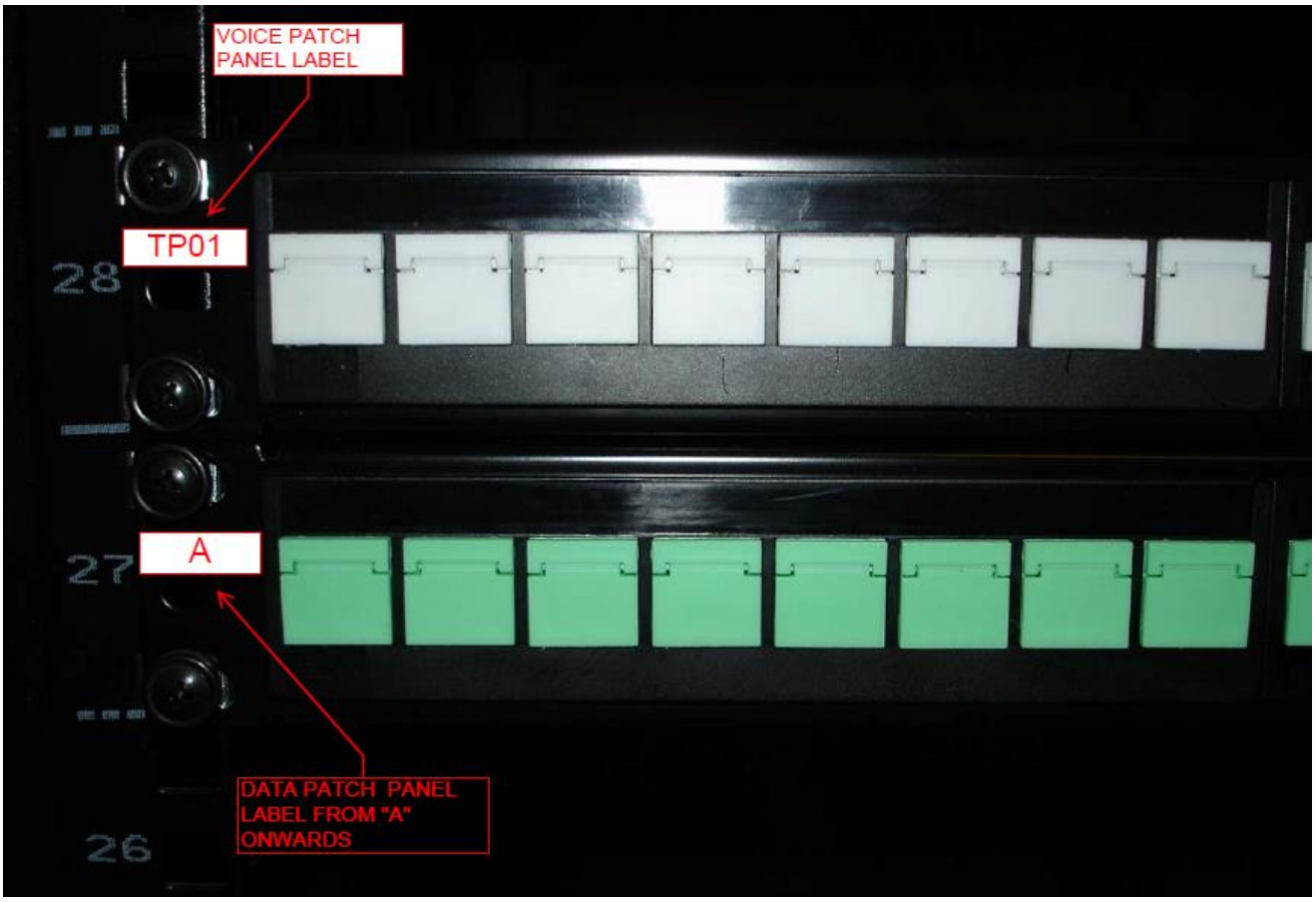
- COT-IT-XYZ-XX00, where:
  - XYZ = Site three-character code name
  - XX00 = First two numbers (XX) identify the closet

- For all closets/enclosures/cabinets in the Equipment Room, the last two numbers are always zero (00).
- For Closets/Cabinets in the Equipment Room, they are numbered from (0100) to (1000).
- Network Core Closet and Server Closet nameplate shall conform as follows:
  - Provide nameplate for each enclosure on the bottom-center of the door, front and back.
  - Use engraved gravoply laminate nameplates using black letters on a white background.
  - The laminate nameplates shall have a dimension of 210mm W x 50mm H.
  - Minimum character height shall be 12mm. Character lettering shall be centered on each line.
  - Mount nameplates with two stainless steel machine screws.
  - Include device identification (tag) number as well as a descriptive name.
  - For example: the tag name: COT-IT-XYZ-0100 followed by the description: Sample nameplate diagram is as below:

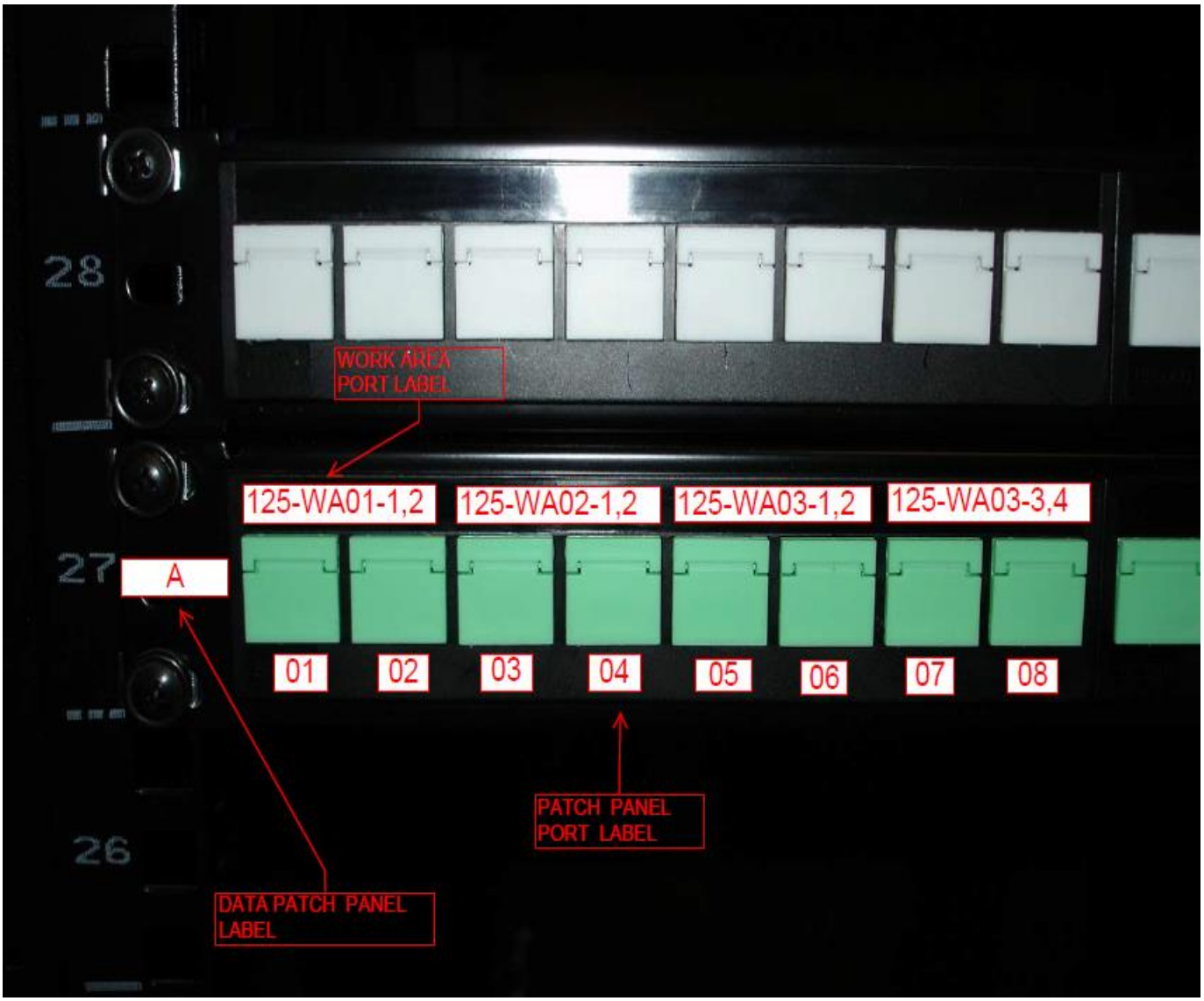


COPPER PATCH PANEL (CP) & WORK AREA OUTLET (WA) IDENTIFICATION AND LABELING

- The copper data patch panels in a Telecommunications Enclosure/Closet shall employ one character A, B, C, …, Z. The rack shall be populated with patch panel(s) as necessary and labeled in sequential order from top to bottom.
- For example, the first copper data patch panel from the top of the rack shall be labeled A, the second shall be B, and so on.
- Each 24-port patch panel shall have six (6) snap-in faceplates that group four terminations. For office areas, the minimum number of ports associated with a work area outlet shall be a group of two (2) ports.
- Labels shall be applied to patch panels in such a manner as to be readily visible and not obscured by structured cabling or patch cords.



- Labels for each 4-port or 2-port, snap-in faceplate shall be laser printed, self-laminating, adhesive, polyester or polyolefin. Hand-written labels shall not be accepted.
- Lettering shall be black on a white background. Characters are a minimum of 4mm high.
- Apply a label on the top of each group of 4-ports or 2-ports on the snap-in faceplate to indicate the destination of the cables terminated on the data ports (RJ).
- For office areas, the label 125-WA01 would be applied on the patch panel for a group of 2 ports with destination cables to work area outlet 125-WA01. Whereas, 125 represents the room number of the facility and WA01 represents the work area 01.



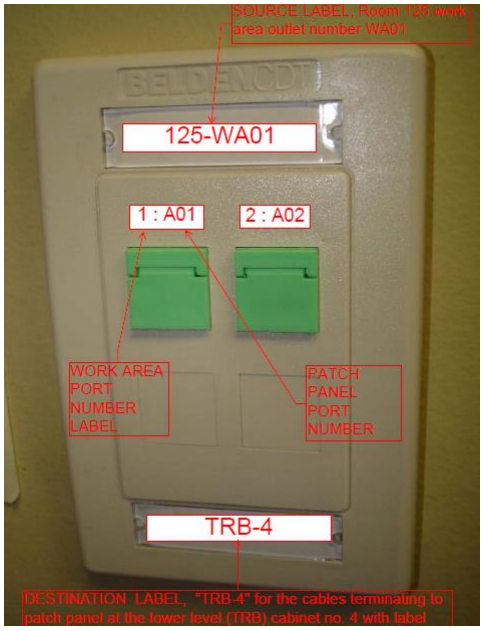
- Apply a two-digit label immediately above each data port (RJ) indicating its destination port number on the work area outlet. For example, a group of four consecutive ports on a 24-port patch panel whose destination is port numbers 1 to 4 on a WAO would have the ports labeled 1, 2, 3, 4. Provide color-coded, snap-in icons for each data port (RJ).

FIBREOPTICS PATCH PANEL (FPP) IDENTIFICATION AND LABELING

- Lettering shall be black on a white background. Characters are a minimum of 4mm high.
- Terminate all 12 fibres of each fibre optic cable in Fibre Enclosures (Telecommunications Enclosure or Network Core Closet).
- The fibre cable for all even-numbered Telecommunications Enclosures shall terminate at Network Core Closet 02 (XYZ-0200) while odd-numbered shall terminate at Network Core Closet 01 (XYZ-0100).
    - For cases where Network Core Closet 01 and Network Core Closet 02 are located in different Equipment Rooms, Telecommunications Rooms / Telecommunications Enclosures shall have fibre terminating in both Network Core Closets.
- The ordering and color of individual fibres shall be the same for each fibre cable and compliant with the latest ANSI/TIA-568.3 and ANSI/TIA-598 standards.
- Labels for patch panels shall be laser printed, self-laminating, adhesive, polyester or polyolefin. Hand-written labels shall not be accepted.
- Labels shall be applied to patch panels in such a manner as to be readily visible and not obscured by structured cabling or patch cords.
- A label shall be applied to the top of the LC duplex adapter modules associated with a single fibre cable indicating the destination of the cable.
- For example, the adapter modules that terminate the fibre cable whose destination is Telecommunications Enclosure 1400 would be labeled as XYZ-1400.
- The fibre patch panel label shall be labeled as follows FPXX where XX is the fIbre patch panel sequence i.e. 01, 02, 03…etc. The rack shall be populated with patch panels as necessary and labeled in sequential order from top to bottom.
- For example, the first patch panel from the top of the rack would be labeled as FP01, the second is FP02 and so on.

WORK AREA OUTLET (WAO) IDENTIFICATION AND LABELING

- Labels for each 4-port, work area outlet shall be laser printed, self-laminating, adhesive, polyester or polyolefin. Hand-written labels shall not be accepted.
- Lettering shall be black on a white background. Characters shall be a minimum of 4mm high.
- A label shall be applied to the top of each 4-port, work-area outlet indicating the source of the Horizontal cables.
- For example, WAO port 1 connected to patch panel A port 1 would be labelled as A01. WAO port 2 to patch panel A port 2 is labelled A02 and so on.



CABLE IDENTIFICATION AND LABELING

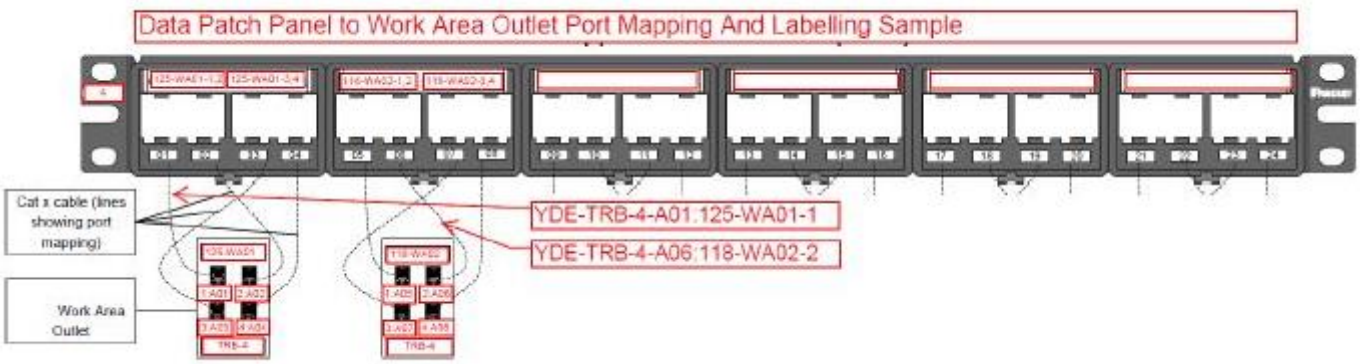
- Use durable non-fading sleeve type wire markers to identify all network cables.
- Labels for cabling shall be laser printed, self-laminating, adhesive, polyester (indoor/outdoor). Hand-written labels will not be accepted.
- Lettering shall be black on a white background. Characters shall be a minimum of 4mm in height.

FIBREOPTICS BACKBONE CABLE IDENTIFICATION AND LABELING

- As a minimum, all fibre optic backbone cables shall be labeled at both ends of the cable, within every pull box and every 15 metres.
- In addition, the fibre backbone cables shall be labeled at each transition. A transition is defined as: a change in ducting (e.g. cable tray to conduit), a change in direction of more than 45 degrees, or an entrance and exit of ducting through a wall or floor.
- If the fibre cable is run in conduit then the transition labels shall be applied to the conduit.
- The tagging convention for identification of fibre optic backbone cables shall indicate the source and destination of the cable separated by a colon.
- For example, a fibre optic backbone cable whose source is Network Core Closet 2 (XYZ-0200), Fibre Patch Panel 01, adapter panel A and terminates in Telecommunications Enclosure 1400 (XYZ-1400) on the fibre patch panel 01 adapter panel A would have the following tag: 0200-FP01-A.01: 1400-FP01-A.01. The last “01” digits represent fibre strands.
- The Telecommunications Enclosure fibre optic patch panel must be labeled. For example: Telecommunication Enclosure 1400 with two fibre optic patch panels would be labeled "FP01" and "FP02", where "FP01" is the first patch panel from the top.

HORIZONTAL COPPER CABLE IDENTIFICATION AND LABELING

- As a minimum, all horizontal CAT6/CAT6A cables shall be labeled at both ends of the cable, within every pull box and every 15 metres.
- In addition, the cables shall be labeled at each transition. A transition is defined as: a change in ducting (e.g. cable tray to conduit), a change in direction of more than 45 degrees, or an entrance and exit of ducting through a wall or floor.
- If the cable is run in conduit then the transition labels shall be applied to the conduit.
- The tagging convention for identification of Horizontal cables shall indicate the source and destination of the cable separated by a colon.
- Example 1: a horizontal cable whose source is Telecommunications Enclosure TRB-4, Patch Panel A, port 01 and whose destination is port 1, Work-Area Outlet 01, in room number 125 would have the following tag: YDE-TRB-4-A01:125-WA01-1.



VOICE BACKBONE COPPER CABLE IDENTIFICATION AND LABELING

- As a minimum, all voice backbone cables shall be labeled at both ends of the cable, within every pull box and every 15 metres.
- In addition, the voice backbone cables shall be labeled at each transition. A transition is defined as - a change in ducting (e.g. cable tray to conduit), a change in direction of more than 45 degrees, or an entrance and exit of ducting through a wall or floor.
- If the voice cable is run in conduit then the transition labels shall be applied to the conduit.
- The tagging convention for identification of voice cables between the voice block and the Telecom Closet/Enclosure patch panel in the building shall be VFFA-CC : XYZ-A-TP01 (indicate the source and destination of the cable separated by a colon), where V indicates voice, FF indicates the floor number, EF indicates telecommunications entrance facility ID, CC indicates 2-digit voice cable number, and XYZ-A is telecommunications closet/enclosure ID.
    - For example, voice cable 01 whose source is entrance room EF and terminates in Telecommunications Room B (YDE-TRB) on patch panel TP01 would have the following tag: V01EF-01 : YDE-TRB-TP01.

PATCH CORD IDENTIFICATION AND LABELING

- As a minimum, all Contractor installed CAT6/CAT6A or fibre optic patch cords shall be labeled at both ends of the cable.
- The tagging convention for identification of patch cords shall indicate the source and destination of the cable separated by a colon. The source is the switch port and the destination is the patch panel, termination point.

CABLE PATHWAYS IDENTIFICATION AND LABELING

- All ducting (cable tray or conduit) carrying fibre optic and multi-pair voice backbone cables shall be tagged as "LAN BACKBONE ".
- All ducting (cable tray or conduit) carrying Horizontal cables shall be tagged as "LAN HORIZONTAL" with the source and destination network panels.
- All ducting shall be labeled at each transition. A transition is defined as - a change in ducting (e.g. cable tray to conduit), a change in direction of more than 45 degrees, or an entrance and exit of ducting through a wall or floor.
- Use engraved gravoply laminate nameplates using black letters on white background.
- The laminate nameplates shall have a dimension of 210mm W x 50mm H.
- Minimum character height shall be 12mm. Character lettering shall be centered on each line.

FIRE STOPPING

- Fire stop systems in commercial premises shall meet the requirements of latest ANSI/TIA-569.
- Fire stop systems should be designed to be compatible with the worst-case environment to which they will be exposed (refer to ANSI/TIA-568.0 for information on environmental classifications).
- Provide EZ PATH solution where conduit penetrates fire rated walls, floors, partitions and ceilings to ensure that the fire rating is maintained. Abandoned penetrations shall be properly fire stopped. Provide EZ PATH system.
- The required fire rating is minimum 2 hours.

SUBMITTALS

- Comply with the requirements of Section 01300 - Submittals.
- Shop Drawings shall be submitted to the City of Toronto IT staff for final review before proceeding with any works.

- The shop drawings and all submissions shall be reviewed and sealed by the RCDD Contractor's PM and re-reviewed and sealed by the Consultant's RCDD before reaching the City for final review.
- Final design drawings/construction drawings shall be submitted to the City of Toronto IT staff for final review and before proceeding with any works. These drawings shall be reviewed by PM RCDD Contractor and re-reviewed and approved by RCDD Consultant before reaching to the City for final review.
- The CADD drawings shall meet the City's CADD standards. Any non-compliance shall be at the Consultants own expense.
- Submit proposed cable and enclosure tag labels to the Contract Administrator and the City of Toronto IT Technical Representative for approval before proceeding with this work.
- Submit red-lined Site Drawings identifying the proposed location of all enclosures including Telecommunication Enclosures, Termination Panels and Work Area Outlets prior to installation and as part of shop drawing submittals.
- Submit site drawings identify the fibre optic backbone cable routes and horizontal cabling routes to be used prior to installation and as part of the shop drawing submittals.
- Prior to x-raying and coring access holes submit red-lined Site Drawings showing the proposed location of the holes.
- Submit red-lined annotated working Drawings to the Contract Administrator, to clearly document the as-built network including details related to: location (closets, work area outlets), cabling (size, length, type, routing), tagging (cable ducting, cabling, closets and work area outlets).
- Submit all submissions in both a hardcopy and electronic native format. Handwritten submissions are not acceptable. Also, submit electronic files in a PDF digital format that is indexed and searchable.
- Submit the following documentation prior to starting the site acceptance test:
    - City of Toronto IT/Network Services — Cable Test Results
    - Operations and Maintenance Manual of any and all electronic equipment to or is installed.
    - Revise and annotate Contract Drawings, to clearly document the as-built network including details related to: location (closets, terminations panels) cabling (size, length,

type, routing), tagging (cable ducting, cabling, closets and termination panels) final as built drawings, cabling schematics, pathways and conduits drawings (containment system), any other documents, reports and drawings needed by the City of Toronto during or after work is completed.

- Consultants shall review and approve all submissions prior to final review by the City.
- Consultant is responsible to submit the final as-built drawings of the project / facility to the City.

END OF SECTION

SECTION -2: PRODUCTS

Products and part numbers often change without notice. The Consultant shall verify all parts specified and used are current and available.

Consultant shall practice the procedure of shop drawings / products approval as stated in this section. Shop drawings shall be submitted by the Contractor to the Consultant. The Consultant / Designer shall review and approve the shop drawings submittal before sending it to the City of Toronto IT for final review. After receiving the submittal from the City IT, the Consultant / Designer shall send the final approval or approval with comments / notes to the Contractor.

APPROVED MANUFACTURERS

- All backbone fibreoptic cables, connectors, patch cords, patch panels, cassettes and adaptors shall be from Belden.
- All CAT6/CAT6A modular jacks, faceplates, U/UTP patch cords and Category 6/6A cables shall be from Belden.
- Where cross connect punch down is required at Entrance Facility for termination of all voice backbone cables, it shall be from Belden.
    - www.belden.com
- All wall mount Telecommunication Enclosures shall be from Hammond Manufacturing.
    - www.hammondmfg.com
- All free standing Paramount Telecommunication Enclosures in the Equipment Room / Telecom Room shall be from Chatsworth Products.
    - www.chatsworth.com
- All fire-stopping EZ-PATH components shall be from Specified Technologies Inc.
    - www.stifirestop.com
- For UPS and Power Distribution Unit, Liebert - Emerson and APC shall be the manufacturers.
    - www.emersonnetworkpower.com ; www.apc.com
- Manufacturer Substitution of any part other than those specified in this standard is strictly prohibited without the written consent of the City of Toronto Information Technology (IT) Network Services Division.

ENTRANCE FACILITY PROTECTION

- Indoor voltage protector to protect entrance terminal to provide voltage and current protection and a disconnect facility at building entry points.
- Integral, 28 AWG (0.32 mm), non-replaceable fuse link wire between the incoming pairs and the protector modules.
- 25-pair connector for single-pair terminations (one pair "IN", one pair "OUT"), compatible with 22 to 26 AWG.
- The protected entrance terminal shall comply with CSA specification C22.2, No. 226-92, "Protectors in Telecommunication Networks," including the high-voltage fault test.
- Protectors to be included with supplied assembly.
- Consultant to use Belden data sheet to specify correct part number for the application.

FIRE RATED BACKBOARD PLYWOOD

- In the Entrance Facility, Equipment Room and Telecom Room Fire Rated plywood shall be provided on the walls or struts such that there is proper cable penetration from behind.
- Plywood shall be void-free and either fire-rated or treated on all sides with at least two coats of fire-retardant light-colored paint.
- Have at least two walls lined with A/C grade or better, 2.4 m (8 ft) high with a minimum thickness of 19 mm (3/4 in). To reduce warping, plywood should be kiln-dried to maximum moisture content of 15 percent. Mount plywood 200 mm (8 in) AFF to avoid damaging the plywood. Have the plywood with the grade A surface exposed. The plywood should be securely fastened to wall-framing members to ensure that it can support attached equipment.
- All joints screw and nail holes are to be caulked and / or covered.
- The plywood is to be provided for cross-connect fields, security panels, power supplies etc. as may be required and is not intended for cabinet installation.

NETWORK CABINETS (CORE AND SERVER CLOSETS)

- 44U Floor Standing Cabinets
    - Cabinets shall be supplied and installed complete with all accessories to provide a complete cabinet as indicated below.

- Cabinets shall be floor mounted, freestanding and have the ability to be ganged together.
- Cabinets shall have a capacity of 44U with mounting holes as per EIA-310-E.
- Each server cabinet shall be black with square hole rails.
- Each network / service provider cabinet shall be black with round hole rails.
- Specified Product:
  - W762mm X D1067mm X H2133mm Cabinet
  - Front Door
  - Rear Split Door
  - Solid Side Panels
  - Rackmount rails (square for server and round for network cabinets)
  - Top Panel
  - 483 mm (19") Mounts with cage nuts
  - 10-32 Cage nuts and screws (square for server and round for network cabinets)

- Electrical
  - Contractor is to provide the electrical distribution for each IT Network and Server cabinet as per the related Electrical Distribution drawings and relevant City standards.
  - Bond each 19” cabinet to ground.
  - Provide each Core and Server cabinet with two (2) 20A, 120 VAC, receptacles for UPS circuits. Terminate each UPS circuit at a 3-wire, duplex receptacle mounted to the rail of the 19” cabinet.
  - The duplex receptacles shall be mounted in such a manner as not to interfere with access to or removal of other equipment within the enclosures.
  - Power distribution within the enclosure shall be via vertically mounted metered power bars.
  - Redundant power supplies, within the same device, shall not be connected to the same UPS circuit.

- Power Distribution Unit (PDU – Power Bar)
    - The Liebert MPH rack PDU shall be managed three-phase power distribution unit that shall be monitoring along with receptacle control.
    - Liebert MPH units shall be available for mounting in either vertical, zero-U configuration and rack-mounting in standard, network enclosures.
    - The output receptacles support equipment requiring connection with NEMA 5-20R and IEC60320-C13 plugs.
    - Remote monitoring shall be enabled by the included communication card, the Liebert RPC™, which permits managing the Liebert MPH over a secure Web page and SNMP-based network management system.
    - The Liebert RPC shall permit interconnecting multiple Liebert MPH and / or Liebert MPX units for monitoring and management.
    - A Liebert MPH shall be monitored locally with an RPC BDM™, an optional display module that connects directly to the communication card. The display module can be handheld, mounted in or on the rack or mounted on a nearby wall.
    - Multiple Liebert MPHs can be centrally managed with Liebert Nform™, which adds group-based receptacle management.

TELECOMMUNICATIONS ENCLOSURE (TE)

- Unless otherwise specified all indoor enclosures containing network components are to be NEMA 12.
- A lockable double hinged door allows front and rear access to rack-mounted components.
- All screws, bolts, fasteners etc. shall be corrosion resistant stainless steel.
- All wall-mounted panels shall be separated from the wall by stainless steel spacers or galvanized steel struts.
- Doors shall have continuous hinges with removable pin and oil resistance cellular neoprene gasket secured by gasket retainers. Front door handles shall be recessed type (freestanding enclosures) or 3-point external latch (wall mount), complete with key locks.
- Provide locking mechanism for rear door. All key locks shall be identically keyed.
- Key number shall be provided.

- Cable bundles shall be neatly laced, run in ducting or approved cable managers and secured to 19" cabinet or mounting back-panel.
- All enclosure doors shall open through 180 degrees without restriction from front and the back.
- Enclosure layout and equipment spacing shall be constructed to allow for device removal, calibration and maintenance without disassembly of adjacent devices.
- All enclosures shall have sufficient structural reinforcements to ensure a limited plane surface vibration and to provide rigidity during shipment, installation and operation without distortion or damage to the enclosure, mounting panel or mounted instruments.
- All enclosure seams shall be continuously welded and ground smooth to be undetectable after painting.
- Devices shall be installed on the enclosure back-panel or 19" cabinet only.
- There shall be no devices installed on the side plates of the enclosure.
- Conduit accessibility shall be per manufacturer's guidelines with conduit egress through the bottom and sides but not the top of the enclosure.
- There are three sizes of TE, 12U, 19U and 26U. All provided by Hammond Manufacturing.
- Minimum items in the TE shall include but are not limited to one fibre termination panel (1U), three 24 port (1U) patch panels (1 x Telephone and 2 x Data), two (2) 24 ports or one (1) 48 ports Cisco switch, two (2) 2U Horizontal Cable Manager, one (1) 1U monitored PDU and other optional equipment as may be requested by CoT-IT such as UPS or other equipment.
- All TEs shall be bonded to the Telecommunications Bonding System as per the standard.
- The bonding cable shall be sized according to distance and terminated at the nearest Telecommunications Grounding Busbar and run within conduit.
- The TE shall be CSA approved and sealed.
- Provide the enclosure electrical distribution as per the Telecommunication Enclosure (Typical) - Electrical Distribution drawing.
    - The Telecommunication Enclosure shall be powered by two separate 15 A, 120 VAC supplies (Utility and Network). The Utility Supply is to power non-critical components (enclosure lighting and power bar). The Network Supply (UPS) is to power the critical network components (Ethernet Switch) and environmental controls (ventilating fans).

Contractor shall provide the Utility Supply from the nearest lighting panel as per the TE Installation drawings. The Network Supply is to be provided by others. Where applicable, the Contractor shall provide a 15A Supplementary DIN rail mounted breaker for termination of the Network Supply. In addition, the Contractor shall provide a knockout for the Network Supply conduit as per the Access Closet Installation drawings. All power distribution installation shall be mounted to the top rear side of the TE.

- Provide 120 VAC, 3-wire, duplex receptacles, circuit breakers, surge suppressor, wire duct and grounding bar per the Telecommunication Enclosure Layout drawing and associated Component Schedule. The Contractor shall provide rigid-steel conduit and wiring to provide the 15 A, 120 VAC Utility Supply as per the Access Closet Installation drawings. The Utility Supply shall be terminated at a 15 A, DIN rail mounted, circuit breaker and surge suppressor. Distribution of the Utility Supply is as documented in the Telecommunications Enclosure – Electrical Distribution drawing.
- All power distribution installation shall be mounted to the top rear side of the TE.

- A rack mount UPS shall be supplied that will power the Telecommunication Enclosure Network Supply. The Contractor shall be responsible for the distribution of the Network Supply within the TE and for providing a 15 A supplemental breaker for termination of the supply by others.
- Power Distribution Unit (PDU - APC)
  - The APC rack mount PDU/transfer switch shall be managed three-phase power distribution unit that monitoring along with receptacle control.
  - The APC units shall be available for rack-mounting in standard, network enclosures.
  - The output receptacles support equipment requiring connections (10) with NEMA 5-15R.
  - Remote monitoring shall be enabled with a secure Web page and SNMP-based network management system.
  - The APC PDU shall permit interconnecting multiple units for monitoring and management.

WORK AREA OUTLETS FOR OFFICE AREA

- All modular jacks, faceplates and furniture inserts shall be Belden and performance rated to Category 6/6A.

- Provide one 4-port, single-gang, work area outlet in each work area for termination of the horizontal CAT6/6A cables with faceplates or decora module frames.
- For new construction, it is recommended that the outlet boxes be 100mm X 100mm X 54mm deep, complete with a mud ring cover specifically designed for single gang faceplates intended for flush mounting to the wall. This single gang outlet box aids in the maintaining of Category 6/6A and higher bend radius requirements.
- Where walls are not suitable or have insufficient depth, stand electrical size outlet boxes shall be used.
- Each manager's office shall have two (2) work area outlets on separate walls.
- One (1) 4-port, work-area outlet shall be associated with as many ports necessary (in groups of 4 or 2) on the snap-in faceplate installed in the patch panel of the TE or TR as is provided.
- Within each office outlet, only two of the ports shall be terminated at the work area faceplate and patch panel unless otherwise specified.
- Space shall be left in each conduit and faceplate for a third and fourth cable to be added at a later time.
- In the majority of cases one (1) 4-port, work-area outlet shall be installed within each systems furniture cubical work area partition.
- In some special situations where the systems furniture is configured fully the work-area outlet shall be installed directly on the wall in the office areas.
- Within systems furniture, only two of the four positions shall be terminated with work area jacks and on the patch panels unless otherwise specified.
- Space shall be left in conduits and faceplates for the inclusion of a third and fourth cable at a later time.
- In boardrooms and large general office areas, one single gang work area outlet shall be provided every 3.0 metres and within 1.0 metres of an electrical outlet if provided.
- Only two of the four positions shall be terminated with work area jacks and on the patch panels unless otherwise specified.

FACEPLATES

- Faceplates shall be modular Belden white format opening to allow the possibility of changing connector types in the future without replacing the entire unit.
- Faceplates shall be equipped with small form factor terminating connectors to fit the individual outlet's requirements
- Faceplates shall be equipped with a minimum of four (4) openings for modules. Contractors are to equip the faceplate with the required number of blank inserts as required.

WORKSTATION FACEPLATES AND ADAPTERS - CUBICLES

- Workstation outlets shall be supplied and installed for all terminations at the workstation end and as further specified below to suit the application.
- Each workstation shall be equipped with minimum two (2) RJ45 Cat6/6A green color jacks.
- The Communications Consultant shall confirm the color of outlets prior to placing order.
- Modular Furniture Faceplates
    - Modular furniture faceplates shall be installed in all furniture outlets that have a modular furniture knockout shall consist of 4 ports.
    - Each outlet shall be installed with the specified termination modules or a blank insert. No openings shall remain exposed.
    - Communications Consultant shall verify furniture modular faceplate requirement.
    - Belden MDVO modular furniture adapter, 4 port, white
    - Belden MDVO modular furniture adapter, 4 port, black
- Surface Mount Boxes
    - Surface mount boxes shall be installed for all furniture outlets that do not have a modular furniture knockout, exposed ceiling outlets or any location not provided with an electrical back box.
    - The surface mounted box shall consist of a minimum of two (2) ports.
    - Each outlet shall be installed with the specified termination modules or a blank insert. No openings are to remain exposed.

- Belden MDVO side entry box, white
- Belden MDVO side entry box, black

RJ45 CAT6/6A JACKS

- Belden Eight-position modular jack (RJ45), type Category 6/6A to TIA-568 shall be green color and shall have the following minimum performance characteristics:
  - Modular jack current rating: 1.5 Amperes maximum
  - Modular jack durability 1,000 mating cycles
  - Modular jack contact Pressure: 100 grams minimum per contact
  - Dielectric voltage strength: 1,000 V RMS at 60Hz for 1 minute
  - Insulation resistance: 200 milli-ohms minimum
  - Contact resistance 1 milli-ohms per contact
- The contact material of the jack in a modular jack connector shall be phosphor bronze with 50 micro-inches of gold over nickel.
- UTP termination modules shall be of the same category as the UTP cabling to ensure that manufacturer end to end warranties can be attained.
- UTP cables used for IP voice shall be terminated with the same specified jacks.
- All UTP termination modules shall be Belden MDVO type.
- Belden CAT6/6A modular jack, MDVO style, green color.
- Belden ID data tab, MDVO style, green color.

COPPER PATCH PANEL (CPP)

- All horizontal CAT6/6A U/UTP cabling shall be terminated on 1U, 24 ports, Belden CAT6/6A modular patch panel.
- All copper patch panels shall be black.
- All modular patch panels shall be populated with CAT6/6A UTP modules/jacks as required.
- The modular copper patch panel shall mount to standard TIA 482.6 mm (19") rack.

- Contractor to refer to installation instructions provided with the patch panel for proper installation.

COPPER CAT6/6A HORIZONTAL CABLE (U/UTP)

- Belden, four-pair, 100 ohm balanced unshielded-twisted-pair (U/UTP) cable, appropriate flame test classification, Category 6/6A (CAT 6/6A) shall be in compliance to TIA-568 standard.
- All cables fully contained within conduit or areas that are not plenum rated shall use CMR/FT4 rated cable.
- Any cable, regardless of length passing through a return air plenum ceiling and not in conduit shall be rated CMP/FT6.
- All UTP cables shall meet requirements identified below:
    - Color: Blue
    - Rating: CMR/FT4 (riser rated or in conduit) or CMP/FT6 (plenum areas or in J-hooks)
    - Category: 6/6A
    - 23 AWG, spool-in-a-box
- All CAT6/6A horizontal cables shall be eligible for the Belden 25 years Certification Warranty.
- Cabling shall be installed and terminated as per the BICSI Installation Methods Manual, Belden Certification training and the manufacturers' installation instructions.

COPPER CAT6/6A PATCH CORD (U/UTP)

- Patch cord shall be manufactured of stranded conductor cable with 8-position, 4-pair terminations at both ends.
- All patch cords shall be manufactured by Belden and performance rated to CAT 6/6A.
- All patch cords shall be of the same or higher performance category and manufacturer of the U/UTP horizontal cabling system that shall be warranted as part of the end-to-end solution.
- All patch cords shall be standard compliant and minimum of FT4 or LSZH rated.
- All patch cords shall be manufactured and certified, 4-pair stranded conductors copper cables, field assembled patch cords are not allowed.

- All patch cords shall be gray in color.
- The Contractor shall supply patch cords in the following length:
  - At patch panel location, provide 0.5 metres long patch cords for all terminated horizontal cables unless otherwise advised by Consultant or CoT-IT.
  - At workstation or work area outlet location, provide patch cords of suitable length and not longer than 5 metres (typically 2.1 metres but Project Consultant to finalize) for every terminated horizontal cable unless otherwise advised by Consultant or CoT-IT.
- Patch cords shall be installed and terminated into the final device by the Contractor as per the BICSI Installation Methods Manual, Belden Certification training and the manufacturer's installation instructions.

BACKBONE CABLE FOR VOICE CENTREX ONLY - ISP (CAT3/5E)

- Category 3/5e rated wire and cable placed in the inside environment shall be solid, 24 AWG, twisted pair and multi-conductor.
- All cables fully contained within conduit or areas that are not plenum rated shall use CMR rated cable.
- Any cable, regardless of length passing through a return air plenum ceiling and not in conduit shall be rated CMP.
  - Belden: CMR: min 25 pairs | CMP: min 25 pairs

TELEPHONE PATCH PANEL FOR VOICE (TPP)

- Minimum 1U 24 RJ45 UTP ports.
- Accommodates 180, 110, or 90 degree patch cord connectors on back of patch panel.
- Does or doesn't require the use of a punch-down tool and mounts to standard EIA 19" rack.
- Belden for voice unloaded patch panel - black
- Belden jacks for voice unloaded patch panel, white – CAT3/5e
- Belden ID voice tab for unloaded patch panel, white

VOICE CROSS CONNECT AT ENTRANCE FACILITY (EF)

- Voice cross-connect is a system that consists of various sizes of BIX blocks, cable distribution accessories (such as moulded rings and strips) and a BIX tool to terminate wires at the BIX block. The voice cross-connect system is primarily composed of two parts: the mount and the connectors.
- Cross-connect mount is a wall-mounted frame, generally built from 16-gauge steel. The frame features a rectangular plastic backplate and two plastic brackets that extend from either side of the backplate to fit between two and ten connectors. The connectors shall be oriented horizontally on the mount.
- The connectors are rectangular punch-down blocks used to terminate up to 25 pairs. The connecters shall have a slip-in fitting which automatically strips the wire as it is punched down, eliminating the need for pre-stripping. The connectors shall also have a pair-splitter to facilitate fast arranging of wires on the punch-down block.
- Backbone cables shall be terminated on the backboard (as shown on drawings) unless otherwise specified in this document.
- All cables shall be terminated on IDC connectors complete with associated hardware such as mounts, cable / cross-connect wire managers, etc.
- The IDC connectors shall accept 24 to 26 AWG solid copper conductors.
- The IDC mounts shall accept cables from behind the connector.
- Cross-connect shall be a 5-pair block and include appropriate mounting and number of designation strips and labels.
- Cable management in the form of distribution rings or approved similar shall be provided between columns and rows of IDC mounts to support cross connect management in a manner recommended by the manufacturer.
- Instruction sheets for products are available from Belden.
- Belden 50 pair BIX mount
- Belden BIX distribution connector – 5 pair marking
- Belden accessories such as jumper wires, labels etc. to complete the system.

FIBREOPTIC CABLES

INDOOR BACKBONE MULTIMODE OM4 FIBREOPTIC CABLE

- The cable is performance rated to OM4 and shall be used only if the backbone link length is less than or equal to 150 meters.
- Primary and redundant, 12 strands in each cable shall run between the equipment room and the telecom room. Total of 2 x 12 strands shall run with diverse pathways between the equipment and telecom rooms.
- All cables shall be fully contained within conduit or areas that are not plenum rated shall use OFNR/FT4 rated cable.
- Any cable, regardless of length passing through a return air plenum ceiling and not in conduit or using cable tray / J-hook shall be rated OFNP/FT6.
- Fiber cables shall be protected when entering the patch panel with a black color flexible conduit.
- Core-locked, tight-buffered, black, indoor/outdoor fiber-express distribution cables.
- 50/125-micron core/cladding, laser optimized.
- 4700 MHz-km bandwidth at 850nm wavelength (EMB).
- 3500 MHz-km bandwidth at 1300nm wavelength.
- Only cables from Belden shall be accepted.
- All fibreoptics cables shall be installed and terminated into fibre optic adapters contained in fibre optic patch panels by the Contractor as per the BICSI Installation Methods Manual, Belden certification training and installation instructions.
- Belden:
    - OFNR/FT4
    - OFNP/FT6

FIBREOPTICS PATCH PANEL (FPP)

- Fibreoptics cabling shall be terminated in patch panels intended for fibre optic cable management.

- Belden Fibreoptics Rack Mount Enclosure for Telecommunication Enclosures shall be:
    - 3U - 19" Rack Mount Enclosure
    - Durable black powder coat finish
    - Be equipped with cable strain relief and slack storage
- Belden Blank Fibre Adapter Panel shall be:
    - Blank Fibre Adapter Panel to fit Fibre Adapter Patch Panel
    - Durable black powder coat finish
- Belden Fibreoptics LC Fibre Adapter Strip shall be:
    - Loaded with TIA-604 FOCIS-10 compatible adapters, TIA-568.3 standard compliant
    - Split sleeve: Zirconia Ceramic
    - Adapter housing colors follow TIA-568.3 suggested color identification scheme.
    - Belden part number for 6 LC duplex adapter strip
- Belden 1U fibre cover, smoked plexiglas
- Belden Splice Case / Modules / Trays for OM4 Cable Terminations shall be:
    - Belden splice tray for 3U rack mount fibre enclosure

FIBREOPTICS LC CONNECTOR FOR FIELD TERMINATION OF OM4 CABLE

- Optical fibre terminations for OM4 cable shall be made for field termination with a pre-polished connector and shall be of the same manufacturer and LC style to suit the cabling installed.
- Fibre connectors shall match the performance of the fibreoptics cable (OM4).
- Fibre terminations shall be made with a ceramic ferrule and cable boot.
- Optical fibre cables shall be terminated with pre-polished connectors having the characteristics as below:
    - Return loss: >20dB (multimode)
    - Termination Style: Pre-Polished

  - Connector Type: LC
  - Ferrule Type Zirconia Ceramic

- The connector shall include connector body / ferrule assemblies, crimp sleeves, dust caps, clip, and appropriate boot.
- All Fibreoptics connector terminations and adapters shall be contained in fibre optic patch panels from Belden by the Contractor as per the BICSI Installation Methods Manual, Belden certification training and installation instructions

FIBREOPTICS LC PIGTAIL FOR FIELD TERMINATION OF OM4 CABLE

- Optical fibre OM4 cable shall be fusion spliced to pig-tails for field termination and shall be of the same manufacturer and LC style to suit the cabling installed.
- Pigtail shall be OFNR (FT4) or LSZH rated and stamped/printed accordingly.
- The pigtail shall be 100% factory terminated and inspected end face geometry in compliance with Telcordia GR-326-CORE, issue 3.
- Typical insertion loss per pigtail connection: 0.25dB.
- Field assembled pigtails are not allowed.
- The Contractor shall supply and fusion splices every strand of the fibre backbone cable with a pigtail. The pigtail length shall be 1m.
- Belden OM4 pigtail
- Belden fusion splice heat shrink protector sleeves

FIBREOPTICS MULTIMODE LC-LC DUPLEX PATCH CORDS – OM4

- All patch cords shall be CSA/TIA/UL approved, CMR (FT4) or LSZH rated and printed accordingly.
- All optical fibre patch cords shall be OM4.
- All optical fibre patch cords shall be manufactured and certified, 1-pair (duplex, 2 strands). Field assembled patch cord is not allowed.
- The Contractor shall supply a minimum two (2) patch cords for every OM4 backbone cable:

- At patch panel in the telecom room (TE), provide one (1) 2-meter-long patch cord unless otherwise specified by CoT IT.
- At patch panel location in the equipment room (ER), entrance facility (EF), or any other space provide one (1) 2-meter-long patch cord unless otherwise specified by CoT IT.

- All optical fibre patch cords shall be LC to LC duplex.

PATHWAY SYSTEM – CONDUIT AND CABLE TRAY

- Cable tray shall be used above ceilings in commercial facilities and below raised floor systems as may be found in equipment rooms or data centers.
- All pathway (conduit and cable tray) systems shall be designed in accordance with the latest version of the ANSI/TIA-569-E Standard which exceeds the minimum requirements of Canadian Electrical Code. Pathway systems that are designed only to the Canadian Electrical Code and do not include all requirements of the ANSI/TIA-569-E standard will be considered substandard and removed until such time as they are in compliance.
- Consultant to confirm with both the facility and CoT-IT regarding the areas that are suitable for Electrical Metallic Tubing (EMT).

ELECTRICAL METALLIC TUBING CONDUIT - EMT

- To be used within the office areas only (if applicable).
- Electrical Metallic Tubing shall be electro-galvanized steel.

FITTINGS

- Fittings for electrical metallic tubing shall be single screw indenter fittings for conduits up to 2" and double screw indenter fittings for conduits 2" and larger.
- Die-cast or pressure cast fittings are not permitted.
- Connectors shall have insulated throat up to and including 1" size. For sizes 1-1/4" and larger, provide plastic insulating bushing.
- Provide conduit body types, shapes and sizes as required to suit application and NEC requirements. Provide matching gasket covers secured with corrosion-resistant screws.

EXPANSION FITTINGS

- Provide expansion fittings with external grounding straps at building expansion joints.
- Minimum 4” movement in either direction.
- At expansion joints in concrete pours, provide deflection/expansion fittings capable of movement of ¾” in all directions from the normal.

WATER PROOFING SEALS

- Provide watertight expanding link-type seals for installation between the conduit and the sleeve or core drilled hole.

WIRE BASKET TRAY

- The wire basket tray shall be 12 – 13 gauge, straight sections shall be powder coated black with an average paint thickness of 1.2 mils (30 microns) to 3.0 mils (75 microns).
- Tray shall be designed in such a way as to be secured to the following, but not limited to: wall, ceiling every 1.2 metres.
- Splicing trays shall be accomplished by using a single manufacturer supplied UL classified connector bolt or splice plate.
- Depth: Tray depth shall be (unless otherwise shown on the drawings) 100mm (4 inches).
- Width: Tray width shall be (unless otherwise shown on the drawings) 300mm (12 inches).
- Turning Fences shall maintain approved bend radius and be constructed from sheet steel and plated in accordance with applicable standards.
- Intersections shall be made from high strength steel, welded and plated in accordance with applicable standards.
- Proper manufactured accessories and fittings such as elbows, reduces, crossovers, tees and riser shall be used for any change in direction, height or size of the cable basket tray.
- Support cable tray to suit loading and recommended support requirements in the Canadian Electrical Code Part II.
- Materials bolted or riveted to the cable tray shall be free of burrs and or sharp edges.

VENTILATED CABLE TRAYS

- All cable tray systems shall be designed in accordance with the latest version of the ANSI/TIA-569-E Standard and BICSI TDMM which exceed the minimum requirements of Canadian Electrical Code. Cable tray systems that are designed only to the Canadian Electrical Code and do not include all requirements of the ANSI/TIA-569-E Standard and BICSI TDMM shall be considered substandard and removed until such time as they are in compliance.
- Consultant to confirm with both the facility and CoT-IT regarding the areas that are suitable for cable tray, if suitable, what material type given the impact of certain airborne chemicals (aka Chlorine) that corrode metals.
- The ventilated cable tray is preferred to be used for horizontal cable distribution.
- The ventilated cable tray shall include but not be limited to the following characteristics:
    - A prefabricated structure consisting of a ventilated bottom with integral longitudinal side rails with no openings exceeding 50mm or 2” in a longitudinal direction.
    - Shall be prefabricated from a pre-punched sheet to produce a one-piece ventilated tray.
    - Shall be available in Aluminum, pre-galvanized Steel, hot dip Galvanized Steel and Stainless Steel 316.
    - Shall be a minimum of 103mm or 4" in depth or as appropriately designed and approved by Project Consultant and CoT-IT.
    - Proper manufactured accessories and fittings such as elbows, reduces, crossovers, tees and riser shall be used for any change in direction, height or size of the cable tray.
    - Spine type cable tray is not acceptable.
    - Support cable tray to suit loading and recommended support requirements in the Canadian Electrical Code Part II.
    - The support shall be placed within a maximum of 610mm on either side of any connection to a fitting.
    - Materials bolted or riveted to the cable tray shall be free of burrs and or sharp edges.

JUNCTION BOX

- All junction box applications shall be designed in accordance with the latest version of the ANSI/TIA-569-E Standard and BICSI TDMM which exceed the minimum requirements of Canadian Electrical Code. Application of junction boxes that are only designed to the Canadian Electrical Code and do not include all requirements of the ANSI/TIA-569-E Standard and BICSI TDMM shall be considered substandard and removed until such time as they are in compliance.
- Consultant to confirm with both the facility and CoT-IT regarding the areas that are suitable for junction box construction type given the impact of certain airborne chemicals (aka Chlorine) that corrode metals.
- For standard non chemically hazardous environments junction boxes shall be constructed of not less than 14-gauge galvanized steel with trim for flush or surface mounting in accordance with the location to be installed.
- Provide screw-on type cover boxes installed in damp or wet locations shall be of rain-tight construction with gasketed cover and threaded conduit hubs.
- Boxes shall be NEMA approved for the environmental condition of the location where they will be installed.

POKE THROUGH FLOOR BOX

- Where office facilities exist but access for cable distribution from above is not possible it may be practical to serve the floor from the ceiling space below with a Poke Through.
- Aluminum modular fire rated poke-through floor boxes coverings.
- Installs in 4" (101.6mm) diameter core drilled hole through concrete.
- UL listed for use in 1-4 hour rated floors.
- Poke-through fitting and universal cover combination exceed UL514A scrub water exclusion requirements.
- Stationary fire barrier expands during fire conditions to provide upper fire seal with adjustable fire barrier that would accommodate concrete floor thickness from 2-1/4" to 7".
- Dual 1" E.M.T. conduit tubes feed from communications feed and one for the electrical (when needed).
- Furniture feed for both power and communication services to modular furniture systems.

- Poke-through to have dual panels, one to hold four (4) RJ45 CAT6/6A Data/Voice ports. The other panel will have a blank plate.
- One-piece dual style line Poke-Through aluminum finish.
- Aluminum modular fire rated poke-through floor boxes coverings.
- Installs in 4" (101.6mm) diameter core drilled hole through concrete.
- UL listed for use in 1-4 hour rated floors.
- Poke-through fitting and universal cover combination exceed UL514A scrub water exclusion requirements.
- Stationary fire barrier expands during fire conditions to provide upper fire seal with adjustable fire barrier that would accommodate concrete floor thickness from 2-1/4" to 7".

GROUNDING AND BONDING

- All bonding to ground systems shall be designed and installed in accordance with the latest version of the ANSI/TIA-607-D Standard and BICSI TDMM which exceed the minimum requirements of the Canadian Electrical Code. Grounding and Bonding for Communications that are designed only to the Canadian Electrical Code and do not include all requirements of the ANSI/TIA-607-D Standard and BICSI TDMM shall be considered substandard and removed until such time as they are in compliance.
- Consultant to confirm with both the facility and CoT-IT regarding the areas that are suitable bonding and grounding points given the impact of certain airborne chemicals (aka Chlorine) that corrode metals.

PRIMARY BONDING BUSBAR (PBB) / TELECOMMUNICATIONS MAIN GROUNDING BUSBAR (TMGB)

- An insulated predrilled copper busbar listed by NRTL, electro-tin plated with holes 8mm diameter for use with standard-sized lugs.
- Dimensions 6mm thick, 100mm wide, variable length as applicable.
- Shall be insulated from its support by a minimum of 50mm.

SECONDARY BONDING BUSBAR (SBB) / TELECOMMUNICATIONS GROUNDING BUSBAR (TGB)

- Predrilled copper busbar listed by NRTL, electro tin plated with holes 8mm diameter for use with standard-sized lugs.
- Dimensions 6mm thick, 50mm wide, variable length as applicable.
- Shall be insulated from its support by a minimum of 50mm.

TELECOMMUNICATIONS BONDING BACKBONE (TBB)

- Cable assemblies shall be UL Listed and CSA Certified and be a minimum of 6 AWG copper conductor, green insulated.
- Telecommunications Grounding and Bonding Conductor Label Kits shall be supplied and installed by the Electrical Contractor at every rack and cabinet as well as one for every Telecommunications Grounding Busbar.
- The bonding conductor size shall be as follows:

TBB Length in Linear metres Metres (feet)	TBB Size (AWG)
Less than 4 (13)	6
4-6 (14 – 20)	4
6-8 (21 – 26)	3
8 – 10 (34 – 41)	2
13 – 16 (42 – 52)	1/0
16 – 20 (53 – 66)	2/0
Greater than 20 (66)	3/0

TELECOMMUNICATIONS BONDING CONDUCTOR (TBC)

- Cable assemblies shall be UL Listed and CSA Certified and be a minimum, the same size as the largest TBB copper conductor.
- Shall be green insulated and marked in accordance with ANSI/TIA-607-D.

WARNING LABELS

- Non-metallic warning labels in English: TIA-607-D.
- Identify labels with wording "If this connector is loose, please call the building telecommunications manager or site / area supervisor".

FIRE-STOPPING

- A fire-stop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.
- All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate fire-stop system (EZ-PATH). This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly fire-stopped with EZ-PATH.
- Firestop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE), licensed (actual or reciprocal) in the state where the work is to be performed. A drawing showing the proposed fire-stop system, stamped/embossed by the Professional Engineer of Ontario (P.Eng.), shall be provided to the Owner's Technical Representative prior to installing the fire-stop system(s).
- EZ-PATH Part Numbers:
    - EZ-PATH Series 22, 33 and 44 (size based on cable quantities).

END OF SECTION

SECTION – 3: EXECUTION

It is Consultant / Designer responsibility to check the latest version of this document from CoT-IT.

GENERAL

- RCDD certified engineer shall perform the design and consulting work.
- Contractors / Technicians shall be certified with Belden and Fluke Networks to perform installations and testing / commissioning.
- Contractors must have an RCDD installation Team Lead / Project Manager.
- Technicians who have not completed the appropriate certification or training shall not pull, terminate or otherwise be involved in the installation of the telecommunications physical infrastructure with the exception of bonding to ground.
- Installers performing the testing (SAT, Acceptance, Commissioning, etc.) shall be Certified Cabling Test Technician on Fluke DSX / Versiv and Optifibre OTDR equipment.
- Following are the procedures to follow for successful project handing over:
    - Cable Acceptance Testing (CAT) – See Appendix for correct Sample Test Results and Compliance Sheet
    - Site Acceptance Testing (SAT) - See Appendix for Sample SAT Documents
    - As-built Drawings and Documents (ADD)
    - Consultant Review and Comments (CRC)
    - CoT-IT Approval of Satisfaction (AoS) – Signing off

HORIZONTAL CABLE INSTALLATION

- All cables and components shall be installed as per the Belden's instruction sheets, ANSI/TIA standards and the BICSI Installation Methods Manual to complete the project.
- All testing of the Category 6/6A cabling system shall be with Fluke DSX-5000 / 8000 Versiv Cable Analyzers.

FIBREOPTIC CABLE INSTALLATION

- All cables and components shall be installed as per Belden's instruction sheets, ANSI/TIA standards and the BICSI Installation Methods Manual to complete the project.
- All testing of the fibre optic installation shall be with test equipment from Fluke DSX-5000 / 8000 Versiv and if required (upon CoT-IT request) Optifbre OTDR.

CABLE ACCEPTANCE TESTING

- This section specifies the acceptance testing requirements for backbone fibre optic as well as horizontal UTP cabling.
- Supply all of the test equipment required to conduct acceptance tests.
- Submit acceptance documentation as defined in this section.
- All of the installed cabling must be tested and successfully pass all test criteria.
- Standards referenced in this section include:
    - ANSI/TIA-568: Telecommunications Cabling Standard. All standards referenced within the TIA-568, where applicable, constitute standard provisions of this specification.
    - ANSI/TIA-526-14: Optical Power Loss Measurement, Multimode
    - ANSI/TIA-526-7: Optical Power Loss Measurement, Single-mode
    - ANSI/TIA-1152: Requirements for field test instruments and measurements for balanced twisted-pair cabling
- Visually inspect all cables, cable reels and shipping cartons to detect possible cable damage incurred during shipping and transport. Visibly damaged goods shall be returned to the supplier and replaced at no additional cost to the City.
- All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA-568 standard. All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed without cost to the City.

COPPER PERMANENT LINK TESTING – HORIZONTAL CABLING

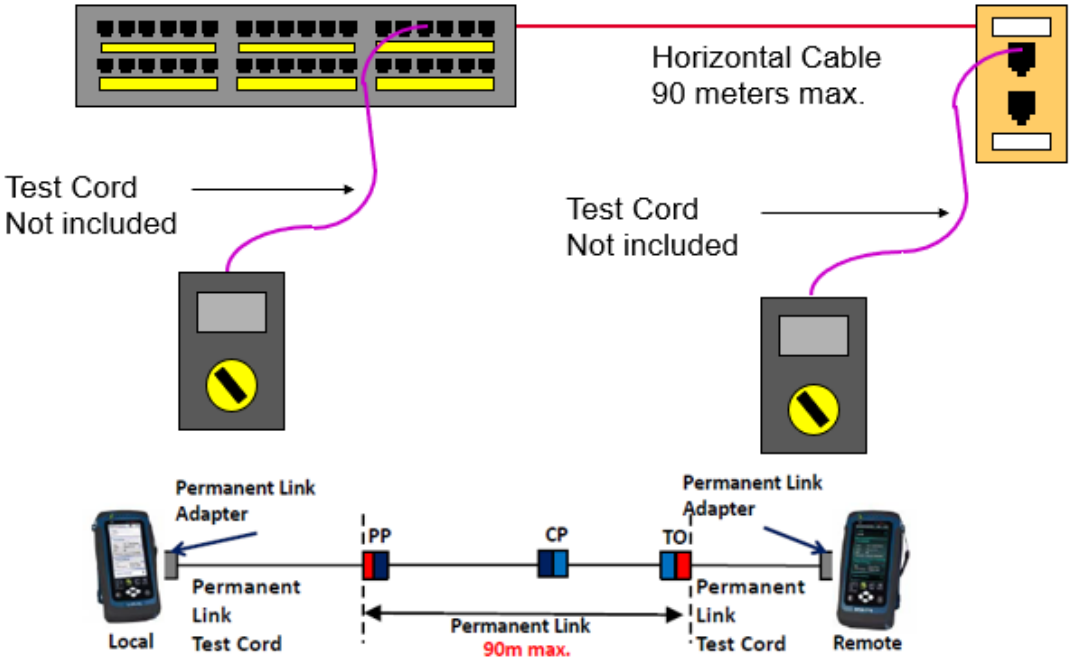
- All unshielded twisted-pair copper cable links shall be tested for continuity, pair reversals, shorts, opens and performance to Category 6/6A. Horizontal cabling shall be tested using a minimum level IIIe test unit for Category 6/6A performance compliance.
- Continuity - Each pair of installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. The test shall be recorded as pass/fail as indicated by the test unit and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.
- Length - Each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI/TIA-568.2 standard. Cable length shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cable, the shortest pair length shall be recorded as the length for the cable.
- Horizontal twisted pair cable shall meet or exceed the permanent link, performance requirements specified in ANSI/TIA-568.2 for Category 6/6A, Unshielded Twisted Pair (U/UTP).
- All tests shall be conducted using permanent link configuration on the testing equipment.

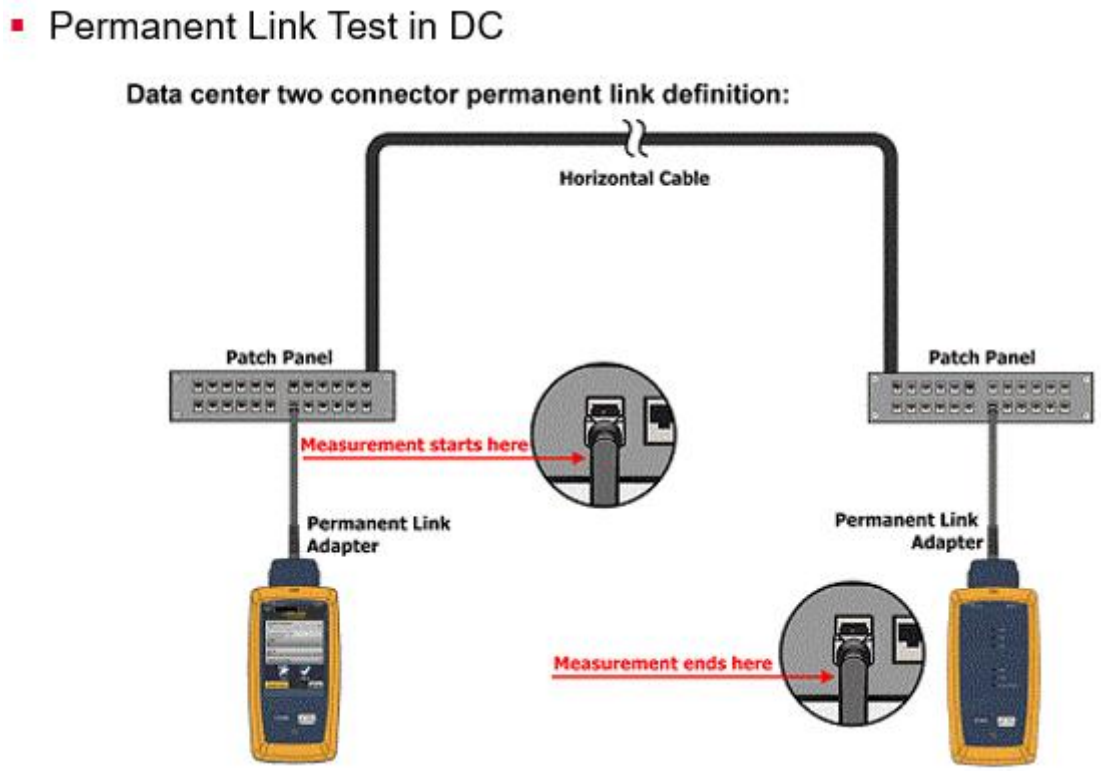
COPPER TEST EQUIPMENT

- Category 6/6A Test Equipment - Category 6/6A test equipment shall meet the following minimum criteria:
    - All test equipment of a given type shall be from the same manufacturer and have compatible electronic results output. Acceptable test equipment manufacturer is Fluke Networks. Unless the manufacturer specifies a more frequent calibration cycle, calibration date shall be not more than a year from cable test date. Recommended test equipment is a Fluke Networks DSX 5000 / 8000 Versiv Cable Analyzer.
    - Test adapters must be approved by the manufacturer of the test equipment. Adapters from other sources are not acceptable. For horizontal cabling, permanent link adapters shall be used.
    - Baseline accuracy of the test equipment must meet or exceed TIA Level IIIe, as indicated by independent laboratory testing.

- Test equipment must be capable of certifying Category 6/6A to TIA-568.2 standard.
- Test equipment must have a dynamic range of at least 100 dB to minimize measurement uncertainty.
- Test equipment must be capable of storing full frequency sweep data for all tests.
- Test equipment must include S-Band time domain diagnostics for NEXT and return loss (TDNXT and TDRL) for accurate and efficient troubleshooting.
- Test equipment must be capable of running individual NEXT, return loss, etc., measurements in addition to auto tests. Individual tests increase productivity when diagnosing faults.
- Test equipment must make swept frequency measurements in compliance with ANSI/TIA-568.2 standard.
- The measurement reference plane of the test equipment shall start immediately at the output of the test equipment interface connector. There shall not be a time domain dead zone of any distance that excludes any part of the link from the measurement.
- The calibration of equipment shall be valid within one (1) year of the test date.

- Permanent Link in LAN





HORIZONTAL CABLE TESTING DOCUMENTATION - COPPER

- Category 6/6A (UTP) Documentation - As a minimum, test reports shall include the following information for each U/UTP CAT6/6A cabling element tested:
    - Wiremap results that indicate the cabling has no shorts, opens, split, reversed, or crossed pairs and end-to-end connectivity is achieved.
    - Attenuation, NEXT, PSNEXT, Return Loss, ELFEXT and PSELFEXT data that indicate the worst-case result, the frequency at which it occurs, the limit at that point and the margin. These tests shall be performed in a swept frequency manner from 1 MHz to highest relevant frequency, using a swept frequency interval that is consistent with TIA and ISO requirements. Information shall be provided for all pairs or pair combinations and in both directions when required by the appropriate standards.
    - Length (in meters), propagation delay and delay skew relative to the limit.
    - Any individual test that fails the relevant performance specification shall be marked as a FAIL.

- Cable manufacturer, cable model number/type and NVP.
- Tester, manufacturer, model, serial number, hardware version and software version.
- Circuit ID number (Cable Tag Id) and Facility name.
- Test criteria used.
- Overall pass/fail indication.
- Date and time of test.

BACKBONE FIBREOPTIC TESTING

- Backbone fibre optic cable shall meet or exceed the permanent link, performance requirements specified in ANSI/TIA-568.3 for multimode and singlemode fibre.
- Test link attenuation with an OLTS:
  - For multimode fibre, make reference measurements in accordance with TIA-526-14, Annex A – One cord reference method. Measure optical loss on each fibre at 850nm and 1300nm. It is required to measure loss on each fibre from each direction (bi-directional).
  - For singlemode fibre, make reference measurements in accordance with TIA-526-7, one cord reference method. Measure optical loss on each fibre at 1310nm and 1550nm. It is required to measure loss on each fibre from each direction (bi-directional).
- Measure link length optically or calculate using cable sheath length markings.
- Multimode backbone fibre optic cabling shall meet the following loss and length criteria:
  - Attenuation @ 850nm shall be less than or equal to: fibre length (km) x 3.0 dB/km + number connector pairs x 0.5 dB + number of splices x 0.3 dB.
  - Attenuation @ 1300nm shall be less than or equal to: fibre length (km) x 1.5 dB/km + number connector pairs x 0.5 dB + number of splices x 0.3 dB.
  - Length shall be less than or equal to 150 meters.
- VCSEL driver is preferred to be used for testing as the SFP active modules on the switch runs with VCSEL drivers up to 10Gbps.
- Singlemode backbone fibre optic cabling shall meet the following loss and length criteria:

- Attenuation @ 1310nm shall be less than or equal to: fibre length (km) x 0.4 dB/km + number connector pairs x 0.75 dB + number of splices x 0.3 dB.
- Attenuation @ 1550nm shall be less than or equal to: fibre length (km) x 0.4 dB/km + number connector pairs x 0.75 dB + number of splices x 0.3 dB.
- Length more than 150 metres and shall be less than or equal to 10000 meters.

BACKBONE FIBREOPTICS TESTING DOCUMENTATION

- Fibreoptics Documentation: As a minimum, test reports shall include the following information for each fibreoptics cabling element (fibre) tested:
  - Actual measured attenuation, maximum allowable attenuation (loss) and the attenuation margin at the specified wavelengths. An individual test that fails the link criteria shall be marked as FAIL.
  - Reference method.
  - Number of mated connectors.
  - Actual length and maximum allowable length. Any individual test that fails the link length criteria shall be marked as FAIL.
  - Group refractive index (GRI) for the type of fibre tested, if length was optically measured.
  - Tester manufacturer, model, serial number and software version.
  - Circuit ID number (Cable Tag ID) and facility name.
  - Link criteria used.
  - Overall pass/fail indication.
  - Date and time of test.

FIBREOPTIC TEST EQUIPMENT

- All test equipment of a given type shall be from the same manufacturer and have compatible electronic results output. Acceptable test equipment manufacturer is Fluke Networks. Unless the manufacturer specifies a more frequent calibration cycle, calibration date shall not be more than a year from cable test date. Recommended test equipment is a Fluke Networks DSX-5000 /

8000 Versiv Cable Analyzers using VCSEL fibre modules (preferred) for multimode testing and/or OptiFiber OTDR (if advised by CoT-IT).

- The calibration of equipment shall be valid within one (1) year of the test date.
- Fibreoptics test equipment shall meet the following minimum criteria:
    - Test equipment shall be capable of measuring relative or absolute optical power in accordance with TIA-526-14, "Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant."
    - Test equipment shall be capable of measuring relative or absolute optical power in accordance with TIA-526-7, “Optical Power Loss Measurement of Installed Single-mode Fibre Cable Plant.”
    - Test equipment shall not include the loss or length of the test jumpers in the cable plant measurements.
    - Multimode test equipment shall incorporate both 850nm and 1300nm VCSEL/LED sources.
    - Single-mode test equipment shall incorporate both 1310nm and 1550nm laser sources.
    - Sources and meters shall automatically synchronize wavelengths to prevent calibration-related errors.
    - Test equipment shall employ a communications port to facilitate uploading of saved information from tester to PC.
    - Test equipment capable of measuring a Tx/Rx fibre pair simultaneously is recommended to enhance productivity. It is recommended that test equipment utilizing dual function main and remote units be used for bi-directional testing, eliminating the need to swap optical source and power meter.

CABLE TEST RESULTS MANUAL

- Consulting Engineer shall first review and comment on the test report. CoT-IT shall only receive the report after the review and approved comments of the Consulting Engineer. CoT-IT will finally provide their final review comment.
- Submit test reports in both a hardcopy and electronic format (native file). Hand-written test reports are not acceptable. If test results cannot be converted to a PDF format then provide any necessary proprietary/native software to view the results at no cost to the City.

- Fibre optic backbone cable test results shall be incorporated in the City of Toronto, Network - Cable Test Results manual. Submit two (2) copies of the Cable Test Results manual for each facility. The manual consists of hardcopy test result reports placed into lockable 'D' ring binders with a cover and spine that clearly indicates the title of the manual. Put a CD with the electronic copies of test reports in a pocket in the Cable Test Results manual.
- The Contractor (RCDD) PM must sign hardcopy reports before submitting it to the Consultant.

TEST COMPLIANCE SHEET

- A compliance sheet shall be prepared for every project of City of Toronto - IT. The criteria is summarized as below:

1	Test equipment with latest software version	8	Test results limits - TIA
2	Test equipment with latest test limit version	9	Test results based on VCSEL/LED Encircled Flux for OM4
3	Calibration of test equipment	10	Test results based on Laser for OS2
4	Test results submitted in native format and PDF format	11	MM testing at 850nm and 1300nm wavelength
5	Test result cable ID in compliance	12	SM testing at 1310nm and 1550nm wavelength
6	Permanent Link testing performed on copper (CAT6/6A)	13	Bi-directional testing
7	Test result cable type (copper and fibre) in compliance	14	Accurate quantity of adapters and splices

SITE ACCEPTANCE TEST (SAT)

- A Site Acceptance Test (SAT) will NOT test functionality of the system or its components. Site Acceptance Tests will evaluate the workmanship and verify installation against the *Installation* and *Layout* drawings.
- The SAT plan shall be submitted to CoT-IT, two (2) weeks in advance of commencement.

- The SAT plan shall have a checklist and identify tests with a schedule for CoT-IT to review and coordinate staff. Submit to the Contract Administrator/Project Manager and Consultant, three weeks prior to the commencement of the test, for review. The Contractor shall conduct the test when directed by the Contract Administrator. As a minimum, the Contract Administrator/Project Manager, Consultant and CoT-IT shall witness the test.
- The plan shall be sealed by the Installation Project Manager RCDD, followed by the RCDD Consultant.
- Prior to SAT, the Consultant shall review and approve all copper and fibre cabling testing, bonding and grounding inspections and any other criteria as may be described in the project tender.
- The SAT shall evaluate workmanship and verify construction and components against the Layout Drawings and associated Component Schedules submitted to and reviewed by the Consultant.
- The SAT shall be completed only when all items in the checklist have been witnessed and installed by the Contract Administrator/Project Manager, Consultant and CoT-IT as being in conformance with the design as specified.
- SAT of Equipment Room / Telecom Room
    - Each facility shall have one or more equipment room / telecom room, which house the server and network core closets. Each equipment / telecom room shall undergo a witnessed SAT.
    - The Consultant is responsible for the equipment / telecom room UPS, lighting panel and any ER/TR modifications noted in the tender drawings and specifications. The extent of ER/TR modifications varies for each facility.
    - In addition to the above, the ER/TR SAT shall include the evaluation of the server and core closet installation, power supplies to each closet and external cable management (e.g. cable tray). For the purpose of the ER/TR SAT the server and core closets shall be empty except for the installation of duplex receptacles to receive the UPS.
- SAT of Telecom Enclosure
    - As a minimum, the complete Telecom Enclosure for the SAT shall include the installation of copper patch panels, fibre patch panel, power supplies, horizontal cable terminations, cable management and patch cords.
    - At each facility, the Contractor shall provide one complete telecom enclosure, associated accessories and horizontal cable for the SAT. Following acceptance, the Contractor will be directed to proceed with the installation of the remaining TEs and horizontal cabling. The Contractor is to note that the fibre optic backbone cable installation will be included in the core closet SAT.

- The City reserves the right to do a random inspection of the telecom enclosure and those that do not comply with the above shall be made compliant at no expense to the City.

FIELD SUPPORT

- Provide 160 hours of on-site support for each facility beginning immediately after successful site acceptance test at that facility for a period of 24 months following Substantial Performance.
- Respond within 24 hours to a request for on-site support.
- The minimum site time per support call will be four (4) hours.
- The cost for the on-site field support shall be paid based on the rates quoted in the Schedule of Prices.

MAINTENANCE

- For a period of twelve (12) months following Final Acceptance, the Contractor shall provide a qualified technician/electrician to assist in the resolution of network related problems. The Contractor shall be given twenty-four (24) hours notice as to their requirement on-site.
- The Contractor will be compensated at the per diem rate quoted by the Contractor in the Form of Tender. However, if the source of the problem is discovered to be a result of work or components supplied by the Contractor, the Contractor shall not be compensated.

WARRANTY

- Testing and certification of the Building Network Distribution Cabling System shall be by the installer and shall include the provision of a Belden Warranty covering performance, products and installation.
- The Warranty shall cover the full repair and/or replacement of any component failing or failure to meet the design requirements within one (1) year.
- Warranty shall be delivered by the Contractor in coordination with Belden to the Client's Project Manager with the Testing and Certification documents. The project site shall receive manufacturer's plaque. All coordination regarding warranty and handing over of the manufacturer's plaque is the responsibility of the Contractor.

- The manufacturer shall warrant the project for twenty-five (25) years against application assurance and extended product manufacturing defects.
- The Contractor shall warrant installation against all product installation defects and that all approved cabling components meet or exceed the specified requirements for a period of twenty-five (25) years following acceptance.
- The Contractor shall warrant that all permanent fibre optic links meet or exceed the performance requirements of TIA-568.3 for multimode and singlemode fibre.
- The Contractor shall warrant that all permanent twisted pair links meet or exceed the performance requirement of TIA-568.2 for category 6/6A, unshielded twisted pair.
- Contractor must provide complete end to end mapping of all connectivity at the end in both hard and softcopy formats. This includes but not limited to horizontal data / voice cable number, copper and fibre backbone cable and active equipment ports.
- Within ten (10) days after testing, the cable installer shall provide the Project Manager with documentation, which shall include cable test results, a marked-up copy of the as-built cable network drawing and an electronic copy of the completed installation in Bentley Microstation Ver. 8 and AutoCAD or as per City's CAD guidelines.
- Contractor shall provide a manufacturer written certificate, plaque and warranty that the structured cabling platform is installed and fully operating in accordance with this standard and manufacturers specification.
- The warranty must guarantee that the design or installation negligence on the part of the Cabling Contractor shall not negate or void any portion of the certified system. The manufacturer must guarantee that all material, components and labour are covered in this circumstance for the full certification period of twenty-five (25) years. It must also guarantee that in the event a Cabling Contractor is no longer able to service the warranty, the full certification remains valid and is responsibility of the manufacturer.
- If a warranty issue arises for the cabling, the Warrantor must make arrangements to undertake the repair or replacement of warranty issues within 24 hours of notification. This may require the repair/replace of cabling components outside regular working hours at no additional cost.
- The warranty for the cabling must be such that the cable meets or exceeds the requirements of TIA-568 'Transmission Performance Specifications for 100 Ohm 4-pair Category 6/6A Cabling" including all Standards stated in this Contract.
- The Cabling Contractor shall forward the Structured Cabling Platform certification request form(s) to the proper authority and ensure that a Plaque and Certificate is issued to the Customer / Project Site along with the Structured Cabling Platform user manual. The successful bidder shall provide a certification number within two weeks of award of this project. Please

note that the Plaque/Certificate must have the Customer name/Project name on the Plaque/Certificate.

- The Cabling Contractor shall provide letter(s) of Certification within two weeks of substantial completion of the project to the Customer. This document will include the following: verification of the performance of the installed system, identification of the installation by location and project number and a copy of the warranty.
- Upon request and at no additional cost to the Customer the Cabling Contractor must provide a manufacturer's technical representative to conduct an on-site visit to ensure complete technical compliance.
- The Cabling Contractor must supply a copy of an unexecuted warranty statement (at the time of bidding) including all related terms and conditions. This copy shall be the Standard to which the warranty will be held. No changes shall be accepted unless it is deemed to benefit the Customer. Any proposed changes to the warranty must be submitted in writing to the Customer/their representative for review. The changes will then be accepted or declined by the Customer at their discretion. This is to remain valid for the entire warranty period.
- All cable Cabling Contractor technicians on site must be trained by the manufacturer of the Structured Cabling Platform being installed.
- Any defective or improperly installed products shall be replaced, or correctly reinstalled at no cost to the Customer.

QUALIFICATIONS AND TRAINING

- An on-site training may be required for the Client to understand the system and installation.
- Contractors shall be certified with Belden and Fluke Networks to perform installations and testing.
- Contractors must have an RCDD installation Project Manager.
- Technicians who have not completed any certification program shall not pull, terminate or otherwise be involved in the installation of the telecommunications physical infrastructure with the exception of bonding to ground.
- Installers performing the testing (SAT, Acceptance, Commissioning, etc.) shall be certified CCTT on Fluke DSX and/or Optifibre OTDR.
- All Fluke credentials shall be submitted to the City during project award process for validation.
- The testing equipment shall be valid and calibrated within one (1) year as per manufacturer specifications.

- The cable installer shall have full working knowledge of cabling low voltage applications such as, but not limited to, Non-Secure Data/Voice communications cabling systems.
- Provide references of the type of installation provided for in this specification.
- Have knowledge of all applicable Telecommunication Standards such as but not limited to: CSA, TIA, IEEE and ANSI.
- Have experience in the installation of pathways and support for horizontal and backbone cabling.
- Be experienced in the installation and testing of telecommunication network cabling system, including the use of a light meter and OTDR.
- Provide proof of being a manufacturer certified installer for all cable network components being installed such as but not limited to cables, connectors and end termination equipment. The use of a non-manufacturer certified installer is not permitted.

AS-BUILT DRAWINGS

- The drawings shall include cable routes and outlet locations.
- Outlet locations shall be identified by their sequential number as defined elsewhere in this document.
- Numbering, icons and drawing conventions used shall be consistent throughout all documentation provided.
- For new infrastructure project, the Consultant shall provide the design drawings / tender drawings / floor plans in paper and electronic (Microstation) formats on which as-built construction information can be added.
- For an existing infrastructure upgrade, the Owner may provide floor plans in paper and electronic (Microstation) formats on which as-built construction information can be added.
- These documents shall be modified accordingly by the Telecommunications Contractor to denote as-built information as defined above and returned to the Owner.
- The Contractors shall annotate the base drawings and return a hard copy (same plot size as originals) and electronic (Microstation) form.

FINAL ACCEPTANCE

- Once all work has been completed including all documentation submissions, the City will notify the satisfaction to the Consultant in writing of formal acceptance of the system.
- Consultant must warrant in writing that 100% of the installation meets the design requirements as specified.
- Contractor must warrant in writing that 100% of the installation meets the requirements specified in the tender documents.
- The CoT-IT reserves the right to conduct, using Contractor equipment and labour, a random re-test of up to five (5) percent of the cable plant to confirm documented results. Any failing cabling shall be re-tested and restored to a passing condition. In the event more than two (2) percent of the cable plant fails during re-test, the entire cable plant shall be re-tested and restored to a passing condition at no additional cost to the Owner.
- Acceptance shall be subject to completion of all work, successful post-installation testing which yields 100% PASS rating and receipt of full documentation as specified.
- The City may agree to allow certain cable runs to exceed acceptable standardized performance criteria. If required these cable runs will be exempt from meeting the specified standards. However, the Contractor will still be required to test these cable runs to validate component and installation performance.
- Documentation: The Contractor shall submit the following documentation for final acceptance:
    - City of Toronto - IT Network — Cable Test Results Manual.
    - Cable Acceptance Test (CAT) – Compliance Sheet
    - Site Acceptance Test (SAT)
    - As-built Drawings and Documents (ADD)
    - Consultant Review and Comments (CRC)
    - CoT-IT Approval of Satisfaction (AoS) – Signing off

APPENDIX-A: SAMPLE OF CABLE ACCEPTANCE TEST (CAT)

TORONTO

CITY OF TORONTO - CABLE TEST RESULTS COMPLIANCE SHEET

Project Name			**Contract/Project Number**
Facility Name		**Facility Address**	
Location		**Closet/Rack Number**	
Consultant		**Contractor**	
Original Submission Date	**Second Submission Date**	**Third Submission Date**	**Fourth Submission Date**
City Reviewer	**Date Issued**	**Status** ❑ Approved ❑ Disapproved	

General

No.	GENERAL	Comply	Does Not Comply	Not Applicable
1	Cable test equipment DSX-5000 / 8000 with latest software version			
2	Cable test equipment DSX-5000 / 8000 with latest limit version			
3	Calibration certificate of the cable test equipment provided to the City			
4	Cable test results supplied to the City in PDF and Native format			
5	Test result specify the project name and / or contract number			
6	Test result specify site name or facility code			

Copper Test Results

No.	COPPER	Comply	Does Not Comply	Not Applicable
1	Permanent link testing performed			
2	Patch cord testing performed			
3	Test result cable identification in compliance with CoT-IT Standard			
4	Test result cable type in compliance with CoT-IT Standard – TIA-568 Horizontal			

Fiberoptics Test Results

No.	FIBRE	Comply	Does Not Comply	Not Applicable
1	Test results based on LED/VCSEL for OM4 50/125 um MM fibre cabling			
2	Test results based on FP Laser for OS2 9/125 um SM fibre cabling			
3	MM testing at 850nm and 1300nm modal bandwidth			
4	SM testing at 1310nm and 1550nm modal bandwidth			
5	Test result cable identification in compliance with City of Toronto-IT Standard			
6	Test result cable type in compliance with City of Toronto-IT Standard and TIA-568 Backbone MM/SM			
7	Test link attenuation in accordance with TIA-526-14 or TIA-526-7 makes reference measurements in accordance with METHOD-B (one jumper cable measurement for MM) or METHOD-A.1 (one jumper cable measurement for SM). Measure optical loss on each fibre at 850nm and1300nm (for MM) or 1310nm and 1550nm (for SM).			
8	Measure loss on each fibre from each direction (bi-directionally) as per CoT-IT Standard			
9	Accurate quantity of adapter and splices			
10	Smart Remote mode used for testing dual-fibre strands			

LINKWARE™ PC
CABLE TEST MANAGEMENT SOFTWARE

Cable ID: CCTV-MZ/02/01/020

Test Summary: PASS

Test Limit: TIA Cat 6A Perm. Link
Limits Version: V7.6
Date / Time: 06/06/2022 04:38:25 PM
Operator:
Headroom 3.3 dB (NEXT 3,6-7,8)
Cable Type: Cat 6A U/UTP
NVP: 68.2%

Main: Versiv
S/N: 2790064
Software Version: V6.6 Build 2
Calibration Date: 01/31/2022
Adapter: DSX-5000 (DSX-PLA004)
S/N: 4710039

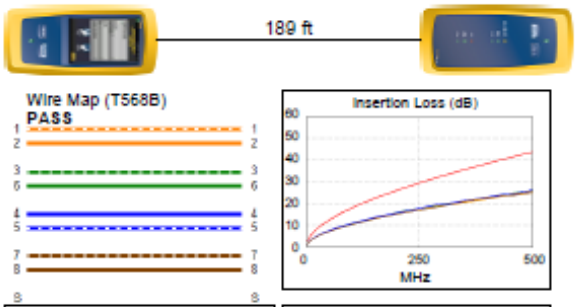
Remote: Versiv
S/N: 2797296
Software Version: V6.6 Build 2
Calibration Date: 01/31/2022
Adapter: DSX-5000R (DSX-PLA004)
S/N: 4710040

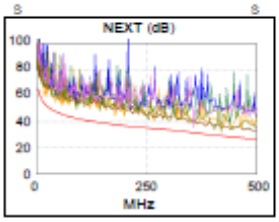
Length (ft), Limit 295	[Pair 7,8]	189
Prop. Delay (ns), Limit 498	[Pair 4,5]	295
Delay Skew (ns), Limit 44	[Pair 4,5]	13
Resistance (ohms)	[Pair 4,5]	9.09
Insertion Loss Margin (dB)	[Pair 3,6]	17.4
Frequency (MHz)	[Pair 3,6]	497.0
Limit (dB)	[Pair 3,6]	43.6

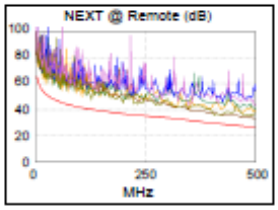
	Worst Case Margin		Worst Case Value	
PASS	MAIN	SR	MAIN	SR
Worst Pair	3,6-7,8	3,6-7,8	3,6-7,8	3,6-4,5
NEXT (dB)	3.3	6.1	3.3	6.4
Freq. (MHz)	410.0	406.0	410.0	497.0
Limit (dB)	29.5	29.6	29.5	26.7
Worst Pair	3,6	3,6	3,6	3,6
PS NEXT (dB)	4.6	5.5	6.4	7.0
Freq. (MHz)	410.0	424.0	500.0	497.0
Limit (dB)	26.7	26.2	23.8	23.8
PASS	MAIN	SR	MAIN	SR
Worst Pair	4,5-3,6	3,6-4,5	4,5-3,6	3,6-4,5
ACR-F (dB)	15.7	15.9	15.7	15.9
Freq. (MHz)	441.0	450.0	441.0	450.0
Limit (dB)	11.3	11.1	11.3	11.1
Worst Pair	3,6	3,6	3,6	3,6
PS ACR-F (dB)	16.9	16.4	18.4	17.8
Freq. (MHz)	1.1	1.3	463.0	453.0
Limit (dB)	60.2	59.3	7.9	8.1
N/A	MAIN	SR	MAIN	SR
Worst Pair	1,2-3,6	1,2-3,6	3,6-4,5	3,6-4,5
ACR-N (dB)	10.6	12.2	24.0	23.8
Freq. (MHz)	17.4	17.4	500.0	497.0
Limit (dB)	46.8	46.8	-17.1	-16.9
Worst Pair	3,6	1,2	3,6	3,6
PS ACR-N (dB)	11.8	13.7	24.1	24.3
Freq. (MHz)	19.3	17.3	500.0	497.0
Limit (dB)	43.3	44.4	-20.0	-19.7
PASS	MAIN	SR	MAIN	SR
Worst Pair	7,8	7,8	7,8	7,8
RL (dB)	1.9	3.5	2.0	5.0
Freq. (MHz)	146.5	274.0	357.0	481.0
Limit (dB)	12.3	9.6	8.5	8.0

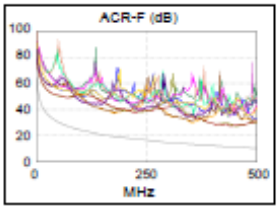
Compliant Network Standards:

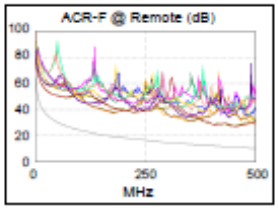
10BASE-T	100BASE-TX	100BASE-T4
1000BASE-T	2.5GBASE-T	5GBASE-T
10GBASE-T	ATM-25	ATM-51
ATM-155	100VG-AnyLan	TR-4
TR-16 Active	TR-16 Passive	

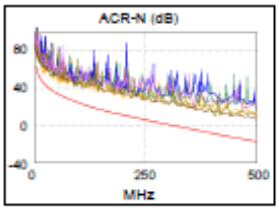


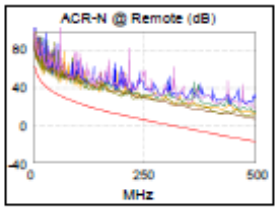


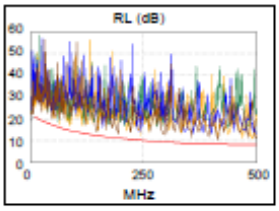


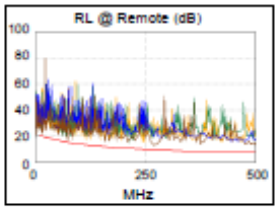












LinkWare™ PC Version 10.5

Project: New Project
Test Results - 00048531.flw

Page 4

FLUKE networks

LINKWARE™ PC
CABLE TEST MANAGEMENT SOFTWARE

Cable ID: 024

Date / Time: 02/15/2022 09:45:58 AM
Cable Type: SMF G652D

n = 1.467000 (1310 nm)
n = 1.468000 (1550 nm)

Test Summary: PASS

Backscatter Coefficient: -79.4dB (1310 nm)
Backscatter Coefficient: -81.7dB (1550 nm)

Loss (R->M)
PASS

Test Limit: ISO/IEC 14763-3
Limits Version: 7.6
Date / Time: 02/15/2022 09:45:58 AM
Operator: JOHN
Main: Versiv
S/N: 21123084
Software Version: V5.7 Build 1
Module: CertiFiber Pro (CFP-QUAD)
S/N: 21212667
Calibration Start Date: 08/12/2021
Remote: Versiv
S/N: 21120065
Software Version: V5.7 Build 1
Module: CertiFiber Pro Remote (CFP-QUAD)
S/N: 21212670
Calibration Start Date: 08/12/2021

Propagation Delay (ns)	7887	
Length ft	5284	PASS
Limit 16404		
	1310 nm	1550 nm
Result	PASS	PASS
Loss (dB)	0.78	0.52
Limit (dB)	3.21	3.21
Margin (dB)	2.43	2.69
Reference (dBm)	-4.04	-4.00

Number of Adapters: 2
Number of Splices: 2
Connector Type: LC
Patch Length1 (ft): 7
Reference Date: 02/15/2022 08:55:51 AM
1 Jumper

Loss (M->R)
PASS

Test Limit:
Limits Version:
Date / Time:

	1310 nm	1550 nm
Result	PASS	PASS
Loss (dB)	0.46	0.32
Limit (dB)	3.21	3.21
Margin (dB)	2.75	2.89
Reference (dBm)	-3.07	-3.05

Compliant Network Standards:

1000BASE-LX	100GBASE-ER4	100GBASE-LR4
10GBASE-E	10GBASE-L	10GBASE-LX4
40GBASE-ER4	40GBASE-LR4	Fibre Channel 100-SM-LC-L
Fibre Channel 1200-SM-LC-L	Fibre Channel 1600-SM-LC-L	Fibre Channel 200-SM-LC-L
Fibre Channel 400-SM-LC-L	Fibre Channel 400-SM-LC-M	Fibre Channel 800-SM-LC-L

LinkWare™ PC Version 10.5

Project:
Test Results - 00045277.flw

Page 3

FLUKE networks

APPENDIX-B: SAMPLE OF SITE ACCEPTANCE TEST (SAT) DOCUMENTS

Checklist of Telecom Enclosure (TE) / Network / Core Closet

Site Acceptance Test (SAT)

Facility:	**Project Name:**
Contract No.:	**Telecom Enclosure / Network / Core Closet Tag:**
Building:	**Sub-Location:**
Consultant:	**Contractor:**
Date:	**CoT-IT Staff:**

TELECOM ENCLOSURE (TE) / NETWORK / CORE CLOSET LAYOUT AND AS-BUILT DRAWINGS

Procedure:

- Verify that the as-built drawings are present.
- Verify the Telecom Enclosure components match the bill of materials.
- Verify equipment layout is as shown in the as-built drawings.
- Verify all components are tagged and wiring is labeled as per the drawings. (Enclosure, Patch Panels, Copper Patch Panel(s) Work Area Outlets, Cables, Power Distribution Components, etc.)
- Verify the horizontal and backbone fibre cable terminations and labeling.

If any comments are necessary, enter a note number in the test form column and record the comment in the comments form at the end of this document.

Acceptance Criteria:

Telecom Enclosure construction and labeling shall match the as-built drawings.

As Built Drawings Verification			
Item No.	**Description**	**Pass/Fail**	**Notes**
1	As built drawings present		
2	Bill of materials in compliance		
3	Layout / arrangement of components in compliance		
4	All components tagged as per as-built drawings. (Enclosure, Patch Panels, Copper Patch Panel(s) Work Area Outlets, Power Distribution Components, etc.)		
5	All wiring labeled as per as-built drawings		

Power and Fusing Verification

Procedure:

Verify that the indicated circuit breakers or fuses are installed and labeled with the indicated rating and source and destination distribution panel, breaker position ID. Refer to as built Telecom Enclosure wiring diagrams for the required circuit protection and rating. Record the installed protection device rating.

If the indicated installed circuit protection device matches the required rating enter PASS in the test form column.

If any comments are necessary, enter a note number in the test form column and record the comment in the comments form at the end of this document.

Acceptance Criteria:

Installed fuses and circuit breakers shall match the required specifications and labeled accordingly. The correct equipment is powered by the fuse and/or circuit breaker as shown on the as-built electrical drawings.

TE AC Power, Fusing and Tagging/Labeling Verification						
Circuit Breaker / Fuse ID	**Description**	**Required Rating**	**Installed Rating**	**Pass / Fail**	**Source / Destination ID**	**Notes**
120V AC UPS Power Supplementary Protectors						
SP02	UPS Receptacle and UPS Pilot Light (if applicable)	15A				
120V AC Hydro Power Supplementary Protectors						
SP01	Surge Suppressor and Utility Pilot Light (if applicable)	15A				
SP03	Panel Light	5A				
SP04	Utility Receptacle	15A				

Grounding & Bonding Verification

Procedure:

Verify that the indicated component is properly connected to the ground.

- Switch off system power.
- Verify the installation of the ground connection between the grounding bus or common ground terminal and the indicated component.
- Measure the DC resistance between the grounding bus or common ground terminal and the indicated component.
- Record the measured DC resistance between the ground connection and the component.

If the indicated grounding connection is installed and meets the maximum DC resistance specification enter a PASS in the test form column. If any comments are necessary, enter a note number in the test form column and record the comment in the comments form at the end of this document.

Acceptance Criteria:

The grounding or bonding conductor is installed and the DC resistance measurement must be less than or equal to 0.2 Ω between termination points.

Telecom Enclosure (TE) Grounding & Bonding Verification				
Grounding / Termination Point	**Ground Conductor Visual Inspection**	**Resistance Ω Measured**	**Pass / Fail**	**Notes**
Surge Suppressor		Ω		
UPS Receptacle / Isolated Ground		Ω		
Utility Receptacle		Ω		
Enclosure Door		Ω		
APC Power Bar		Ω		
Rack Mount Ground Bus		Ω		

Spare Parts, Loose Shipped Components, TE - Bill of Material Verification

Procedure:

Verify all spare parts and loose shipped components as required in the as-built drawings and bill of material are present. Typical items may be Fiber Optic Patch Cables, Copper Patch Cables, etc.

Enter PASS in the test form column if parts are present. If any comments are necessary, enter a note number in the test form column and record the comment in the comments form at the end of this document.

Acceptance Criteria:

Spare parts and loose shipped components are present as required.

Spare Parts and Loose Shipped Items			
Item No.	**Description**	**Pass / Fail**	**Notes**
1	Drawings		
2	Fiber Optic Patch Cords		
3	Copper Patch Cords		
4			
5			
6			
7			
8			
9			
10			

SAT NOTES / COMMENTS

Notes Ref. No.	Notes / Comments

Approvals / Sign Off

Site Acceptance Test

City

Name : _____ Company: _____

Signature: _____ Date: _____

Consultant

Name : _____ Company: _____

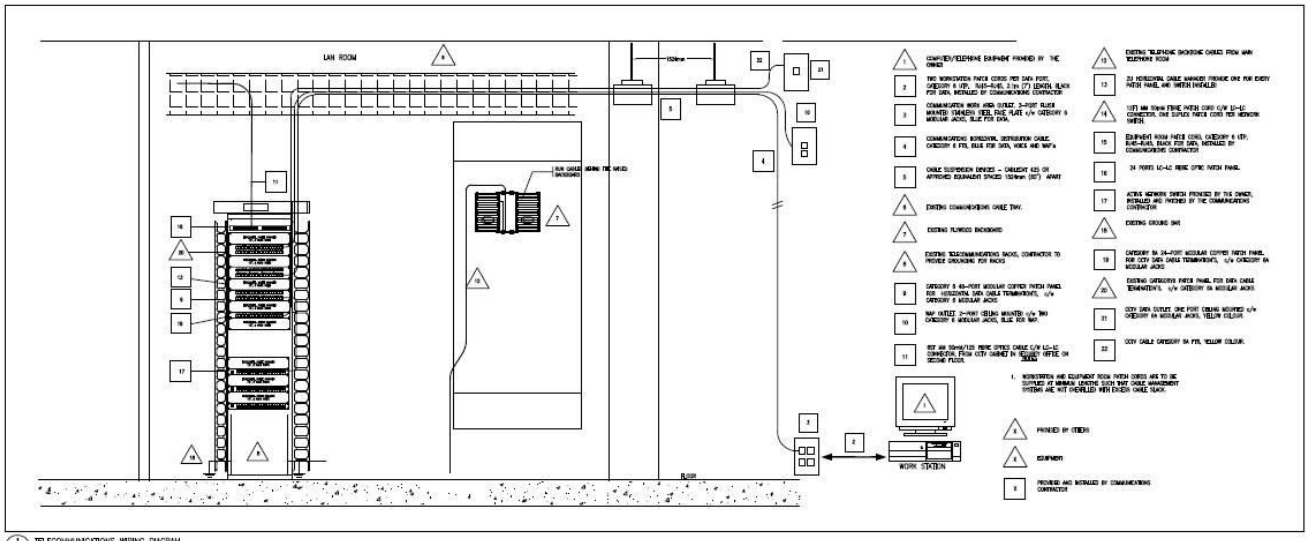
Signature: _____ Date: _____

Contractor

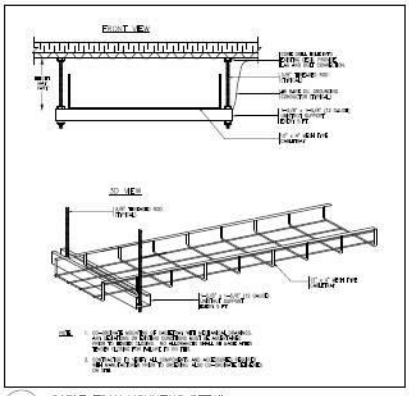
Name : _____ Company: _____

Signature: _____ Date: _____

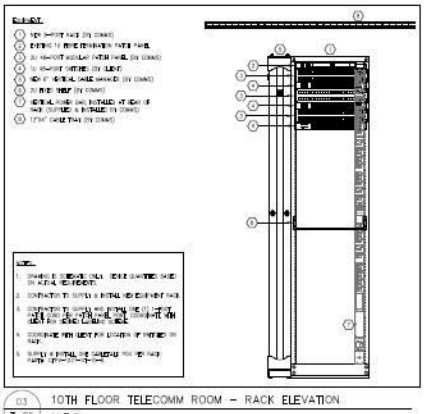
APPENDIX-C: SAMPLE OF TELECOM WIRING DIAGRAMS | DRAWINGS | PHOTOGRAPHS



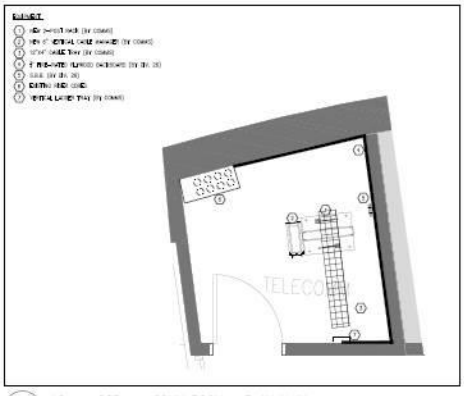
1 T2.0 TELECOMMUNICATIONS WIRING DIAGRAM
N.T.S.



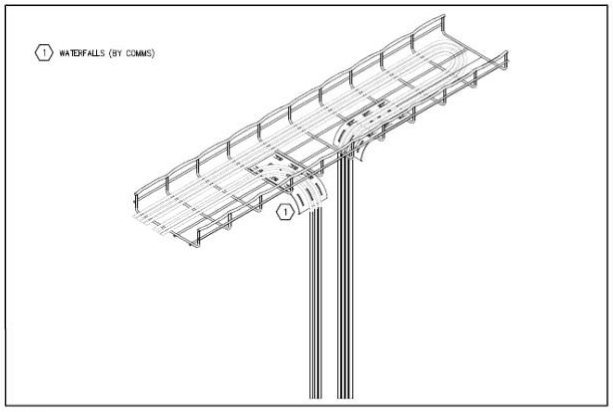
05 T-05 CABLE TRAY MOUNTING DETAIL
N.T.S.



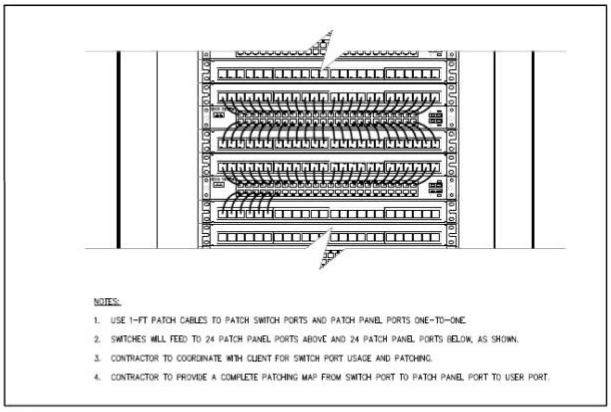
03 T-05 10TH FLOOR TELECOMM ROOM – RACK ELEVATION
N.T.S.



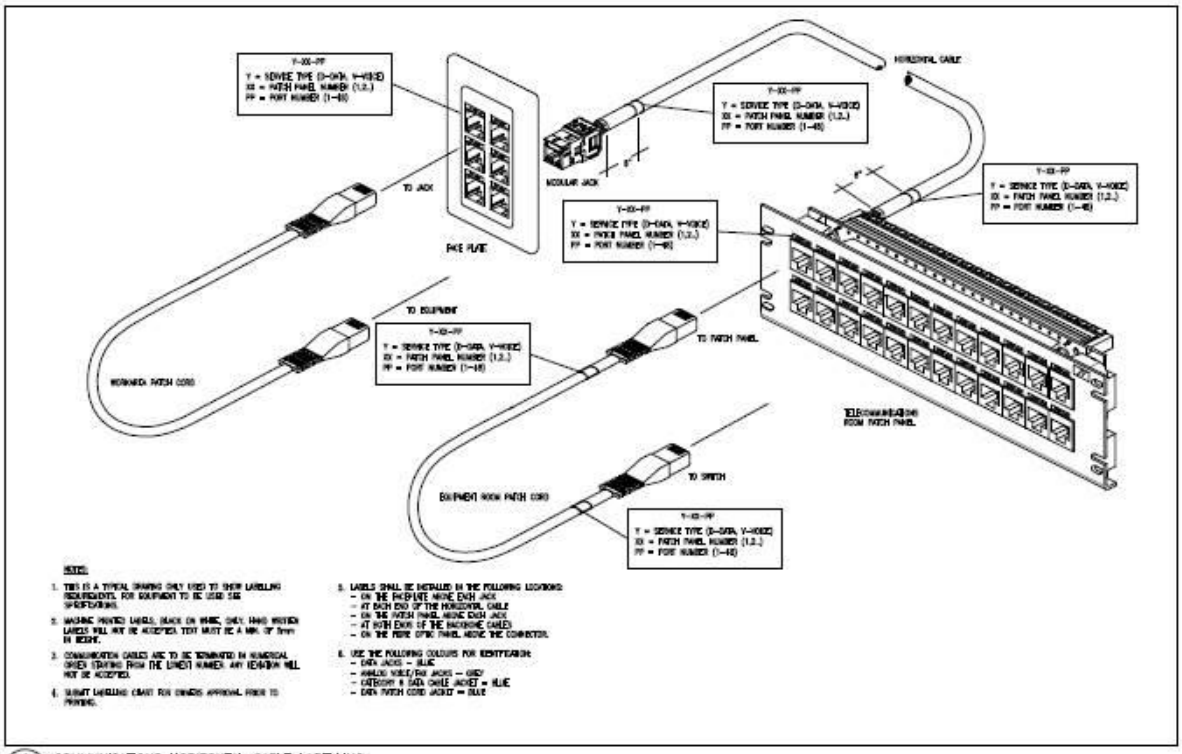
01 T-05 10TH FLOOR TELECOMM ROOM – PLAN VIEW
SCALE: 1/4" = 1'-0"



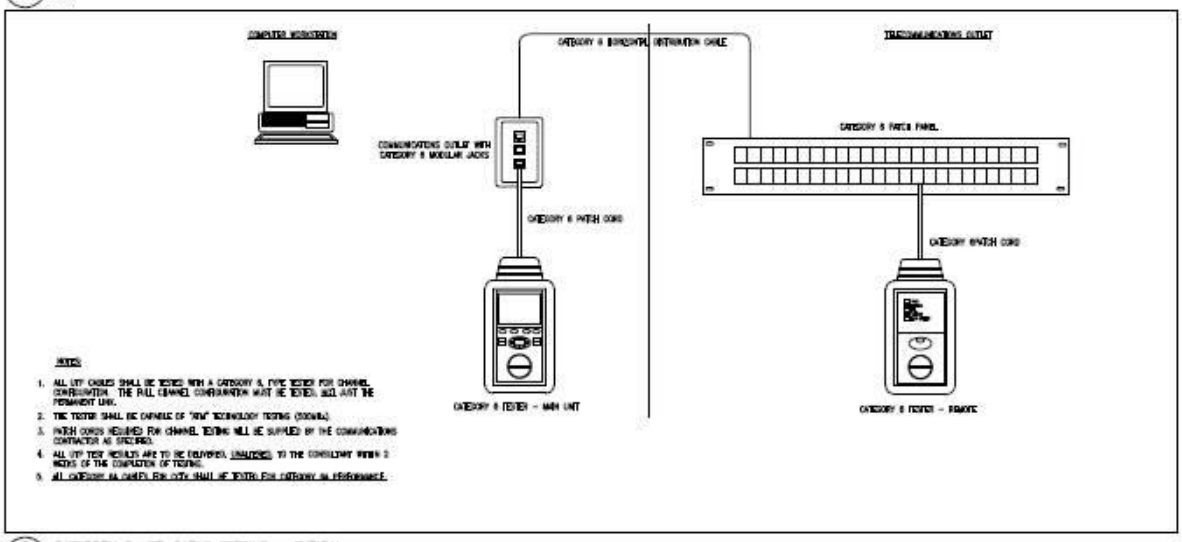
06 T-04 CABLE TRAY/WATERFALL – CABLE SLACK DETAIL
N.T.S.



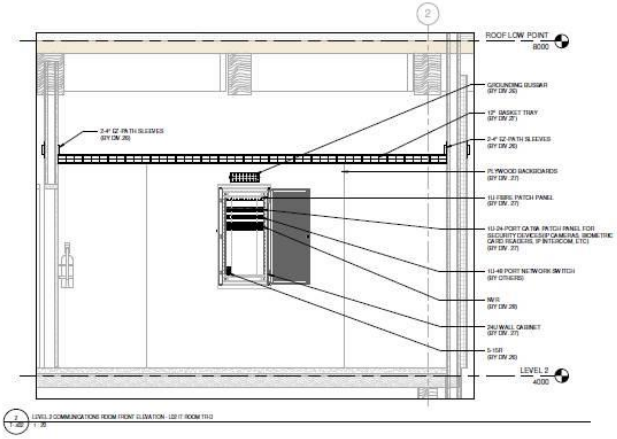
03 T-04 PATCHING DETAIL
N.T.S.

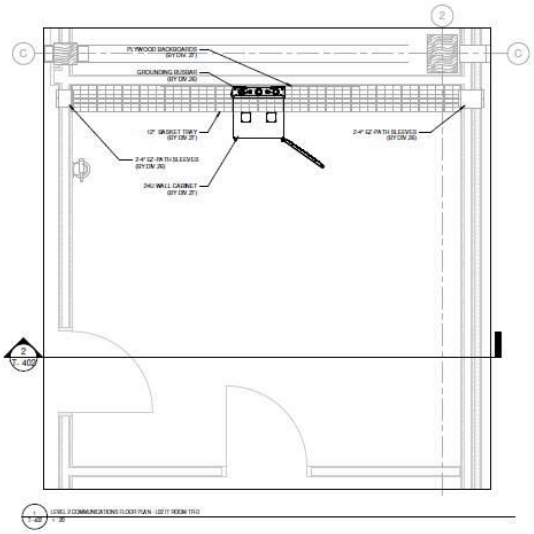


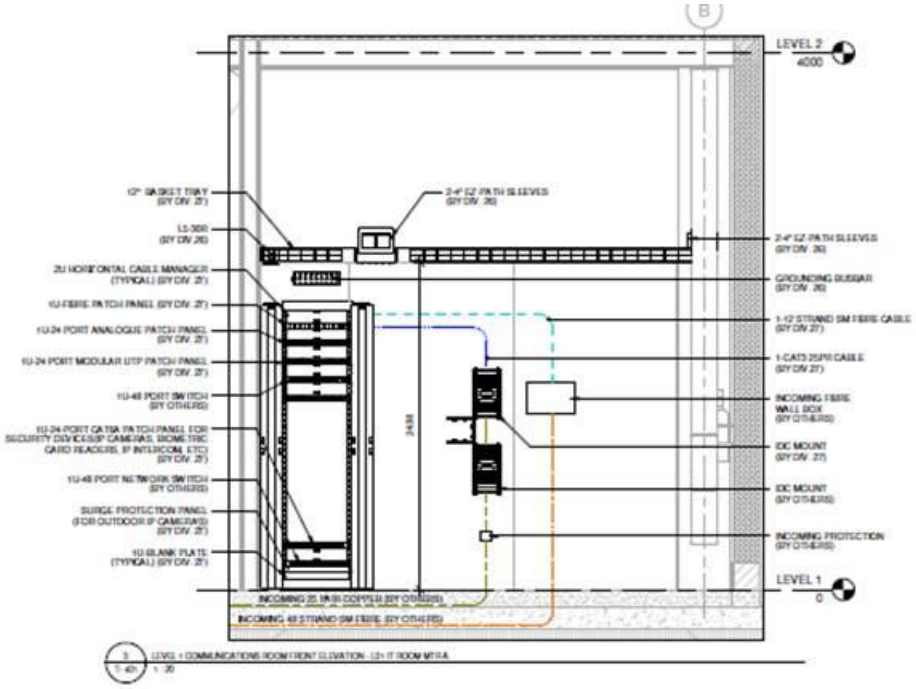
1 COMMUNICATIONS HORIZONTAL CABLE LABELLING
N.T.S.

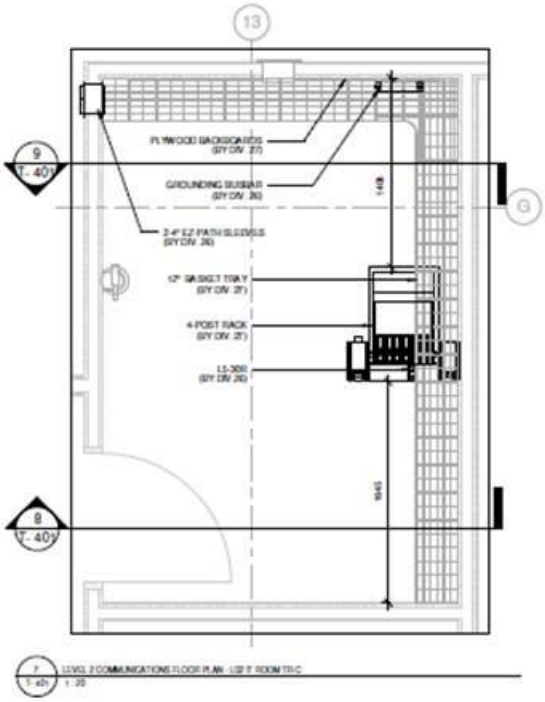


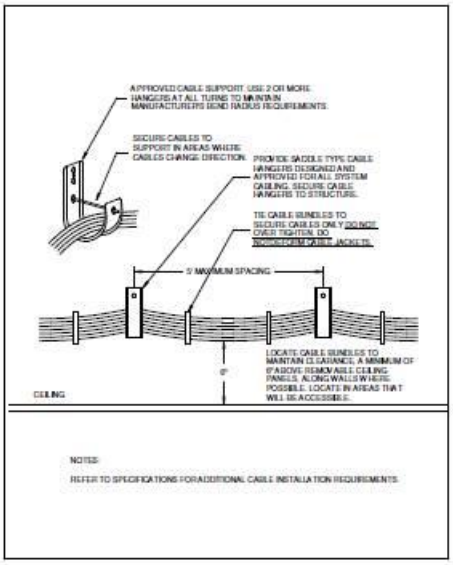
2 CATEGORY 6 UTP CABLE TESTING – TYPICAL
N.T.S.


ROOF LOW POINT
GROUNDING BUSBAR
12" BASKET TRAY
2-4" EZ PATH SLEEVES
PLYWOOD BACKBOARDS
1U FIBRE PATCH PANEL
1U 24-PORT CAT6A PATCH PANEL FOR SECURITY DEVICES(IP CAMERAS, BIOMETRIC CARD READERS, IP INTERCOM, ETC)
1U 48 PORT NETWORK SWITCH
MR
24U WALL CABINET
5-100
LEVEL 2


PLYWOOD BACKBOARDS
GROUNDING BUSBAR
12" BASKET TRAY
2-4" EZ PATH SLEEVES
24U WALL CABINET

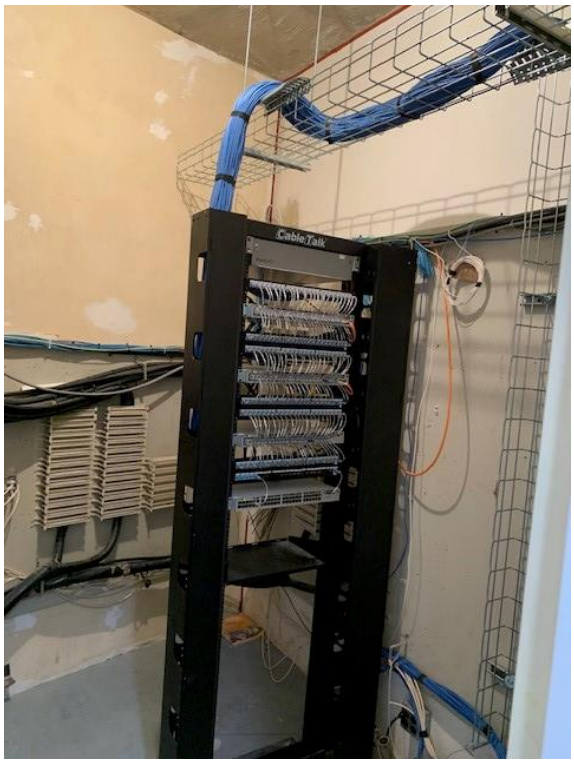

LEVEL 2
4000
12" BASKET TRAY
2-4" EZ PATH SLEEVES
L3-300
2U HORIZONTAL CABLE MANAGER (TYPICAL)
1U FIBRE PATCH PANEL
1U 24 PORT ANALOGUE PATCH PANEL
1U 24 PORT MODULAR UTP PATCH PANEL
1U 48 PORT SWITCH
1U 24-PORT CAT6A PATCH PANEL FOR SECURITY DEVICES(IP CAMERAS, BIOMETRIC CARD READERS, IP INTERCOM, ETC)
1U 48 PORT NETWORK SWITCH
SURGE PROTECTION PANEL (FOR OUTDOOR IP CAMERAS)
1U BLANK PLATE (TYPICAL)
GROUNDING BUSBAR
1-12 STRAND SM FIBRE CABLE
1-CAT3 25PR CABLE
INCOMING FIBRE WALL BOX
IDC MOUNT
IDC MOUNT
INCOMING PROTECTION
LEVEL 1
0



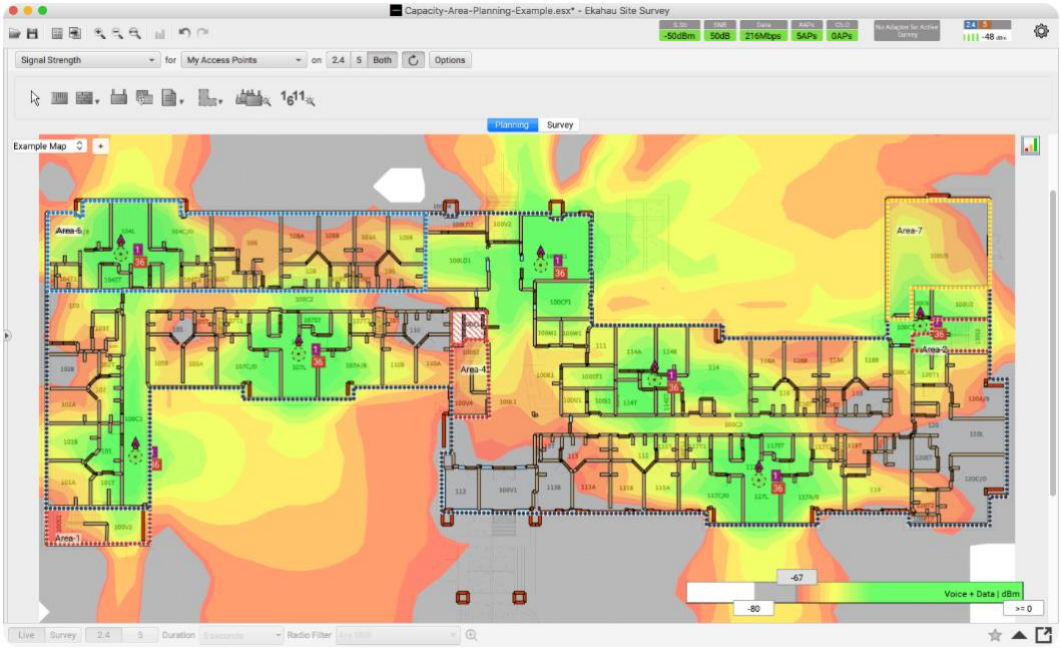


5 J-HOOK - INSTALLATION W/ CABLE HANGERS
N.T.S.

CableTalk
CableTalk


CableTalk

CableTalk
RADIANT



WI-FI COVERAGE HEATMAP – EXAMPLE (EKAHAU)

END OF DOCUMENT

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.

.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).

.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 mm 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 Canadian Council of Ministers of the Environment (CCME).

.1 CCME PN1055, Environmental Code of Practice for Underground Storage Tank Systems Containing Petroleum Products and Allied Petroleum Products.

.2 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.

.3 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.

.4 Ministry of the Environment, Conservation and Parks of Ontario

.5 Occupational Safety and Health Act; Ministry of Labour of Ontario

.6 Local municipal by-laws

.7 Local municipal by-laws

.8 Environmental Protection Act, RSO 1990, Chapter E.19

.9 Ontario Regulation 153/04 Records of Site Condition – Part XV.1 of the Act.

.10 Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act, April 15, 2011

.11 Ontario Regulation 406/19, On-Site and Excess Soil Management

.12 Ontario Regulation 347, General – Waste Management

.13 Preliminary Environmental Soil Quality Investigation, 160 Rivalda Road, North York, ON, prepared by GHD and dated October 24, 2024.

1.3 **DEFINITIONS**

.1 Environmental Consultant: a third party consultant and Qualified Person (as defined by Ontario Regulation 153/04) retained by City of Toronto to provide support with respect to environmental conditions of the Site, and management of soil in accordance with Ontario Regulation 406/19, as amended.

.2 Consultant: A third party consultant retained by City of Toronto to administer the contract

.3 MECP Table 3 ICC: Full depth generic site condition standards established in Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act, April 2011 for industrial, commercial or community (ICC) property use in non-potable groundwater conditions with coarse textured soil (MECP Table 3).

.4 MECP Table 3.1 ICC: Volume independent standards established in Rules for Soil Management and Excess Soil Quality Standards, December 2022 for industrial, commercial or community (ICC) property use in non-potable groundwater conditions with coarse textured soil (MECP Table 3.1 ESQS).

1.4 MEASUREMENT PROCEDURES

.1 Payment for soil removal, stockpiling, off-site disposal of soil, and replacement are included in the stipulated price.

1.5 EXAMINATION

.1 Verification of Conditions:

.1 Examine results of soil sampling included in Preliminary Environmental Soil Quality Investigation, 160 Rivalda Road, North York, ON

.2 If more and/or more recent analysis is required by the receiving site, Contractor must notify Consultant.

.3 Upon completion of any required soil removal, and prior to placement of any backfill or construction, document top of subgrade elevation through photographs and measurements, to the satisfaction of Consultant.

.2 Evaluation and Assessment:

.1 Complete sampling of source material, and ensure that planning documentation required under Regulation 406/19 is provided to the Environmental Consultant a minimum of 10 days prior to any soil importation. Sampling and preparation of documentation to support soil sourcing will be at the Contractor's sole cost.

1.6 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.

.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 in accordance with the City of Toronto Tree Protection Policy and Specifications for Construction Near Trees.

.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.

1.7 **SUBMITTALS**

.1 Hazardous materials: Provide description of hazardous materials and notification of filing with proper authorities prior to beginning Work, as required.

.2 Waste Management Certificates of Approval or Environmental Compliance Approvals.

.3 Prior to removal of soil from the Work Area, provide the Environmental Consultant with a copy of the Certificate of Authorization or Environmental Compliance Approval (whichever applies) for any transportation system and receiving facility selected for the management of soil removed from the Work Area. Provide the Environmental Consultant with documentation related to the management of Excess Soil (as required) a minimum of ten (10) business days prior to removal of soil from the Site. This consists of all O.Reg.406/19 documentation (as required), including an Assessment of Past Uses, Sampling and Analysis Plan, Soil Characterization Report, Excess Soil Destination and Assessment Report, Receiver Acceptance Letter and tracking on the Soil Registry. Inform the Environmental Consultant of any additional soil sampling requirements the receiving site may have.

.4 Provide the Consultant and Environmental Consultant with copies of weigh bills from receiving facilities within two (2) weeks of offsite removal.

.5 Documentation for source of imported soil, such as a soil report documenting physical and chemical properties of the soil. Documentation must comply with the requirements of Ontario Regulation 406/19, as required.

.6 A minimum of 10 business days prior to importing soil (as defined by O.Reg.153/04 and O.Reg.406/19), provide the Environmental Consultant with information about the source site and documentation under Ontario Regulation 406/19 (as required), including verification of soil quality for soil imported for backfill of the excavated areas . For clarity, soil quality documentation is required, despite any potential exemptions from Registry or Planning Document preparation that may apply to the source Site . O.Reg.153/04 and O.Reg.406/19 requirements do not apply to imported material that does not meet the definition of a soil (as defined by O.Reg.153/04 and O.Reg.406/19), such as virgin material from a licenced pit or quarry. The City, at their sole discretion, will accept the proposed source site, request additional information, or choose to not accept the source

site. No claims shall be submitted related to delays in identifying and obtaining approval for source sites.

1.8 **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.

1.9 **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.

.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.

1.10 **EXCAVATION**

.1 Slope excavations, as may be necessary for the safe removal of soil, protect slopes and banks and perform work in accordance with Provincial and Municipal regulations.

.2 Excavate in careful manner to avoid contamination of adjacent soil. Environmental Consultant may monitor excavation on a part-time basis.

.3 If soil will be stockpiled prior to loading in transport vehicles, place soil on a tarpaulin to demarcate the separation between stockpiled soil and soil acceptable to remain onsite. If a tarpaulin is not used, the Contractor will be required to remove a 5-cm thickness underlying the stockpile for off-site disposal at no cost to the Owner.

.4 All excavated soil removed from the site shall be managed consistent with all applicable laws and regulations, including O.Reg.153/04, O.Reg.406/19 and O.Reg.347.

1.11 **HAULING AND DISPOSAL**

.1 Prior to hauling of any soil, ensure that any required documentation or receiving site approvals under Ontario Regulation 406/19 have been obtained and approved by the Consultant and/or City's QP.

.2 Haul all material designated for disposal in tarped/covered trucks, or other appropriate means.

.3 Prevent hauled material from being spilled on the site of Works, roadways, public or private property.

.4 All excavated soil shall be disposed of at an appropriately licenced receiver.

.5 Disposal and hauling shall conform to all Provincial, Federal regulations, and Municipal legislation.

.6 All vehicles used for haulage of disposal materials must have their current registration available for inspection by the Consultant.

.7 The Contractor will provide copies of weigh bills for each truck at the end of each week to the Consultant and the Environmental Consultant.

1.12 **BACKFILLING**

.1 Fill excavated areas with material in accordance with specifications that is approved by the Environmental Consultant and supported with chemical analyses (as required).

.2 If soil (as defined by O.Reg.153/04 and O.Reg.406/19) is imported as backfill, the analytical results must comply with Table 3.1 Soil Quality Standards (Rules for Soil Management and Excess Soil Quality Standards, 2022) and any necessary O.Reg.406/10 documentation must be provided.

1.13 **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 **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 Backfill sources to be approved by Environmental Consultant in writing and supported with sampling at the rate required by Ontario Regulation 406/19, as amended (if required).

3.3 **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.

3.4 **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

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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 OPSS 310 - Ontario Provincial Standard Specification, Construction Specification for Hot Mix Asphalt

.2 OPSS 1101 - Ontario Provincial Standard Specification, Material Specification for Performance Graded Asphalt Cement

.3 OPSS 1150 - Ontario Provincial Standard Specification, Material Specification for Hot Mix Asphalt

1.3 **SUBMITTALS**

.1 Submit Shop Drawings in accordance with Section 01 33 00. Submit the following:

.1 Asphalt mix designs.

.2 Information regarding manufacture and installation of pavement markings, blackout paint, asphalt crack sealant and road reinforcement mesh.

1.4 **QUALITY ASSURANCE**

.1 Refer to “Quality Control” in Section 01 10 00 – General Requirements.

.2 Implement a quality control program which includes testing and inspection to comply with the intent of these Specifications.

.3 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.

.4 Consultant may have cores taken from finished pavement by an independent testing firm to ensure that paving has been placed to required thickness as shown and to specified degree of compaction. Testing will be at the expense of the Owner. Patch core holes resulting from the removal of samples, with asphaltic concrete material as specified herein.

.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 buildings and work of other trades from damage caused by work of this section. Correct damage caused by work of this section at no cost to Owner.

.2 Protect work of this section from damage or deformation during period of construction. Remove and replace precast bumper curb that are cracked, chipped, broken or otherwise damaged with new units acceptable to Consultant at no cost to Owner.

.3 Erect temporary barriers, signs, protective covers, and rain protection as required. Remove protection when pavement is ready for traffic.

.4 Do not apply pavement during wet weather, or unless granular base is dry in terms of asphaltic concrete paving.

2 Products

2.1 **MATERIALS**

.1 Asphaltic concrete paving: Conforming to OPSS 310, composed of a base course and a surface course, of types as shown.

.1 Asphalt cement: Conforming to requirements of OPSS 1101, PGAC 58-28 for light duty traffic and PGAC 64-28 for heavy duty traffic.

.2 Asphalt primer: Liquid asphalt emulsion, slow drying for spray or brush application.

.3 Recycled content: Use recycled asphalt product (RAP) in binder/base course mixes only. Do not use for wearing course.

.2 Pavement marking: Refer to Section 32 17 23.23 Pavement Markings.

.3 Precast bumper curbs / wheel stops: 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.

.4 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.

.5 Blackout paint: "Black Knight" polymer modified industrial grade emulsion sealer by U.S.E. Hickson Products or approved equivalent heavy bodied sealer. Use oil spot primer for oil and chemical stains, and crack filler as required, of types compatible with sealer.

.6 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 paving base preparation 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 Shape bases as necessary to correspond with finish elevations of pavement, providing for slope as shown. Compact granular bases to densities and methods specified in Section 31 00 00.

.2 Correct irregularities or depressions that develop under rolling by loosening granular material at such locations and adding or replacing material and recompacting until the surface is smooth and uniform. Dig out and replace soft spots which develop in granular base during or after compaction operations.

.3 To aid in compaction work or to reduce dust nuisance or both, sprinkle granular base with water during rolling, tamping and blading. Where water is added for improvement of compaction, apply immediately ahead of the compacting unit pass.

.4 Maximum allowable tolerance in cross-sectional and longitudinal profile is 6 mm at any place measured with a 3 m straight edge.

.5 When paving over existing asphalt surfaces, clean pavement surface to approval of Consultant. When leveling course is not required, patch and correct depressions and other irregularities before beginning paving operations.

3.3 **PRIMING**

.1 Prior to application of paving, prime paint vertical contact surfaces with liquid asphalt emulsion.

.2 Where paving of a course of asphalt has been delayed and/or will not be completed immediately after the underlying course of asphalt has been placed, thoroughly clean surfaces to be paved and apply one full coverage tack coat of asphalt primer immediately before paving.

3.4 **TACK COAT**

.1 Tack coat to existing asphalt surfaces is to be covered with hot mix asphalt.

.2 Power broom clean and air blast surfaces to remove debris and dust prior to tack coat.

.3 Apply tack coat of asphalt emulsion diluted with an equal part of water. Apply tack coat to continuous uniform thickness in accordance with manufacturer’s recommended rate of application, to bonding surfaces and allow to dry to manufacturer’s recommended tackiness before placing hot mix.

3.5 **REMOVING 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.

3.6 **ASPHALT CRACK REPAIR**

.1 Clean out and let dry existing cracks with hot compressed air lance.

.2 Fill crack with sealant to minimum depth of 10 mm in accordance with manufacturer's recommendations.

.3 Dust sealant with sand to prevent vehicle tracking.

3.7 **APPLICATION**

.1 Install asphaltic concrete paving to lines and compacted thicknesses shown conforming to methods of application and compaction requirements of OPSS 310.

.2 Clean prepared base of all foreign matter prior to application of the mixture to substrate.

.3 Form well bonded joints. Cut back bituminous course to full depth in straight line as required to expose fresh vertical surfaces. Remove broken or loose material. Paint exposed vertical edge of asphaltic joints with asphalt primer prior to placing asphalt courses.

.4 Form joints between new and existing work in same manner as specified herein for new work, and in such a manner as to ensure continuous bond at interface.

.5 Finish surface of pavement free from depressions exceeding 6 mm when measured with a 3 m straight edge. Remedy any low or defective areas by cutting out the course and replacing it with fresh hot mixture, and re-compact.

3.8 **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.

3.9 **PRECAST BUMPER CURBS / WHEEL STOPS**

.1 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.

3.10 **PROTECTION OF PAVING**

.1 After completion of surface course, prevent vehicular parking on pavement until surface has cured and hardened.

End of Section

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**

.1 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.

.2 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 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.

3.2 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.

3.3 PROTECTION AND CLEAN UP

.1 Upon completion of any portion of the concrete work, remove all debris and excess materials from the site and leave in a neat and tidy condition to the satisfaction of the Consultant.

.2 Clean Tactile immediately prior to occupancy of the building, using methods recommended by the tactile manufacturer.

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 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 and Ontario Traffic Manual Book 11, and with reflectorizing glass beads in accordance with 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 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 surface of any contaminants that would hinder adhesion.

.2 Verify pavement surface is free from ponding water, frozen matter, dust, oil, grease, scaling, or laitance, and other foreign matter detrimental to performance.

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 Lay out pavement markings as indicated on Contract Drawings and in accordance with manufacturer’s instructions.

.2 Allow paving to cure before applying markings.

.3 Paint 100 mm wide lines on pavement for parking stalls and accessible symbol, unless indicated otherwise.

.4 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.

.5 Lines to be parallel and have neat, straight, clean and sharp edges. Lines to be of uniform colour and density.

.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.

.8 Refinish ragged edges or lines incorrectly laid out. Remove incorrect lines and make them inconspicuous in accordance with manufacturer’s instructions.

3.5 **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.

3.6 **PROTECTION**

.1 Protect pavement marking until dry.

.2 Repair damage to adjacent materials caused by pavement marking application.

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 mm1" 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

Designated Substance Survey
For Accessibility Upgrades

160 Rivalda Road, Toronto, ON

New Paramedics Road

Issued April 20, 2022, by Fisher Environmental Ltd.

ENGINEERING

Professional Engineers Ontario

LABORATORY

CALA
Canadian Association for Laboratory Accreditation Inc.

DESIGNATED SUBSTANCES SURVEY FOR ACCESSIBILITY UPGRADES (IBI GROUP)

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Project No. FE-P 22-11972

April 20, 2022

TABLE OF CONTENTS

1.0. EXECUTIVE SUMMARY 1

2.0. INTRODUCTION 4

3.0. REGULATIONS 4

4.0. METHODOLOGY 5

5.0. REVIEW OF PREVIOUS REPORTS 6

6.0. FINDINGS AND RECOMMENDATIONS 6

6.1. ACRYLONITRILE 6
6.2. ARSENIC 6
6.3. ASBESTOS 7
6.3.1. General Information 7
6.3.2. Friable vs. Non-Friable ACM 7
6.3.3. Regulations 8
6.3.4. Findings 9
6.3.4.1. Sprayed or Troweled Fireproofing and Thermal Insulation 9
6.3.4.2. Texture Finish 9
6.3.4.3. Mechanical Insulation 9
6.3.4.4. Acoustic Ceiling Tile 9
6.3.4.5. Plaster / Drywall Joint Compound 9
6.3.4.6. Asbestos Cement Products 9
6.3.4.7. Vinyl Sheet Flooring 10
6.3.4.8. Vinyl Floor Tile 10
6.3.4.9. Other ACM 10
6.3.5. Recommendations 10
6.4. BENZENE 11
6.5. COKE OVEN EMISSIONS 12
6.6. ETHYLENE OXIDES 12
6.7. ISOCYANATES 12
6.8. LEAD 12
6.8.1. General Information 12
6.8.2. Regulations and Guidelines 12

6.8.3. Findings 13
6.8.4. Recommendations 13
6.9. MERCURY 14
6.9.1. General Information 14
6.9.2. Regulations 14
6.9.3. Findings 15
6.9.4. Recommendations 15
6.10. SILICA 15
6.10.1. General Information 15
6.10.2. Regulations 15
6.10.3. Findings 16
6.10.4. Recommendations 16
6.11. VINYL CHLORIDE 16
6.12. MOULD 16
7.0. LIMITATIONS 17
APPENDIX A – SITE PLANS ..... A
APPENDIX B – CERTIFICATE OF ANALYSIS ..... B
APPENDIX C – SITE PHOTOS C
APPENDIX D – PREVIOUS DSS REPORT ..... D

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 new Paramedic Stations, located at 160 Rivalda Road, Toronto, Ontario, herein after referred to as the “Site”. The site inspection and sampling works were conducted on March 8, 2022.

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 February 18, 2022.

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.

Please note that during the survey, Fisher observed that the specified work areas were under construction works. Most of the interior building materials like partitions walls, floorings and ceilings, have been demolished and removed.

Asbestos

Fisher was provided with the report of a previous DSS, which was conducted by Fisher on December 2017. This report has indicated the only assumed ACM was caulking (windows/doors).

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 following material are found to contain asbestos:

- Vinyl Floor Tile (9”x9” Cream with Brown Streaks) on the upper floor on a stairs’ landing.
- Black Mastic on the concrete deck used for glued-on ceiling tiles on the upper floor; and

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 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.
- Remove the asbestos-containing black mastic on the upper floor concrete deck using Type 1 abatement procedures, as outlined in O. Reg. 278/05. Please note that if the black mastic 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.

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 paint was collected from the handrailing of the stair and submitted to Fisher Environmental Laboratories for lead analysis. The results of analysis revealed that the grey paint contains 514 ppm of lead, which is below the action limit.

Fisher recommends that, prior to the planned renovation work, the removal of lead containing materials found within the specified work areas, must be conducted using the appropriate lead abatement procedures. Lead abatement procedures to be used are determined by the methods 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 the new Paramedic Stations, located at 160 Rivalda Road, Toronto, Ontario, herein after referred to as the “Site”. The site inspection and sampling works were conducted on March 8, 2022.

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 February 18, 2022.

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 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 Fisher on December 2017, attached in Appendix D. This report has indicated the only assumed ACM was caulking (windows/doors).

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

During the current survey, texture finish was observed on the upper-level ceiling. The previous report confirmed that bulk samples of the texture finish were collected for analysis. The results of analysis revealed that the texture finish on the ceiling does not contain asbestos.

6.3.4.3. Mechanical Insulation

The majority of mechanical insulation observed throughout the building are either not insulated or are insulated with fibreglass which is not suspected to contain asbestos.

6.3.4.4. Acoustic Ceiling Tile

During the current survey, one (1) style of ceiling tiles were observed within the specified work areas.

- Ceiling Tile 2 (12"×12" Smooth)

The previous report confirmed that Ceiling Tile 2 were sampled for analysis. The results of analysis revealed that Ceiling Tile 2 does not contain asbestos.

6.3.4.5. Plaster / Drywall Joint Compound

Plaster was not observed within the specified work areas during the survey. Drywall Joint Compound (DJC) was observed throughout the building. The previous report indicated that 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 was observed within the specified work areas.

- VFT – 9” x 9”, Cream with Brown Streaks

Three (3) samples of this vinyl floor tile were collected for analysis. The results of analysis revealed that this vinyl floor tile, observed on the landing of the stairs, contains 0.5-5% Chrysotile asbestos.

6.3.4.9. Other ACM

Mortar

Mortar was observed along the joints of the concrete block. 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 and the window frames at the Site. Three (3) samples of the brown caulking were collected for analysis. The results of analysis revealed that the brown caulking around the door frames and the window frames does not contain asbestos.

Black Mastic

Black mastic was observed under the glued-on ceiling tile (12"×12" Plain) on the upper-level within the specific work areas. Three (3) samples of the black mastic were collected for analysis. The results of analysis revealed that the black mastic contains 5-25% Chrysotile asbestos.

Brown Mastic

Brown mastic was observed on the upper-level concrete deck within the specific work areas. Three (3) samples of the brown mastic were collected for analysis. The results of analysis revealed that the brown mastic on the upper-level concrete deck does not contain asbestos.

Asphalt

Three (3) samples of the asphalt were collected for analysis. The results of analysis revealed that the asphalt in the parking area 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 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;
- 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.
- Remove the asbestos-containing black mastic on the concrete deck behind the glued on ceiling tiles, using Type 1 abatement procedures, as outlined in O. Reg. 278/05. Please note that if the black mastic 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. 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/m^3 (TWA) depending on the type of lead, and for tetraethyl lead 0.30 mg/m^3 (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 paint from the handrailing of the stairs was collected and submitted to Fisher Environmental Laboratories for lead analysis. The results of analysis revealed that this grey paint contains 514 ppm of lead, which 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 methods 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; • 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; • 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; • 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/m^3 (TWA) for all forms of mercury excluding alkyl, and for alkyl compounds of mercury 0.03 mg/m^3 (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/m^3 (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.

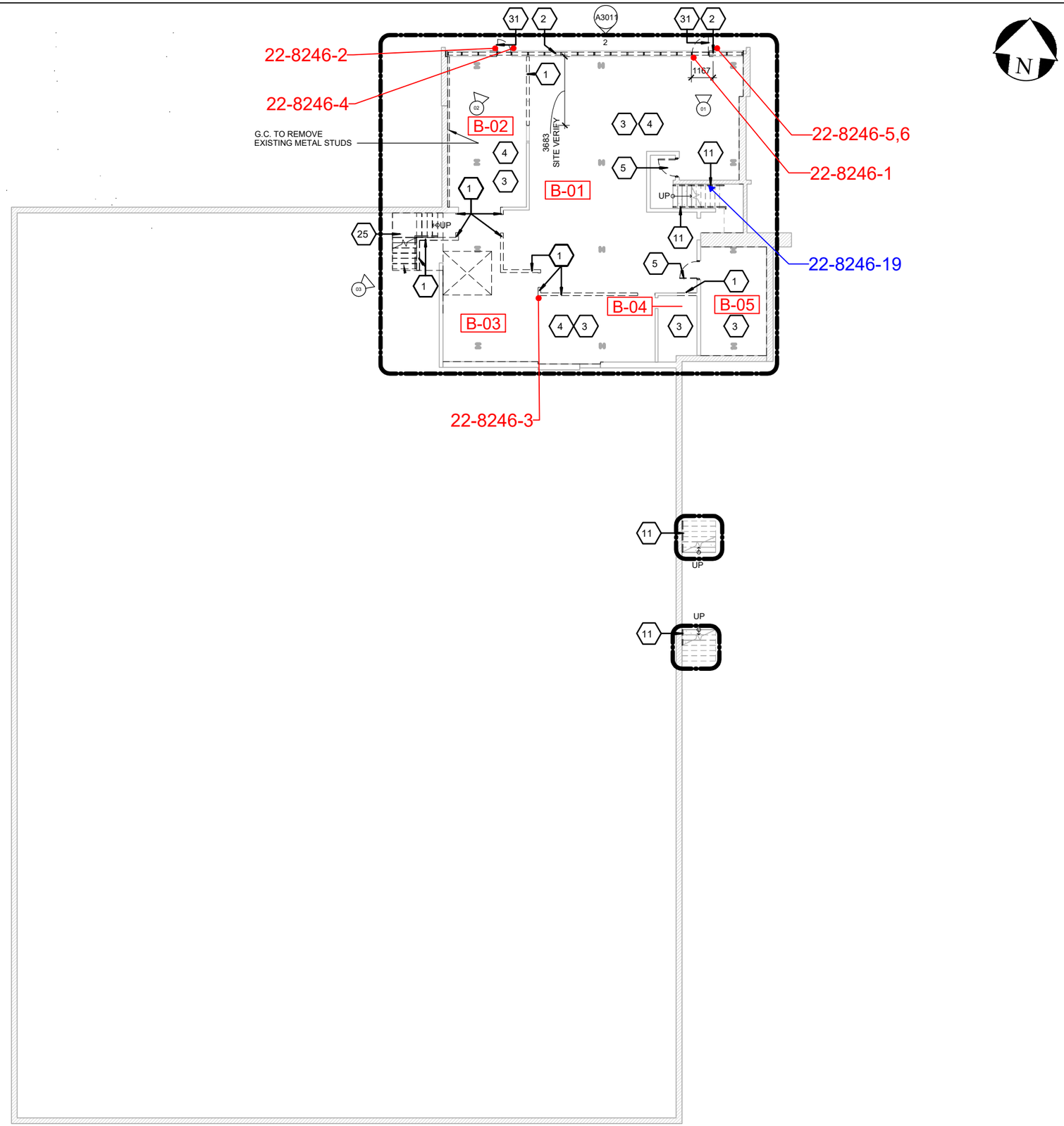
We trust that the information provided in the report meets your current requirements. If you have any questions or concerns, please do not hesitate to contact the undersigned.

Respectfully submitted,

Iqbal Fattah, M.Sc.
Project Manager

David Fisher, P. Eng., C. Chem.
Principal

APPENDIX A – SITE PLANS



Legend

Area of Work

Asbestos Sample Location

Lead Sample Location

1-01 Location Number

Figure 1

LOCATION:
160 Rivalda Road
Toronto, Ontario

BUILDING NAME:
New Paramedics Stations

Basement Floor Plan
Pre-Reno DSS
Asbestos and Lead Sample Locations

CLIENT: IBI Group

PROJECT NUMBER: FE-P 22-11972	DATE: April 2022	DRW BY: ZA
CAD FILE: FIG1	SCALE: Not to Scale	CHK BY: IF

FISHER ENVIRONMENTAL LTD.

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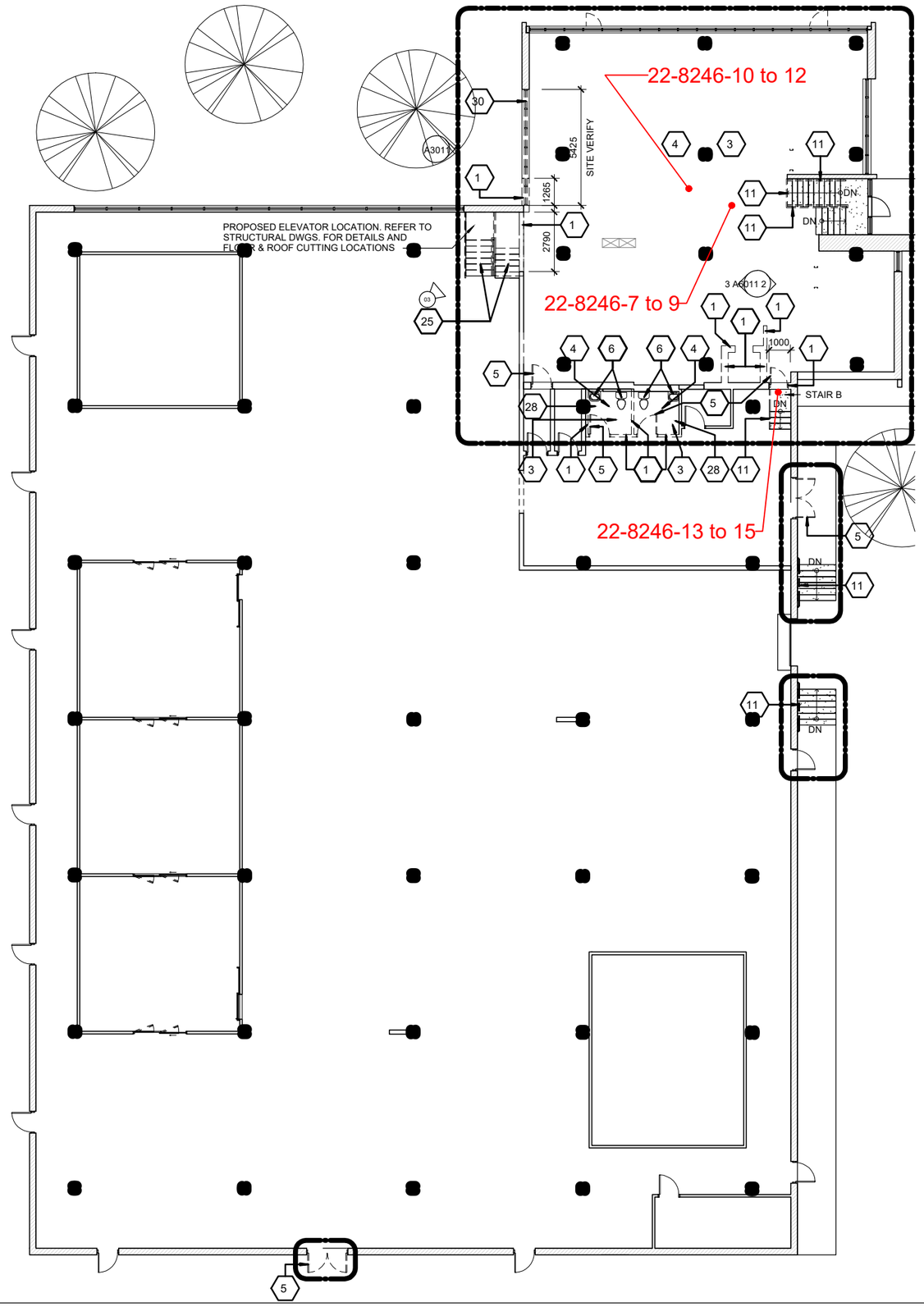

Legend

Area of Work

Asbestos Sample Location

Figure 2

LOCATION:
160 Rivalda Road
Toronto, Ontario

BUILDING NAME:
New Paramedics Stations

Upper Level Floor Plan
Pre-Reno DSS
Asbestos Sample Locations

CLIENT: IBI Group

PROJECT NUMBER:	FE-P 22-11972	DATE:	April 2022	DRW BY:	ZA
CAD FILE:	FIG2	SCALE:	Not to Scale	CHK BY:	IF

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Tel: 905 475-7755
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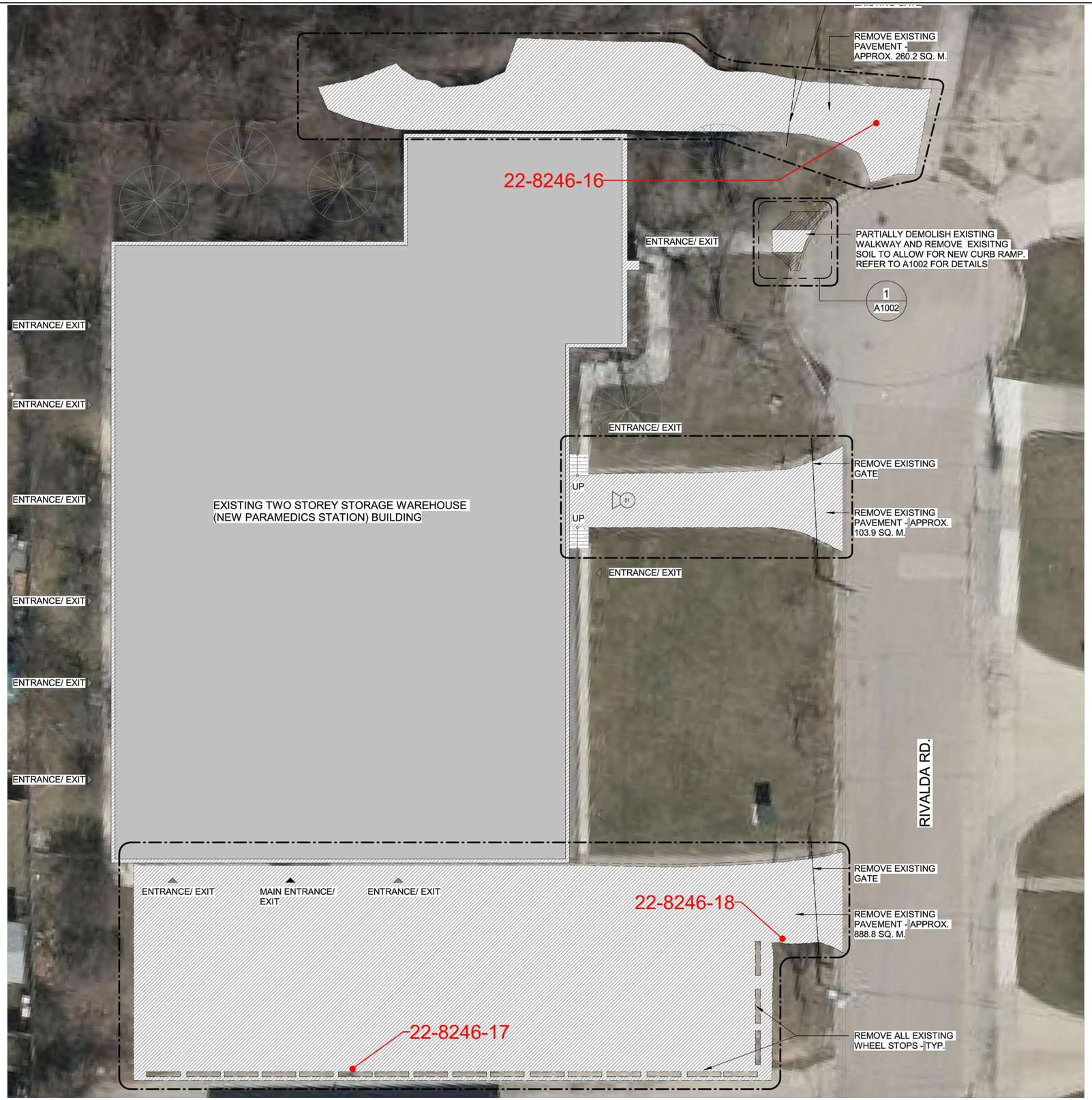

N

Legend

Area of Work

Asbestos Sample Location

Figure 3

LOCATION:

160 Rivalda Road
Toronto, Ontario

BUILDING NAME:

New Paramedics Stations

Site Plan
Pre-Reno DSS
Asbestos Sample Locations

CLIENT: IBI Group

PROJECT NUMBER:	FE-P 22-11972	DATE:	April 2022	DRW BY:	ZA
CAD FILE:	FIG3	SCALE:	Not to Scale	CHK BY:	IF

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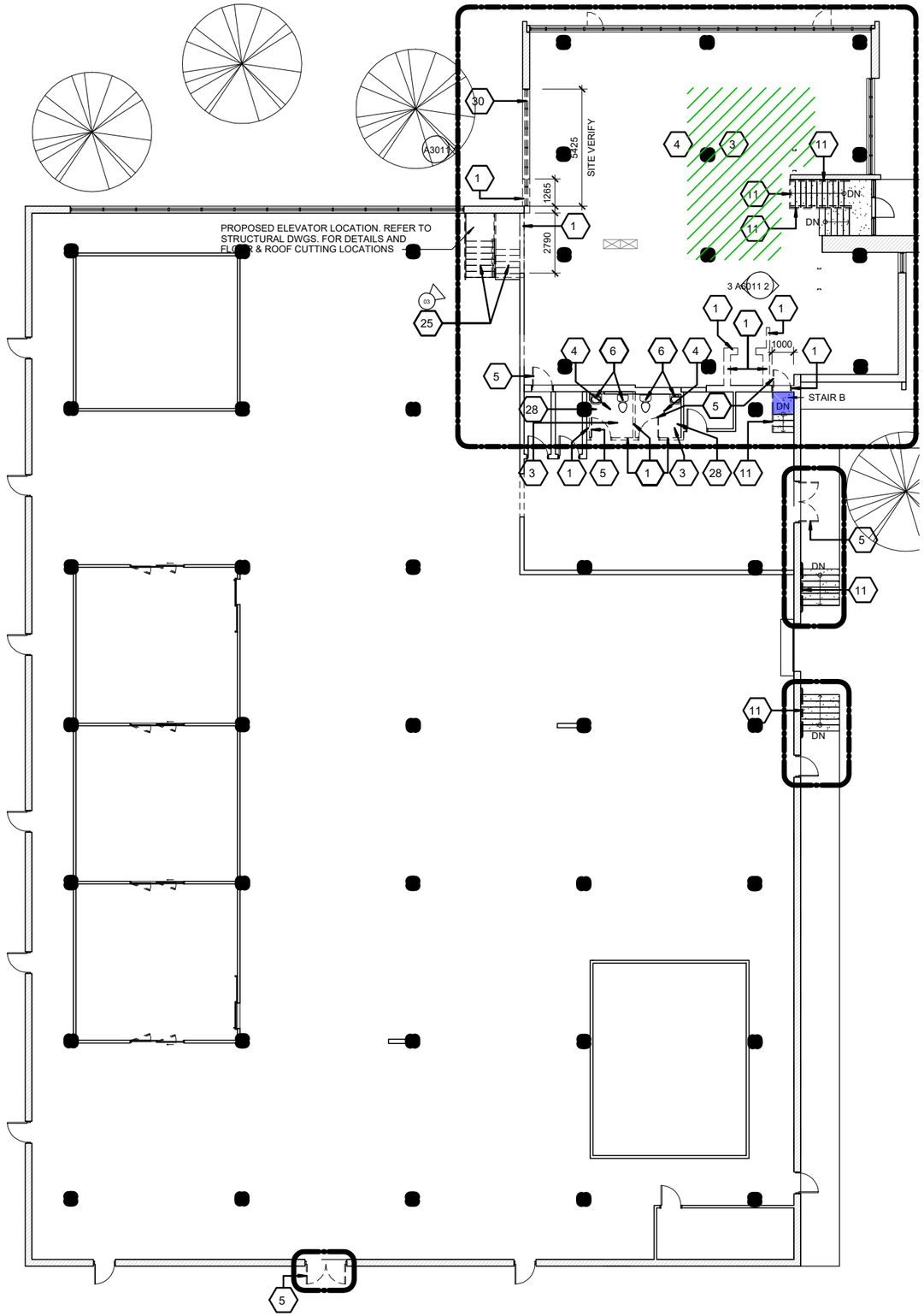

Legend

Area of Work

Vinyl Floor Tiles

Black Mastic

Figure 4

LOCATION:
160 Rivalda Road
Toronto, Ontario

BUILDING NAME:
New Paramedics Stations

Upper Level Floor Plan
Pre-Reno DSS
Asbestos- Containing Material Locations

CLIENT: IBI Group

PROJECT NUMBER: FE-P 22-11972	DATE: April 2022	DRW BY: ZA
CAD FILE: FIG4	SCALE: Not to Scale	CHK BY: IF

FISHER ENVIRONMENTAL LTD.

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Markham, Ontario
L3R 3K2

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Fax: 905 475-7718

APPENDIX B – CERTIFICATE OF ANALYSIS

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Toronto, ON
M9W 0C9
Tel.: 416-679-1930
E-mail: jonathan.bruno@ibigroup.com
Attn: Jonathan Bruno

F.E. Job #: 22-8246
Project Name: DSS
Project ID: FE-P 22-11972
Date Sampled: N/A
Date Received: 31-Mar-2022
Date Reported: 1-Apr-2022
Location: 160 Rivalda Road

Certificate of Analysis

Analysis Requested:	Asbestos, Lead
Sample Description:	19 Bulk Sample(s) (***Rush***)

Sample Matrix and Client Sample Description	Client Sample Location	Lab Sample ID	Asbestos Content and Fibre Type
1A - Mortar	Basement, Loc. B-01, Activity Room and Exit, North Wall, along the Joint of the Concrete Blocks	22-8246-1	Not Detected
1B - Mortar	Basement, Loc. B-02, Former Kitchen, North Wall, along the Joint of the Concrete Blocks	22-8246-2	Not Detected
1C - Mortar	Basement, Loc. B-01, Activity Room and Exit, South Wall, along the Joint of the Concrete Blocks	22-8246-3	Not Detected
2A - Brown Caulking	Basement, Loc. B-02, Former Kitchen, Exterior of the Door Frame, around the Door Frame	22-8246-4	Not Detected
2B - Brown Caulking	Basement, Loc. B-01, Activity Room and Exit, Exterior of the Door Frame, around the Door Frame	22-8246-5	Not Detected
2C - Brown Caulking	Basement, Loc. B-01, Activity Room and Exit, Exterior of the Door Frame, around the Door Frame	22-8246-6	Not Detected
3A - Black Mastic	Upper-Level Floor, Concrete Deck	22-8246-7	5-25%; Chrysotile
3B - Black Mastic	Upper-Level Floor, Concrete Deck	22-8246-8	5-25%; Chrysotile
3C - Black Mastic	Upper-Level Floor, Concrete Deck	22-8246-9	5-25%; Chrysotile

Results relate only to the items tested

Certificate of Analysis

Analysis Requested:	Asbestos, Lead
Sample Description:	19 Bulk Sample(s) (Rush)

Sample Matrix and Client Sample Description	Client Sample Location	Lab Sample ID	Asbestos Content and Fibre Type
4A - Brown Mastic	Upper-Level Floor, Concrete Deck	22-8246-10	Not Detected
4B - Brown Mastic	Upper-Level Floor, Concrete Deck	22-8246-11	Not Detected
4C - Brown Mastic	Upper-Level Floor, Concrete Deck	22-8246-12	Not Detected
5A - VFT - 9"x9" Cream with Brown Streaks	Upper-Level Floor, Concrete Deck, Stair's Landing	22-8246-13	0.5-5%; Chrysotile
5B - VFT - 9"x9" Cream with Brown Streaks	Upper-Level Floor, Concrete Deck, Stair's Landing	22-8246-14	0.5-5%; Chrysotile
5C - VFT - 9"x9" Cream with Brown Streaks	Upper-Level Floor, Concrete Deck, Stair's Landing	22-8246-15	0.5-5%; Chrysotile
6A - Asphalt	Exterior, North Pavement	22-8246-16	Not Detected
6B - Asphalt	Exterior, South Pavement	22-8246-17	Not Detected
6C - Asphalt	Exterior, South Pavement	22-8246-18	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.

Results relate only to the items tested

Certificate of Analysis

Analysis Requested:	Asbestos, Lead
Sample Description:	19 Bulk Sample(s) (Rush)

Sample Matrix and Client Sample Description	Client Sample Location	Lab Sample ID	Lead (ppm)
L1 - Grey Paint	Stairwell, Handrailing	22-8246-19	514

< 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	92	80-120	94	70-130

Parameter	Duplicate (%)					
	RPD	AR				
Lead	8.3	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

ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO
CHARTERED
Ronggen (Roger) Lin
CHEMIST

Results relate only to the items tested

APPENDIX C – SITE PHOTOS

Photo 1: View of the asbestos-containing Vinyl Floor Tile 9”x9” Cream with Brown Streaks on the stairs landing on the upper-level.

Photo 2: View of the asbestos-containing black mastic on the concrete deck behind the glued-on ceiling tiles on the upper-level within the specific work areas.

Photo 3: View of the asbestos-containing black mastic on the concrete deck behind the drywall ceiling (2nd layer) which is covered the glued-on ceiling tiles on the upper-level within the specific work areas.

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APPENDIX D – PREVIOUS DSS REPORT

DESIGNATED SUBSTANCE SURVEY

FORMER COMMERCIAL BUILDING
160 RIVALDA ROAD

Toronto, Ontario

Presented to:

Meaghan Aldcroft

City of Toronto
Facilities Management

Fisher Environmental Ltd.
Project Number: FE-P 17-8532

DECEMBER, 2017

TABLE OF CONTENTS

1. INTRODUCTION AND REGULATORY REQUIREMENTS 1

1.1 INTRODUCTION AND SCOPE 1

2. SURVEY METHODOLOGY 1

2.1 GENERAL APPROACH 1
2.2 SURVEY METHODOLOGY 1

3. FINDINGS AND RECOMMENDATIONS 2

3.1 *ASBESTOS* 2
3.1.1 Findings 2
3.1.2 Recommendations 3
3.2 *LEAD* 4
3.2.1 Findings 4
3.2.2 Recommendations 4
3.3 *ACRYLONITRILE* 4
3.3.1 Findings 4
3.3.2 Recommendations 5
3.4 *ARSENIC* 5
3.4.1 Findings 5
3.4.2 Recommendations 5
3.5 *BENZENE* 5
3.5.1 Findings 5
3.5.2 Recommendations 5
3.6 *COKE OVEN EMISSIONS* 5
3.6.1 Findings 5
3.6.2 Recommendations 5
3.7 *ETHYLENE OXIDES* 6
3.7.1 Findings 6
3.7.2 Recommendations 6
3.8 *ISOCYANATES* 6
3.8.1 Findings 6
3.8.2 Recommendations 6
3.9 *MERCURY* 6
3.9.1 Findings 6
3.9.2 Recommendations 6
3.10 *SILICA* 7
3.10.1 Findings 7
3.10.2 Recommendations 7
3.11 *VINYL CHLORIDE* 7
3.11.1 Findings 7
3.11.2 Recommendations 7
3.12 *POLYCHLORINATED BIPHENYLS (PCBS)* 7
3.12.1 Findings 7
3.12.2 Recommendations 8
3.13 *MOULD* 8
3.13.1 Findings 8
3.13.2 Recommendations 8

4. CORRECTIVE ACTIONS 8

5. STATEMENT OF LIMITATIONS 9

6. SIGN-OFF 9

TABLE OF CONTENTS

APPENDIX I – REASSESSMENT SURVEY FORM
APPENDIX II – RESULTS OF BULK SAMPLE ANALYSIS
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 a former commercial building located at 160 Rivalda 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 Fisher Environmental on October 19, 2009.

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. Yvonne Hoogeveen of Fisher Environmental Ltd. performed the fieldwork on November 29, 2017.

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,
- Plaster/Drywall Joint Compound,
- Vinyl Floor Tiles – four (4) varieties, and
- Ceiling Tiles – two (2) varieties.

Vinyl Floor Tile 2 (12” x 12” Brown with White Streaks) not identified during previous assessment surveys was observed in location B-01 Exit.

Vinyl Floor Tile 3 (12” x 12” Beige with Brown Streaks) not identified during previous assessment surveys was observed in location B-01 Exit.

Asbestos-containing Vinyl Floor Tile (9" x 9" Brown with white / Beige with rust) previously identified in the Basement, Washrooms and was not observed during the 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.

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
17-7651-01 to 03	Drywall Joint Compound	W1-01 Warehouse area, W1-02 Electrical Room	None Detected
17-7651-04 to 06	CT1- 2' x 4' Pinhole Fissure	W1-04 Washroom, W1-05 Washroom	None Detected
17-7651-07 to 09	VFT1- 12" x 12" Beige Mosaic	1-06 Main Office, 1-07 Office Area	None Detected
17-7651-10 to 12	Mastic	1-06 Main Office, 1-07 Office Area	None Detected
17-7651-13 to 15	CT2- 12" x 12" Smooth	1-05 Washroom, 1-10 Girls Washroom, 1-11 Boys Washroom	None Detected
17-7651-16 to 20	Drywall Joint Compound	1-05 Washroom, 1-07 Office Area, 1-08 Office, 1-09 Office	None Detected
17-7651-21 to 23	Texture Coat on Columns	1-06 Main Office, 1-08 Office, 1-13 Storage	None Detected
17-7651-24 to 26	VFT2- 12" x 12" Brown with White Streaks	B-01 Exit	None Detected
17-7651-27 to 29	Mastic	B-01 Exit	None Detected
17-7651-30 to 32	VFT3- 12" x 12" Beige with Brown Streaks	B-01 Exit	None Detected
17-7651-33 to 35	Mastic	B-01 Exit	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

During the current investigation, no lead samples were collected for 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 volatized 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:

Yvonne Hoogeveen
Project Manager

Reviewed By:

LICENSED PROFESSIONAL ENGINEER
D. A. FISHER
PROVINCE OF ONTARIO

David Fisher, P. Eng., C. Chem.
Principal

APPENDIX I

REASSESSMENT SURVEY FORM

APPENDIX I - REASSESSMENT SURVEY FORM

Building Address:	160 Rivalda Road	Date(s) of Current Reassessment:	November 29, 2017
Building Name:	Former Commercial Building	Organization Completing Reassessment:	Fisher Environmental Ltd. / Project FE-P 17-8532
Original Survey Conducted By:	Fisher Environmental	Name of Surveyor:	Yvonne Hoogeveen
Date(s) of Original Survey:	October 19, 2009	Signature of Surveyor:	

Summary of Findings
No Hazardous Materials

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	20000	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	Activity Room & Exit	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
B-01	Activity Room & Exit	Floor	Vinyl Floor Tile 2	Asbestos	17-7651-24 to 26	Not Detected	8 SF	N/A	12" x 12" Brown with White Streaks
B-01	Activity Room & Exit	Floor	Mastic	Asbestos	17-7651-27 to 29	Not Detected	8 SF	N/A	
B-01	Activity Room & Exit	Floor	Vinyl Floor Tile 3	Asbestos	17-7651-30 to 32	Not Detected	8 SF	N/A	12" x 12" Beige with Brown Streaks
B-01	Activity Room & Exit	Floor	Mastic	Asbestos	17-7651-33 to 35	Not Detected	8 SF	N/A	
B-01	Activity Room & Exit	Walls	Concrete/Wood/Brick	N/A	N/A	N/A	N/A	N/A	
B-01	Activity Room & Exit	Ceiling	Concrete	N/A	N/A	N/A	N/A	N/A	
B-02	Former Kitchen	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
B-02	Former Kitchen	Walls	Concrete	N/A	N/A	N/A	N/A	N/A	
B-02	Former Kitchen	Ceiling	Concrete	N/A	N/A	N/A	N/A	N/A	
B-03	Storage Area	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
B-03	Storage Area	Walls	Concrete/Block	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-03	Storage Area	Ceiling	Concrete	N/A	N/A	N/A	N/A	N/A	
B-04	Storage Room	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
B-04	Storage Room	Walls	Concrete	N/A	N/A	N/A	N/A	N/A	
B-04	Storage Room	Ceiling	Concrete	N/A	N/A	N/A	N/A	N/A	
B-05	Boiler Room	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
B-05	Boiler Room	Walls	Concrete/Block	N/A	N/A	N/A	N/A	N/A	
B-05	Boiler Room	Ceiling	Concrete	N/A	N/A	N/A	N/A	N/A	
1-01	Reception Hallway	Floor	Vinyl Floor Tile 1	Asbestos	Homogeneous w/ 17-7651-07 to 09	Not Detected	125 SF	N/A	12" x 12" Beige Mosaic
1-01	Reception Hallway	Floor	Mastic	Asbestos	Homogeneous w/ 17-7651-10 to 12	Not Detected	125 SF	N/A	
1-01	Reception Hallway	Walls	Wood	N/A	N/A	N/A	N/A	N/A	
1-01	Reception Hallway	Ceiling	Concrete	N/A	N/A	N/A	N/A	N/A	
1-02	Meeting Room	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-02	Meeting Room	Walls	Wood/Decorative Rock	N/A	N/A	N/A	N/A	N/A	
1-02	Meeting Room	Ceiling	Drywall Compound	Asbestos	Homogeneous w/ 17-7651-16 to 20	Not Detected	150 SF	N/A	
1-03	Office	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-03	Office	Walls	Wood	N/A	N/A	N/A	N/A	N/A	
1-03	Office	Ceiling	Drywall Compound	Asbestos	Homogeneous w/ 17-7651-16 to 20	Not Detected	30 SF	N/A	
1-04	Office	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-04	Office	Walls	Wood	N/A	N/A	N/A	N/A	N/A	
1-04	Office	Ceiling	Drywall Compound	Asbestos	Homogeneous w/ 17-7651-16 to 20	Not Detected	30 SF	N/A	
1-05	Washroom	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-05	Washroom	Walls	Drywall Compound	Asbestos	17-7651-16	Not Detected	160 SF	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
1-05	Washroom	Ceiling	Ceiling Tile 2	Asbestos	17-7651-15	Not Detected	25 SF	N/A	12" x 12" Smooth
1-06	Main Office	Floor	Vinyl Floor Tile 1	Asbestos	17-7651-07	Not Detected	400 SF	N/A	12" x 12" Beige Mosaic
1-06	Main Office	Floor	Mastic	Asbestos	17-7651-10	Not Detected	400 SF	N/A	
1-06	Main Office	Walls	Wood/Brick	N/A	N/A	N/A	N/A	N/A	
1-06	Main Office	Column	Texture Coat	Asbestos	17-7651-23	Not Detected	200 SF	N/A	
1-06	Main Office	Ceiling	Texture Coat	Asbestos	09-4587-10 to 12*	Not Detected	400 SF	N/A	*Pre-Reno DSS, Fisher October 2009
1-07	Office Area & Exit	Floor	Vinyl Floor Tile 1	Asbestos	17-7651-08 and 09	Not Detected	575 SF	N/A	12" x 12" Beige Mosaic
1-07	Office Area & Exit	Floor	Mastic	Asbestos	17-7651-11 and 12	Not Detected	575 SF	N/A	
1-07	Office Area & Exit	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-07	Office Area & Exit	Walls	Drywall Compound	Asbestos	17-7651-17 and 18	Not Detected	400 SF	N/A	
1-07	Office Area & Exit	Walls	Wood	N/A	N/A	N/A	N/A	N/A	
1-07	Office Area & Exit	Ceiling	Concrete	N/A	N/A	N/A	N/A	N/A	
1-08	Office	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-08	Office	Walls	Block	N/A	N/A	N/A	N/A	N/A	
1-08	Office	Walls	Drywall Compound	Asbestos	17-7651-19	Not Detected	120 SF	N/A	
1-08	Office	Column	Texture Coat	Asbestos	17-7651-22	Not Detected	65 SF	N/A	
1-08	Office	Ceiling	Concrete	N/A	N/A	N/A	N/A	N/A	
1-09	Office	Floor	Vinyl Floor Tile 1	Asbestos	Homogeneous w/ 17-7651-07 to 09	Not Detected	65 SF	N/A	12" x 12" Beige Mosaic
1-09	Office	Walls	Drywall Compound	Asbestos	17-7651-20	Not Detected	200 SF	N/A	
1-09	Office	Walls	Block	N/A	N/A	N/A	N/A	N/A	
1-09	Office	Ceiling	Concrete	N/A	N/A	N/A	N/A	N/A	
1-10	Girls Washroom	Floor	Concrete	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
1-10	Girls Washroom	Walls	Drywall Compound	Asbestos	Homogeneous w/ 17-7651-16 to 20	Not Detected	160 SF	N/A	
1-10	Girls Washroom	Ceiling	Ceiling Tile 2	Asbestos	17-7651-14	Not Detected	25 SF	N/A	12" x 12" Smooth
1-11	Boys Washroom	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-11	Boys Washroom	Walls	Drywall Compound	Asbestos	Homogeneous w/ 17-7651-16 to 20	Not Detected	160 SF	N/A	
1-11	Boys Washroom	Ceiling	Ceiling Tile 2	Asbestos	17-7651-13	Not Detected	25 SF	N/A	12" x 12" Smooth
1-12	Hot Water Closet	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-12	Hot Water Closet	Walls	Drywall, No Tape	N/A	N/A	N/A	N/A	N/A	
1-12	Hot Water Closet	Ceiling	Concrete	N/A	N/A	N/A	N/A	N/A	
1-13	Storage	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
1-13	Storage	Walls	Block/Wood	N/A	N/A	N/A	N/A	N/A	
1-13	Storage	Column	Texture Coat	Asbestos	17-7651-21	Not Detected	65 SF	N/A	
1-13	Storage	Ceiling	Concrete	N/A	N/A	N/A	N/A	N/A	
1-14	Stairwell	Floor	Terrazzo/Concrete	N/A	N/A	N/A	N/A	N/A	
1-14	Stairwell	Walls	Brick/Decorative Rock	N/A	N/A	N/A	N/A	N/A	
1-14	Stairwell	Ceiling	Concrete	N/A	N/A	N/A	N/A	N/A	
Warehouse Building									
W1-01	Warehouse Area	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
W1-01	Warehouse Area	Walls	Block	N/A	N/A	N/A	N/A	N/A	
W1-01	Warehouse Area	Walls	Drywall Compound	Asbestos	17-7651-02 and 03	Not Detected	650 SF	N/A	
W1-01	Warehouse Area	Ceiling	Concrete	N/A	N/A	N/A	N/A	N/A	
W1-02	Electrial Room	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
W1-02	Electrial Room	Walls	Block	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
W1-02	Electrial Room	Walls	Drywall Compound	Asbestos	17-7651-01	Not Detected	210 SF	N/A	
W1-02	Electrial Room	Ceiling	Concrete	N/A	N/A	N/A	N/A	N/A	
W1-03	Storage	Floor	Concrete	N/A	N/A	N/A	N/A	N/A	
W1-03	Storage	Walls	Drywall Compound	Asbestos	Homogeneous w/ 17-7651-01 to 03	Not Detected	330 SF	N/A	
W1-03	Storage	Ceiling	Concrete	N/A	N/A	N/A	N/A	N/A	
W1-04	Washroom	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
W1-04	Washroom	Walls	Drywall Compound	Asbestos	Homogeneous w/ 17-7651-01 to 03	Not Detected	330 SF	N/A	
W1-04	Washroom	Ceiling	Ceiling Tile 1	Asbestos	17-7651-04 and 05	Not Detected	50 SF	N/A	2' x 4' Pinhole Fissure
W1-05	Washroom	Floor	Ceramic	N/A	N/A	N/A	N/A	N/A	
W1-05	Washroom	Walls	Drywall Compound	Asbestos	Homogeneous w/ 17-7651-01 to 03	Not Detected	330 SF	N/A	
W1-05	Washroom	Ceiling	Ceiling Tile 1	Asbestos	17-7651-06	Not Detected	50 SF	N/A	2' x 4' Pinhole Fissure

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
MARKHAM, ONT. L3R 3K2
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: meaghan.aldcroft@toronto.ca
Attn: Meaghan Aldcroft

F.E. Job #: 17-7651
Project Name: Industrial Bldg
Project ID: FE-P-17-8532
Date Sampled: 29-Nov-17
Date Received: 30-Nov-17
Date Reported: 5-Dec-17
Location: 160 Rivalda Road
Toronto, ON

Certificate of Analysis

Analysis Requested:	Asbestos
Sample Description:	35 Bulk Samples

Client Sample ID	Lab Sample ID	Sample Matrix	Fibre Type	Asbestos Content
Warehouse DJC a	17-7651-01	Drywall Joint Compound		Not Detected
Warehouse DJC b	17-7651-02	Drywall Joint Compound		Not Detected
Warehouse DJC c	17-7651-03	Drywall Joint Compound		Not Detected
Warehouse CT1 a	17-7651-04	Ceiling Tile		Not Detected
Warehouse CT1 b	17-7651-05	Ceiling Tile		Not Detected
Warehouse CT1 c	17-7651-06	Ceiling Tile		Not Detected
Upper Office VFT1 a	17-7651-07	Vinyl Floor Tile		Not Detected
Upper Office VFT1 b	17-7651-08	Vinyl Floor Tile		Not Detected
Upper Office VFT1 c	17-7651-09	Vinyl Floor Tile		Not Detected
Upper Office Mastic1 a	17-7651-10	Mastic		Not Detected
Upper Office Mastic1 b	17-7651-11	Mastic		Not Detected
Upper Office Mastic1 c	17-7651-12	Mastic		Not Detected
Upper Office CT2 a	17-7651-13	Ceiling Tile		Not Detected

Results relate only to the items tested

Certificate of Analysis

Analysis Requested:	Asbestos
Sample Description:	35 Bulk Samples

Client Sample ID	Lab Sample ID	Sample Matrix	Fibre Type	Asbestos Content
Upper Office CT2 b	17-7651-14	Ceiling Tile		Not Detected
Upper Office CT2 c	17-7651-15	Ceiling Tile		Not Detected
Upper Office DJC a	17-7651-16	Drywall Joint Compound		Not Detected
Upper Office DJC b	17-7651-17	Drywall Joint Compound		Not Detected
Upper Office DJC c	17-7651-18	Drywall Joint Compound		Not Detected
Upper Office DJC e	17-7651-19	Drywall Joint Compound		Not Detected
Upper Office DJC f	17-7651-20	Drywall Joint Compound		Not Detected
Upper Office TC1 a	17-7651-21	Texture Coat		Not Detected
Upper Office TC1 b	17-7651-22	Texture Coat		Not Detected
Upper Office TC1 c	17-7651-23	Texture Coat		Not Detected
Lower Office VFT2 a	17-7651-24	Vinyl Floor Tile		Not Detected
Lower Office VFT2 b	17-7651-25	Vinyl Floor Tile		Not Detected
Lower Office VFT2 c	17-7651-26	Vinyl Floor Tile		Not Detected
Lower Office Mastic2 a	17-7651-27	Mastic		Not Detected
Lower Office Mastic2 b	17-7651-28	Mastic		Not Detected
Lower Office Mastic2 c	17-7651-29	Mastic		Not Detected
Lower Office VFT3 a	17-7651-30	Vinyl Floor Tile		Not Detected
Lower Office VFT3 b	17-7651-31	Vinyl Floor Tile		Not Detected
Lower Office VFT3 c	17-7651-32	Vinyl Floor Tile		Not Detected
Lower Office Mastic3 a	17-7651-33	Mastic		Not Detected

Results relate only to the items tested

Certificate of Analysis

Analysis Requested:	Asbestos
Sample Description:	35 Bulk Samples

Client Sample ID	Lab Sample ID	Sample Matrix	Fibre Type	Asbestos Content
Lower Office Mastic3 b	17-7651-34	Mastic		Not Detected
Lower Office Mastic3 c	17-7651-35	Mastic		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

ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO
CHARTERED
Ronggen (Roger) Lin
CHEMIST

Results relate only to the items tested

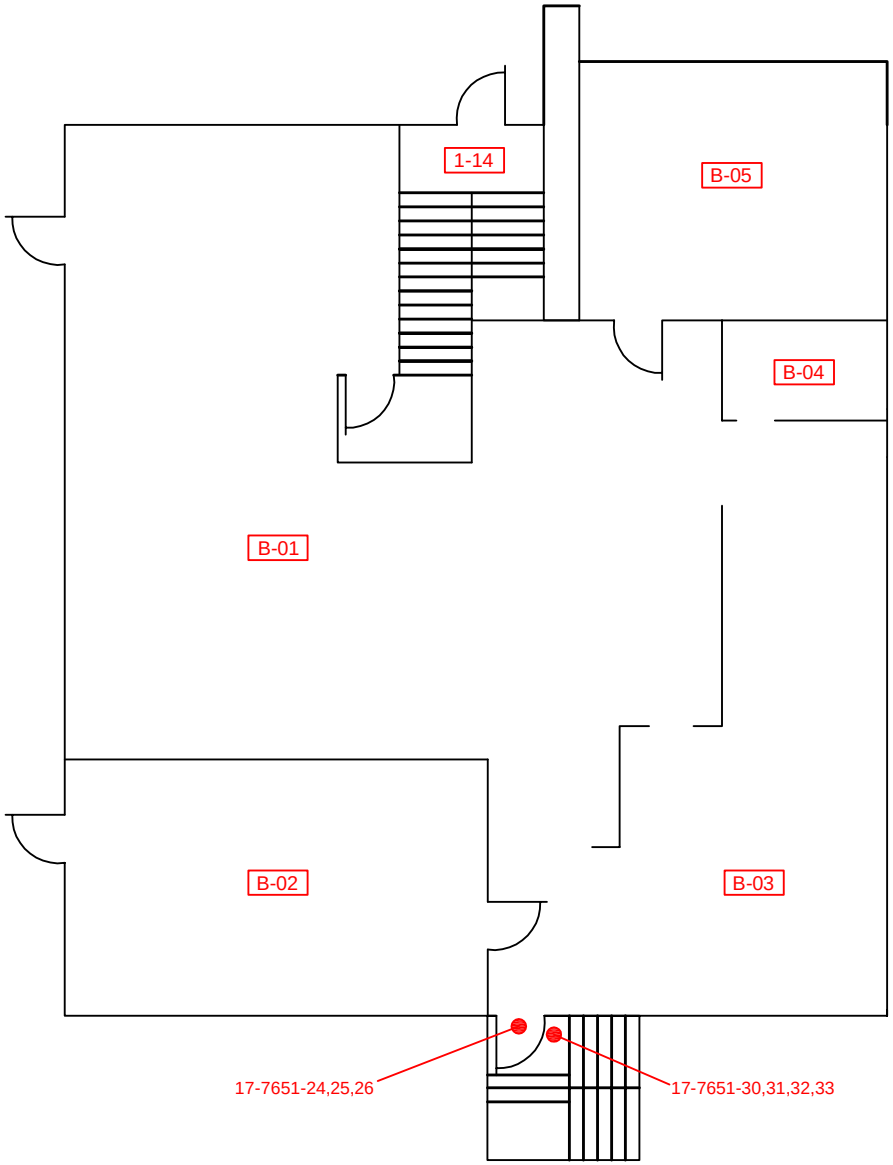
APPENDIX III

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

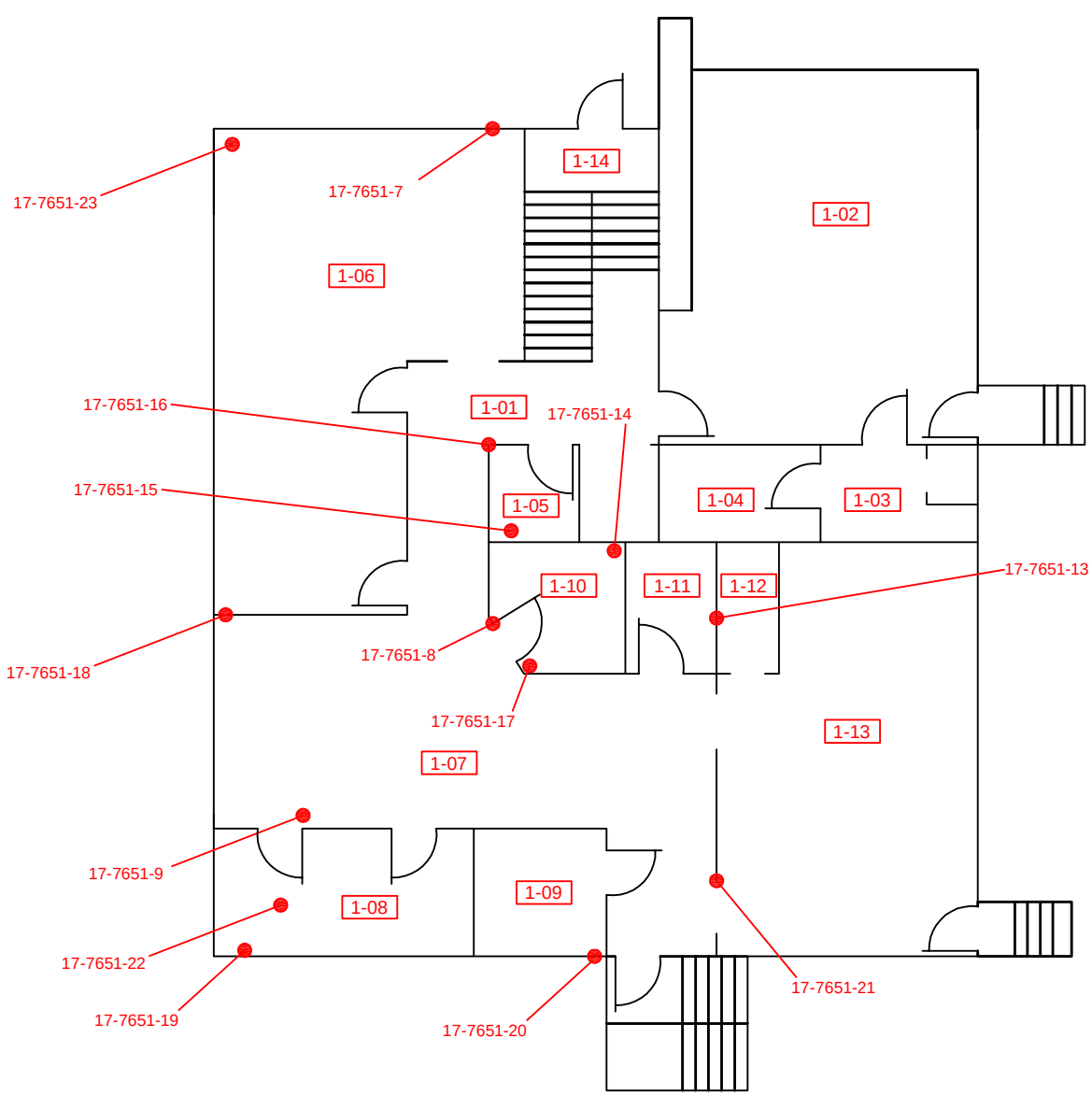
LOCATION:
160 Rivalda Road
Toronto, ON

BUILDING NAME:
Former Commercial Building

Basement Plan
Asbestos-Containing Material Locations

CLIENT: City of Toronto			
PROJECT NUMBER: FE-P 17-8532	DATE: JAN 2018	DRW BY: AH	
CAD FILE: FIG1	SCALE: Not to Scale	CHK BY: YH	

TORONTO



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 2

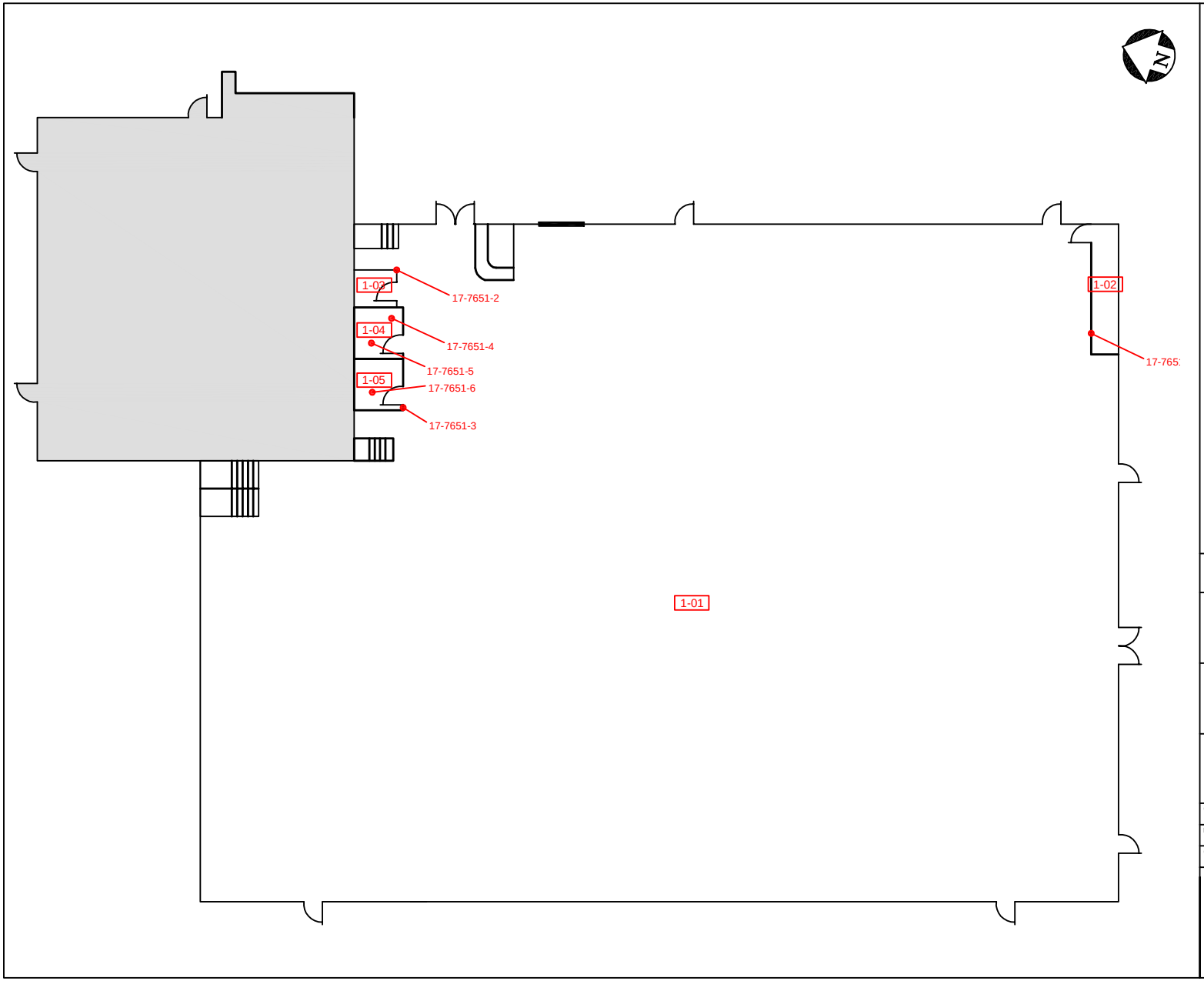
LOCATION:
160 Rivalda Road
Toronto, ON

BUILDING NAME:
Former Commercial Building

Main Floor Plan
Asbestos-Containing Material Locations

CLIENT:	City of Toronto				
PROJECT NUMBER:	FE-P 17-8532	DATE:	JAN 2018	DRW BY:	AH
CAD FILE:	FIG2	SCALE:	Not to Scale	CHK BY:	YH

TORONTO



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:
160 Rivalda Road
Toronto, ON

BUILDING NAME:
Former Commercial Building

Warehouse Plan
Asbestos-Containing Material Locations

CLIENT:	City of Toronto		
PROJECT NUMBER: FE-P 17-8532	DATE: JAN 2018	DRW BY: AH	
CAD FILE: FIG3	SCALE: Not to Scale	CHK BY: YH	

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APPENDIX V

SITE PHOTOGRAPHS

(NO INFORMATION TO REPORT)

APPENDIX B1

Part 3 of City RFQ for Elevators

TABLE OF CONTENTS

RFQ No. Doc2471878011

PART 3 – TECHNICAL SPECIFICATIONS AND REQUIREMENTS FOR DELIVERABLES

1. Background 2
3. Scope of Work and Associated Deliverables 3
4. Performance Security – Not Applicable 3
5. Insurance Requirements 3
6. Delivery 4
7. Substitutions of Deliverables 5
8. Warranty 5
9. Usage Reports 5
10. Product and Service Specifications 6

Appendices

~~Appendix A – City of Toronto Corporate Accessibility Policy~~ NOT INCLUDED
~~Appendix B – Building Addresses and Estimated Construction Dates~~ NOT INCLUDED
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 Design
~~Appendix H – Fair Wage Policy~~ NOT INCLUDED
~~Appendix I – Agreement with 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 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)

Contents

1. General 4
1.1. General requirements 4
1.2. Scope 4
1.3. Definitions 4
1.4. Assignment 5
1.5. Warranty 6
1.6. Hoarding 6
1.7. Removal of equipment 6
1.8. Conduct 6
1.9. Codes and Ordinances 7
1.10. Certificates of Inspection 7
1.11. Materials and Workmanship 7
1.12. Trade Marks 7
1.13. Fixture Type and Finish 7
1.14. Machine Guarding 7
1.15. Electrical Diagrams 8
1.16. Maintenance Manual 8
1.17. Operation Manual 8
1.18. Technical Seminar 9
1.19. Painting 9
1.20. Operating Environment 9
1.21. Acceleration of Work 9
1.22. Test Data Form: Elevator 9
1.23. Inspection of Elevators 10
1.24. Generic Maintenance 10
1.25. Non-Proprietary 10
1.26. Diagnostic 10
1.27. Temporary Group Controller: 11
1.28. Installation Flow Chart Schedule 11
1.29. Conflict Resolution 11
1.30. Venue, Jurisdiction, and Jury Waiver 11

1.31. Attorneys' Fees 12
1.32. Waiver 12
1.33. Energy Saving 12
1.34. Words 12
1.35. Additional or Hidden Costs 12
1.36. Workplace Safety and Insurance Board Coverage 12
1.37. Non-Compliance 13
1.38. Security System 13
1.39. Security Card Access 13
1.40. Hoistway Access by Others 13
1.41. Performance 13
1.42. Eco Friendly Alternative 14
1.43. Remote Elevator Monitoring System 14
1.44. Singular or Plural 14
1.45. Notice of Project 15
1.46. Errors and Omissions 16

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.

Appendix B – Building Addresses and Estimated Construction Dates

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

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

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)

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)

No.	Building Type	1st Landing Finish	2nd Landing Finish	3rd Landing Finish	4th 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)

Contents

1. General 5
1.1. General Requirements 5
1.2. Number of Elevators 5
1.3. Device Type: Hydraulic 5
1.4. Arrangement 5
1.5. Designations 5
1.6. Drive Method 5
1.7. Speed 5
1.8. Capacity 5
1.9. Openings and Stops 5
1.10. Dimensions 5
1.11. Door Type 5
1.12. Door Entrances 5
1.13. Related Work 5
1.14. Changes in Material and Work 6
1.15. Cutting, Patching and Other work 6
1.16. Remote Conduit and Wiring 7
2. Machine Room 7
2.1. Motors 7
2.2. Hydraulic Valve 8
2.3. Controllers 8
2.4. Grounding 10
2.5. Solid State Starters 10
2.6. MINI PI 10
2.7. Victaulic Piping and Coupling 10
2.8. Hydraulic pipeline identification, where required 10
2.9. Rupture Valve 11
3. Hoistway Equipment 11
3.1. Guide Rails 11
3.2. Pit Equipment 11
3.3. Hall Door Entrances 11

3.4. Hall Doors and Hardware 12
3.5. Buffers, Pit Steel and Switches 12
3.6. Car Sling and Platform 13
3.7. Car Roller Guides 13
3.8. Hall Stations 13
3.9. Hall Position Indicators 14
3.10. Lobby Fixtures 14
3.11. New Jack (Cylinder and Plunger) 14
3.12. Electrical Ducts, Troughs and Wireways 15
4. Elevator Cab 16
4.1. Elevator Cab 16
4.2. Car Direction Indicators and Chimes 16
4.3. Car Slings 17
4.4. Top of Car Stations 17
4.5. Infra-Red Door Detector 17
4.6. Hoistway Access 18
4.7. Car Stations 18
4.8. Traveling Cables 20
4.9. Wiring 20
4.10. Barrier Free Access 20
4.11. Floor Passing Tone 20
4.12. Crosshead Data Plate 21
4.13. Door Operators 21
4.14. Car Gate Switches 21
4.15. Car Top Solid State Reader Head 21
4.16. Car Door Clutch 22
4.17. Car Top Railing 22
4.18. Car Door Equipment 22
4.19. Car Top Inspection Station 22
4.20. Car Restrictor 23
4.21. Car Apron 23
5. Elevator Control and Dispatching 23

5.1. Door Operation 23
5.2. Delayed Car Operation 24
5.3. Door Nudging Operation ..... **Error! Bookmark not defined.**
5.4. Door Failure Protection ..... **Error! Bookmark not defined.**
5.5. Advance Door Opening 25
5.6. Performance Criteria 25
5.7. Noise Levels 25
5.8. Independent Service 25
5.9. Inspection 26
5.10. Riding Lantern Operation 26
5.11. Levelling 26
5.12. Automatic Emergency Recall Operation: initiation 26
5.13. Automatic Emergency Recall Operation: return to designated floor 27
5.14. Manual Emergency Recall Operation: Initiation 27
5.15. Automatic Emergency Recall Operation: termination 27
5.16. Remote Monitoring System 28
5.17. Ride Quality Improvement System 28

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 80^0 F (27^0 C) minimum, 150° F (65^0 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” (225m) – 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)

Contents

1. General 5
1.1 General Requirements 5
1.2 Number of Elevators 5
1.3 Device Type: Traction 5
1.4 Arrangement 5
1.5 Designations 5
1.6 Drive Method 5
1.7 Speed 5
1.8 Capacity 5
1.9 Openings and Stops 5
1.10 Dimensions 5
1.11 Door Type 5
1.12 Door Entrances 5
1.13 Related Work 5
1.14 Changes in Material and Work 6
1.15 Cutting, Patching and Other work 7
1.16 Remote Conduit and Wiring 7
2. Machine Room 7
2.1 Motors 7
2.2 Machine Brake 8
2.3 Auxiliary Braking Device 8
2.4 Governor and Governor Ropes 8
2.5 Hoist Ropes 9
2.6 Controllers 9
2.7 Emergency Battery Lowering 10
2.8 Auxiliary Disconnect Micro Switch 11
2.9 Solid State Motor Drives 11
2.10 Solid State Position Encoder 12
2.11 Feedback Devices 12
2.12 Auxiliary Disconnects 12
2.13 Grounding 12
3. Hoistway Equipment 12
3.1 Guide Rails 12
3.2 Counterweights 13
3.3 Counterweight Roller Guides 13

3.4 Buffers, Pit Steel and Switches 13
3.5 Hall Door Entrances 14
3.6 Hall Doors and Hardware 14
3.7 Car Sling and Platform 14
3.8 Car Roller Guides 15
3.9 Hall Stations 15
3.10 Hall Position indicators 15
3.11 Lobby Fixtures 16
3.12 Electrical Ducts, Troughs and Wireways 16
4. Elevator Cab 16
4.1 Elevator Cab 16
4.2 Car Direction Indicators and Chimes 17
4.3 Car Slings 17
4.4 Top of Car Stations 17
4.5 Infra-Red Door Detector 17
4.6 Load Weighing Devices 18
4.7 Hoistway Access 18
[redacted] Car Stations 18
4.8 Traveling Cables 21
4.9 Wiring 21
4.10 Barrier Free Access 21
4.11 Door Operators 21
4.12 Car Gate Switches 22
4.13 Car Door Clutch 22
4.14 Car Top Railing 22
4.15 Car Restrictor 22
4.16 Car Safeties 23
5. Elevator Control and Dispatching 23
5.1 Door Operation 23
5.2 Delayed Car Operation 24
5.3 Door Nudging Operation 24
5.4 Door Failure Protection 24
5.5 Advance Door Opening 25
5.6 Performance Criteria 25
5.7 Noise Levels 25
5.8 Independent Service 25

5.9 Inspection 26
5.10 Anti-Nuisance 26
5.11 Load By–pass 26
5.12 Load Weighing 26
5.13 Hall Lantern Operation 26
5.14 Leveling 26
5.15 Automatic Emergency Recall Operation: initiation 26
5.16 Automatic Emergency Recall Operation: return to designated floor 27
5.17 Automatic Emergency Recall Operation: car operation 27
5.18 Automatic Emergency Recall Operation: termination 28
5.19 Firefighter's Elevator 28
5.20 Emergency Power - Provision 28

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 +/- ⅛" 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 ⅛".

2.11 Feedback Devices

1. Provide position transducer devices to transmit to the controllers the exact car position with an accuracy of +/- ⅛" 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 (½”).
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.

[redacted]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” (225m) – 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/sec3	3.5 ft/sec2	+/- 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:

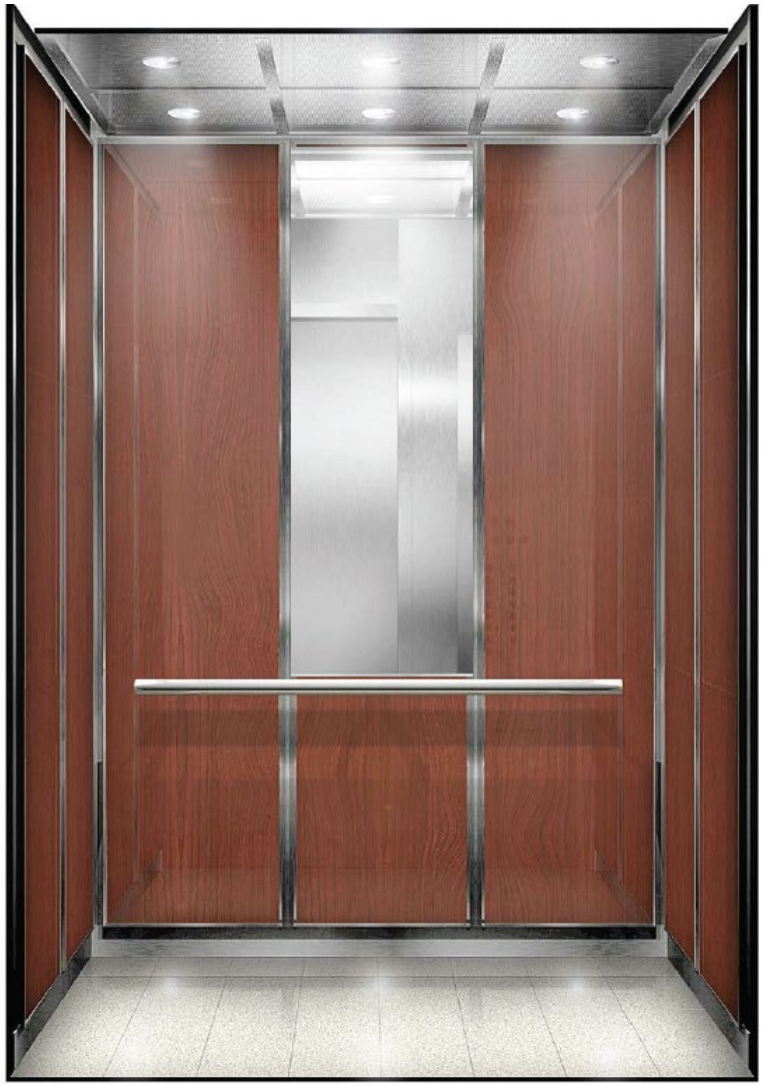
CAB DESIGN - A

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.

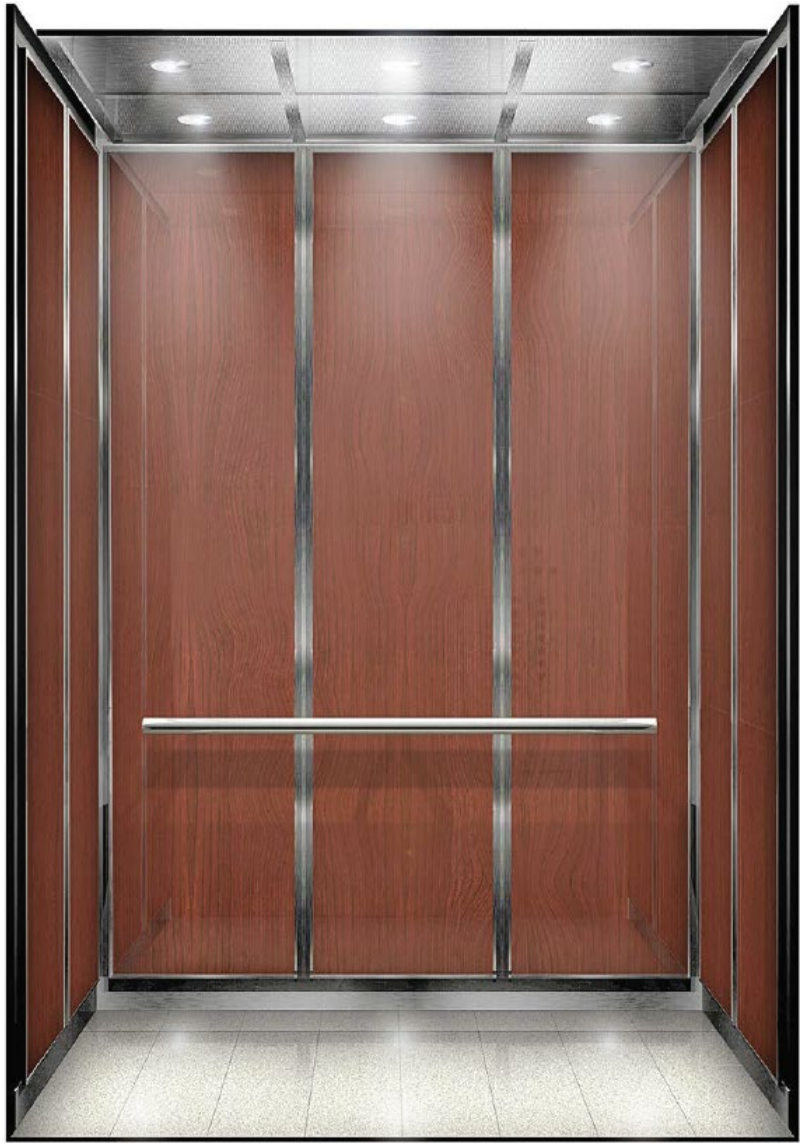
2. Provide a clear mirror in the centre panel and two P-Lam panels both sides of the mirror.
3. Provide stainless steel reveals and kick-plates.

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 B2

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 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 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 B3

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 C1

Part 3 of City RFQ for ADO's

TABLE OF CONTENTS

RFQ No. Doc2399202340

PART 3 – TECHNICAL SPECIFICATIONS AND REQUIREMENTS FOR DELIVERABLES

1. Background 2
2. Scope of Work and Associated Deliverables 2
3. Performance Security – Not Applicable 3
4. Work Hours 3
5. Insurance Requirements 3
6. Delivery 4
7. Substitutions of Deliverables 5
8. Warranty 5
9. Usage Reports 5
10. Product and Service Specifications 6

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. Intergraded 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 senor. 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 ASSITANCE" 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 mulit-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-WC13XSM
1	Emergency Call Kit – CX-WEC10K2
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 leu of standard Buttons
2	6" x 6" Square Button with surface mount box, stainless steel button with barrier free logo & "Push to Open" – in leu 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	L021 lock out relay
1	Le21 lock out relay
1	24V Transformer

APPENDIX C2

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 C3

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 CYLNIDER	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 CYLNIDER	CAMDEN	

1.6	Package #2C	1	Heavy Duty Model Operator	SW200-Single	BESAM	$2,798.30
		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 CYLNIDER	CAMDEN	
1.7	Package #3A	1	Standard Duty Model Operator	SW00-Single	BESAM	$2,644.88
		2	4 ½" x 4 ½" Push Button – C/W Barrier free logo & "Push to Open"	CM45/4	CAMDEN	
		2	4 ½" x 4 ½" 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 ½" x 4 ½" Push Button – C/W Barrier free logo & "Push to Open"	CM45/4	CAMDEN	
		2	4 ½" x 4 ½" 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 ½" x 4 ½" Push Button – C/W Barrier free logo & "Push to Open"	CM45/4	CAMDEN	
		2	4 ½" x 4 ½" 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 ½" x 4 ½" Push Button – C/W Barrier free logo & "Push to Open"	CM45/4	CAMDEN	
		2	4 ½" x 4 ½" 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 ½" x 4 ½" Push Button – C/W Barrier free logo & "Push to Open"	CM45/4	CAMDEN	
		2	4 ½" x 4 ½" 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 ½" x 4 ½" 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 ½" x 4 ½" 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 leu 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 leu 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 D

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 L2H

Item#	Product No.	Description	Qty
3.1	0475047.020	American Standard - AQUALYN C-TOP LAVA CHO WHT	
3.2	8559	Moen Align sensor faucet	
3.3	MC-155wc	McGuire - 1-1/4" Open Grid Strainer Offset	
3.4	MC-8872CB	McGuire - 1 1/4" Cast Body P-Trap	
3.5	H170LK-BVRB	McGuire - Supply Kit	
3.6	MC-PW2000wc	McGuire - PROWRAPRETROFITKITFORLAV - 1-1/4"	
3.7	LFE480-10	POWERS POINT OF USE UNDER COUNTER THERMOSTATIC MIXING VALVE	
	182538	Moen AC conversion kit	
3.8	104630	Moen AC transformer	
		Section Total	

Urinals

Type U1H (Barrier Free Use)

Item#	Product No.	Description	Qty
4.1	6590001.020	American Standard - WASHBROOK UNIVERSAL URINAL, TS	
4.2	8315AC05	Moen Sensor operated urinal flush valve	
4.3	CA-321	Watts - Urinal Carrier	
4.4	WUCO	WATTS WALL ACCESS CLEANOUT OUTLET SIZE UP TO 2"	
4.5	104630	Moen AC transformer	
		Section Total	

Water Closets

Type W1 - Flush Valve

Item#	Product No.	Description	Qty
5.1	3351101.020	American Standard - AFWALL MILLENNIUM FLOWISE EL WITH EC, TS	
5.2	8311AC12	Moen sensor operated WC flush valve	
5.3	500STSCC	Centoco - ELONGATED, OPEN front less cover, heavy duty, with stainless steel check hinge	
5.4	ISCA-101-L/R-M11	Watts - WC Single LH Carrier	
5.5	104630	Moen AC transformer	
		Section Total	

Type W1H (Barrier Free Use) - Flush Valve

Item#	Product No.	Description	Qty
6.1	3351101.020	American Standard - AFWALL MILLENNIUM FLOWISE EL WITH EC, TS	
6.2	8311AC12	Moen sensor operated WC flush valve	
6.3	500STSCC	Centoco - ELONGATED, OPEN front less cover, heavy duty, with stainless steel check hinge	
6.4	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	
6.5	104630	Moen AC transformer	
		Section Total	

Type W2 - Flush Valve

Item#	Product No.	Description	Qty
7.1	3451001.020	American Standard - MADERA EC15" UNIV BOWL TOP SPUD WHT	
7.2	8311AC12	Moen sensor operated WC flush valve	
7.3	500STSCC	Centoco - ELONGATED, OPEN front less cover, heavy duty, with stainless steel check hinge	
7.4	12X4SPONGEGASK	Next Supply - SPONGE RUBBER CLOSET GASKET 1/2X4	
7.5	CBNW	Next Supply - 5/16-18 X 21/4 BRASS CLOSET BOLTS C/W PAIR OF	
26.6	104630	Moen AC transformer	
		Section Total	

Type W2H

Item#	Product No.	Description	Qty
8.1	3461001.020	American Standard - MADERA EC 16-1/2 UN BOWL TP SPD WHT	
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	12X4SPONGEGASK	Next Supply - SPONGE RUBBER CLOSET GASKET 1/2X4	
8.5	CBNW	Next Supply - 5/16-18 X 21/4 BRASS CLOSET BOLTS C/W PAIR OF	
8.6	104630	Moen AC transformer	
	104585	Moen 24" flush tube	
8.7	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
9.1	3483001.020	American Standard - CADET RH PA UNIV BOWL WHT	
9.2	4142100.020	American Standard - PA TANK, 1.1 GPF WHITE	
9.3	820STS	Centoco - ELONGATED, OPEN front with cover extra, heavy duty, commercial, stainless steel hinge	
9.4	mc-h172lk-bv	McGuire supply kit	
9.5	12X4SPONGEGASK	Next Supply - SPONGE RUBBER CLOSET GASKET 1/2X4	
9.6	CBNW	Next Supply - 5/16-18 X 21/4 BRASS CLOSET BOLTS C/W PAIR OF	
		Section Total	

Type W3H - (Barrier Free Use) - Pressure Assist Tank

Item#	Product No.	Description	Qty
10.1	3483001.020	American Standard - CADET RH PA UNIV BOWL WHT	
10.2	4142100.020	American Standard - PA TANK, 1.1 GPF WHITE	
10.3	820STS	Centoco - ELONGATED, OPEN front with cover extra, heavy duty, commercial, stainless steel hinge	
10.4	mc-h172lk-bv	McGuire supply kit	
10.5	12X4SPONGEGASK	Next Supply - SPONGE RUBBER CLOSET GASKET 1/2X4	
10.6	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
11.1	EZSDWSLK	Elkay - EZH20 Cooler L/REF KITSS	
11.2	CA-311	Watts - Carrier	
11.3	HST-11LK	McGuire - Supply	
11.4	MC-8872CB	McGuire - 1 1/4" Cast Body P-Trap	
		Section Total	

Hand Dryer

Item#	Product No.	Description	Qty
12.4	DysoHU02N	Dyson Sprayed Nickle	
		Section Total	

Washroom Accessories			
Item#	**Product No.**	**Description**	**Qty**
13.1	5425000000	BRADLEY BX JUMBO ROLL DISPENSER	
13.2	6A00110000	BRADLEY BX-SOAP/SANITIZER DISPENSER- SENSOR WALL MOUNT SURF	
13.3	4781110000	BRADLEY BX-NAPKIN DISPOSAL	
13.4	781018300	BRADLEY BX-CHANNEL FRAME MIRROR 18X30 BRIGHT POLISHED FINISH	
13.5	8122001240	BRADLEY BX-GRAB BAR 1 1/2" ODX24 STRAIGHT CONC FLANGE PEENED	
13.6	8122057000	BRADLEY BX-GRAB BAR 1 1/2" ODX30X30 W/STANDOFF ON BEND CONC. PEENED	
13.7	8372107000	BRADLEY BX-SWING UP GRAB BAR 1 1/4"OD-30" LONG-SAFETY GRIP FINISH	
13.8	962110000	BRADLEY BX - BABY CHANGING STATION - SATIN STEEL - SURFACE MOUNT	
13.9	2442110000	BRADLEY BX- TOWEL DISPENSER - SURFACE 400 MULTI/300 C-FOLD	
13.10	901-000000	BRADLEY BX-SOAP DISH - CHROME-PLATED SS	
13.11	9569000000	BRADLEY BX-REVERSIBLE SHOWER SEAT - WHITE PHENOLIC - ADA COMPLIANT	
		Section Total	

Appendix E

Preliminary Environmental Soil Quality Investigation Report

100 Milverton Drive, Suite 404
Mississauga, Ontario L5R 4H1
Canada
www.ghd.com

Our ref: 12642634-LTR-2-Hoekstra

24 October 2024

Ms. Anne Marie Hoekstra, EP
Environmental Project Manager – Project Management Office
Corporate Real Estate Management
City of Toronto
Metro Hall
55 John Street, 2nd Floor
Toronto, Ontario
M5V 3C6

Environmental Consulting Services
160 Rivalda Road, North York, Ontario
Preliminary Environmental Soil Quality Investigation

Dear Ms. Hoekstra,

1. Introduction

GHD Limited (GHD) was retained by the City of Toronto (the City) for the provision of environmental consulting services for the property municipally identified as 160 Rivalda Road in North York, Ontario (herafter referred to as Site or Property). The Site location is shown on **Figure 1**. The Site is currently owned by the City and is currently utilized as a paramedic office. Accessibility upgrades are proposed at the Site (Demolition Site Plan G21-086-A1001) and are limited to the exterior areas of the Site as presented on **Figure 2**.

The Site is approximately 1.20 acres (0.48 hectares) in size and currently includes a single building. The Property includes a designated paved parking lot area located on the southern portion of the Site, a paved entrance/exit pathway located on the eastern portion of the Site and an additional paved walkway located on the northeastern portion of the Site.

Based on the preliminary design, accessibility upgrade activities are proposed at the Site, including the removal and replacement of the aforementioned paved areas of the Site. It has been assumed that the upgrade activities in the paved areas of the Site mentioned above will entail an excavation depth of approximately 0.5 meters below ground surface (mBGS).

Based on discussions with the City, at this time an estimated initial volume of approximately 500 m^3 of excess soil will be generated at the Site during the future construction activities.

This letter-report presents the results of the preliminary soil sampling undertaken at the Site by GHD for the areas of proposed excavation activities at the Site.

2. Background

2.1 Site Description

The Site is currently owned by the City and is currently utilized as a paramedic office. Accessibility upgrades are proposed at the Site (Demolition Site Plan G21-086-A1001) and are limited to the exterior areas of the Site (as presented on **Figure 2)**. The Site is approximately 1.20 acres (0.48 hectares) in size and currently includes a single building. The Property includes a designated paved parking lot area located on the southern portion of the Site, a paved entrance/exit pathway located on the eastern portion of the Site and an additional paved walkway located on the northeastern portion of the Site.

Based on the preliminary design, accessibility upgrade activities are proposed at the Site, including the removal and replacement of the aforementioned paved areas of the Site. It has been assumed that the upgrade activities in the paved areas of the Site mentioned above will entail an excavation depth of approximately 0.5 mBGS.

Based on discussions with the City, at this time an estimated initial volume of approximately 500 m^3 of excess soil will be generated at the Site during the future construction activities. Based on the information provided to GHD in the design package (Demolition Site Plan G21-086-A1001), the following amounts of excess soil are planned to be generated based on the proposed upgrade activities:

- Removal of existing pavement (parking lot) located on the southern portion of the Site (approximately 888.8 m^2): approximately 444.4 m^3 of excess soil.
- Removal of existing pavement (entrance/exit pathway) located on the eastern portion of the Site (approximately 103.9 m^2): approximately 51.95 m^3 of excess soil.
- Partial removal of existing pavement (walkway) and surrounding soil for the construction of a new curb ramp (approximately 5.0 m^2): approximately 2.5 m^3 of excess soil.

3. Scope of Work

3.1 Preparation & Planning

Prior to initiating on-Site activities, a Site-specific Health and Safety Plan (HASP) was prepared in accordance with the requirements of the Occupational Health and Safety Act and reviewed prior to initiating field activities.

All applicable utility companies (gas, telephone, hydro, water, sewers, etc.) were contacted to demarcate the location of their respective underground utilities prior to initiating subsurface activities. GHD also retained a private utility locating contractor to demarcate any additional utilities. On August 9, 2024, multiVIEW Locates Inc. (multiVIEW) completed private locates at the Site.

3.2 Field Activities

3.2.1 Drilling

Four (4) boreholes were advanced to a maximum depth of 1.22 metres below ground surface (mBGS) using a track-mounted direct push drill rig equipped with hollow stem augers (Powerprobe 9700 VTR PRO). Drilling

activities were undertaken by Ontario Ministry of Environment, Conservation and Parks (MECP)[1] licensed driller (Profile Drilling Inc.) on August 14, 2024.

The investigative locations are presented on **Figure 3**. The boreholes were advanced within the proposed areas of excavation, with the exception of BH4-24. Due to the presence of utilities, BH4-24 was advanced to the southwest of the proposed excavation area on the northwestern portion of the Site. During the advancement of the boreholes, soil samples were generally collected for soil classification and screening every 0.61 m to the total depth (1.22 mBGS). Prior to use and between each borehole location, the drilling and sampling equipment were thoroughly cleaned using Alconox® soap and potable water rinse.

Soil samples were logged in the field to detail geologic conditions encountered using the modified unified soil classification system (USCS), noting stratigraphy and relative moisture content. The logged soil information is summarized on borehole stratigraphic and instrumentation logs provided in **Attachment A**.

Soil samples were also collected for field screening and/or laboratory analysis, which is further discussed in Section 3.2.2 below.

All investigative locations were surveyed for vertical control relative to benchmark S728.

3.2.2 Soil Sample Collection

Soil samples obtained from each borehole were qualitatively and quantitatively screened for the presence of impact. Qualitative screening was based on visual and olfactory observations, while quantitative screening was based on the presence of undifferentiated VOCs in the headspace of soil samples collected as measured using a photoionization detector (PID) (RKI GX-6000). Prior to screening, the PID was inspected and calibrated according to the manufacturer's recommendations. Calibrating the RKI GX-6000 is a two-point process using "fresh air" and the standard reference gas (also known as span gas). First, a "fresh air" calibration, which contained no detectable VOC [0.0 parts per million (ppm)], was used to set the zero point for the sensor. Then, a standard reference gas (isobutylene) that contains a known concentration (100 ppm) was used to set the second point of reference.

PID Model specifications are listed below:

Detector:	Photoionization detector with 10.6 electron volt (eV) ultraviolet (UV) lamp
Measurement Accuracy (isobutylene):	0-2000 ppm: +/- 2 ppm or 10% of reading >2000 ppm: +/- 20% of reading
Calibration:	Two-point field calibration of zero and standard reference gas

Soil samples collected for field screening were placed immediately into a sealable plastic bag and the headspace in the plastic bag was measured for undifferentiated VOC vapours using a PID. The PID readings ranged from 0.0 ppm to 0.2 ppm.

Soil samples were collected from the soils directly below the topsoil/asphalt layer. Samples were collected from the upper 1.0 m for representation of soils proposed to be excavated during the construction activities (upper 0.5 m) and to ensure enough sample was collected for laboratory analyses.

The soil samples collected for laboratory analysis were placed in laboratory-supplied sample containers specific to the analytical parameter, transported in a cooler with ice, and submitted to a Standards Council of Canada accredited laboratory [ALS Environmental (ALS)] for chemical analysis of one or more of the following:

[1] MECP was previously known as the Ontario Ministry of Environment (MOE) or Ontario Ministry of the Environment and Climate Change (MOECC).

– Petroleum Hydrocarbons (PHCs), Volatile Organic Compounds (VOCs), Semi-Volatile Organic Compounds (SVOCs), polyaromatic hydrocarbons (PAHs) and metals/inorganics.
– Modified Synthetic Precipitation Leaching Procedure (mSPLP) metals and VOCs.
– Toxicity Characteristic Leachate Procedure (TCLP) waste package (PHC/BTEX, VOCs, SVOCs PCBs, metals and inorganics and ignitability).

All soil samples were collected using the required sampling techniques in accordance with O. Reg. 153/04, including the methanol field preservation method for those soil samples being submitted for analysis of VOC/PHC F1. In addition, one QA/QC sample was collected to ensure quality data are generated. The number of soil samples and analytical parameters were selected based on the minimum requirements in the Soil Rules.

A total of ten (10) soil samples [including one (1) field duplicate sample and one (1) TCLP sample] were collected from the four (4) borehole locations for laboratory analysis. A sample identification key is presented in **Table 1**.

3.2.3 Field Quality Assurance and Quality Control Program

A QA/QC program was implemented to ensure quality data was generated. In general, one QA/QC sample was submitted for analysis for every ten samples collected. The QA/QC program included the collection/submission of the following:

– One (1) field duplicate soil sample and one (1) trip blank sample.

The field duplicate sample was one of two samples taken from the same media (i.e., soil) at the same location and time following the same sampling procedures in an identical manner. The field duplicate sample is used to validate field and laboratory analysis. The trip blank was a sample of analyte-free media prepared by the laboratory, taken to the Site and returned to the laboratory unopened. The trip blank is used to document contamination attributable to shipping and field handling procedures. In addition to the above, QC samples were analyzed by the laboratory as required by their analytical methods.

All samples were submitted to the analytical laboratory following chain-of-custody procedures.

4. Results

4.1 Site Geology

During the field activities, the following materials or geologic deposits were encountered in descending order from the ground surface to the termination depths of the boreholes:

– *Asphalt* – Asphalt [ranging between 125 and 150 millimeters (mm) in thickness] was encountered at the ground surface of BH1-24 and BH2-24, advanced within the southern parking lot; and at BH3-24, advanced within the existing pathway entering the eastern portion of the building.
– *Topsoil* – A 75 mm thick layer of topsoil was encountered at the ground surface of BH4-24, advanced on the northeastern portion of the Site.
– *Fill* – Fill material consisting of silt, sand, silty sand and/or sandy silt was encountered beneath the asphalt/topsoil layers at BH1-24 through BH4-24 and extended to the termination depths of the boreholes (1.22 mBGS).

4.2 Field Evidence of Impact

As discussed previously, soil samples were screened in the field for evidence of impact based on visual and olfactory observations as well as based on undifferentiated VOC vapour readings, as measured by a PID. The PID headspace readings at all the locations were between 0.0 and 0.2 parts per million (ppm).

4.3 Selection of Regulatory Standards

The bulk soil analytical results were assessed to the 2011 Ministry of the Environment (MOE) (now known as the MECP) full depth generic site condition standards in a non-potable groundwater condition for coarse textured soils textured soils and an industrial/commercial/community (ICC) property use (2011 MOE Table 3 standards [ICC]) referenced in O. Reg. 153/04[2].

In anticipation of potential excess soils being generated during the future construction activities, the bulk soil analytical results were also assessed to the following Excess Soil Quality Standards (ESQS) provided in the Excess Soil Rules referenced in O. Reg. 406/19[3]:

- Table 1: Full Depth Background Site Condition Standards for Residential/ Parkland/ Institutional/ Industrial/ Commercial/ Community (RPIICC) Property Use (Table 1 ESQS).
- Table 2.1: Full Depth ESQS in a Potable Ground Water Condition Volume Independent for RPI Property Use (Table 2.1 ESQS [RPI]).
- Table 2.1: Full Depth ESQS in a Potable Ground Water Condition Volume Independent for ICC Property Use (Table 2.1 ESQS [ICC]).
- Table 3.1: Full Depth ESQS in a Non-Potable Ground Water Condition Volume Independent for RPI Property Use (Table 3.1 ESQS [RPI]).
- Table 3.1: Full Depth ESQS in a Non-Potable Ground Water Condition Volume Independent for ICC Property Use (Table 3.1 ESQS [ICC]).

The mSPLP analytical results were assessed to the following leachate screening levels for excess soils provided in the Excess Soil Rules:

- Table 1: Leachate Screening Levels for Excess Soil Reuse for RPIICC Property Use (Table 1 LSL [RPIICC]).
- Table 2.1: Leachate Screening Levels for Full Depth Excess Soil in a Potable Ground Water Condition Volume Independent for RPI Property Uses (Table 2.1 LSL [RPI]).
- Table 2.1: Leachate Screening Levels for Full Depth Excess Soil in a Potable Ground Water Condition Volume Independent for ICC Property Uses (Table 2.1 LSL [ICC]).
- Table 3.1: Leachate Screening Levels for Full Depth Excess Soil in a Non-Potable Ground Water Condition Volume Independent for RPI Property Use (Table 3.1 LSL [RPI]).
- Table 3.1: Leachate Screening Levels for Full Depth Excess Soil in a Non-Potable Ground Water Condition Volume Independent for ICC Property Use (Table 3.1 LSL [ICC]).

The TCLP analytical results were assessed to Schedule 4 leachate quality criteria referenced in O. Reg. 347, as amended[4].

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2 MOE, “Soil, Groundwater and Sediment Standards for use under Part XV.1 of the Environmental Protection Act”, dated April 15, 2011, referenced in O. Reg. 153/04 (Records of Site Condition).

3 MECP, "Excess Soil Quality Standards" contained in Part II (dated April 23, 2024) of the document entitled "Rules for Soil Management and Excess Soil Quality Standards", adopted by reference in O. Reg. 406/19 (Generic Excess Soil Quality Standards) made under the Environmental Protection Act, R.S.O. 1990, c. E.19 (EPA), 2024.

4 Environmental Protection Act, Waste Management Regulation 347, as amended by O. Reg. 558, Schedule 4, 1990.

4.4 Analytical Results

4.4.1 Soil

The soil analytical results were assessed to the 2011 MOE Table 3 standards and are presented in **Table 2**. The laboratory certificates of analysis are provided in **Attachment B.**

Based on the soil analytical results, all analyzed parameters had concentrations below the 2011 MOE Table 3 standards with the exception of salt-related parameters:

- Electrical conductivity (EC) was detected at concentrations between 1.48 mS/cm and 1.89 mS/cm, above the Table 3 standard of 1.4 mS/cm at all investigative locations.
- Sodium adsorption ratio (SAR) was detected at concentrations between 12.2 and 41.6, above the Table 3 standard of 12 at all investigative locations.

The EC/SAR exceedances are likely related to the use of de-icing agents on Site and on surrounding municipal roads and sidewalks during the winter months for vehicular and pedestrian safety.

A summary of the analytical results that are greater than the 2011 MOE Table 3 standards are shown on **Figure 3**.

4.4.2 Excess Soil Quality

The soil analytical results were also assessed to the ESQS and are presented in **Table 3**. The laboratory certificates of analysis are provided in **Attachment B**.

Based on the soil analytical results, all analyzed parameters had concentrations below the ESQS with the exception of EC and SAR:

- EC was detected at concentrations greater than the Table 1, Table 2.1 and Table 3.1 ESQS at all investigative locations. EC concentrations ranged from 1.48 ug/g to 1.89 ug/g compared to the Table 1 standard of 0.57 ug/g, Table 2.1 and Table 3.1 RPI standard of 0.7 ug/g; and the Table 2.1 and Table 3.1 ICC standard of 1.4 ug/g.
- SAR was detected at concentrations greater than the Table 1, Table 2.1 and Table 3.1 ESQS at all investigative locations. SAR concentrations ranged from 12.2 to 41.6 compared to the Table 1 standard of 2.4, Table 2.1 and Table 3.1 RPI standard of 5; and the Table 2.1 and Table 3.1 ICC standard of 12.

A summary of the analytical results that are greater than the ESQS are shown on **Figure 4**.

To further assess the quality of the excess soil that may be generated during future construction activities, four (4) soil samples were analyzed for mSPLP. Metals mSPLP analysis was completed in the event that a full mSPLP metals analysis suite is requested by potential receivers in the future as part of their soil acceptance requirements, should soil be managed off-Site.

The mSPLP analytical results were assessed to the Table 1 LSL (RPIICC), Table 2.1 LSL (RPI and ICC), Table 3.1 LSL (RPI and ICC) and are presented in **Table 4** and the laboratory certificates of analysis are provided in **Attachment B**. Based on a review of the mSPLP results, select metals were found to be above the LSL standards; although the bulk metals concentrations were in some cases below the ESQS standards. The exceedances are as follows:

- Chromium was detected at a concentration of 53.9 ug/L at BH02-24, above the Table 2.1 RPI/ICC LSLs of 50 ug/L
- Cobalt was detected at concentrations of 10.8 ug/L, 9.2 ug/L and 4.0 ug/L at BH01-24, BH02-24 and BH04-24, respectively. Cobalt exceeded the Table 2.1 and Table 3.1 RPI/ICC LSLs (3.8 ug/L and 10 ug/L, respectively) at BH01-24; and the Table 2.1 RPI/ICC LSLs at BH02-24 and BH04-24.

– Copper was detected at concentrations of 67.1 ug/L, 67.3 ug/L and 20.9 ug/L at BH01-24, BH02-24 and BH04-24, respectively. Copper exceeded the Table 2.1 and Table 3.1 RPI/ICC LSLs (14 ug/L) at BH01-24, BH02-24, and BH04-24.

The soil sample locations detected at concentrations greater than the Table 2.1 and 3.1 LSLs are shown on **Figure 5**.

4.4.3 TCLP Analytical Data

The TCLP analytical results were assessed to the Schedule 4 leachate quality criteria referenced in O. Reg. 347 (as amended). The TCLP analytical results are presented in **Table 4**. The laboratory certificates of analysis are provided in **Attachment B**. Based on the analytical results, the soils would be classified as non-hazardous waste soils if disposed of at a MECP-licensed facility.

5. Conclusions

Based on discussions with the City, at this time an estimated initial volume of approximately 500 m^3 of excess soil will be generated at the Site during the future construction activities.

Based on the soil analytical results, the following conclusions are provided:

– All analyzed parameters had concentrations below the 2011 MOE Table 3 standards with the exception of EC and SAR (salt-related parameters) at all investigative locations.
– All analyzed parameters had concentrations below the ESQS (Table 1, Table 2.1 RPIICC and Table 3.1 RPIICC) with the exception of EC and SAR at all investigative locations.
– Based on a review of the mSPLP results, all analyzed parameters had concentrations below the LSL standards with the exception of chromium, cobalt and/or copper at BH01-24, BH02-24 and BH04-24.
– If the excess soils will be sent to a re-use site, the EC/SAR impacts above 2011 MOE Table 3 standards and ESQS (Table 1, Table 2.1 RPIICC and Table 3.1 RPIICC) and the mSPLP metals concentrations above the LSL standards should be reviewed with potential receivers of the material.
– Based on the waste characterization analytical results, the soils would be classified as non-hazardous waste soils if disposed of at a MECP-licensed facility.

The characterization of excess soils needs to be representative of the soils that will be deposited outside of the Project Area, as defined under O. Reg. 406/19. Additional field investigation activities may be required if the design of the upgrade activities is modified and as the excess soil volume, and the location of the excess soil to be generated, becomes better known to support an overall soil management plan for the project.

Based on the final volume of excess soils to be leaving the Project Area for reuse at another property and the requirements of potential receiving sites, the preparation of planning documents as included in Ontario Regulation 406/19 may be required. This planning documentation, if required, would include the preparation of Assessment of Past Uses (APU), Sampling and Analysis Plan (SAP), Soil Characterization Report (SCR) and Excess Soil Destination Assessment Report (ESDAR).

We trust this meets your current needs at this time. Should you have any questions regarding the above, please do not hesitate to contact our office.

Regards,

GHD

Chanel McMahon

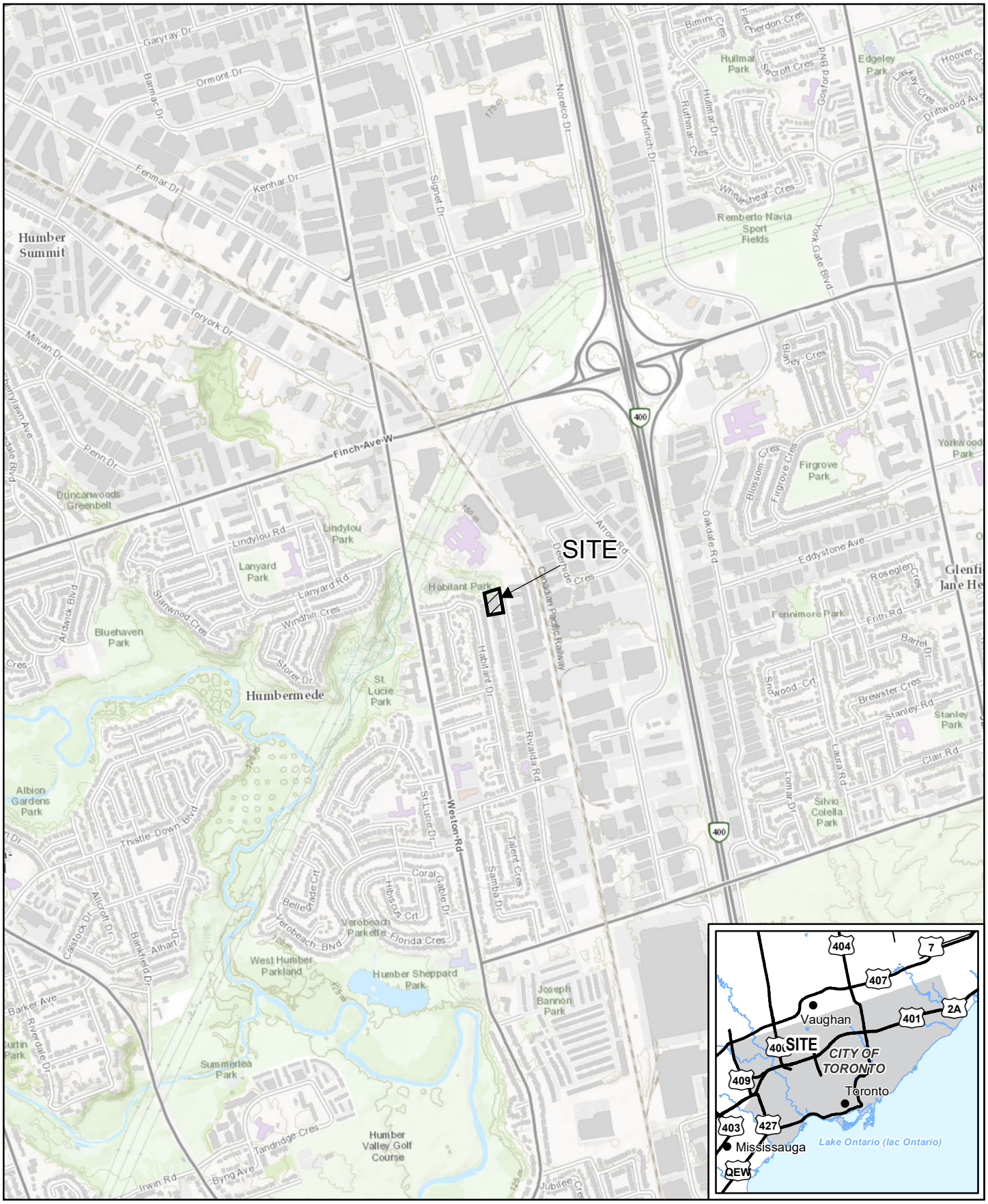
Chanel McMahon, B.Sc.

David J. Hutchinson, P. Eng., QP$_{ESA}$

CM/ps/LTR-2-Hoekstra

Encl.

Figures



Paper Size ANSI A

0 200 400 600

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

N

GHD

CITY OF TORONTO
160 RIVALDA ROAD, NORTH YORK, ONTARIO
PRELIMINARY ENVIRONMENTAL
SOIL QUALITY INVESTIGATION

Project No. **12642634**
Revision No. **-**
Date **Sep 27, 2024**

SITE LOCATION MAP

FIGURE 1

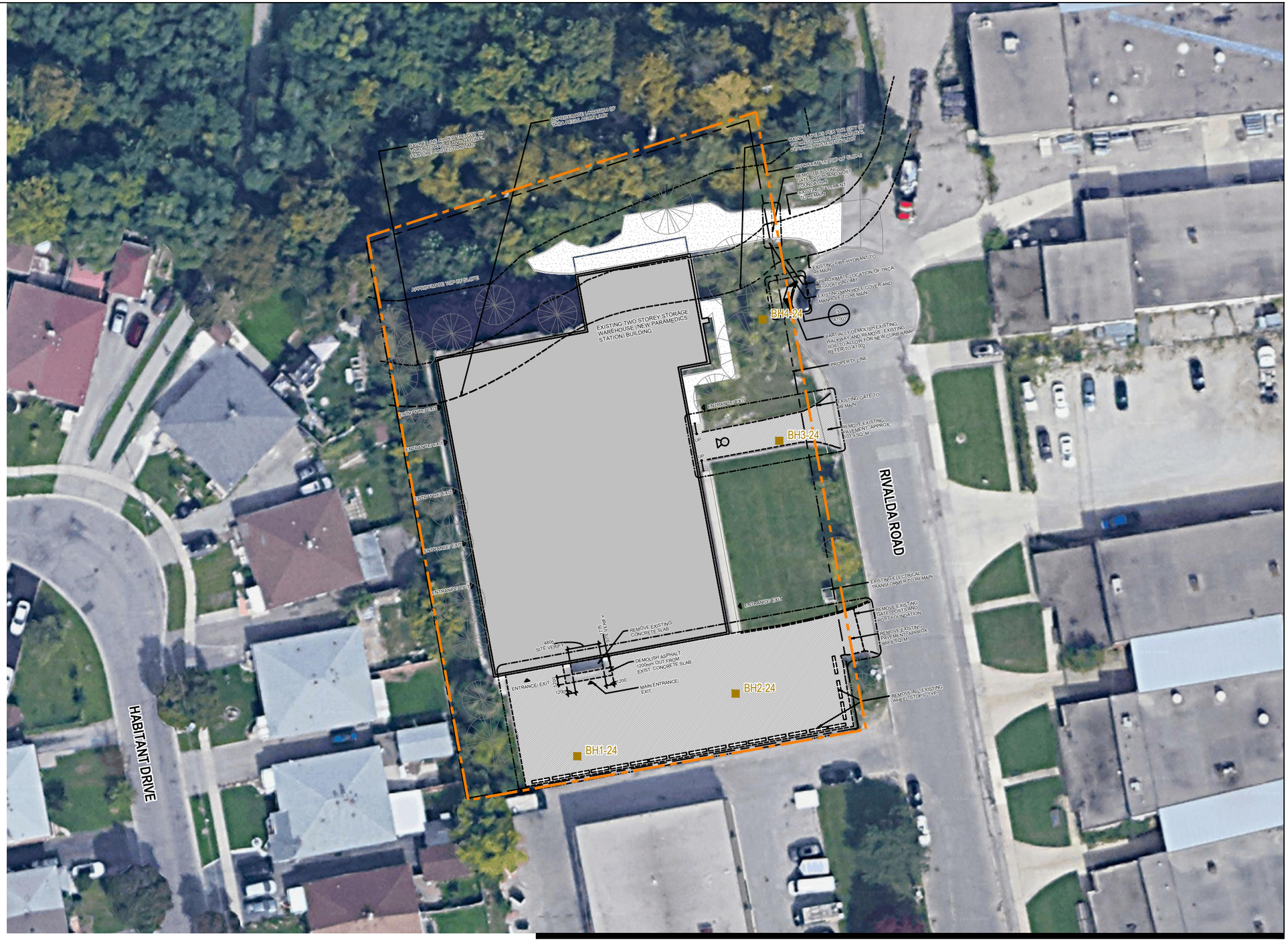
O:\GIS\PROJECTS\12642000s\12642634\GIS\Maps\Deliverables\202409_LTR-Hoekstra002\12642634_202409_LTR-Hoekstra002_001_SiteLocationMap.mxd
Print date: 27 Sep 2024 - 09:02

Data source: MNRF NRVIS, 2018. Produced by GHD under licence from Ontario Ministry of Natural Resources and Forestry, © Queen's Printer 2024. Esri World Topographic basemap.

LEGEND

PROPERTY BOUNDARY

APPROXIMATE BOREHOLE LOCATION (GHD, AUGUST 2024)



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Coordinate System: UTM83-17

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GHD

CITY OF TORONTO
160 RIVALDA ROAD, NORTH YORK, ONTARIO
PRELIMINARY ENVIRONMENTAL SOIL QUALITY INVESTIGATION

SITE PLAN AND INVESTIGATIVE LOCATIONS

Project No. **12642634**
Date **September 2024**

FIGURE 2

Filename: \\ghdnet\ghd\CA\Mississauga\Projects\662\12642634\Digital_Design\ACAD\Figures\LTR-Hoekstra002\12642634-GHD-00-00-LTR-EN-D101_WA-Hoekstra002.dwg
Plot Date: 30 September 2024 2:03 PM

Data Source: @2023 PLEX-EARTH - IMAGE @2023 GOOGLE MAPS
IBI GROUP, PROJECT NUMBER 9119-19-0162, SHEET NUMBER G21-086-A1001, ISSUE F

LEGEND

- PROPERTY BOUNDARY
- APPROXIMATE BOREHOLE LOCATION (GHD, AUGUST 2024)
- 10 CONCENTRATION EXCEEDS SC STANDARDS
- EXCEEDS STANDARDS
- MEETS STANDARDS

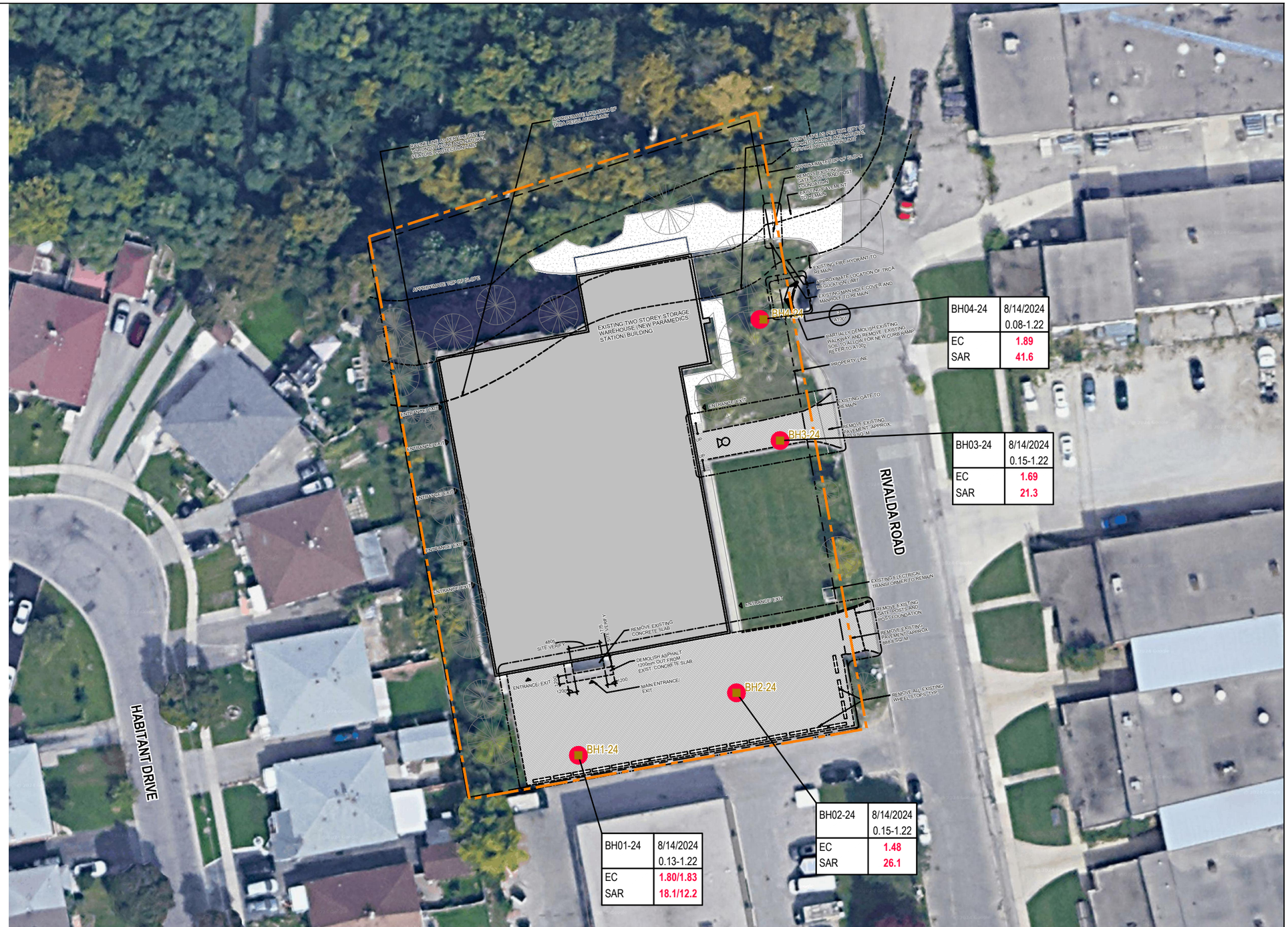
BH04-24	8/14/2024	SAMPLE DATE (mm/dd/yyyy)
	0.08-1.22	DEPTH (m BGS)
EC	1.89	
SAR	41.6	RESULT

SAMPLE LOCATION

PARAMETER

NOTES:

LSL	LEACHATE SCREENING LEVELS
ug/L	MICROGRAMS PER LITRE
mBGS	METRES BELOW GROUND SURFACE
ND(0.50)	PARAMETER NOT DETECTED AT VALUE STATED IN PARENTHESIS
0.1/0.1	PARENT RESULT/DUPLICATE RESULT
(1)	ONTARIO MINISTRY OF THE ENVIRONMENT (MOE), "SOIL, GROUND WATER AND SEDIMENT STANDARDS FOR USE UNDER PART XV.1 OF THE ENVIRONMENTAL PROTECTION. ACT", APRIL 15, 2011. TABLE 3: FULL DEPTH GENERIC SITE CONDITION STANDARDS IN A NON-POTABLE GROUND WATER CONDITION FOR INDUSTRIAL/COMMERCIAL/COMMUNITY (ICC) PROPERTY USE AND COARSE-TEXTURED SOILS



BH04-24	8/14/2024
	0.08-1.22
EC	1.89
SAR	41.6

BH03-24	8/14/2024
	0.15-1.22
EC	1.69
SAR	21.3

BH02-24	8/14/2024
	0.15-1.22
EC	1.48
SAR	26.1

BH01-24	8/14/2024
	0.13-1.22
EC	1.80/1.83
SAR	18.1/12.2

Parameters	Units	O.Reg 153/04 Table 3 ICC Coarse(1)
EC	mS/cm	1.4
SAR	none	12

0 6 12 18m

1:600

Coordinate System: UTM83-17

N

GHD

CITY OF TORONTO
160 RIVALDA ROAD, NORTH YORK, ONTARIO
PRELIMINARY ENVIRONMENTAL SOIL QUALITY INVESTIGATION

SUMMARY OF SOIL EXCEEDANCES (GREATER THAN 2011 MOE TABLE 3 STANDARDS)

Project No. **12642634**
Date **October 2024**

FIGURE 3

Filename: \\ghdnet\ghd\CA\Mississauga\Projects\662\12642634\Digital_Design\ACAD\Figures\LTR-Hoekstra002\12642634-GHD-00-00-LTR-EN-D104_WA-Hoekstra002.dwg
Plot Date: 11 October 2024 2:08 PM

Data Source: @2023 PLEX-EARTH - IMAGE @2023 GOOGLE MAPS
IBI GROUP, PROJECT NUMBER 9119-19-0162, SHEET NUMBER G21-086-A1001, ISSUE F

LEGEND

- PROPERTY BOUNDARY
- APPROXIMATE BOREHOLE LOCATION (GHD, AUGUST 2024)
- 10 CONCENTRATION EXCEEDS ESQS STANDARDS
- EXCEEDS STANDARDS
- MEETS STANDARDS

BH04-24	8/14/2024	SAMPLE DATE (mm/dd/yyyy)
	0.08-1.22	DEPTH (m BGS)
EC	1.89 abcde	
SAR	41.6 abcde	RESULT

SAMPLE LOCATION

PARAMETER

NOTES:

MBGS METRES BELOW GROUND SURFACE

MS/CM MILLISIEMENS PER CENTIMETER

ND(0.50) PARAMETER NOT DETECTED AT CONCENTRATION STATED IN PARENTHESIS

0.1/0.1 PARENT RESULT/DUPLICATE RESULT

(1) ONTARIO MINISTRY OF THE ENVIRONMENT, CONSERVATION AND PARKS (MECP), EXCESS SOIL QUALITY STANDARDS" DATED DECEMBER 8, 2020 CONTAINED IN PART II OF THE DOCUMENT ENTITLED "RULES FOR SOIL MANAGEMENT AND EXCESS SOIL QUALITY STANDARDS", ADOPTED BY REFERENCE IN O. REG. 406/19 (ON-SITE AND EXCESS SOIL MANAGEMENT) MADE UNDER THE ENVIRONMENTAL PROTECTION ACT, R.S.O. 1990, C.Þ.19 (EPA), 2024.

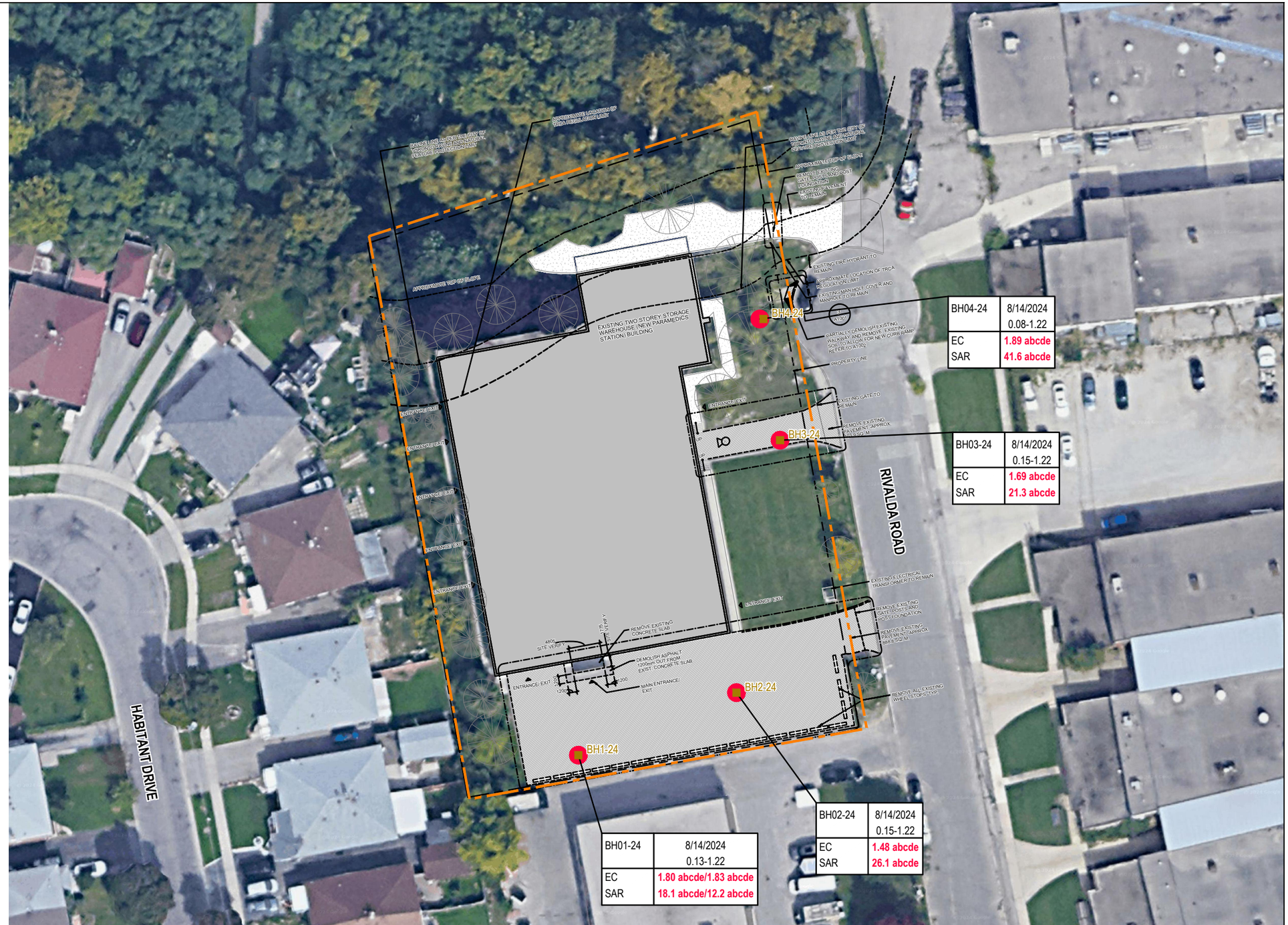
a TABLE 1 RPI/ICC: FULL DEPTH BACKGROUND SITE CONDITION STANDARDS FOR RESIDENTIAL/ PARKLAND/ INSTITUTIONAL/ INDUSTRIAL/ COMMERCIAL/ COMMUNITY PROPERTY USE.

b TABLE 2.1 RPI: FULL DEPTH EXCESS SOIL QUALITY STANDARDS IN A POTABLE GROUNDWATER CONDITION FOR RESIDENTIAL/ PARKLAND/ INSTITUTIONAL PROPERTY USE.

c TABLE 2.1 ICC: FULL DEPTH EXCESS SOIL QUALITY STANDARDS IN A POTABLE GROUNDWATER CONDITION FOR INDUSTRIAL/ COMMERCIAL/ COMMUNITY PROPERTY USE.

d TABLE 3.1 RPI: FULL DEPTH EXCESS SOIL QUALITY STANDARDS IN A NON-POTABLE GROUND WATER CONDITION FOR RESIDENTIAL/ PARKLAND/ INSTITUTIONAL PROPERTY USE.

e TABLE 3.1 ICC: FULL DEPTH EXCESS SOIL QUALITY STANDARDS IN A NON-POTABLE GROUND



Parameter	Units	Generic Excess Soil Quality Standards (1)				
		Table 1	Table 2.1	Table 2.1	Table 3.1	Table 3.1
		RPI/ICC	RPI	ICC	RPI	ICC
		a	b	c	d	e
EC	mS/cm	0.57	0.7	1.4	0.7	1.4
SAR	none	2.4	5	12	5	12

0 6 12 18m

1:600

Coordinate System: UTM83-17

N

GHD

CITY OF TORONTO
160 RIVALDA ROAD, NORTH YORK, ONTARIO
PRELIMINARY ENVIRONMENTAL SOIL QUALITY INVESTIGATION

SUMMARY OF SOIL EXCEEDANCES (EC/SAR)

Project No. 12642634
Date October 2024

FIGURE 4

Filename: \\ghdnet\ghd\CA\Mississauga\Projects\662\12642634\Digital_Design\ACAD\Figures\LTR-Hoekstra002\12642634-GHD-00-00-LTR-EN-D102_WA-Hoekstra002.dwg
Plot Date: 01 October 2024 3:37 PM

Data Source: @2023 PLEX-EARTH - IMAGE @2023 GOOGLE MAPS
IBI GROUP, PROJECT NUMBER 9119-19-0162, SHEET NUMBER G21-086-A1001, ISSUE F

LEGEND

- PROPERTY BOUNDARY
- APPROXIMATE BOREHOLE LOCATION (GHD, AUGUST 2024)
- 10 CONCENTRATION EXCEEDS LSL STANDARDS
- EXCEEDS LSL STANDARDS
- MEETS LSL STANDARDS

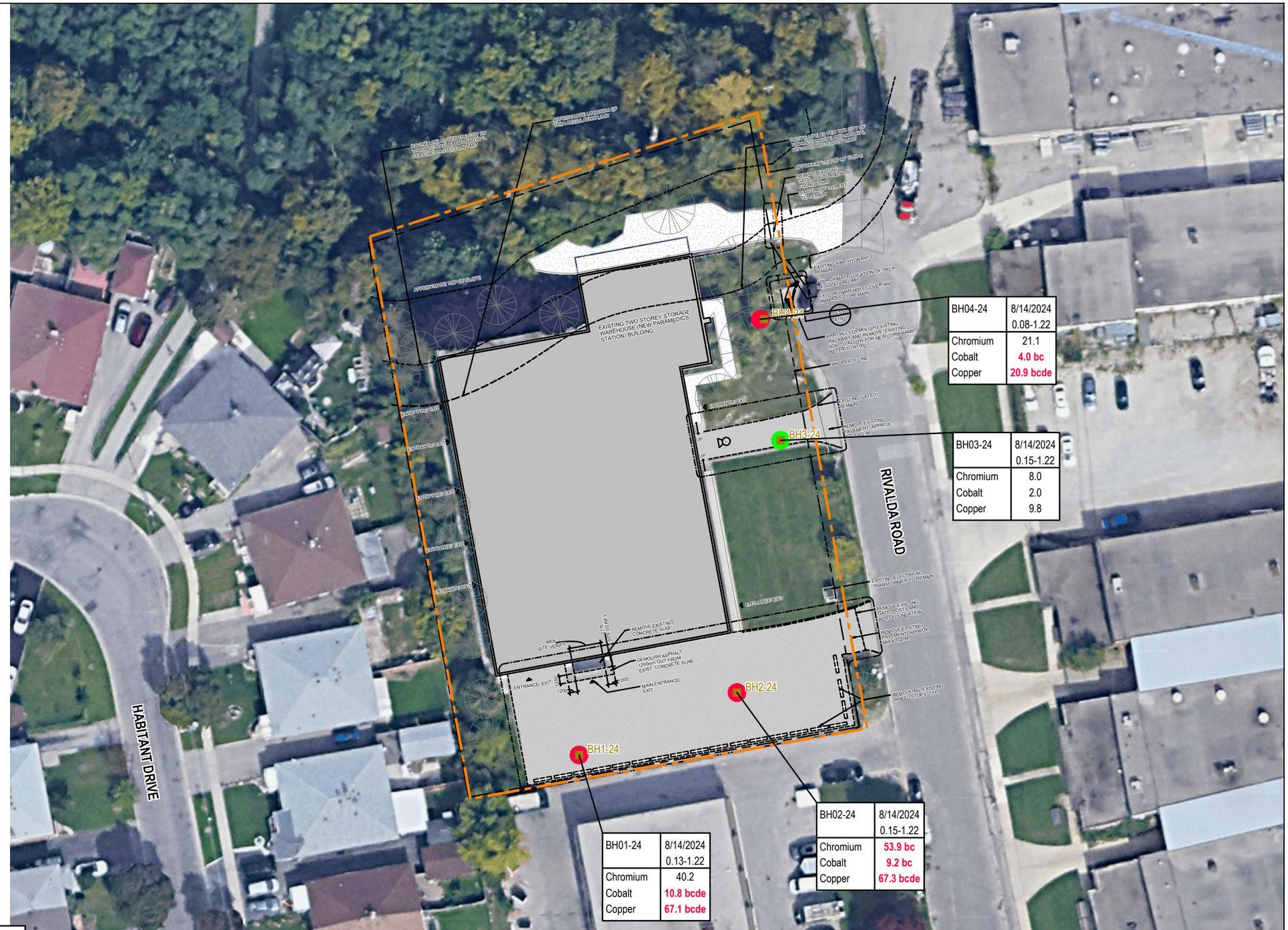
BH04-24	8/14/2024	SAMPLE DATE (mm/dd/yyyy)
	0.08-1.22	DEPTH (m BGS)
EC	1.89 abcde	
SAR	41.6 abcde	RESULT

SAMPLE LOCATION

PARAMETER

NOTES:

LSL	LEACHATE SCREENING LEVELS
ug/L	MICROGRAMS PER LITRE
mBGS	METRES BELOW GROUND SURFACE
ND(0.50)	PARAMETER NOT DETECTED AT VALUE STATED IN PARENTHESIS
0.1/0.1	PARENT RESULT/DUPLICATE RESULT
(1)	ONTARIO MINISTRY OF THE ENVIRONMENT, CONSERVATION AND PARKS (MECP), EXCESS SOIL QUALITY STANDARDS" DATED DECEMBER 8, 2020 CONTAINED IN PART II OF THE DOCUMENT ENTITLED "RULES FOR SOIL MANAGEMENT AND EXCESS SOIL QUALITY STANDARDS", ADOPTED BY REFERENCE IN O. REG. 406/19 (ON-SITE AND EXCESS SOIL MANAGEMENT) MADE UNDER THE ENVIRONMENTAL PROTECTION ACT, R.S.O. 1990, C.E.19 (EPA), 2022.
a	TABLE 1: LEACHATE SCREENING LEVELS FOR EXCESS SOIL REUSE FOR RESIDENTIAL/ PARKLAND/ INSTITUTIONAL/ INDUSTRIAL/ COMMERCIAL/ COMMUNITY PROPERTY USE.
b	TABLE 2.1 RPI: LEACHATE SCREENING LEVELS FOR FULL DEPTH EXCESS SOIL IN A POTABLE GROUND WATER CONDITION FOR RESIDENTIAL/ PARKLAND/ INSTITUTIONAL PROPERTY USE.
c	TABLE 2.1 ICC: LEACHATE SCREENING LEVELS FOR FULL DEPTH EXCESS SOIL IN A POTABLE GROUND WATER CONDITION FOR INDUSTRIAL/ COMMERCIAL/ COMMUNITY PROPERTY USE.
d	TABLE 3.1 RPI: LEACHATE SCREENING LEVELS FOR FULL DEPTH EXCESS SOIL IN A NON-POTABLE GROUND WATER CONDITION FOR RESIDENTIAL/ PARKLAND/ INSTITUTIONAL PROPERTY USE.
e	TABLE 3.1 ICC: LEACHATE SCREENING LEVELS FOR FULL DEPTH EXCESS SOIL IN A NON-POTABLE GROUND WATER CONDITION FOR INDUSTRIAL/ COMMERCIAL/ COMMUNITY PROPERTY USE.



Parameters	Units	Generic Leachate Screening Levels for Excess Soil Reuse (1)				
		Table 1	Table 2.1	Table 2.1	Table 3.1	Table 3.1
		RPI/ICC	RPI	ICC	RPI	ICC
		a	b	c	d	e
Chromium	ug/L	-	50	50	130	130
Cobalt	ug/L	-	3.8	3.8	10	10
Copper	ug/L	-	14	14	14	14

0 6 12 18m

1:600

Coordinate System: UTM83-17

N

GHD

CITY OF TORONTO
160 RIVALDA ROAD, NORTH YORK, ONTARIO
PRELIMINARY ENVIRONMENTAL SOIL QUALITY INVESTIGATION

SUMMARY OF SOIL EXCEEDANCES (mSPLP METALS)

Project No. **12642634**
Date **October 2024**

FIGURE 5

Filename: \\ghdnet\ghd\CA\Mississauga\Projects\662\12642634\Digital_Design\ACAD\Figures\LTR-Hoekstra002\12642634-GHD-00-00-LTR-EN-D103_WA-Hoekstra002.dwg
Plot Date: 01 October 2024 3:39 PM

Data Source: @2023 PLEX-EARTH - IMAGE @2023 GOOGLE MAPS
IBI GROUP, PROJECT NUMBER 9119-19-0162, SHEET NUMBER G21-086-A1001, ISSUE F

Tables

Table 1

Soil Sample Identification Key and Analytical Parameter List
Preliminary Environmental Soil Quality Investigation
160 Rivalda Road, North York, Ontario
City of Toronto

Sample Location	Sample Identification	Sample Depth (mBGS)			Sample Date	Laboratory COA	Sample Analysis							
							Metals & Inorganics	VOCs	PHCs	PAHs	mSPLP Metals	mSPLP VOCs	F1/VOCs	TCLP
Soil														
BH01-24	BH01-24	0.13	-	1.22	14-Aug-2024	WT2423419	X	X	X	X				
BH01-24 (Field Duplicate)	DUP 1	0.13	-	1.22	14-Aug-2024	WT2423419	X	X	X	X				
BH01-24-mSPLP	BH01-24-mSPLP	0.13	-	1.22	14-Aug-2024	WT2423419					X	X		
BH02-24	BH02-24	0.15	-	1.22	14-Aug-2024	WT2423419	X	X	X	X				
BH02-24-mSPLP	BH02-24-mSPLP	0.15	-	1.22	14-Aug-2024	WT2423419					X	X		
BH03-24	BH03-24	0.15	-	1.22	14-Aug-2024	WT2423419	X	X	X	X				
BH03-24-mSPLP	BH03-24-mSPLP	0.15	-	1.22	14-Aug-2024	WT2423419					X	X		
BH04-24	BH04-24	0.08	-	1.22	14-Aug-2024	WT2423419	X	X	X	X				
BH04-24-mSPLP	BH04-24-mSPLP	0.08	-	1.22	14-Aug-2024	WT2423419					X	X		
Trip Blank	Trip Blank	-	-	-	14-Aug-2024	WT2423419							X	
Waste Characterization														
TCLP (Composite BH01-24, BH02-24, BH03-24 and BH04-24)	TCLP	0.08	-	1.22	14-Aug-2024	WT2423419								X

Notes:

mBGS	metres Below Ground Surface
COA	Certificate of Analysis
VOCs	Volatile Organic Compounds
PHCs	Petroleum Hydrocarbons
PAHs	Polyaromatic Hydrocarbons
mSPLP	modified Synthetic Precipitation Leachate Procedure
TCLP	Toxicity Characteristic Leachate Procedure
-	No Value

Table 2

Summary of Soil Analytical Data - 2011 MOE Table 3 Standards
Preliminary Environmental Soil Quality Investigation
160 Rivalda Road, North York, Ontario
City of Toronto

		Sample Location:	**BH01-24**	**BH01-24**	**BH02-24**	**BH03-24**	**BH04-24**	**TRIPBLANK**
		Sample Identification:	**BH01-24**	**DUP-1**	**BH02-24**	**BH03-24**	**BH04-24**	**Trip Blank**
		Sample Date:	**8/14/2024**	**8/14/2024**	**8/14/2024**	**8/14/2024**	**8/14/2024**	**8/14/2024**
		Sample Depth (mBGS):	**0.13-1.22**	**0.13-1.22**	**0.15-1.22**	**0.15-1.22**	**0.08-1.22**	**-**
		Lab COA:	**C1V9046**	**C1V9046**	**C1V9046**	**C1V9046**	**C1V9025**	**C1X4855**
Parameters	**Units**	**MOE Table 3 [(1)] Standard ICC**						
Volatile Organic Compounds (VOCs)								
1,1,1,2-Tetrachloroethane	µg/g	0.087	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
1,1,1-Trichloroethane	µg/g	6.1	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
1,1,2,2-Tetrachloroethane	µg/g	0.05	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
1,1,2-Trichloroethane	µg/g	0.05	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
1,1-Dichloroethane	µg/g	17	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
1,1-Dichloroethene	µg/g	0.064	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
1,2-Dibromoethane (Ethylene dibromide)	µg/g	0.05	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
1,2-Dichlorobenzene	µg/g	6.8	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
1,2-Dichloroethane	µg/g	0.05	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
1,2-Dichloropropane	µg/g	0.16	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
1,3-Dichlorobenzene	µg/g	9.6	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
1,4-Dichlorobenzene	µg/g	0.2	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
2-Butanone (Methyl ethyl ketone) (MEK)	µg/g	70	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	µg/g	31	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
Acetone	µg/g	16	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
Benzene	µg/g	0.32	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
Bromodichloromethane	µg/g	18	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
Bromoform	µg/g	0.61	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
Bromomethane (Methyl bromide)	µg/g	0.05	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
Carbon tetrachloride	µg/g	0.21	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
Chlorobenzene	µg/g	2.4	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
Chloroform (Trichloromethane)	µg/g	0.47	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
cis-1,2-Dichloroethene	µg/g	55	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
cis-1,3-Dichloropropene	µg/g	NV	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)
cis-1,3-Dichloropropene/trans-1,3-Dichloropropene	µg/g	0.18	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
Dibromochloromethane	µg/g	13	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
Dichlorodifluoromethane (CFC-12)	µg/g	16	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
Ethylbenzene	µg/g	9.5	ND(0.015)	ND(0.015)	ND(0.015)	ND(0.015)	ND(0.015)	ND(0.015)
Hexane	µg/g	46	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
m&p-Xylenes	µg/g	NV	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)
Methyl tert butyl ether (MTBE)	µg/g	11	ND(0.040)	ND(0.040)	ND(0.040)	ND(0.040)	ND(0.040)	ND(0.040)
Methylene chloride	µg/g	1.6	ND(0.045)	ND(0.045)	ND(0.045)	ND(0.045)	ND(0.045)	ND(0.045)
o-Xylene	µg/g	NV	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)
Styrene	µg/g	34	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
Tetrachloroethene	µg/g	4.5	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
Toluene	µg/g	68	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
Total BTEX	µg/g	NV	ND(0.10)	ND(0.10)	ND(0.10)	ND(0.10)	ND(0.10)	ND(0.10)
trans-1,2-Dichloroethene	µg/g	1.3	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
trans-1,3-Dichloropropene	µg/g	NV	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)
Trichloroethene	µg/g	0.91	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
Trichlorofluoromethane (CFC-11)	µg/g	4	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
Vinyl chloride	µg/g	0.032	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)
Xylenes (total)	µg/g	26	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)

Table 2

Summary of Soil Analytical Data - 2011 MOE Table 3 Standards
Preliminary Environmental Soil Quality Investigation
160 Rivalda Road, North York, Ontario
City of Toronto

		Sample Location:	**BH01-24**	**BH01-24**	**BH02-24**	**BH03-24**	**BH04-24**	**TRIPBLANK**
		Sample Identification:	**BH01-24**	**DUP-1**	**BH02-24**	**BH03-24**	**BH04-24**	**Trip Blank**
		Sample Date:	**8/14/2024**	**8/14/2024**	**8/14/2024**	**8/14/2024**	**8/14/2024**	**8/14/2024**
		Sample Depth (mBGS):	**0.13-1.22**	**0.13-1.22**	**0.15-1.22**	**0.15-1.22**	**0.08-1.22**	**-**
		Lab COA:	**C1V9046**	**C1V9046**	**C1V9046**	**C1V9046**	**C1V9025**	**C1X4855**
Parameters	**Units**	**MOE Table 3 [(1)] Standard ICC**						
Polyaromatic Hydrocarbons (PAHs)								
1-Methylnaphthalene	µg/g	76	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	-
1-Methylnaphthalene/2-Methylnaphthalene	µg/g	76	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-
2-Methylnaphthalene	µg/g	76	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	-
Acenaphthene	µg/g	96	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-
Acenaphthylene	µg/g	0.15	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-
Anthracene	µg/g	0.67	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-
Benzo(a)anthracene	µg/g	0.96	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-
Benzo(a)pyrene	µg/g	0.3	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-
Benzo(b)fluoranthene/Benzo(j)fluoranthene	µg/g	0.96	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-
Benzo(g,h,i)perylene	µg/g	9.6	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-
Benzo(k)fluoranthene	µg/g	0.96	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-
Chrysene	µg/g	9.6	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-
Dibenz(a,h)anthracene	µg/g	0.1	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-
Fluoranthene	µg/g	9.6	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-
Fluorene	µg/g	62	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-
Indeno(1,2,3-cd)pyrene	µg/g	0.76	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-
Naphthalene	µg/g	9.6	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	-
Phenanthrene	µg/g	12	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-
Pyrene	µg/g	96	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-
Metals								
Antimony	µg/g	40	ND(0.10)	ND(0.10)	ND(0.10)	0.11	ND(0.10)	-
Arsenic	µg/g	18	3.00	2.86	3.71	3.47	2.88	-
Barium	µg/g	670	60.7	58.0	63.8	159	91.7	-
Beryllium	µg/g	8	0.57	0.52	0.58	0.87	0.66	-
Boron	µg/g	120	6.1	ND(5.0)	7.4	15.8	8.1	-
Boron (hot water soluble)	µg/g	2	0.22	0.18	ND(0.10)	ND(0.10)	ND(0.10)	-
Cadmium	µg/g	1.9	0.111	0.111	0.073	0.106	0.107	-
Chromium	µg/g	160	18.6	17.8	20.7	30.0	23.6	-
Chromium VI (hexavalent)	µg/g	8	ND(0.10)	ND(0.10)	ND(0.10)	0.15	0.22	-
Cobalt	µg/g	80	7.32	7.15	7.70	11.9	9.15	-
Copper	µg/g	230	14.6	12.0	19.9	20.4	14.5	-
Lead	µg/g	120	8.65	8.18	7.23	9.76	8.38	-
Mercury	µg/g	3.9	0.0292	0.0267	0.0209	0.0129	0.0288	-
Molybdenum	µg/g	40	0.28	0.24	0.23	0.27	0.29	-
Nickel	µg/g	270	15.6	13.8	17.9	25.3	18.7	-
Selenium	µg/g	5.5	ND(0.20)	ND(0.20)	ND(0.20)	ND(0.20)	ND(0.20)	-
Silver	µg/g	40	ND(0.10)	ND(0.10)	ND(0.10)	ND(0.10)	ND(0.10)	-
Thallium	µg/g	3.3	0.108	0.103	0.119	0.209	0.146	-
Uranium	µg/g	33	0.410	0.452	0.423	0.519	0.581	-
Vanadium	µg/g	86	30.7	29.1	32.5	41.8	37.1	-
Zinc	µg/g	340	36.1	36.3	36.8	58.1	41.3	-

Table 2

Summary of Soil Analytical Data - 2011 MOE Table 3 Standards
Preliminary Environmental Soil Quality Investigation
160 Rivalda Road, North York, Ontario
City of Toronto

		Sample Location:	**BH01-24**	**BH01-24**	**BH02-24**	**BH03-24**	**BH04-24**	**TRIPBLANK**
		Sample Identification:	**BH01-24**	**DUP-1**	**BH02-24**	**BH03-24**	**BH04-24**	**Trip Blank**
		Sample Date:	**8/14/2024**	**8/14/2024**	**8/14/2024**	**8/14/2024**	**8/14/2024**	**8/14/2024**
		Sample Depth (mBGS):	**0.13-1.22**	**0.13-1.22**	**0.15-1.22**	**0.15-1.22**	**0.08-1.22**	**-**
		Lab COA:	**C1V9046**	**C1V9046**	**C1V9046**	**C1V9046**	**C1V9025**	**C1X4855**
Parameters	**Units**	**MOE Table 3 (1) Standard ICC**						
SAR Metals								
Calcium (soluble)	ug/L	NV	13.5	28.0	7.55	12.7	4.81	-
Magnesium (soluble)	ug/L	NV	9.47	23.6	0.61	2.02	0.76	-
Sodium (soluble)	ug/L	NV	355	364	277	310	372	-
Petroleum Hydrocarbons (PHCs)								
Chromatogram to baseline at nC50	µg/g		YES	YES	YES	YES	YES	-
Petroleum hydrocarbons F1 (C6-C10)	µg/g	55	ND(5.0)	ND(5.0)	ND(5.0)	ND(5.0)	ND(5.0)	ND(5.0)
Petroleum hydrocarbons F1 minus BTEX	µg/g	55	ND(5.0)	ND(5.0)	ND(5.0)	ND(5.0)	ND(5.0)	ND(5.0)
Petroleum hydrocarbons F2 (C10-C16)	µg/g	230	ND(10)	ND(10)	ND(10)	ND(10)	ND(10)	-
Petroleum hydrocarbons F2 minus Naphthalene	µg/g	230	ND(25)	ND(25)	ND(25)	ND(25)	ND(25)	-
Petroleum hydrocarbons F3 (C16-C34)	µg/g	1700	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	-
Petroleum hydrocarbons F3 minus PAH	µg/g	1700	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	-
Petroleum hydrocarbons F4 (C34-C50)	µg/g	3300	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	-
Total Petroleum Hydrocarbons (C6-C50)	µg/g		ND(80)	ND(80)	ND(80)	ND(80)	ND(80)	-
General Chemistry								
Conductivity	mS/cm	1.4	**1.80**	**1.83**	**1.48**	**1.69**	**1.89**	-
Cyanide, weak acid dissociable	µg/g	0.051	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-
Moisture	%	NV	18.3	16.1	16.0	18.2	11.6	ND(0.25)
pH, soluble (1:2)	s.u.	(5-11) 5-9	7.14	7.40	7.64	7.62	7.84	-
Sodium adsorption ratio (SAR)	none	12	**18.1**	**12.2**	**26.1**	**21.3**	**41.6**	-

Notes:

(1) Ontario Ministry of the Environment (MOE), "Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection. Act", April 15, 2011. Table 3: Full Depth Generic Site Condition Standards in a Non-Potable Ground Water Condition for Industrial/Commercial/Community (ICC) Property Use (coarse-grained).

- = Not value or not analyzed.

mBGS - metres below ground surface.

µg/g - micrograms per gram.

µg/L - micrograms per litre.

mS/cm - Millisiemens per centimetre.

ND (RL) - Not detected at the associated laboratory reporting limit.

s.u. - Standard units.

% - Percent.

5-9 (5-11) - surface soil (0-1.5m BGS) (subsurface [>1.5 m BGS])

Concentrations in **RED** indicate the analyte was detected at a concentration greater than the referenced Standard.

Table 3

Summary of Soil Analytical Data - Excess Soil Quality Standards
Preliminary Environmental Soil Quality Investigation
160 Rivalda Road, North York, Ontario
City of Toronto

						Sample Location:	**BH01-24**	**BH01-24**	**BH02-24**	**BH03-24**	**BH04-24**	**TRIPBLANK**
						Sample Identification:	**BH01-24**	**DUP-1**	**BH02-24**	**BH03-24**	**BH04-24**	**Trip Blank**
						Sample Date:	**8/14/2024**	**8/14/2024**	**8/14/2024**	**8/14/2024**	**8/14/2024**	**8/14/2024**
						Sample Depth (mBGS):	**0.13-1.22**	**0.13-1.22**	**0.15-1.22**	**0.15-1.22**	**0.08-1.22**	**-**
						Lab COA:	**WT2423419**	**WT2423419**	**WT2423419**	**WT2423419**	**WT2423419**	**WT2423419**
								Field Duplicate				
		Excess Soil Quality Standards (1)										
Parameters	**Units**	**Tbl 1 RPI/ICC a**	**Tbl 2.1 RPI b**	**Tbl 2.1 ICC c**	**Tbl 3.1 RPI d**	**Tbl 3.1 ICC e**						
Volatile Organic Compounds (VOCs)												
1,1,1,2-Tetrachloroethane	µg/g	0.05	0.05	0.05	0.05	0.05	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
1,1,1-Trichloroethane	µg/g	0.05	0.11	0.12	0.11	0.4	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
1,1,2,2-Tetrachloroethane	µg/g	0.05	0.05	0.05	0.05	0.05	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
1,1,2-Trichloroethane	µg/g	0.05	0.05	0.05	0.05	0.05	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
1,1-Dichloroethane	µg/g	0.05	0.05	0.05	0.14	0.57	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
1,1-Dichloroethene	µg/g	0.05	0.05	0.05	0.05	0.05	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
1,2-Dibromoethane (Ethylene dibromide)	µg/g	0.05	0.05	0.05	0.05	0.05	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
1,2-Dichlorobenzene	µg/g	0.05	3.4	6.8	3.4	6.8	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
1,2-Dichloroethane	µg/g	0.05	0.05	0.05	0.05	0.05	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
1,2-Dichloropropane	µg/g	0.05	0.05	0.05	0.05	0.05	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
1,3-Dichlorobenzene	µg/g	0.05	0.26	0.26	4.8	6.8	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
1,4-Dichlorobenzene	µg/g	0.05	0.05	0.05	0.05	0.05	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
2-Butanone (Methyl ethyl ketone) (MEK)	µg/g	0.5	0.5	0.5	14	26	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	µg/g	0.5	0.5	0.5	0.89	17	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
Acetone	µg/g	0.5	0.5	0.5	1.8	1.8	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
Benzene	µg/g	0.02	0.02	0.02	0.02	0.034	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)	ND(0.0050)
Bromodichloromethane	µg/g	0.05	0.05	0.05	5.8	5.8	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
Bromoform	µg/g	0.05	0.05	0.05	2.5	2.5	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
Bromomethane (Methyl bromide)	µg/g	0.05	0.05	0.05	0.05	0.05	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
Carbon tetrachloride	µg/g	0.05	0.05	0.05	0.05	0.05	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
Chlorobenzene	µg/g	0.05	0.083	0.083	0.28	0.28	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
Chloroform (Trichloromethane)	µg/g	0.05	0.05	0.05	0.08	0.26	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
cis-1,2-Dichloroethene	µg/g	0.05	0.05	0.05	0.05	0.05	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
cis-1,3-Dichloropropene	µg/g	NV	NV	NV	NV	NV	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)
cis-1,3-Dichloropropene/trans-1,3-Dichloropropene	µg/g	0.05	0.05	0.05	0.05	0.05	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
Dibromochloromethane	µg/g	0.05	0.05	0.05	5.5	5.5	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
Dichlorodifluoromethane (CFC-12)	µg/g	0.05	1.5	1.5	1.8	1.8	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
Ethylbenzene	µg/g	0.05	0.05	0.05	1.9	1.9	ND(0.015)	ND(0.015)	ND(0.015)	ND(0.015)	ND(0.015)	ND(0.015)
Hexane	µg/g	0.05	2.5	2.5	2.5	2.5	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
m&p-Xylenes	µg/g	NV	NV	NV	NV	NV	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)
Methyl tert butyl ether (MTBE)	µg/g	0.05	0.05	0.05	0.05	0.05	ND(0.040)	ND(0.040)	ND(0.040)	ND(0.040)	ND(0.040)	ND(0.040)
Methylene chloride	µg/g	0.05	0.05	0.05	0.06	0.2	ND(0.045)	ND(0.045)	ND(0.045)	ND(0.045)	ND(0.045)	ND(0.045)
o-Xylene	µg/g	NV	NV	NV	NV	NV	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)
Styrene	µg/g	0.05	0.05	0.05	0.5	6.8	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
Tetrachloroethene	µg/g	0.05	0.05	0.05	0.05	0.05	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
Toluene	µg/g	0.2	0.2	0.2	0.99	7.8	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
Total BTEX	µg/g	NV	NV	NV	NV	NV	ND(0.10)	ND(0.10)	ND(0.10)	ND(0.10)	ND(0.10)	ND(0.10)
trans-1,2-Dichloroethene	µg/g	0.05	0.05	0.05	0.05	0.05	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
trans-1,3-Dichloropropene	µg/g	NV	NV	NV	NV	NV	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)
Trichloroethene	µg/g	0.05	0.05	0.05	0.05	0.05	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
Trichlorofluoromethane (CFC-11)	µg/g	0.25	0.25	0.25	0.46	0.46	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)
Vinyl chloride	µg/g	0.02	0.02	0.02	0.02	0.02	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)
Xylenes (total)	µg/g	0.05	0.091	0.091	0.9	3	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)

Table 3

Summary of Soil Analytical Data - Excess Soil Quality Standards
Preliminary Environmental Soil Quality Investigation
160 Rivalda Road, North York, Ontario
City of Toronto

						Sample Location:	**BH01-24**	**BH01-24**	**BH02-24**	**BH03-24**	**BH04-24**	**TRIPBLANK**
						Sample Identification:	**BH01-24**	**DUP-1**	**BH02-24**	**BH03-24**	**BH04-24**	**Trip Blank**
						Sample Date:	**8/14/2024**	**8/14/2024**	**8/14/2024**	**8/14/2024**	**8/14/2024**	**8/14/2024**
						Sample Depth (mBGS):	**0.13-1.22**	**0.13-1.22**	**0.15-1.22**	**0.15-1.22**	**0.08-1.22**	**-**
						Lab COA:	**WT2423419**	**WT2423419**	**WT2423419**	**WT2423419**	**WT2423419**	**WT2423419**
								Field Duplicate				
		Excess Soil Quality Standards (1)										
Parameters	**Units**	**Tbl 1 RPI/ICC a**	**Tbl 2.1 RPI b**	**Tbl 2.1 ICC c**	**Tbl 3.1 RPI d**	**Tbl 3.1 ICC e**						
Polyaromatic Hydrocarbons (PAHs)												
1-Methylnaphthalene	µg/g	0.59	0.59	0.59	0.92	8.7	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	-
1-Methylnaphthalene/2-Methylnaphthalene	µg/g	0.59	0.59	0.59	0.92	8.7	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-
2-Methylnaphthalene	µg/g	0.59	0.59	0.59	0.92	8.7	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	ND(0.030)	-
Acenaphthene	µg/g	0.072	2.5	2.5	14	15	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-
Acenaphthylene	µg/g	0.093	0.093	0.093	0.093	0.093	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-
Anthracene	µg/g	0.16	0.16	0.16	0.16	0.16	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-
Benzo(a)anthracene	µg/g	0.36	0.5	0.92	0.5	1	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-
Benzo(a)pyrene	µg/g	0.3	0.31	0.31	0.57	0.7	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-
Benzo(b)fluoranthene/Benzo(j)fluoranthene	µg/g	0.47	3.2	3.2	5.7	7	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-
Benzo(g,h,i)perylene	µg/g	0.68	6.6	13	6.6	13	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-
Benzo(k)fluoranthene	µg/g	0.48	3.1	3.1	5.7	7	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-
Chrysene	µg/g	2.8	7	9.4	7	14	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-
Dibenz(a,h)anthracene	µg/g	0.1	0.57	0.7	0.57	0.7	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-
Fluoranthene	µg/g	0.56	0.69	2.8	0.69	70	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-
Fluorene	µg/g	0.12	6.8	6.8	6.8	6.8	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-
Indeno(1,2,3-cd)pyrene	µg/g	0.23	0.38	0.76	0.38	0.76	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-
Naphthalene	µg/g	0.09	0.2	0.2	0.59	1.8	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	-
Phenanthrene	µg/g	0.69	6.2	12	6.2	12	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-
Pyrene	µg/g	1	28	28	70	70	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-

Table 3

Summary of Soil Analytical Data - Excess Soil Quality Standards
Preliminary Environmental Soil Quality Investigation
160 Rivalda Road, North York, Ontario
City of Toronto

						Sample Location:	**BH01-24**	**BH01-24**	**BH02-24**	**BH03-24**	**BH04-24**	**TRIPBLANK**
						Sample Identification:	**BH01-24**	**DUP-1**	**BH02-24**	**BH03-24**	**BH04-24**	**Trip Blank**
						Sample Date:	**8/14/2024**	**8/14/2024**	**8/14/2024**	**8/14/2024**	**8/14/2024**	**8/14/2024**
						Sample Depth (mBGS):	**0.13-1.22**	**0.13-1.22**	**0.15-1.22**	**0.15-1.22**	**0.08-1.22**	**-**
						Lab COA:	**WT2423419**	**WT2423419**	**WT2423419**	**WT2423419**	**WT2423419**	**WT2423419**
								Field Duplicate				
		Excess Soil Quality Standards (1)										
Parameters	**Units**	**Tbl 1 RPI/ICC a**	**Tbl 2.1 RPI b**	**Tbl 2.1 ICC c**	**Tbl 3.1 RPI d**	**Tbl 3.1 ICC e**						
Metals												
Antimony	µg/g	1.3	7.5	40	7.5	40	ND(0.10)	ND(0.10)	ND(0.10)	0.11	ND(0.10)	-
Arsenic	µg/g	18	18	18	18	18	3.00	2.86	3.71	3.47	2.88	-
Barium	µg/g	220	390	670	390	670	60.7	58.0	63.8	159	91.7	-
Beryllium	µg/g	2.5	4	8	4	8	0.57	0.52	0.58	0.87	0.66	-
Boron	µg/g	36	120	120	120	120	6.1	ND(5.0)	7.4	15.8	8.1	-
Boron (hot water soluble)	µg/g	NV	1.5	2	1.5	2	0.22	0.18	ND(0.10)	ND(0.10)	ND(0.10)	-
Cadmium	µg/g	1.2	1.2	1.9	1.2	1.9	0.111	0.111	0.073	0.106	0.107	-
Chromium	µg/g	70	160	160	160	160	18.6	17.8	20.7	30.0	23.6	-
Chromium VI (hexavalent)	µg/g	0.66	8	8	8	8	ND(0.10)	ND(0.10)	ND(0.10)	0.15	0.22	-
Cobalt	µg/g	21	22	80	22	80	7.32	7.15	7.70	11.9	9.15	-
Copper	µg/g	92	140	230	140	230	14.6	12.0	19.9	20.4	14.5	-
Lead	µg/g	120	120	120	120	120	8.65	8.18	7.23	9.76	8.38	-
Mercury	µg/g	0.27	0.27	0.27	0.27	0.27	0.0292	0.0267	0.0209	0.0129	0.0288	-
Molybdenum	µg/g	2	6.9	40	6.9	40	0.28	0.24	0.23	0.27	0.29	-
Nickel	µg/g	82	100	270	100	270	15.6	13.8	17.9	25.3	18.7	-
Selenium	µg/g	1.5	2.4	5.5	2.4	5.5	ND(0.20)	ND(0.20)	ND(0.20)	ND(0.20)	ND(0.20)	-
Silver	µg/g	0.5	20	40	20	40	ND(0.10)	ND(0.10)	ND(0.10)	ND(0.10)	ND(0.10)	-
Thallium	µg/g	1	1	3.3	1	3.3	0.108	0.103	0.119	0.209	0.146	-
Uranium	µg/g	2.5	23	33	23	33	0.410	0.452	0.423	0.519	0.581	-
Vanadium	µg/g	86	86	86	86	86	30.7	29.1	32.5	41.8	37.1	-
Zinc	µg/g	290	340	340	340	340	36.1	36.3	36.8	58.1	41.3	-
SAR Metals												
Calcium (soluble)	µg/L	NV	NV	NV	NV	NV	13.5	28.0	7.55	12.7	4.81	-
Magnesium (soluble)	µg/L	NV	NV	NV	NV	NV	9.47	23.6	0.61	2.02	0.76	-
Sodium (soluble)	µg/L	NV	NV	NV	NV	NV	355	364	277	310	372	-
Petroleum Hydrocarbons (PHCs)												
Chromatogram to baseline at nC50	µg/g	NV	NV	NV	NV	NV	YES	YES	YES	YES	YES	-
Petroleum hydrocarbons F1 (C6-C10)	µg/g	25	25	25	25	25	ND(5.0)	ND(5.0)	ND(5.0)	ND(5.0)	ND(5.0)	ND(5.0)
Petroleum hydrocarbons F1 minus BTEX	µg/g	25	25	25	25	25	ND(5.0)	ND(5.0)	ND(5.0)	ND(5.0)	ND(5.0)	ND(5.0)
Petroleum hydrocarbons F2 (C10-C16)	µg/g	10	10	26	10	26	ND(10)	ND(10)	ND(10)	ND(10)	ND(10)	-
Petroleum hydrocarbons F2 minus Naphthalene	µg/g	10	10	26	10	26	ND(25)	ND(25)	ND(25)	ND(25)	ND(25)	-
Petroleum hydrocarbons F3 (C16-C34)	µg/g	240	240	240	300	1700	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	-
Petroleum hydrocarbons F3 minus PAH	µg/g	240	240	240	300	1700	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	-
Petroleum hydrocarbons F4 (C34-C50)	µg/g	120	2800	3300	2800	3300	ND(50)	ND(50)	ND(50)	ND(50)	ND(50)	-
Total Petroleum Hydrocarbons (C6-C50)	µg/g	NV	NV	NV	NV	NV	ND(80)	ND(80)	ND(80)	ND(80)	ND(80)	-

Table 3

Summary of Soil Analytical Data - Excess Soil Quality Standards
Preliminary Environmental Soil Quality Investigation
160 Rivalda Road, North York, Ontario
City of Toronto

						Sample Location:	**BH01-24**	**BH01-24**	**BH02-24**	**BH03-24**	**BH04-24**	**TRIPBLANK**
						Sample Identification:	**BH01-24**	**DUP-1**	**BH02-24**	**BH03-24**	**BH04-24**	**Trip Blank**
						Sample Date:	**8/14/2024**	**8/14/2024**	**8/14/2024**	**8/14/2024**	**8/14/2024**	**8/14/2024**
						Sample Depth (mBGS):	**0.13-1.22**	**0.13-1.22**	**0.15-1.22**	**0.15-1.22**	**0.08-1.22**	**-**
						Lab COA:	**WT2423419**	**WT2423419**	**WT2423419**	**WT2423419**	**WT2423419**	**WT2423419**
								Field Duplicate				
		Excess Soil Quality Standards (1)										
Parameters	**Units**	**Tbl 1 RPI/ICC a**	**Tbl 2.1 RPI b**	**Tbl 2.1 ICC c**	**Tbl 3.1 RPI d**	**Tbl 3.1 ICC e**						
General Chemistry												
Conductivity	mS/cm	0.57	0.7	1.4	0.7	1.4	**1.80[abcde]**	**1.83[abcde]**	**1.48[abcde]**	**1.69[abcde]**	**1.89[abcde]**	-
Cyanide, weak acid dissociable	µg/g	0.051	0.051	0.051	0.051	0.051	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	ND(0.050)	-
Moisture	%	NV	NV	NV	NV	NV	18.3	16.1	16.0	18.2	11.6	ND(0.25)
pH, soluble (1:2)	s.u.	(5-11) 5-9	(5-11) 5-9	(5-11) 5-9	(5-11) 5-9	(5-11) 5-9	7.14	7.40	7.64	7.62	7.84	-
Sodium adsorption ratio (SAR)	none	2.4	5	12	5	12	**18.1[abcde]**	**12.2[abcde]**	**26.1[abcde]**	**21.3[abcde]**	**41.6[abcde]**	-

Notes:

(1) Ontario Ministry of the Environment, Conservation and Parks (MECP), "Excess Soil Quality Standards" dated April 23, 2024 contained in Part II of the document entitled "Rules for Soil Management and Excess Soil Quality Standards", adopted by reference in O. Reg. 406/19 (On-Site and Excess Soil Management) made under the Environmental Protection Act, R.S.O. 1990, c. E.19 (EPA), 2024.

a - Table 1 RPIICC: Full Depth Background Site Condition Standards for Residential/ Parkland/ Institutional/ Industrial/ Commercial/Community Property Use.

b - Table 2.1 RPI: Full Depth Excess Soil Quality Standards in a Potable Ground Water Condition for Residential/ Parkland/ Institutional Property Use.

c - Table 2.1 ICC: Full Depth Excess Soil Quality Standards in a Potable Ground Water Condition for Industrial/ Commercial/ Community Property Use.

d - Table 3.1 RPI: Full Depth Excess Soil Quality Standards in a Non-Potable Ground Water Condition for Residential/ Parkland/ Institutional Property Use.

e - Table 3.1 ICC: Full Depth Excess Soil Quality Standards in a Non-Potable Ground Water Condition for Industrial/ Commercial/ Community Property Use.

NV - No Value

- = Not analyzed.

mBGS - metres below ground surface.

µg/g - micrograms per gram.

mS/cm - Millisiemens per centimetre.

ND (RL) - Not detected at the associated laboratory reporting limit.

s.u. - Standard units.

% - Percent.

5-9 (5-11) - surface soil (0-1.5m BGS) (subsurface [>1.5 m BGS])

Concentrations in **RED** indicate the analyte was detected at a concentration greater than the referenced Standard.

Table 4

Summary of mSPLP Leachate Analytical Data
Preliminary Environmental Soil Quality Investigation
160 Rivalda Road, North York, Ontario
City of Toronto

						Sample Location:	**BH01-24**	**BH02-24**	**BH03-24**	**BH04-24**
						Sample Identification:	**BH01-24-MSPLP**	**BH02-24-MSPLP**	**BH03-24-MSPLP**	**BH04-24-MSPLP**
						Sample Date:	**8/14/2024**	**8/14/2024**	**8/14/2024**	**8/14/2024**
						Sample Depth (mBGS):	**0.13-1.22**	**0.15-1.22**	**0.15-1.22**	**0.08-1.22**
						Lab COA:	**WT2423419**	**WT2423419**	**WT2423419**	**WT2423419**
		Generic Leachate Screening Levels for Excess Soil Reuse (1)								
Parameters	**Units**	**Table 1 RPI/ICC a**	**Table 2.1 RPI b**	**Table 2.1 ICC c**	**Table 3.1 RPI d**	**Table 3.1 ICC e**				
SPLP Volatile Organic Compounds										
1,1,1,2-Tetrachloroethane	ug/L	0.5	NV	NV	NV	NV	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
1,1,2,2-Tetrachloroethane	ug/L	0.5	0.5	0.5	NV	NV	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
1,1,2-Trichloroethane	ug/L	0.5	NV	NV	NV	NV	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
1,1-Dichloroethane	ug/L	0.5	NV	NV	NV	NV	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
1,1-Dichloroethene	ug/L	0.5	0.5	0.5	0.5	0.5	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
1,2-Dibromoethane (Ethylene dibromide)	ug/L	0.2	0.2	0.2	0.2	0.2	ND(0.20)	ND(0.20)	ND(0.20)	ND(0.20)
1,2-Dichlorobenzene	ug/L	0.55	0.55	0.55	NV	NV	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
1,2-Dichloroethane	ug/L	0.5	0.5	0.5	NV	NV	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
1,2-Dichloropropane	ug/L	0.5	0.5	0.5	NV	NV	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
1,4-Dichlorobenzene	ug/L	0.5	0.5	0.5	NV	NV	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
Bromomethane (Methyl bromide)	ug/L	0.5	0.5	0.5	0.5	0.5	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
Carbon tetrachloride	ug/L	0.2	0.2	0.2	0.2	0.2	ND(0.20)	ND(0.20)	ND(0.20)	ND(0.20)
Chloroform (Trichloromethane)	ug/L	1	NV	NV	NV	NV	ND(1.00)	ND(1.00)	ND(1.00)	ND(1.00)
cis-1,2-Dichloroethene	ug/L	0.5	0.5	0.5	NV	NV	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
cis-1,3-Dichloropropene	ug/L	NV	NV	NV	NV	NV	ND(0.20)	ND(0.20)	ND(0.20)	ND(0.20)
cis-1,3-Dichloropropene/trans-1,3-Dichloropropene	ug/L	0.5	NV	NV	NV	NV	ND(0.30)	ND(0.30)	ND(0.30)	ND(0.30)
Tetrachloroethene	ug/L	0.5	0.5	0.5	0.5	0.5	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
trans-1,2-Dichloroethene	ug/L	0.5	0.5	0.5	0.5	0.5	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
trans-1,3-Dichloropropene	ug/L	NV	NV	NV	NV	NV	ND(0.20)	ND(0.20)	ND(0.20)	ND(0.20)
Trichloroethene	ug/L	0.5	0.5	0.5	0.5	0.5	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)

Table 4

Summary of mSPLP Leachate Analytical Data
Preliminary Environmental Soil Quality Investigation
160 Rivalda Road, North York, Ontario
City of Toronto

						Sample Location:	**BH01-24**	**BH02-24**	**BH03-24**	**BH04-24**
						Sample Identification:	**BH01-24-MSPLP**	**BH02-24-MSPLP**	**BH03-24-MSPLP**	**BH04-24-MSPLP**
						Sample Date:	**8/14/2024**	**8/14/2024**	**8/14/2024**	**8/14/2024**
						Sample Depth (mBGS):	**0.13-1.22**	**0.15-1.22**	**0.15-1.22**	**0.08-1.22**
						Lab COA:	**WT2423419**	**WT2423419**	**WT2423419**	**WT2423419**
		Generic Leachate Screening Levels for Excess Soil Reuse (1)								
Parameters	**Units**	**Table 1**	**Table 2.1**	**Table 2.1**	**Table 3.1**	**Table 3.1**				
SPLP Metals										
Antimony	ug/L	NV	6	6	NV	NV	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
Arsenic	ug/L	NV	NV	NV	NV	NV	11.0	10.8	1.6	4.9
Barium	ug/L	NV	1000	1000	4600	4600	220	240	82	98
Beryllium	ug/L	NV	4	4	11	11	1.64	1.76	ND(0.50)	0.68
Boron	ug/L	NV	5000	5000	NV	NV	17	14	10	ND(10)
Cadmium	ug/L	NV	NV	0.5	NV	0.5	0.19	ND(0.10)	ND(0.10)	ND(0.10)
Chromium	ug/L	NV	50	50	130	130	40.2	**53.9[bc]**	8.0	21.1
Cobalt	ug/L	NV	3.8	3.8	10	10	**10.8[bcde]**	**9.2[bc]**	2.0	**4.0[bc]**
Copper	ug/L	NV	14	14	14	14	**67.1[bcde]**	**67.3[bcde]**	9.8	**20.9[bcde]**
Final pH	s.u.	NV	NV	NV	NV	NV	8.92	9.73	9.50	9.57
Initial pH	s.u.	NV	NV	NV	NV	NV	8.88	9.93	9.84	9.68
Lead	ug/L	NV	NV	NV	NV	NV	28.3	16.6	2.4	6.6
Molybdenum	ug/L	23	23	23	NV	1500	1.09	ND(0.50)	0.74	0.83
Nickel	ug/L	NV	78	78	78	78	33.9	43.8	7.2	19.4
Selenium	ug/L	NV	10	10	10	10	ND(1.0)	ND(1.0)	ND(1.0)	ND(1.0)
Silver	ug/L	0.3	0.3	0.3	0.3	0.3	ND(0.25)	ND(0.25)	ND(0.25)	ND(0.25)
Thallium	ug/L	2	2	2	NV	80	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
Uranium	ug/L	NV	20	20	66	66	ND(2.0)	ND(2.0)	ND(2.0)	ND(2.0)
Vanadium	ug/L	NV	NV	NV	NV	NV	76.6	67.0	13.9	31.8
Zinc	ug/L	NV	180	180	180	180	63.1	91.8	19.1	35.0
SPLP General Chemistry										
Extraction fluid	none	NV	NV	NV	NV	NV	fluid #3	fluid #3	fluid #3	fluid #3

Notes:

(1) Ontario Ministry of the Environment, Conservation and Parks (MECP), "Excess Soil Quality Standards" dated April 23, 2024 contained in Part II of the document entitled "Rules for Soil Management and Excess Soil Quality Standards", adopted by reference in O. Reg. 406/19 (On-Site and Excess Soil Management) made under the Environmental Protection Act, R.S.O. 1990, c. E.19 (EPA), 2024.

a - Table 1 RPIICC: Leachate Screening Levels for Excess Soils for Residential/ Parkland/ Institutional/ Industrial/ Commercial/ Community Property Use, and all types of soils.

b - Table 2.1 ICC: Leachate Screening Levels for Full Depth Excess Soil in a Potable Ground Water Condition for Residential/ Parkland/ Institutional Property Use.

c - Table 2.1 ICC: Leachate Screening Levels for Full Depth Excess Soil in a Potable Ground Water Condition for Industrial/ Commercial/ Community Property Use.

d - Table 3.1 ICC: Leachate Screening Levels for Full Depth Excess Soil in a Non-Potable Ground Water Condition for Residential/ Parkland/ Institutional Property Use.

e - Table 3.1 ICC: Leachate Screening Levels for Full Depth Excess Soil in a Non-Potable Ground Water Condition for Industrial/ Commercial/ Community Property Use.

mBGS - metres below ground surface.

ND (RL) - Not detected at the associated reporting limit.

µg/L = microgram per litre

s.u. - Standard units.

NV - No Value

Concentrations in **RED** indicate the analyte was detected at a concentration greater than the referenced Standard.

Table 5

TCLP Waste Characterization Data
Preliminary Environmental Soil Quality Investigation
160 Rivalda Road, North York, Ontario
City of Toronto

		Sample Location:	**TCLP (Composite BH01-24, BH02-24, BH03-24 and BH04-24)**
		Sample Identification:	**TCLP**
		Sample Date:	**8/14/2024**
		Sample Depth (mBGS):	**0.08-1.22**
		Lab COA:	**WT2423419**
Parameters	**Units**	**O. Reg. 558/00 [1] Schedule 4**	
Volatile Organic Compounds (VOCs)			
1,1-Dichloroethene	mg/L	1.4	ND(0.025)
1,2-Dichlorobenzene	mg/L	20	ND(0.025)
1,2-Dichloroethane	mg/L	0.5	ND(0.025)
1,4-Dichlorobenzene	mg/L	0.5	ND(0.025)
2-Butanone (Methyl ethyl ketone) (MEK)	mg/L	200	ND(0.10)
Benzene	mg/L	0.5	ND(0.0050)
Carbon tetrachloride	mg/L	0.5	ND(0.025)
Chlorobenzene	mg/L	8	ND(0.025)
Chloroform (Trichloromethane)	mg/L	10	ND(0.10)
Methylene chloride	mg/L	5	ND(0.10)
Tetrachloroethene	mg/L	3	ND(0.025)
Trichloroethene	mg/L	5	ND(0.025)
Vinyl chloride	mg/L	0.2	ND(0.050)
Semi-volatile Organic Compounds (SVOCs)			
2,3,4,6-Tetrachlorophenol	mg/L	10	ND(0.0050)
2,4,5-Trichlorophenol	mg/L	400	ND(0.0050)
2,4,6-Trichlorophenol	mg/L	0.5	ND(0.0050)
2,4-Dichlorophenol	mg/L	90	ND(0.0050)
2,4-Dinitrotoluene	mg/L	0.13	ND(0.0040)
2-Methylphenol	mg/L	200	ND(0.0050)
3&4-Methylphenol	mg/L	200	ND(0.010)
Benzo(a)pyrene	mg/L	0.001	ND(0.00020)
Hexachlorobenzene	mg/L	0.13	ND(0.0040)
Hexachlorobutadiene	mg/L	0.5	ND(0.0040)
Hexachloroethane	mg/L	3	ND(0.0040)
Methylphenol (cresol)	mg/L	200	ND(0.012)
Nitrobenzene	mg/L	2	ND(0.0040)
Pentachlorophenol	mg/L	6	ND(0.0050)
Pyridine	mg/L	5	ND(2.0)
Metals			
Arsenic	mg/L	2.5	ND(1.0)
Barium	mg/L	100	ND(2.5)
Boron	mg/L	500	ND(0.50)
Cadmium	mg/L	0.5	ND(0.050)
Chromium	mg/L	5	ND(0.25)
Lead	mg/L	5	ND(0.25)
Mercury	mg/L	0.1	ND(0.0010)
Selenium	mg/L	1	ND(0.10)
Silver	mg/L	5	ND(0.050)
Uranium	mg/L	10	ND(0.20)
Polychlorinated Biphenyls (PCBs)			
Aroclor-1016 (PCB-1016)	mg/L	NV	ND(0.010)
Aroclor-1221 (PCB-1221)	mg/L	NV	ND(0.010)
Aroclor-1232 (PCB-1232)	mg/L	NV	ND(0.010)
Aroclor-1242 (PCB-1242)	mg/L	NV	ND(0.010)
Aroclor-1248 (PCB-1248)	mg/L	NV	ND(0.010)
Aroclor-1254 (PCB-1254)	mg/L	NV	ND(0.010)
Aroclor-1260 (PCB-1260)	mg/L	NV	ND(0.010)
Aroclor-1262 (PCB-1262)	mg/L	NV	ND(0.010)
Aroclor-1268 (PCB-1268)	mg/L	NV	ND(0.010)
Total PCBs	mg/L	NV	ND(0.030)
General Chemistry			
Comment	none	NV	BROWN SILTY CLAY LOA
Flow rate	m/sec	NV	0.42
Ignitability	none	NV	Negative
Ignitability temperature	Deg C	NV	20.3
Moisture	%	NV	17.7
Cyanide, weak acid dissociable	mg/L	20	ND(0.10)
Final pH	s.u.	NV	5.86
Fluoride	mg/L	150	ND(10)
Nitrate (as N)	mg/L	NV	ND(5.0)
Nitrite (as N)	mg/L	NV	ND(5.0)
Nitrite/Nitrate	mg/L	1000.00	ND(7.50)
pH, TCLP Extraction fluid initial	s.u.	NV	2.86

Notes:

ND - Not detected at the associated reporting limit.
TCLP - Toxicity Characteristic Leaching Procedure
mg/L - milligram per litre
m/sec - metre per second
Deg C - degrees celcius
% - Percent
NV - No Value
ND (RL) = Not detected at the associated reporting limit.
[1] - Ontario Regulation 347/90 Schedule 4 Leachate Quality Criteria (as amended by O. Reg. 558/00)

Attachments

Attachment A

Stratigraphy Logs

STRATIGRAPHIC AND INSTRUMENTATION RECORD
(Overburden)

BH01-24
Project No: 12642634

Client: City of Toronto
Project: Preliminary Soil Quality Investigation
Location: 160 Rivalda Road, North York, Ontario
Date Started: 08/14/2024
Date Completed: 08/14/2024

Drill Co.: Profile Drilling
Drilling Method(s): Direct Push
Sampling Method(s): SS
Logged By: R. Daliri
Reviewed By: C. McMahon

Easting: 617763.74 E
Northing: 4844696.03 N
Horiz. Datum: NAD83 / UTM zone 17N
Elevation: 147.95 m
Elev. Datum: CGVD28 : PRE78
Final Depth: 1.22 m
Hole Diameter(s):

Depth (Metres)	Elevation (Metres)	Strat Symbol	Stratigraphy	Method	Run Number	Recovery %	Sample Number	Analysis	PID (ppm)	Water Level(s)	Backfill
0.00	147.95		ASPHALT: 125 mm								
0.13	147.82		FILL-SILT, trace clay and sand, brown, dry	Direct Push	1	71	BH01-24	C	0.2		
0.91	147.04		FILL-SAND, trace clay and silt, black/brown, moist								
1.22	146.73		End of Drilling at 1.22 m.								

1.0
2.0
3.0

Legend:
Measuring Point Elevation may change; Refer to Current Elevation Table
▽ At Time of Drilling:
▼ After Drilling:
Chemical Analysis: C

Backfill Details

Description	From(m BGS)	To(m BGS)
Bentonite Grout	0.00	1.22

STRATIGRAPHIC AND INSTRUMENTATION RECORD
(Overburden)

BH02-24
Project No: 12642634

Client: City of Toronto
Project: Preliminary Soil Quality Investigation
Location: 160 Rivalda Road, North York, Ontario
Date Started: 08/14/2024
Date Completed: 08/14/2024

Drill Co.: Profile Drilling
Drilling Method(s): Direct Push
Sampling Method(s): SS
Logged By: R. Daliri
Reviewed By: C. McMahon

Easting: 617787.54 E
Northing: 4844705.44 N
Horiz. Datum: NAD83 / UTM zone 17N
Elevation: 147.74 m
Elev. Datum: CGVD28 : PRE78
Final Depth: 1.22 m
Hole Diameter(s):

Depth (Metres)	Elevation (Metres)	Strat Symbol	Stratigraphy	Method	Run Number	Recovery %	Sample Number	Analysis	PID (ppm)	Water Level(s)	Backfill
0.00	147.74		ASPHALT: 150 mm								
0.15	147.59		FILL-SILTY SAND, trace gravel, brown, dry								
0.46	147.28		FILL-SILT, trace clay, grey/brown, moist	Direct Push	1	79	BH02-24	C	0.0		
1.22	146.52		End of Drilling at 1.22 m.								

1.0
2.0
3.0

Legend:
Measuring Point Elevation may change; Refer to Current Elevation Table
▽ At Time of Drilling:
▼ After Drilling:
Chemical Analysis: C

Backfill Details

Description	From(m BGS)	To(m BGS)
Bentonite Grout	0.00	1.22

STRATIGRAPHIC AND INSTRUMENTATION RECORD
(Overburden)

BH03-24
Project No: 12642634

Client: City of Toronto
Project: Preliminary Soil Quality Investigation
Location: 160 Rivalda Road, North York, Ontario
Date Started: 08/14/2024
Date Completed: 08/14/2024

Drill Co.: Profile Drilling
Drilling Method(s): Direct Push
Sampling Method(s): SS
Logged By: R. Daliri
Reviewed By: C. McMahon

Easting: 617794.10 E
Northing: 4844743.42 N
Horiz. Datum: NAD83 / UTM zone 17N
Elevation: 147.54 m
Elev. Datum: CGVD28 : PRE78
Final Depth: 1.22 m
Hole Diameter(s):

Depth (Metres)	Elevation (Metres)	Strat Symbol	Stratigraphy	Method	Run Number	Recovery %	Sample Number	Analysis	PID (ppm)	Water Level(s)	Backfill
0.00	147.54		ASPHALT: 150 mm								
0.15	147.39		FILL-SAND, trace gravel, brown, dry								
0.31	147.23		FILL-SANDY SILT, trace clay, brown, moist	Direct Push	1	0	BH03-24	C	0.0		
1.22	146.32		End of Drilling at 1.22 m.								

Legend:
Measuring Point Elevation may change; Refer to Current Elevation Table
▽ At Time of Drilling:
▼ After Drilling:
Chemical Analysis: C

Backfill Details

Description	From(m BGS)	To(m BGS)
Bentonite Grout	0.00	1.22

STRATIGRAPHIC AND INSTRUMENTATION RECORD
(Overburden)

BH04-24
Project No: 12642634

Client: City of Toronto
Project: Preliminary Soil Quality Investigation
Location: 160 Rivalda Road, North York, Ontario
Date Started: 08/14/2024
Date Completed: 08/14/2024

Drill Co.: Profile Drilling
Drilling Method(s): Direct Push
Sampling Method(s): SS
Logged By: R. Daliri
Reviewed By: C. McMahon

Easting: 617791.06 E
Northing: 4844743.42 N
Horiz. Datum: NAD83 / UTM zone 17N
Elevation: 147.92 m
Elev. Datum: CGVD28 : PRE78
Final Depth: 1.22 m
Hole Diameter(s):

Depth (Metres)	Elevation (Metres)	Strat Symbol	Stratigraphy	Method	Run Number	Recovery %	Sample Number	Analysis	PID (ppm)	Water Level(s)	Backfill
0.00	147.92										
			TOPSOIL: 75 mm								
0.08	147.84		FILL-SILTY SAND, brown, dry								
0.38	147.54		FILL-SILTY SAND, trace clay, brown, moist	Direct Push	1	42	BH04-24	C	0.0		
1.22	146.70		End of Drilling at 1.22 m.								

Legend:
Measuring Point Elevation may change; Refer to Current Elevation Table
▽ At Time of Drilling:
▼ After Drilling:
Chemical Analysis: C

Backfill Details

Description	From(m BGS)	To(m BGS)
Bentonite Grout	0.00	1.22

Attachment B

Laboratory Certificates of Analysis

ALS Canada Ltd.

right solutions.
right partner.

CERTIFICATE OF ANALYSIS

Work Order	: **WT2423419**	Page	: 1 of 25
Client	: **GHD Limited**	Laboratory	: ALS Environmental - Waterloo
Contact	: Jennifer Balkwill	Account Manager	: Rick Hawthorne
Address	: 455 Phillip Street Waterloo ON Canada N2L 3X2	Address	: 60 Northland Road, Unit 1 Waterloo ON Canada N2V 2B8
Telephone	: 604 748 3661	Telephone	: +1 519 886 6910
Project	: 12642634-02	Date Samples Received	: 14-Aug-2024 13:37
PO	: 735-011200	Date Analysis Commenced	: 14-Aug-2024
C-O-C number	: ----	Issue Date	: 22-Aug-2024 13:50
Sampler	: RD		
Site	: ----		
Quote number	: 12642634-02 _ COT - 735-011200		
No. of samples received	: 11		
No. of samples analysed	: 11		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Andrea Armstrong	Department Manager - Air Quality and Volatiles	VOC, Waterloo, Ontario
David Tremblett	VOC Section Supervisor	Air Quality, Waterloo, Ontario
Jeremy Gingras	Supervisor - Semi-Volatile Instrumentation	Organics, Waterloo, Ontario
Jocelyn Kennedy	Department Manager - Semi-Volatile Organics	Organics, Waterloo, Ontario
Josphin Masihi	Analyst	Centralized Prep, Waterloo, Ontario
Nik Perkio	Senior Analyst	Inorganics, Waterloo, Ontario
Nik Perkio	Senior Analyst	Metals, Waterloo, Ontario
Niral Patel		Centralized Prep, Waterloo, Ontario
Robert Braun	Soils Team Supervisor	Inorganics, Waterloo, Ontario

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.
Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).
Measurement Uncertainty: The reported uncertainties in this report are expanded uncertainties calculated using a coverage factor of 2, which gives a level of confidence of approximately 95%.
Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Unit	*Description*
-	no units
%	percent
°C	degrees celsius
µg/L	micrograms per litre
m/sec	metres per second
mg/kg	milligrams per kilogram
mg/L	milligrams per litre
mm/sec	millimetres per second
mS/cm	millisiemens per centimetre
pH units	pH units
sec	seconds

>: greater than.
<: less than.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Sample Comments

Sample	Client Id	*Comment*
WT2423419-011	TCLP	RRQC/RRR: Recovery is below ALS control limits. Reported non-detect results for associated samples have not been affected.

Qualifiers

Qualifier	*Description*
RRR	*Refer to report comments for issues regarding this analysis.*

Analytical Results

WT2423419-001

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Client sample ID: BH01-24
Client sampling date / time: 14-Aug-2024

Analyte	CAS Number	Result	LOR	Unit	Method/Lab	Prep Date	Analysis Date	QCLot
Physical Tests								
Conductivity (1:2 leachate)	----	1.80	0.00500	mS/cm	E100-L/WT	20-Aug-2024	20-Aug-2024	1596485
Moisture	----	18.3	0.25	%	E144/WT	-	14-Aug-2024	1596489
pH (1:2 soil:CaCl2-aq)	----	7.14	0.10	pH units	E108A/WT	15-Aug-2024	20-Aug-2024	1596483
Cyanides								
Cyanide, weak acid dissociable	----	<0.050	0.050	mg/kg	E336A/WT	15-Aug-2024	16-Aug-2024	1596780
Fixed-Ratio Extractables								
Calcium, soluble ion content	7440-70-2	13.5	0.50	mg/L	E484/WT	20-Aug-2024	20-Aug-2024	1596484
Magnesium, soluble ion content	7439-95-4	9.47	0.50	mg/L	E484/WT	20-Aug-2024	20-Aug-2024	1596484
Sodium, soluble ion content	17341-25-2	355	0.50	mg/L	E484/WT	20-Aug-2024	20-Aug-2024	1596484
Sodium adsorption ratio [SAR]	----	18.1	0.10	-	E484/WT	20-Aug-2024	20-Aug-2024	1596484
Metals								
Antimony	7440-36-0	<0.10	0.10	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Arsenic	7440-38-2	3.00	0.10	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Barium	7440-39-3	60.7	0.50	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Beryllium	7440-41-7	0.57	0.10	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Boron	7440-42-8	6.1	5.0	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Boron, hot water soluble	7440-42-8	0.22	0.10	mg/kg	E487/WT	20-Aug-2024	20-Aug-2024	1596486
Cadmium	7440-43-9	0.111	0.020	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Chromium	7440-47-3	18.6	0.50	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Cobalt	7440-48-4	7.32	0.10	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Copper	7440-50-8	14.6	0.50	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Lead	7439-92-1	8.65	0.50	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Mercury	7439-97-6	0.0292	0.0050	mg/kg	E510C/WT	20-Aug-2024	20-Aug-2024	1596487
Molybdenum	7439-98-7	0.28	0.10	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Nickel	7440-02-0	15.6	0.50	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Selenium	7782-49-2	<0.20	0.20	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Silver	7440-22-4	<0.10	0.10	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Thallium	7440-28-0	0.108	0.050	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Uranium	7440-61-1	0.410	0.050	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Vanadium	7440-62-2	30.7	0.20	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Zinc	7440-66-6	36.1	2.0	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Speciated Metals								
Chromium, hexavalent [Cr VI]	18540-29-9	<0.10	0.10	mg/kg	E532/WT	15-Aug-2024	16-Aug-2024	1596783
Volatile Organic Compounds								
Acetone	67-64-1	<0.50	0.50	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Benzene	71-43-2	<0.0050	0.0050	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Bromodichloromethane	75-27-4	<0.050	0.050	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Bromoform	75-25-2	<0.050	0.050	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Bromomethane	74-83-9	<0.050	0.050	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Carbon tetrachloride	56-23-5	<0.050	0.050	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Chlorobenzene	108-90-7	<0.050	0.050	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Chloroform	67-66-3	<0.050	0.050	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Dibromochloromethane	124-48-1	<0.050	0.050	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Dibromoethane, 1,2-	106-93-4	<0.050	0.050	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Dichlorobenzene, 1,2-	95-50-1	<0.050	0.050	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541

Analytical Results

WT2423419-001

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Client sample ID: BH01-24
Client sampling date / time: 14-Aug-2024

Analyte	CAS Number	Result	LOR	Unit	Method/Lab	Prep Date	Analysis Date	QCLot
Volatile Organic Compounds								
Dichlorobenzene, 1,3-	541-73-1	<0.050	0.050	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Dichlorobenzene, 1,4-	106-46-7	<0.050	0.050	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Dichlorodifluoromethane	75-71-8	<0.050	0.050	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Dichloroethane, 1,1-	75-34-3	<0.050	0.050	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Dichloroethane, 1,2-	107-06-2	<0.050	0.050	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Dichloroethylene, 1,1-	75-35-4	<0.050	0.050	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Dichloroethylene, cis-1,2-	156-59-2	<0.050	0.050	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Dichloroethylene, trans-1,2-	156-60-5	<0.050	0.050	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Dichloromethane	75-09-2	<0.045	0.045	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Dichloropropane, 1,2-	78-87-5	<0.050	0.050	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Dichloropropylene, cis+trans-1,3-	542-75-6	<0.050	0.05	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Dichloropropylene, cis-1,3-	10061-01-5	<0.030	0.030	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Dichloropropylene, trans-1,3-	10061-02-6	<0.030	0.030	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Ethylbenzene	100-41-4	<0.015	0.015	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Hexane, n-	110-54-3	<0.050	0.050	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Methyl ethyl ketone [MEK]	78-93-3	<0.50	0.50	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Methyl isobutyl ketone [MIBK]	108-10-1	<0.50	0.50	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Methyl-tert-butyl ether [MTBE]	1634-04-4	<0.040	0.040	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Styrene	100-42-5	<0.050	0.050	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Tetrachloroethane, 1,1,1,2-	630-20-6	<0.050	0.050	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Tetrachloroethane, 1,1,2,2-	79-34-5	<0.050	0.050	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Tetrachloroethylene	127-18-4	<0.050	0.050	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Toluene	108-88-3	<0.050	0.050	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Trichloroethane, 1,1,1-	71-55-6	<0.050	0.050	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Trichloroethane, 1,1,2-	79-00-5	<0.050	0.050	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Trichloroethylene	79-01-6	<0.010	0.010	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Trichlorofluoromethane	75-69-4	<0.050	0.050	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Vinyl chloride	75-01-4	<0.020	0.020	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Xylene, m+p-	179601-23-1	<0.030	0.030	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Xylene, o-	95-47-6	<0.030	0.030	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Xylenes, total	1330-20-7	<0.050	0.05	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
BTEX, total	----	<0.10	0.1	mg/kg	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Hydrocarbons								
F1 (C6-C10)	----	<5.0	5.0	mg/kg	E581.F1/WT	14-Aug-2024	16-Aug-2024	1596542
F2 (C10-C16)	----	<10	10	mg/kg	E601.SG-L/WT	19-Aug-2024	20-Aug-2024	1603038
F2-Naphthalene	----	<25	25	mg/kg	EC600/WT	-	20-Aug-2024	-
F3 (C16-C34)	----	<50	50	mg/kg	E601.SG-L/WT	19-Aug-2024	20-Aug-2024	1603038
F3-PAH	n/a	<50	50	mg/kg	EC600/WT	-	20-Aug-2024	-
F4 (C34-C50)	----	<50	50	mg/kg	E601.SG-L/WT	19-Aug-2024	20-Aug-2024	1603038
F1-BTEX	----	<5.0	5	mg/kg	EC580/WT	-	16-Aug-2024	-
Hydrocarbons, total (C6-C50)	n/a	<80	80	mg/kg	EC581/WT	-	16-Aug-2024	-
Chromatogram to baseline at nC50	n/a	YES	-	-	E601.SG-L/WT	19-Aug-2024	20-Aug-2024	1603038
Hydrocarbons Surrogates								
Bromobenzotrifluoride, 2- (F2-F4 surrogate)	392-83-6	96.0	1.0	%	E601.SG-L/WT	19-Aug-2024	20-Aug-2024	1603038
Dichlorotoluene, 3,4-	95-75-0	100	1.0	%	E581.F1/WT	14-Aug-2024	16-Aug-2024	1596542

Analytical Results

WT2423419-001

Sub-Matrix:**Soil** *Client sample ID:* BH01-24

(Matrix: **Soil/Solid**) *Client sampling date / time:* 14-Aug-2024

Analyte	CAS Number	Result	LOR	Unit	Method/Lab	Prep Date	Analysis Date	QCLot
Volatile Organic Compounds Surrogates								
Bromofluorobenzene, 4-	460-00-4	129	0.10	%	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Difluorobenzene, 1,4-	540-36-3	139	0.10	%	E611D/WT	14-Aug-2024	16-Aug-2024	1596541
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	83-32-9	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Acenaphthylene	208-96-8	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Anthracene	120-12-7	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Benz(a)anthracene	56-55-3	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Benzo(a)pyrene	50-32-8	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Benzo(b+j)fluoranthene	n/a	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Benzo(g,h,i)perylene	191-24-2	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Benzo(k)fluoranthene	207-08-9	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Chrysene	218-01-9	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Dibenz(a,h)anthracene	53-70-3	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Fluoranthene	206-44-0	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Fluorene	86-73-7	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Indeno(1,2,3-c,d)pyrene	193-39-5	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Methylnaphthalene, 1-	90-12-0	<0.030	0.030	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Methylnaphthalene, 1+2-	----	<0.050	0.05	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Methylnaphthalene, 2-	91-57-6	<0.030	0.030	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Naphthalene	91-20-3	<0.010	0.010	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Phenanthrene	85-01-8	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Pyrene	129-00-0	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Polycyclic Aromatic Hydrocarbons Surrogates								
Acridine-d9	34749-75-2	90.8	0.1	%	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Chrysene-d12	1719-03-5	99.0	0.1	%	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Naphthalene-d8	1146-65-2	115	0.1	%	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Phenanthrene-d10	1517-22-2	103	0.1	%	E641A/WT	19-Aug-2024	21-Aug-2024	1603037

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

Analytical Results

WT2423419-002

Sub-Matrix:**Soil** *Client sample ID:* BH02-24

(Matrix: **Soil/Solid**) *Client sampling date / time:* 14-Aug-2024

Analyte	CAS Number	Result	LOR	Unit	Method/Lab	Prep Date	Analysis Date	QCLot
Physical Tests								
Conductivity (1:2 leachate)	----	1.48	0.00500	mS/cm	E100-L/WT	20-Aug-2024	20-Aug-2024	1596485
Moisture	----	16.0	0.25	%	E144/WT	-	14-Aug-2024	1596489
pH (1:2 soil:CaCl2-aq)	----	7.64	0.10	pH units	E108A/WT	15-Aug-2024	20-Aug-2024	1596483
Cyanides								
Cyanide, weak acid dissociable	----	<0.050	0.050	mg/kg	E336A/WT	15-Aug-2024	16-Aug-2024	1596780
Fixed-Ratio Extractables								
Calcium, soluble ion content	7440-70-2	7.55	0.50	mg/L	E484/WT	20-Aug-2024	20-Aug-2024	1596484

Analytical Results

WT2423419-002

Sub-Matrix:**Soil**
(Matrix: **Soil/Solid**)

Client sample ID: BH02-24
Client sampling date / time: 14-Aug-2024

Analyte	CAS Number	Result	LOR	Unit	Method/Lab	Prep Date	Analysis Date	QCLot
Fixed-Ratio Extractables								
Magnesium, soluble ion content	7439-95-4	0.61	0.50	mg/L	E484/WT	20-Aug-2024	20-Aug-2024	1596484
Sodium, soluble ion content	17341-25-2	277	0.50	mg/L	E484/WT	20-Aug-2024	20-Aug-2024	1596484
Sodium adsorption ratio [SAR]	----	26.1	0.10	-	E484/WT	20-Aug-2024	20-Aug-2024	1596484
Metals								
Antimony	7440-36-0	<0.10	0.10	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Arsenic	7440-38-2	3.71	0.10	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Barium	7440-39-3	63.8	0.50	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Beryllium	7440-41-7	0.58	0.10	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Boron	7440-42-8	7.4	5.0	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Boron, hot water soluble	7440-42-8	<0.10	0.10	mg/kg	E487/WT	20-Aug-2024	20-Aug-2024	1596486
Cadmium	7440-43-9	0.073	0.020	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Chromium	7440-47-3	20.7	0.50	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Cobalt	7440-48-4	7.70	0.10	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Copper	7440-50-8	19.9	0.50	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Lead	7439-92-1	7.23	0.50	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Mercury	7439-97-6	0.0209	0.0050	mg/kg	E510C/WT	20-Aug-2024	20-Aug-2024	1596487
Molybdenum	7439-98-7	0.23	0.10	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Nickel	7440-02-0	17.9	0.50	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Selenium	7782-49-2	<0.20	0.20	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Silver	7440-22-4	<0.10	0.10	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Thallium	7440-28-0	0.119	0.050	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Uranium	7440-61-1	0.423	0.050	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Vanadium	7440-62-2	32.5	0.20	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Zinc	7440-66-6	36.8	2.0	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Speciated Metals								
Chromium, hexavalent [Cr VI]	18540-29-9	<0.10	0.10	mg/kg	E532/WT	15-Aug-2024	16-Aug-2024	1596783
Volatile Organic Compounds								
Acetone	67-64-1	<0.50	0.50	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Benzene	71-43-2	<0.0050	0.0050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Bromodichloromethane	75-27-4	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Bromoform	75-25-2	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Bromomethane	74-83-9	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Carbon tetrachloride	56-23-5	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Chlorobenzene	108-90-7	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Chloroform	67-66-3	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dibromochloromethane	124-48-1	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dibromoethane, 1,2-	106-93-4	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichlorobenzene, 1,2-	95-50-1	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichlorobenzene, 1,3-	541-73-1	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichlorobenzene, 1,4-	106-46-7	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichlorodifluoromethane	75-71-8	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloroethane, 1,1-	75-34-3	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloroethane, 1,2-	107-06-2	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloroethylene, 1,1-	75-35-4	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloroethylene, cis-1,2-	156-59-2	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602

Analytical Results

WT2423419-002

Sub-Matrix:**Soil**
(Matrix: **Soil/Solid**)

Client sample ID: BH02-24
Client sampling date / time: 14-Aug-2024

Analyte	CAS Number	Result	LOR	Unit	Method/Lab	Prep Date	Analysis Date	QCLot
Volatile Organic Compounds								
Dichloroethylene, trans-1,2-	156-60-5	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloromethane	75-09-2	<0.045	0.045	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloropropane, 1,2-	78-87-5	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloropropylene, cis+trans-1,3-	542-75-6	<0.050	0.05	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloropropylene, cis-1,3-	10061-01-5	<0.030	0.030	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloropropylene, trans-1,3-	10061-02-6	<0.030	0.030	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Ethylbenzene	100-41-4	<0.015	0.015	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Hexane, n-	110-54-3	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Methyl ethyl ketone [MEK]	78-93-3	<0.50	0.50	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Methyl isobutyl ketone [MIBK]	108-10-1	<0.50	0.50	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Methyl-tert-butyl ether [MTBE]	1634-04-4	<0.040	0.040	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Styrene	100-42-5	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Tetrachloroethane, 1,1,1,2-	630-20-6	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Tetrachloroethane, 1,1,2,2-	79-34-5	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Tetrachloroethylene	127-18-4	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Toluene	108-88-3	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Trichloroethane, 1,1,1-	71-55-6	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Trichloroethane, 1,1,2-	79-00-5	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Trichloroethylene	79-01-6	<0.010	0.010	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Trichlorofluoromethane	75-69-4	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Vinyl chloride	75-01-4	<0.020	0.020	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Xylene, m+p-	179601-23-1	<0.030	0.030	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Xylene, o-	95-47-6	<0.030	0.030	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Xylenes, total	1330-20-7	<0.050	0.05	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
BTEX, total	----	<0.10	0.1	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Hydrocarbons								
F1 (C6-C10)	----	<5.0	5.0	mg/kg	E581.F1/WT	15-Aug-2024	16-Aug-2024	1596603
F2 (C10-C16)	----	<10	10	mg/kg	E601.SG-L/WT	19-Aug-2024	20-Aug-2024	1603038
F2-Naphthalene	----	<25	25	mg/kg	EC600/WT	-	20-Aug-2024	-
F3 (C16-C34)	----	<50	50	mg/kg	E601.SG-L/WT	19-Aug-2024	20-Aug-2024	1603038
F3-PAH	n/a	<50	50	mg/kg	EC600/WT	-	20-Aug-2024	-
F4 (C34-C50)	----	<50	50	mg/kg	E601.SG-L/WT	19-Aug-2024	20-Aug-2024	1603038
F1-BTEX	----	<5.0	5	mg/kg	EC580/WT	-	19-Aug-2024	-
Hydrocarbons, total (C6-C50)	n/a	<80	80	mg/kg	EC581/WT	-	19-Aug-2024	-
Chromatogram to baseline at nC50	n/a	YES	-	-	E601.SG-L/WT	19-Aug-2024	20-Aug-2024	1603038
Hydrocarbons Surrogates								
Bromobenzotrifluoride, 2- (F2-F4 surrogate)	392-83-6	93.4	1.0	%	E601.SG-L/WT	19-Aug-2024	20-Aug-2024	1603038
Dichlorotoluene, 3,4-	95-75-0	98.4	1.0	%	E581.F1/WT	15-Aug-2024	16-Aug-2024	1596603
Volatile Organic Compounds Surrogates								
Bromofluorobenzene, 4-	460-00-4	94.9	0.10	%	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Difluorobenzene, 1,4-	540-36-3	100	0.10	%	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	83-32-9	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Acenaphthylene	208-96-8	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Anthracene	120-12-7	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037

Analytical Results

WT2423419-002

Sub-Matrix:**Soil** *Client sample ID:* BH02-24

(Matrix: **Soil/Solid**) *Client sampling date / time:* 14-Aug-2024

Analyte	CAS Number	Result	LOR	Unit	Method/Lab	Prep Date	Analysis Date	QCLot
Polycyclic Aromatic Hydrocarbons								
Benz(a)anthracene	56-55-3	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Benzo(a)pyrene	50-32-8	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Benzo(b+j)fluoranthene	n/a	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Benzo(g,h,i)perylene	191-24-2	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Benzo(k)fluoranthene	207-08-9	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Chrysene	218-01-9	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Dibenz(a,h)anthracene	53-70-3	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Fluoranthene	206-44-0	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Fluorene	86-73-7	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Indeno(1,2,3-c,d)pyrene	193-39-5	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Methylnaphthalene, 1-	90-12-0	<0.030	0.030	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Methylnaphthalene, 1+2-	----	<0.050	0.05	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Methylnaphthalene, 2-	91-57-6	<0.030	0.030	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Naphthalene	91-20-3	<0.010	0.010	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Phenanthrene	85-01-8	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Pyrene	129-00-0	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Polycyclic Aromatic Hydrocarbons Surrogates								
Acridine-d9	34749-75-2	83.0	0.1	%	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Chrysene-d12	1719-03-5	99.8	0.1	%	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Naphthalene-d8	1146-65-2	105	0.1	%	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Phenanthrene-d10	1517-22-2	90.3	0.1	%	E641A/WT	19-Aug-2024	21-Aug-2024	1603037

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

Analytical Results

WT2423419-003

Sub-Matrix:**Soil** *Client sample ID:* BH03-24

(Matrix: **Soil/Solid**) *Client sampling date / time:* 14-Aug-2024

Analyte	CAS Number	Result	LOR	Unit	Method/Lab	Prep Date	Analysis Date	QCLot
Physical Tests								
Conductivity (1:2 leachate)	----	1.69	0.00500	mS/cm	E100-L/WT	20-Aug-2024	20-Aug-2024	1596485
Moisture	----	18.2	0.25	%	E144/WT	-	14-Aug-2024	1596489
pH (1:2 soil:CaCl2-aq)	----	7.62	0.10	pH units	E108A/WT	15-Aug-2024	20-Aug-2024	1596483
Cyanides								
Cyanide, weak acid dissociable	----	<0.050	0.050	mg/kg	E336A/WT	15-Aug-2024	16-Aug-2024	1596780
Fixed-Ratio Extractables								
Calcium, soluble ion content	7440-70-2	12.7	0.50	mg/L	E484/WT	20-Aug-2024	20-Aug-2024	1596484
Magnesium, soluble ion content	7439-95-4	2.02	0.50	mg/L	E484/WT	20-Aug-2024	20-Aug-2024	1596484
Sodium, soluble ion content	17341-25-2	310	0.50	mg/L	E484/WT	20-Aug-2024	20-Aug-2024	1596484
Sodium adsorption ratio [SAR]	----	21.3	0.10	-	E484/WT	20-Aug-2024	20-Aug-2024	1596484
Metals								
Antimony	7440-36-0	0.11	0.10	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Arsenic	7440-38-2	3.47	0.10	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488

Analytical Results

WT2423419-003

Sub-Matrix:**Soil**
(Matrix: **Soil/Solid**)

Client sample ID: BH03-24
Client sampling date / time: 14-Aug-2024

Analyte	CAS Number	Result	LOR	Unit	Method/Lab	Prep Date	Analysis Date	QCLot
Metals								
Barium	7440-39-3	159	0.50	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Beryllium	7440-41-7	0.87	0.10	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Boron	7440-42-8	15.8	5.0	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Boron, hot water soluble	7440-42-8	<0.10	0.10	mg/kg	E487/WT	20-Aug-2024	20-Aug-2024	1596486
Cadmium	7440-43-9	0.106	0.020	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Chromium	7440-47-3	30.0	0.50	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Cobalt	7440-48-4	11.9	0.10	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Copper	7440-50-8	20.4	0.50	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Lead	7439-92-1	9.76	0.50	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Mercury	7439-97-6	0.0129	0.0050	mg/kg	E510C/WT	20-Aug-2024	20-Aug-2024	1596487
Molybdenum	7439-98-7	0.27	0.10	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Nickel	7440-02-0	25.3	0.50	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Selenium	7782-49-2	<0.20	0.20	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Silver	7440-22-4	<0.10	0.10	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Thallium	7440-28-0	0.209	0.050	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Uranium	7440-61-1	0.519	0.050	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Vanadium	7440-62-2	41.8	0.20	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Zinc	7440-66-6	58.1	2.0	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1596488
Speciated Metals								
Chromium, hexavalent [Cr VI]	18540-29-9	0.15	0.10	mg/kg	E532/WT	15-Aug-2024	16-Aug-2024	1596783
Volatile Organic Compounds								
Acetone	67-64-1	<0.50	0.50	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Benzene	71-43-2	<0.0050	0.0050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Bromodichloromethane	75-27-4	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Bromoform	75-25-2	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Bromomethane	74-83-9	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Carbon tetrachloride	56-23-5	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Chlorobenzene	108-90-7	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Chloroform	67-66-3	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dibromochloromethane	124-48-1	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dibromoethane, 1,2-	106-93-4	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichlorobenzene, 1,2-	95-50-1	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichlorobenzene, 1,3-	541-73-1	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichlorobenzene, 1,4-	106-46-7	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichlorodifluoromethane	75-71-8	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloroethane, 1,1-	75-34-3	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloroethane, 1,2-	107-06-2	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloroethylene, 1,1-	75-35-4	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloroethylene, cis-1,2-	156-59-2	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloroethylene, trans-1,2-	156-60-5	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloromethane	75-09-2	<0.045	0.045	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloropropane, 1,2-	78-87-5	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloropropylene, cis+trans-1,3-	542-75-6	<0.050	0.05	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloropropylene, cis-1,3-	10061-01-5	<0.030	0.030	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloropropylene, trans-1,3-	10061-02-6	<0.030	0.030	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602

Analytical Results

WT2423419-003

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Client sample ID: BH03-24
Client sampling date / time: 14-Aug-2024

Analyte	CAS Number	Result	LOR	Unit	Method/Lab	Prep Date	Analysis Date	QCLot
Volatile Organic Compounds								
Ethylbenzene	100-41-4	<0.015	0.015	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Hexane, n-	110-54-3	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Methyl ethyl ketone [MEK]	78-93-3	<0.50	0.50	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Methyl isobutyl ketone [MIBK]	108-10-1	<0.50	0.50	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Methyl-tert-butyl ether [MTBE]	1634-04-4	<0.040	0.040	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Styrene	100-42-5	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Tetrachloroethane, 1,1,1,2-	630-20-6	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Tetrachloroethane, 1,1,2,2-	79-34-5	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Tetrachloroethylene	127-18-4	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Toluene	108-88-3	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Trichloroethane, 1,1,1-	71-55-6	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Trichloroethane, 1,1,2-	79-00-5	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Trichloroethylene	79-01-6	<0.010	0.010	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Trichlorofluoromethane	75-69-4	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Vinyl chloride	75-01-4	<0.020	0.020	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Xylene, m+p-	179601-23-1	<0.030	0.030	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Xylene, o-	95-47-6	<0.030	0.030	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Xylenes, total	1330-20-7	<0.050	0.05	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
BTEX, total	----	<0.10	0.1	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Hydrocarbons								
F1 (C6-C10)	----	<5.0	5.0	mg/kg	E581.F1/WT	15-Aug-2024	16-Aug-2024	1596603
F2 (C10-C16)	----	<10	10	mg/kg	E601.SG-L/WT	19-Aug-2024	20-Aug-2024	1603038
F2-Naphthalene	----	<25	25	mg/kg	EC600/WT	-	20-Aug-2024	-
F3 (C16-C34)	----	<50	50	mg/kg	E601.SG-L/WT	19-Aug-2024	20-Aug-2024	1603038
F3-PAH	n/a	<50	50	mg/kg	EC600/WT	-	20-Aug-2024	-
F4 (C34-C50)	----	<50	50	mg/kg	E601.SG-L/WT	19-Aug-2024	20-Aug-2024	1603038
F1-BTEX	----	<5.0	5	mg/kg	EC580/WT	-	19-Aug-2024	-
Hydrocarbons, total (C6-C50)	n/a	<80	80	mg/kg	EC581/WT	-	19-Aug-2024	-
Chromatogram to baseline at nC50	n/a	YES	-	-	E601.SG-L/WT	19-Aug-2024	20-Aug-2024	1603038
Hydrocarbons Surrogates								
Bromobenzotrifluoride, 2- (F2-F4 surrogate)	392-83-6	101	1.0	%	E601.SG-L/WT	19-Aug-2024	20-Aug-2024	1603038
Dichlorotoluene, 3,4-	95-75-0	99.4	1.0	%	E581.F1/WT	15-Aug-2024	16-Aug-2024	1596603
Volatile Organic Compounds Surrogates								
Bromofluorobenzene, 4-	460-00-4	92.7	0.10	%	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Difluorobenzene, 1,4-	540-36-3	98.3	0.10	%	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	83-32-9	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Acenaphthylene	208-96-8	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Anthracene	120-12-7	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Benz(a)anthracene	56-55-3	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Benzo(a)pyrene	50-32-8	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Benzo(b+j)fluoranthene	n/a	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Benzo(g,h,i)perylene	191-24-2	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Benzo(k)fluoranthene	207-08-9	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Chrysene	218-01-9	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037

Analytical Results

WT2423419-003

Sub-Matrix:**Soil** *Client sample ID:* BH03-24

(Matrix: **Soil/Solid**) *Client sampling date / time:* 14-Aug-2024

Analyte	CAS Number	Result	LOR	Unit	Method/Lab	Prep Date	Analysis Date	QCLot
Polycyclic Aromatic Hydrocarbons								
Dibenz(a,h)anthracene	53-70-3	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Fluoranthene	206-44-0	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Fluorene	86-73-7	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Indeno(1,2,3-c,d)pyrene	193-39-5	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Methylnaphthalene, 1-	90-12-0	<0.030	0.030	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Methylnaphthalene, 1+2-	----	<0.050	0.05	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Methylnaphthalene, 2-	91-57-6	<0.030	0.030	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Naphthalene	91-20-3	<0.010	0.010	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Phenanthrene	85-01-8	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Pyrene	129-00-0	<0.050	0.050	mg/kg	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Polycyclic Aromatic Hydrocarbons Surrogates								
Acridine-d9	34749-75-2	87.0	0.1	%	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Chrysene-d12	1719-03-5	97.4	0.1	%	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Naphthalene-d8	1146-65-2	106	0.1	%	E641A/WT	19-Aug-2024	21-Aug-2024	1603037
Phenanthrene-d10	1517-22-2	93.4	0.1	%	E641A/WT	19-Aug-2024	21-Aug-2024	1603037

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

Analytical Results

WT2423419-004

Sub-Matrix:**Soil** *Client sample ID:* BH04-24

(Matrix: **Soil/Solid**) *Client sampling date / time:* 14-Aug-2024

Analyte	CAS Number	Result	LOR	Unit	Method/Lab	Prep Date	Analysis Date	QCLot
Physical Tests								
Conductivity (1:2 leachate)	----	1.89	0.00500	mS/cm	E100-L/WT	20-Aug-2024	20-Aug-2024	1597643
Moisture	----	11.6	0.25	%	E144/WT	-	16-Aug-2024	1600128
pH (1:2 soil:CaCl2-aq)	----	7.84	0.10	pH units	E108A/WT	15-Aug-2024	20-Aug-2024	1597645
Cyanides								
Cyanide, weak acid dissociable	----	<0.050	0.050	mg/kg	E336A/WT	17-Aug-2024	20-Aug-2024	1601471
Fixed-Ratio Extractables								
Calcium, soluble ion content	7440-70-2	4.81	0.50	mg/L	E484/WT	20-Aug-2024	20-Aug-2024	1597644
Magnesium, soluble ion content	7439-95-4	0.76	0.50	mg/L	E484/WT	20-Aug-2024	20-Aug-2024	1597644
Sodium, soluble ion content	17341-25-2	372	0.50	mg/L	E484/WT	20-Aug-2024	20-Aug-2024	1597644
Sodium adsorption ratio [SAR]	----	41.6	0.10	-	E484/WT	20-Aug-2024	20-Aug-2024	1597644
Metals								
Antimony	7440-36-0	<0.10	0.10	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Arsenic	7440-38-2	2.88	0.10	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Barium	7440-39-3	91.7	0.50	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Beryllium	7440-41-7	0.66	0.10	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Boron	7440-42-8	8.1	5.0	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Boron, hot water soluble	7440-42-8	<0.10	0.10	mg/kg	E487/WT	20-Aug-2024	20-Aug-2024	1597650
Cadmium	7440-43-9	0.107	0.020	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Chromium	7440-47-3	23.6	0.50	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648

Analytical Results

WT2423419-004

Sub-Matrix:**Soil**
(Matrix: **Soil/Solid**)

Client sample ID: BH04-24
Client sampling date / time: 14-Aug-2024

Analyte	CAS Number	Result	LOR	Unit	Method/Lab	Prep Date	Analysis Date	QCLot
Metals								
Cobalt	7440-48-4	9.15	0.10	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Copper	7440-50-8	14.5	0.50	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Lead	7439-92-1	8.38	0.50	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Mercury	7439-97-6	0.0288	0.0050	mg/kg	E510C/WT	20-Aug-2024	21-Aug-2024	1597649
Molybdenum	7439-98-7	0.29	0.10	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Nickel	7440-02-0	18.7	0.50	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Selenium	7782-49-2	<0.20	0.20	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Silver	7440-22-4	<0.10	0.10	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Thallium	7440-28-0	0.146	0.050	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Uranium	7440-61-1	0.581	0.050	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Vanadium	7440-62-2	37.1	0.20	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Zinc	7440-66-6	41.3	2.0	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Speciated Metals								
Chromium, hexavalent [Cr VI]	18540-29-9	0.22	0.10	mg/kg	E532/WT	17-Aug-2024	19-Aug-2024	1601472
Volatile Organic Compounds								
Acetone	67-64-1	<0.50	0.50	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Benzene	71-43-2	<0.0050	0.0050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Bromodichloromethane	75-27-4	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Bromoform	75-25-2	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Bromomethane	74-83-9	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Carbon tetrachloride	56-23-5	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Chlorobenzene	108-90-7	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Chloroform	67-66-3	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dibromochloromethane	124-48-1	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dibromoethane, 1,2-	106-93-4	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichlorobenzene, 1,2-	95-50-1	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichlorobenzene, 1,3-	541-73-1	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichlorobenzene, 1,4-	106-46-7	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichlorodifluoromethane	75-71-8	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloroethane, 1,1-	75-34-3	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloroethane, 1,2-	107-06-2	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloroethylene, 1,1-	75-35-4	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloroethylene, cis-1,2-	156-59-2	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloroethylene, trans-1,2-	156-60-5	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloromethane	75-09-2	<0.045	0.045	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloropropane, 1,2-	78-87-5	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloropropylene, cis+trans-1,3-	542-75-6	<0.050	0.05	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloropropylene, cis-1,3-	10061-01-5	<0.030	0.030	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloropropylene, trans-1,3-	10061-02-6	<0.030	0.030	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Ethylbenzene	100-41-4	<0.015	0.015	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Hexane, n-	110-54-3	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Methyl ethyl ketone [MEK]	78-93-3	<0.50	0.50	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Methyl isobutyl ketone [MIBK]	108-10-1	<0.50	0.50	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Methyl-tert-butyl ether [MTBE]	1634-04-4	<0.040	0.040	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Styrene	100-42-5	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602

Analytical Results

WT2423419-004

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Client sample ID: BH04-24
Client sampling date / time: 14-Aug-2024

Analyte	CAS Number	Result	LOR	Unit	Method/Lab	Prep Date	Analysis Date	QCLot
Volatile Organic Compounds								
Tetrachloroethane, 1,1,1,2-	630-20-6	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Tetrachloroethane, 1,1,2,2-	79-34-5	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Tetrachloroethylene	127-18-4	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Toluene	108-88-3	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Trichloroethane, 1,1,1-	71-55-6	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Trichloroethane, 1,1,2-	79-00-5	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Trichloroethylene	79-01-6	<0.010	0.010	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Trichlorofluoromethane	75-69-4	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Vinyl chloride	75-01-4	<0.020	0.020	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Xylene, m+p-	179601-23-1	<0.030	0.030	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Xylene, o-	95-47-6	<0.030	0.030	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Xylenes, total	1330-20-7	<0.050	0.05	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
BTEX, total	----	<0.10	0.1	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Hydrocarbons								
F1 (C6-C10)	----	<5.0	5.0	mg/kg	E581.F1/WT	15-Aug-2024	16-Aug-2024	1596603
F2 (C10-C16)	----	<10	10	mg/kg	E601.SG-L/WT	18-Aug-2024	20-Aug-2024	1597646
F2-Naphthalene	----	<25	25	mg/kg	EC600/WT	-	20-Aug-2024	-
F3 (C16-C34)	----	<50	50	mg/kg	E601.SG-L/WT	18-Aug-2024	20-Aug-2024	1597646
F3-PAH	n/a	<50	50	mg/kg	EC600/WT	-	20-Aug-2024	-
F4 (C34-C50)	----	<50	50	mg/kg	E601.SG-L/WT	18-Aug-2024	20-Aug-2024	1597646
F1-BTEX	----	<5.0	5	mg/kg	EC580/WT	-	19-Aug-2024	-
Hydrocarbons, total (C6-C50)	n/a	<80	80	mg/kg	EC581/WT	-	19-Aug-2024	-
Chromatogram to baseline at nC50	n/a	YES	-	-	E601.SG-L/WT	18-Aug-2024	20-Aug-2024	1597646
Hydrocarbons Surrogates								
Bromobenzotrifluoride, 2- (F2-F4 surrogate)	392-83-6	77.0	1.0	%	E601.SG-L/WT	18-Aug-2024	20-Aug-2024	1597646
Dichlorotoluene, 3,4-	95-75-0	96.4	1.0	%	E581.F1/WT	15-Aug-2024	16-Aug-2024	1596603
Volatile Organic Compounds Surrogates								
Bromofluorobenzene, 4-	460-00-4	94.3	0.10	%	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Difluorobenzene, 1,4-	540-36-3	100	0.10	%	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	83-32-9	<0.050	0.050	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Acenaphthylene	208-96-8	<0.050	0.050	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Anthracene	120-12-7	<0.050	0.050	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Benz(a)anthracene	56-55-3	<0.050	0.050	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Benzo(a)pyrene	50-32-8	<0.050	0.050	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Benzo(b+j)fluoranthene	n/a	<0.050	0.050	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Benzo(g,h,i)perylene	191-24-2	<0.050	0.050	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Benzo(k)fluoranthene	207-08-9	<0.050	0.050	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Chrysene	218-01-9	<0.050	0.050	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Dibenz(a,h)anthracene	53-70-3	<0.050	0.050	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Fluoranthene	206-44-0	<0.050	0.050	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Fluorene	86-73-7	<0.050	0.050	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Indeno(1,2,3-c,d)pyrene	193-39-5	<0.050	0.050	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Methylnaphthalene, 1-	90-12-0	<0.030	0.030	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Methylnaphthalene, 1+2-	----	<0.050	0.05	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647

Analytical Results

WT2423419-004

Sub-Matrix:**Soil**
(Matrix: **Soil/Solid**)

Client sample ID: BH04-24
Client sampling date / time: 14-Aug-2024

Analyte	CAS Number	Result	LOR	Unit	Method/Lab	Prep Date	Analysis Date	QCLot
Polycyclic Aromatic Hydrocarbons								
Methylnaphthalene, 2-	91-57-6	<0.030	0.030	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Naphthalene	91-20-3	<0.010	0.010	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Phenanthrene	85-01-8	<0.050	0.050	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Pyrene	129-00-0	<0.050	0.050	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Polycyclic Aromatic Hydrocarbons Surrogates								
Acridine-d9	34749-75-2	88.5	0.1	%	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Chrysene-d12	1719-03-5	76.2	0.1	%	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Naphthalene-d8	1146-65-2	79.6	0.1	%	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Phenanthrene-d10	1517-22-2	84.5	0.1	%	E641A/WT	18-Aug-2024	20-Aug-2024	1597647

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

Analytical Results

WT2423419-005

Sub-Matrix:**Soil**
(Matrix: **Soil/Solid**)

Client sample ID: BH01-24-MSPLP
Client sampling date / time: 14-Aug-2024

Analyte	CAS Number	Result	LOR	Unit	Method/Lab	Prep Date	Analysis Date	QCLot
ON mSPLP Metal (target pH= 5)								
Antimony, mSPLP	7440-36-0	<0.50	0.50	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Arsenic, mSPLP	7440-38-2	11.0	1.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Barium, mSPLP	7440-39-3	220	2	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Beryllium, mSPLP	7440-41-7	1.64	0.50	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Boron, mSPLP	7440-42-8	17	10	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Cadmium, mSPLP	7440-43-9	0.19	0.10	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Chromium, mSPLP	7440-47-3	40.2	5.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Cobalt, mSPLP	7440-48-4	10.8	1.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Copper, mSPLP	7440-50-8	67.1	5.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Lead, mSPLP	7439-92-1	28.3	1.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Molybdenum, mSPLP	7439-98-7	1.09	0.50	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Nickel, mSPLP	7440-02-0	33.9	1.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
pH, mSPLP final	n/a	8.92	0.010	pH units	EPP443/WT	-	16-Aug-2024	-
pH, mSPLP initial	n/a	8.88	0.010	pH units	EPP443/WT	-	16-Aug-2024	-
Selenium, mSPLP	7782-49-2	<1.0	1.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Silver, mSPLP	7440-22-4	<0.25	0.25	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Thallium, mSPLP	7440-28-0	<0.50	0.50	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Uranium, mSPLP	7440-61-1	<2.0	2.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Vanadium, mSPLP	7440-62-2	76.6	0.50	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Zinc, mSPLP	7440-66-6	63.1	5.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
mSPLP VOCs								
Bromomethane, mSPLP	74-83-9	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Carbon tetrachloride, mSPLP	56-23-5	<0.20	0.20	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Chloroform, mSPLP	67-66-3	<1.00	1.00	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dibromoethane, 1,2-, mSPLP	106-93-4	<0.20	0.20	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208

Analytical Results

WT2423419-005

Sub-Matrix:**Soil**
(Matrix: **Soil/Solid**)

Client sample ID: BH01-24-MSPLP
Client sampling date / time: 14-Aug-2024

Analyte	CAS Number	Result	LOR	Unit	Method/Lab	Prep Date	Analysis Date	QCLot
mSPLP VOCs								
Dichlorobenzene, 1,2-, mSPLP	95-50-1	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichlorobenzene, 1,4-, mSPLP	106-46-7	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloroethane, 1,1-, mSPLP	75-34-3	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloroethane, 1,2-, mSPLP	107-06-2	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloroethylene, 1,1-, mSPLP	75-35-4	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloroethylene, cis-1,2-, mSPLP	156-59-2	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloroethylene, trans-1,2-, mSPLP	156-60-5	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloropropane, 1,2-, mSPLP	78-87-5	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloropropylene, cis+trans-1,3-, mSPLP	542-75-6	<0.30	0.3	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloropropylene, cis-1,3-, mSPLP	10061-01-5	<0.20	0.20	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloropropylene, trans-1,3-, mSPLP	10061-02-6	<0.20	0.20	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Tetrachloroethane, 1,1,1,2-, mSPLP	630-20-6	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Tetrachloroethane, 1,1,2,2-, mSPLP	630-20-6	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Tetrachloroethylene, mSPLP	127-18-4	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Trichloroethane, 1,1,2-, mSPLP	79-00-5	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Trichloroethylene, mSPLP	79-01-6	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
mSPLP VOCs Surrogates								
Bromofluorobenzene, 4-, mSPLP	460-00-4	103	1.0	%	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Difluorobenzene, 1,4-, mSPLP	540-36-3	98.9	1.0	%	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
ON mSPLP VOC (reagent water)								
Extraction fluid	----	fluid #3	-	-	EPP584/WT	-	16-Aug-2024	-

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

Analytical Results

WT2423419-006

Sub-Matrix:**Soil**
(Matrix: **Soil/Solid**)

Client sample ID: BH02-24-MSPLP
Client sampling date / time: 14-Aug-2024

Analyte	CAS Number	Result	LOR	Unit	Method/Lab	Prep Date	Analysis Date	QCLot
ON mSPLP Metal (target pH= 5)								
Antimony, mSPLP	7440-36-0	<0.50	0.50	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Arsenic, mSPLP	7440-38-2	10.8	1.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Barium, mSPLP	7440-39-3	240	2	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Beryllium, mSPLP	7440-41-7	1.76	0.50	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Boron, mSPLP	7440-42-8	14	10	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Cadmium, mSPLP	7440-43-9	<0.10	0.10	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Chromium, mSPLP	7440-47-3	53.9	5.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Cobalt, mSPLP	7440-48-4	9.2	1.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Copper, mSPLP	7440-50-8	67.3	5.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Lead, mSPLP	7439-92-1	16.6	1.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Molybdenum, mSPLP	7439-98-7	<0.50	0.50	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Nickel, mSPLP	7440-02-0	43.8	1.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
pH, mSPLP final	n/a	9.73	0.010	pH units	EPP443/WT	-	16-Aug-2024	-

Analytical Results

WT2423419-006

Sub-Matrix:**Soil**
(Matrix: **Soil/Solid)**

Client sample ID: BH02-24-MSPLP
Client sampling date / time: 14-Aug-2024

Analyte	CAS Number	Result	LOR	Unit	Method/Lab	Prep Date	Analysis Date	QCLot
ON mSPLP Metal (target pH= 5)								
pH, mSPLP initial	n/a	9.93	0.010	pH units	EPP443/WT	-	16-Aug-2024	-
Selenium, mSPLP	7782-49-2	<1.0	1.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Silver, mSPLP	7440-22-4	<0.25	0.25	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Thallium, mSPLP	7440-28-0	<0.50	0.50	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Uranium, mSPLP	7440-61-1	<2.0	2.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Vanadium, mSPLP	7440-62-2	67.0	0.50	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Zinc, mSPLP	7440-66-6	91.8	5.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
mSPLP VOCs								
Bromomethane, mSPLP	74-83-9	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Carbon tetrachloride, mSPLP	56-23-5	<0.20	0.20	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Chloroform, mSPLP	67-66-3	<1.00	1.00	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dibromoethane, 1,2-, mSPLP	106-93-4	<0.20	0.20	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichlorobenzene, 1,2-, mSPLP	95-50-1	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichlorobenzene, 1,4-, mSPLP	106-46-7	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloroethane, 1,1-, mSPLP	75-34-3	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloroethane, 1,2-, mSPLP	107-06-2	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloroethylene, 1,1-, mSPLP	75-35-4	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloroethylene, cis-1,2-, mSPLP	156-59-2	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloroethylene, trans-1,2-, mSPLP	156-60-5	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloropropane, 1,2-, mSPLP	78-87-5	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloropropylene, cis+trans-1,3-, mSPLP	542-75-6	<0.30	0.3	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloropropylene, cis-1,3-, mSPLP	10061-01-5	<0.20	0.20	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloropropylene, trans-1,3-, mSPLP	10061-02-6	<0.20	0.20	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Tetrachloroethane, 1,1,1,2-, mSPLP	630-20-6	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Tetrachloroethane, 1,1,2,2-, mSPLP	630-20-6	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Tetrachloroethylene, mSPLP	127-18-4	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Trichloroethane, 1,1,2-, mSPLP	79-00-5	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Trichloroethylene, mSPLP	79-01-6	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
mSPLP VOCs Surrogates								
Bromofluorobenzene, 4-, mSPLP	460-00-4	103	1.0	%	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Difluorobenzene, 1,4-, mSPLP	540-36-3	99.2	1.0	%	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
ON mSPLP VOC (reagent water)								
Extraction fluid	----	fluid #3	-	-	EPP584/WT	-	16-Aug-2024	-

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

Analytical Results

WT2423419-007

Sub-Matrix:**Soil**
(Matrix: **Soil/Solid)**

Client sample ID: BH03-24-MSPLP
Client sampling date / time: 14-Aug-2024

Analyte	CAS Number	Result	LOR	Unit	Method/Lab	Prep Date	Analysis Date	QCLot
ON mSPLP Metal (target pH= 5)								
Antimony, mSPLP	7440-36-0	<0.50	0.50	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986

Analytical Results

WT2423419-007

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Client sample ID: BH03-24-MSPLP
Client sampling date / time: 14-Aug-2024

Analyte	CAS Number	Result	LOR	Unit	Method/Lab	Prep Date	Analysis Date	QCLot
ON mSPLP Metal (target pH= 5)								
Arsenic, mSPLP	7440-38-2	1.6	1.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Barium, mSPLP	7440-39-3	82	2	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Beryllium, mSPLP	7440-41-7	<0.50	0.50	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Boron, mSPLP	7440-42-8	10	10	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Cadmium, mSPLP	7440-43-9	<0.10	0.10	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Chromium, mSPLP	7440-47-3	8.0	5.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Cobalt, mSPLP	7440-48-4	2.0	1.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Copper, mSPLP	7440-50-8	9.8	5.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Lead, mSPLP	7439-92-1	2.4	1.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Molybdenum, mSPLP	7439-98-7	0.74	0.50	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Nickel, mSPLP	7440-02-0	7.2	1.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
pH, mSPLP final	n/a	9.50	0.010	pH units	EPP443/WT	-	16-Aug-2024	-
pH, mSPLP initial	n/a	9.84	0.010	pH units	EPP443/WT	-	16-Aug-2024	-
Selenium, mSPLP	7782-49-2	<1.0	1.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Silver, mSPLP	7440-22-4	<0.25	0.25	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Thallium, mSPLP	7440-28-0	<0.50	0.50	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Uranium, mSPLP	7440-61-1	<2.0	2.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Vanadium, mSPLP	7440-62-2	13.9	0.50	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Zinc, mSPLP	7440-66-6	19.1	5.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
mSPLP VOCs								
Bromomethane, mSPLP	74-83-9	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Carbon tetrachloride, mSPLP	56-23-5	<0.20	0.20	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Chloroform, mSPLP	67-66-3	<1.00	1.00	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dibromoethane, 1,2-, mSPLP	106-93-4	<0.20	0.20	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichlorobenzene, 1,2-, mSPLP	95-50-1	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichlorobenzene, 1,4-, mSPLP	106-46-7	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloroethane, 1,1-, mSPLP	75-34-3	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloroethane, 1,2-, mSPLP	107-06-2	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloroethylene, 1,1-, mSPLP	75-35-4	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloroethylene, cis-1,2-, mSPLP	156-59-2	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloroethylene, trans-1,2-, mSPLP	156-60-5	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloropropane, 1,2-, mSPLP	78-87-5	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloropropylene, cis+trans-1,3-, mSPLP	542-75-6	<0.30	0.3	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloropropylene, cis-1,3-, mSPLP	10061-01-5	<0.20	0.20	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloropropylene, trans-1,3-, mSPLP	10061-02-6	<0.20	0.20	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Tetrachloroethane, 1,1,1,2-, mSPLP	630-20-6	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Tetrachloroethane, 1,1,2,2-, mSPLP	630-20-6	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Tetrachloroethylene, mSPLP	127-18-4	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Trichloroethane, 1,1,2-, mSPLP	79-00-5	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Trichloroethylene, mSPLP	79-01-6	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
mSPLP VOCs Surrogates								
Bromofluorobenzene, 4-, mSPLP	460-00-4	103	1.0	%	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Difluorobenzene, 1,4-, mSPLP	540-36-3	98.6	1.0	%	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
ON mSPLP VOC (reagent water)								
Extraction fluid	----	fluid #3	-	-	EPP584/WT	-	16-Aug-2024	-

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

Analytical Results

WT2423419-008

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Client sample ID: BH04-24-MSPLP
Client sampling date / time: 14-Aug-2024

Analyte	CAS Number	Result	LOR	Unit	Method/Lab	Prep Date	Analysis Date	QCLot
ON mSPLP Metal (target pH= 5)								
Antimony, mSPLP	7440-36-0	<0.50	0.50	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Arsenic, mSPLP	7440-38-2	4.9	1.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Barium, mSPLP	7440-39-3	98	2	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Beryllium, mSPLP	7440-41-7	0.68	0.50	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Boron, mSPLP	7440-42-8	<10	10	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Cadmium, mSPLP	7440-43-9	<0.10	0.10	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Chromium, mSPLP	7440-47-3	21.1	5.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Cobalt, mSPLP	7440-48-4	4.0	1.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Copper, mSPLP	7440-50-8	20.9	5.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Lead, mSPLP	7439-92-1	6.6	1.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Molybdenum, mSPLP	7439-98-7	0.83	0.50	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Nickel, mSPLP	7440-02-0	19.4	1.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
pH, mSPLP final	n/a	9.57	0.010	pH units	EPP443/WT	-	16-Aug-2024	-
pH, mSPLP initial	n/a	9.68	0.010	pH units	EPP443/WT	-	16-Aug-2024	-
Selenium, mSPLP	7782-49-2	<1.0	1.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Silver, mSPLP	7440-22-4	<0.25	0.25	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Thallium, mSPLP	7440-28-0	<0.50	0.50	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Uranium, mSPLP	7440-61-1	<2.0	2.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Vanadium, mSPLP	7440-62-2	31.8	0.50	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
Zinc, mSPLP	7440-66-6	35.0	5.0	µg/L	E443/WT	19-Aug-2024	19-Aug-2024	1602986
mSPLP VOCs								
Bromomethane, mSPLP	74-83-9	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Carbon tetrachloride, mSPLP	56-23-5	<0.20	0.20	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Chloroform, mSPLP	67-66-3	<1.00	1.00	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dibromoethane, 1,2-, mSPLP	106-93-4	<0.20	0.20	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichlorobenzene, 1,2-, mSPLP	95-50-1	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichlorobenzene, 1,4-, mSPLP	106-46-7	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloroethane, 1,1-, mSPLP	75-34-3	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloroethane, 1,2-, mSPLP	107-06-2	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloroethylene, 1,1-, mSPLP	75-35-4	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloroethylene, cis-1,2-, mSPLP	156-59-2	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloroethylene, trans-1,2-, mSPLP	156-60-5	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloropropane, 1,2-, mSPLP	78-87-5	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloropropylene, cis+trans-1,3-, mSPLP	542-75-6	<0.30	0.3	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloropropylene, cis-1,3-, mSPLP	10061-01-5	<0.20	0.20	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Dichloropropylene, trans-1,3-, mSPLP	10061-02-6	<0.20	0.20	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Tetrachloroethane, 1,1,1,2-, mSPLP	630-20-6	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Tetrachloroethane, 1,1,2,2-, mSPLP	630-20-6	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Tetrachloroethylene, mSPLP	127-18-4	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Trichloroethane, 1,1,2-, mSPLP	79-00-5	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
Trichloroethylene, mSPLP	79-01-6	<0.50	0.50	µg/L	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
mSPLP VOCs Surrogates								
Bromofluorobenzene, 4-, mSPLP	460-00-4	103	1.0	%	E619D/WT	19-Aug-2024	19-Aug-2024	1603208

Analytical Results

WT2423419-008

Sub-Matrix:**Soil** *Client sample ID:* BH04-24-MSPLP

(Matrix: **Soil/Solid**) *Client sampling date / time:* 14-Aug-2024

Analyte	CAS Number	Result	LOR	Unit	Method/Lab	Prep Date	Analysis Date	QCLot
mSPLP VOCs Surrogates								
Difluorobenzene, 1,4-, mSPLP	540-36-3	98.5	1.0	%	E619D/WT	19-Aug-2024	19-Aug-2024	1603208
ON mSPLP VOC (reagent water)								
Extraction fluid	----	fluid #3	-	-	EPP584/WT	-	16-Aug-2024	-

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

Analytical Results

WT2423419-009

Sub-Matrix:**Soil** *Client sample ID:* DUP-1

(Matrix: **Soil/Solid**) *Client sampling date / time:* 14-Aug-2024

Analyte	CAS Number	Result	LOR	Unit	Method/Lab	Prep Date	Analysis Date	QCLot
Physical Tests								
Conductivity (1:2 leachate)	----	1.83	0.00500	mS/cm	E100-L/WT	20-Aug-2024	20-Aug-2024	1597643
Moisture	----	16.1	0.25	%	E144/WT	-	16-Aug-2024	1600128
pH (1:2 soil:CaCl2-aq)	----	7.40	0.10	pH units	E108A/WT	15-Aug-2024	20-Aug-2024	1597645
Cyanides								
Cyanide, weak acid dissociable	----	<0.050	0.050	mg/kg	E336A/WT	17-Aug-2024	20-Aug-2024	1601471
Fixed-Ratio Extractables								
Calcium, soluble ion content	7440-70-2	28.0	0.50	mg/L	E484/WT	20-Aug-2024	20-Aug-2024	1597644
Magnesium, soluble ion content	7439-95-4	23.6	0.50	mg/L	E484/WT	20-Aug-2024	20-Aug-2024	1597644
Sodium, soluble ion content	17341-25-2	364	0.50	mg/L	E484/WT	20-Aug-2024	20-Aug-2024	1597644
Sodium adsorption ratio [SAR]	----	12.2	0.10	-	E484/WT	20-Aug-2024	20-Aug-2024	1597644
Metals								
Antimony	7440-36-0	<0.10	0.10	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Arsenic	7440-38-2	2.86	0.10	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Barium	7440-39-3	58.0	0.50	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Beryllium	7440-41-7	0.52	0.10	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Boron	7440-42-8	<5.0	5.0	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Boron, hot water soluble	7440-42-8	0.18	0.10	mg/kg	E487/WT	20-Aug-2024	20-Aug-2024	1597650
Cadmium	7440-43-9	0.111	0.020	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Chromium	7440-47-3	17.8	0.50	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Cobalt	7440-48-4	7.15	0.10	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Copper	7440-50-8	12.0	0.50	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Lead	7439-92-1	8.18	0.50	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Mercury	7439-97-6	0.0267	0.0050	mg/kg	E510C/WT	20-Aug-2024	21-Aug-2024	1597649
Molybdenum	7439-98-7	0.24	0.10	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Nickel	7440-02-0	13.8	0.50	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Selenium	7782-49-2	<0.20	0.20	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Silver	7440-22-4	<0.10	0.10	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Thallium	7440-28-0	0.103	0.050	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Uranium	7440-61-1	0.452	0.050	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Vanadium	7440-62-2	29.1	0.20	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648
Zinc	7440-66-6	36.3	2.0	mg/kg	E440C/WT	20-Aug-2024	20-Aug-2024	1597648

Analytical Results

WT2423419-009

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Client sample ID: DUP-1
Client sampling date / time: 14-Aug-2024

Analyte	CAS Number	Result	LOR	Unit	Method/Lab	Prep Date	Analysis Date	QCLot
Speciated Metals								
Chromium, hexavalent [Cr VI]	18540-29-9	<0.10	0.10	mg/kg	E532/WT	17-Aug-2024	19-Aug-2024	1601472
Volatile Organic Compounds								
Acetone	67-64-1	<0.50	0.50	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Benzene	71-43-2	<0.0050	0.0050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Bromodichloromethane	75-27-4	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Bromoform	75-25-2	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Bromomethane	74-83-9	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Carbon tetrachloride	56-23-5	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Chlorobenzene	108-90-7	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Chloroform	67-66-3	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dibromochloromethane	124-48-1	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dibromoethane, 1,2-	106-93-4	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichlorobenzene, 1,2-	95-50-1	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichlorobenzene, 1,3-	541-73-1	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichlorobenzene, 1,4-	106-46-7	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichlorodifluoromethane	75-71-8	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloroethane, 1,1-	75-34-3	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloroethane, 1,2-	107-06-2	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloroethylene, 1,1-	75-35-4	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloroethylene, cis-1,2-	156-59-2	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloroethylene, trans-1,2-	156-60-5	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloromethane	75-09-2	<0.045	0.045	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloropropane, 1,2-	78-87-5	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloropropylene, cis+trans-1,3-	542-75-6	<0.050	0.05	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloropropylene, cis-1,3-	10061-01-5	<0.030	0.030	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloropropylene, trans-1,3-	10061-02-6	<0.030	0.030	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Ethylbenzene	100-41-4	<0.015	0.015	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Hexane, n-	110-54-3	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Methyl ethyl ketone [MEK]	78-93-3	<0.50	0.50	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Methyl isobutyl ketone [MIBK]	108-10-1	<0.50	0.50	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Methyl-tert-butyl ether [MTBE]	1634-04-4	<0.040	0.040	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Styrene	100-42-5	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Tetrachloroethane, 1,1,1,2-	630-20-6	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Tetrachloroethane, 1,1,2,2-	79-34-5	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Tetrachloroethylene	127-18-4	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Toluene	108-88-3	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Trichloroethane, 1,1,1-	71-55-6	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Trichloroethane, 1,1,2-	79-00-5	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Trichloroethylene	79-01-6	<0.010	0.010	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Trichlorofluoromethane	75-69-4	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Vinyl chloride	75-01-4	<0.020	0.020	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Xylene, m+p-	179601-23-1	<0.030	0.030	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Xylene, o-	95-47-6	<0.030	0.030	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Xylenes, total	1330-20-7	<0.050	0.05	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
BTEX, total	----	<0.10	0.1	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602

Analytical Results

WT2423419-009

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Client sample ID: DUP-1
Client sampling date / time: 14-Aug-2024

Analyte	CAS Number	Result	LOR	Unit	Method/Lab	Prep Date	Analysis Date	QCLot
Hydrocarbons								
F1 (C6-C10)	----	<5.0	5.0	mg/kg	E581.F1/WT	15-Aug-2024	16-Aug-2024	1596603
F2 (C10-C16)	----	<10	10	mg/kg	E601.SG-L/WT	18-Aug-2024	20-Aug-2024	1597646
F2-Naphthalene	----	<25	25	mg/kg	EC600/WT	-	20-Aug-2024	-
F3 (C16-C34)	----	<50	50	mg/kg	E601.SG-L/WT	18-Aug-2024	20-Aug-2024	1597646
F3-PAH	n/a	<50	50	mg/kg	EC600/WT	-	20-Aug-2024	-
F4 (C34-C50)	----	<50	50	mg/kg	E601.SG-L/WT	18-Aug-2024	20-Aug-2024	1597646
F1-BTEX	----	<5.0	5	mg/kg	EC580/WT	-	19-Aug-2024	-
Hydrocarbons, total (C6-C50)	n/a	<80	80	mg/kg	EC581/WT	-	19-Aug-2024	-
Chromatogram to baseline at nC50	n/a	YES	-	-	E601.SG-L/WT	18-Aug-2024	20-Aug-2024	1597646
Hydrocarbons Surrogates								
Bromobenzotrifluoride, 2- (F2-F4 surrogate)	392-83-6	72.1	1.0	%	E601.SG-L/WT	18-Aug-2024	20-Aug-2024	1597646
Dichlorotoluene, 3,4-	95-75-0	138	1.0	%	E581.F1/WT	15-Aug-2024	16-Aug-2024	1596603
Volatile Organic Compounds Surrogates								
Bromofluorobenzene, 4-	460-00-4	138	0.10	%	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Difluorobenzene, 1,4-	540-36-3	98.3	0.10	%	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	83-32-9	<0.050	0.050	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Acenaphthylene	208-96-8	<0.050	0.050	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Anthracene	120-12-7	<0.050	0.050	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Benz(a)anthracene	56-55-3	<0.050	0.050	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Benzo(a)pyrene	50-32-8	<0.050	0.050	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Benzo(b+j)fluoranthene	n/a	<0.050	0.050	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Benzo(g,h,i)perylene	191-24-2	<0.050	0.050	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Benzo(k)fluoranthene	207-08-9	<0.050	0.050	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Chrysene	218-01-9	<0.050	0.050	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Dibenz(a,h)anthracene	53-70-3	<0.050	0.050	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Fluoranthene	206-44-0	<0.050	0.050	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Fluorene	86-73-7	<0.050	0.050	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Indeno(1,2,3-c,d)pyrene	193-39-5	<0.050	0.050	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Methylnaphthalene, 1-	90-12-0	<0.030	0.030	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Methylnaphthalene, 1+2-	----	<0.050	0.05	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Methylnaphthalene, 2-	91-57-6	<0.030	0.030	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Naphthalene	91-20-3	<0.010	0.010	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Phenanthrene	85-01-8	<0.050	0.050	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Pyrene	129-00-0	<0.050	0.050	mg/kg	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Polycyclic Aromatic Hydrocarbons Surrogates								
Acridine-d9	34749-75-2	83.6	0.1	%	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Chrysene-d12	1719-03-5	73.6	0.1	%	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Naphthalene-d8	1146-65-2	76.6	0.1	%	E641A/WT	18-Aug-2024	20-Aug-2024	1597647
Phenanthrene-d10	1517-22-2	82.0	0.1	%	E641A/WT	18-Aug-2024	20-Aug-2024	1597647

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

Analytical Results

WT2423419-010

Sub-Matrix:**Soil**
(Matrix: **Soil/Solid**)

Client sample ID: Trip Blank
Client sampling date / time: 14-Aug-2024

Analyte	CAS Number	Result	LOR	Unit	Method/Lab	Prep Date	Analysis Date	QCLot
Physical Tests								
Moisture	----	<0.25	0.25	%	E144/WT	-	16-Aug-2024	1599874
Volatile Organic Compounds								
Acetone	67-64-1	<0.50	0.50	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Benzene	71-43-2	<0.0050	0.0050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Bromodichloromethane	75-27-4	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Bromoform	75-25-2	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Bromomethane	74-83-9	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Carbon tetrachloride	56-23-5	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Chlorobenzene	108-90-7	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Chloroform	67-66-3	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dibromochloromethane	124-48-1	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dibromoethane, 1,2-	106-93-4	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichlorobenzene, 1,2-	95-50-1	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichlorobenzene, 1,3-	541-73-1	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichlorobenzene, 1,4-	106-46-7	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichlorodifluoromethane	75-71-8	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloroethane, 1,1-	75-34-3	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloroethane, 1,2-	107-06-2	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloroethylene, 1,1-	75-35-4	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloroethylene, cis-1,2-	156-59-2	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloroethylene, trans-1,2-	156-60-5	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloromethane	75-09-2	<0.045	0.045	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloropropane, 1,2-	78-87-5	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloropropylene, cis+trans-1,3-	542-75-6	<0.050	0.05	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloropropylene, cis-1,3-	10061-01-5	<0.030	0.030	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Dichloropropylene, trans-1,3-	10061-02-6	<0.030	0.030	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Ethylbenzene	100-41-4	<0.015	0.015	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Hexane, n-	110-54-3	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Methyl ethyl ketone [MEK]	78-93-3	<0.50	0.50	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Methyl isobutyl ketone [MIBK]	108-10-1	<0.50	0.50	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Methyl-tert-butyl ether [MTBE]	1634-04-4	<0.040	0.040	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Styrene	100-42-5	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Tetrachloroethane, 1,1,1,2-	630-20-6	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Tetrachloroethane, 1,1,2,2-	79-34-5	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Tetrachloroethylene	127-18-4	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Toluene	108-88-3	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Trichloroethane, 1,1,1-	71-55-6	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Trichloroethane, 1,1,2-	79-00-5	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Trichloroethylene	79-01-6	<0.010	0.010	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Trichlorofluoromethane	75-69-4	<0.050	0.050	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Vinyl chloride	75-01-4	<0.020	0.020	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Xylene, m+p-	179601-23-1	<0.030	0.030	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Xylene, o-	95-47-6	<0.030	0.030	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Xylenes, total	1330-20-7	<0.050	0.05	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
BTEX, total	----	<0.10	0.1	mg/kg	E611D/WT	15-Aug-2024	16-Aug-2024	1596602

Analytical Results

WT2423419-010

Sub-Matrix:**Soil** *Client sample ID:* Trip Blank

(Matrix: **Soil/Solid**) *Client sampling date / time:* 14-Aug-2024

Analyte	CAS Number	Result	LOR	Unit	Method/Lab	Prep Date	Analysis Date	QCLot
Hydrocarbons								
F1 (C6-C10)	----	<5.0	5.0	mg/kg	E581.F1/WT	15-Aug-2024	16-Aug-2024	1596603
F1-BTEX	----	<5.0	5	mg/kg	EC580/WT	-	19-Aug-2024	-
Hydrocarbons Surrogates								
Dichlorotoluene, 3,4-	95-75-0	99.3	1.0	%	E581.F1/WT	15-Aug-2024	16-Aug-2024	1596603
Volatile Organic Compounds Surrogates								
Bromofluorobenzene, 4-	460-00-4	100	0.10	%	E611D/WT	15-Aug-2024	16-Aug-2024	1596602
Difluorobenzene, 1,4-	540-36-3	108	0.10	%	E611D/WT	15-Aug-2024	16-Aug-2024	1596602

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

Analytical Results

WT2423419-011

Sub-Matrix:**Soil** *Client sample ID:* TCLP

(Matrix: **Soil/Solid**) *Client sampling date / time:* 14-Aug-2024

Analyte	CAS Number	Result	LOR	Unit	Method/Lab	Prep Date	Analysis Date	QCLot
Physical Tests								
Ignitability	----	Negative	-	-	E209/WT	-	15-Aug-2024	-
Moisture	----	17.7	0.25	%	E144/WT	-	16-Aug-2024	1600128
Sample comment	----	BROWN SILTY CLAY LOAM	-	-	E209/WT	-	15-Aug-2024	-
Time to ignition	----	Not Determined	1	sec	E209/WT	-	15-Aug-2024	-
Burning rate	----	Not Determined	0.01	mm/sec	E209/WT	-	15-Aug-2024	-
Temperature of test material	----	20.3	1.0	°C	E209/WT	-	15-Aug-2024	-
Air velocity, fume hood	----	0.42	0.10	m/sec	E209/WT	-	15-Aug-2024	-
TCLP Anions & Nutrients								
Nitrate + Nitrite (as N), TCLP	----	<7.50	7.5	mg/L	EC240.N+N/WT	-	19-Aug-2024	-
TCLP Extractables								
Benzo(a)pyrene, TCLP	50-32-8	<0.00020	0.00020	mg/L	E644/WT	16-Aug-2024	19-Aug-2024	1600366
Cyanide, weak acid dissociable, TCLP	----	<0.10	0.10	mg/L	E337A/WT	16-Aug-2024	16-Aug-2024	1600322
Dichlorophenol, 2,4-, TCLP	120-83-2	<0.0050	0.0050	mg/L	E656/WT	19-Aug-2024	20-Aug-2024	1604069
Dinitrotoluene, 2,4-, TCLP	121-14-2	<0.0040	0.0040	mg/L	E656/WT	19-Aug-2024	20-Aug-2024	1604069
Fluoride, TCLP	16984-48-8	<10	10	mg/L	E240.F/WT	16-Aug-2024	16-Aug-2024	1599677
Hexachlorobenzene, TCLP	118-74-1	<0.0040	0.0040	mg/L	E656/WT	19-Aug-2024	20-Aug-2024	1604069
Hexachlorobutadiene, TCLP	87-68-3	<0.0040 RRR,	0.0040	mg/L	E656/WT	19-Aug-2024	20-Aug-2024	1604069
Hexachloroethane, TCLP	67-72-1	<0.0040 RRR,	0.0040	mg/L	E656/WT	19-Aug-2024	20-Aug-2024	1604069
Methylphenol, 2-, TCLP	95-48-7	<0.0050	0.0050	mg/L	E656/WT	19-Aug-2024	20-Aug-2024	1604069
Methylphenol, 3+4-, TCLP	----	<0.010	0.010	mg/L	E656/WT	19-Aug-2024	20-Aug-2024	1604069
Methylphenols, total, TCLP	----	<0.012	0.012	mg/L	E656/WT	19-Aug-2024	20-Aug-2024	1604069
Nitrate (as N), TCLP	14797-55-8	<5.0	5.0	mg/L	E240.NO3/WT	16-Aug-2024	16-Aug-2024	1599678
Nitrite (as N), TCLP	14797-65-0	<5.0	5.0	mg/L	E240.NO2/WT	16-Aug-2024	16-Aug-2024	1599679
Nitrobenzene, TCLP	98-95-3	<0.0040	0.0040	mg/L	E656/WT	19-Aug-2024	20-Aug-2024	1604069

Analytical Results

WT2423419-011

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Client sample ID: TCLP
Client sampling date / time: 14-Aug-2024

Analyte	CAS Number	Result	LOR	Unit	Method/Lab	Prep Date	Analysis Date	QCLot
TCLP Extractables								
Pentachlorophenol [PCP], TCLP	87-86-5	<0.0050	0.0050	mg/L	E656/WT	19-Aug-2024	20-Aug-2024	1604069
Pyridine, TCLP	110-86-1	<2.0	2.0	mg/L	E667A/WT	19-Aug-2024	20-Aug-2024	1603116
Tetrachlorophenol, 2,3,4,6-, TCLP	58-90-2	<0.0050	0.0050	mg/L	E656/WT	19-Aug-2024	20-Aug-2024	1604069
Trichlorophenol, 2,4,5-, TCLP	95-95-4	<0.0050	0.0050	mg/L	E656/WT	19-Aug-2024	20-Aug-2024	1604069
Trichlorophenol, 2,4,6-, TCLP	88-06-2	<0.0050	0.0050	mg/L	E656/WT	19-Aug-2024	20-Aug-2024	1604069
TCLP Extractables Surrogates								
Chrysene-d12, TCLP	1719-03-5	124	5.0	%	E644/WT	16-Aug-2024	19-Aug-2024	1600366
Fluorobiphenyl, 2-, TCLP	321-60-8	81.4	1.0	%	E656/WT	19-Aug-2024	20-Aug-2024	1604069
Naphthalene-d8, TCLP	1146-65-2	96.3	5.0	%	E644/WT	16-Aug-2024	19-Aug-2024	1600366
Nitrobenzene-d5, TCLP	4165-60-0	93.3	1.0	%	E656/WT	19-Aug-2024	20-Aug-2024	1604069
Phenanthrene-d10, TCLP	1517-22-2	108	5.0	%	E644/WT	16-Aug-2024	19-Aug-2024	1600366
Terphenyl-d14, p-, TCLP	1718-51-0	99.1	1.0	%	E656/WT	19-Aug-2024	20-Aug-2024	1604069
Tribromophenol, 2,4,6-, TCLP	118-79-6	92.4	1.0	%	E656/WT	19-Aug-2024	20-Aug-2024	1604069
TCLP Metals								
Arsenic, TCLP	7440-38-2	<1.0	1.0	mg/L	E444/WT	16-Aug-2024	16-Aug-2024	1599537
Barium, TCLP	7440-39-3	<2.5	2.5	mg/L	E444/WT	16-Aug-2024	16-Aug-2024	1599537
Boron, TCLP	7440-42-8	<0.50	0.50	mg/L	E444/WT	16-Aug-2024	16-Aug-2024	1599537
Cadmium, TCLP	7440-43-9	<0.050	0.050	mg/L	E444/WT	16-Aug-2024	16-Aug-2024	1599537
Chromium, TCLP	7440-47-3	<0.25	0.25	mg/L	E444/WT	16-Aug-2024	16-Aug-2024	1599537
Lead, TCLP	7439-92-1	<0.25	0.25	mg/L	E444/WT	16-Aug-2024	16-Aug-2024	1599537
Mercury, TCLP	7439-97-6	<0.0010	0.0010	mg/L	E512/WT	16-Aug-2024	16-Aug-2024	1599521
pH, TCLP 1st preliminary	----	9.43	0.010	pH units	EPP444/WT	-	15-Aug-2024	-
pH, TCLP 2nd preliminary	----	6.24	0.010	pH units	EPP444/WT	-	15-Aug-2024	-
pH, TCLP extraction fluid initial	----	2.86	0.010	pH units	EPP444/WT	-	15-Aug-2024	-
pH, TCLP final	----	5.86	0.010	pH units	EPP444/WT	-	15-Aug-2024	-
Selenium, TCLP	7782-49-2	<0.10	0.10	mg/L	E444/WT	16-Aug-2024	16-Aug-2024	1599537
Silver, TCLP	7440-22-4	<0.050	0.050	mg/L	E444/WT	16-Aug-2024	16-Aug-2024	1599537
Uranium, TCLP	7440-61-1	<0.20	0.20	mg/L	E444/WT	16-Aug-2024	16-Aug-2024	1599537
TCLP VOCs								
Benzene, TCLP	71-43-2	<0.0050	0.0050	mg/L	E615B/WT	16-Aug-2024	16-Aug-2024	1599615
Carbon tetrachloride, TCLP	56-23-5	<0.025	0.025	mg/L	E615B/WT	16-Aug-2024	16-Aug-2024	1599615
Chlorobenzene, TCLP	108-90-7	<0.025	0.025	mg/L	E615B/WT	16-Aug-2024	16-Aug-2024	1599615
Chloroform, TCLP	67-66-3	<0.10	0.10	mg/L	E615B/WT	16-Aug-2024	16-Aug-2024	1599615
Dichlorobenzene, 1,2-, TCLP	95-50-1	<0.025	0.025	mg/L	E615B/WT	16-Aug-2024	16-Aug-2024	1599615
Dichlorobenzene, 1,4-, TCLP	106-46-7	<0.025	0.025	mg/L	E615B/WT	16-Aug-2024	16-Aug-2024	1599615
Dichloroethane, 1,2-, TCLP	107-06-2	<0.025	0.025	mg/L	E615B/WT	16-Aug-2024	16-Aug-2024	1599615
Dichloroethylene, 1,1-, TCLP	75-35-4	<0.025	0.025	mg/L	E615B/WT	16-Aug-2024	16-Aug-2024	1599615
Dichloromethane, TCLP	75-09-2	<0.10	0.10	mg/L	E615B/WT	16-Aug-2024	16-Aug-2024	1599615
Methyl ethyl ketone [MEK], TCLP	78-93-3	<0.10	0.10	mg/L	E615B/WT	16-Aug-2024	16-Aug-2024	1599615
Tetrachloroethylene, TCLP	127-18-4	<0.025	0.025	mg/L	E615B/WT	16-Aug-2024	16-Aug-2024	1599615
Trichloroethylene, TCLP	79-01-6	<0.025	0.025	mg/L	E615B/WT	16-Aug-2024	16-Aug-2024	1599615
Vinyl chloride, TCLP	75-01-4	<0.050	0.050	mg/L	E615B/WT	16-Aug-2024	16-Aug-2024	1599615
TCLP VOCs Surrogates								
Bromofluorobenzene, 4-, TCLP	460-00-4	90.1	1.0	%	E615B/WT	16-Aug-2024	16-Aug-2024	1599615
Difluorobenzene, 1,4-, TCLP	540-36-3	95.4	1.0	%	E615B/WT	16-Aug-2024	16-Aug-2024	1599615

Analytical Results

WT2423419-011

Sub-Matrix:**Soil**
(Matrix: **Soil/Solid)**

Client sample ID: TCLP
Client sampling date / time: 14-Aug-2024

Analyte	CAS Number	Result	LOR	Unit	Method/Lab	Prep Date	Analysis Date	QCLot
Polychlorinated Biphenyls								
Aroclor 1016	12674-11-2	<0.010	0.010	mg/kg	E687/WT	19-Aug-2024	20-Aug-2024	1603143
Aroclor 1221	11104-28-2	<0.010	0.010	mg/kg	E687/WT	19-Aug-2024	20-Aug-2024	1603143
Aroclor 1232	11141-16-5	<0.010	0.010	mg/kg	E687/WT	19-Aug-2024	20-Aug-2024	1603143
Aroclor 1242	53469-21-9	<0.010	0.010	mg/kg	E687/WT	19-Aug-2024	20-Aug-2024	1603143
Aroclor 1248	12672-29-6	<0.010	0.010	mg/kg	E687/WT	19-Aug-2024	20-Aug-2024	1603143
Aroclor 1254	11097-69-1	<0.010	0.010	mg/kg	E687/WT	19-Aug-2024	20-Aug-2024	1603143
Aroclor 1260	11096-82-5	<0.010	0.010	mg/kg	E687/WT	19-Aug-2024	20-Aug-2024	1603143
Aroclor 1262	37324-23-5	<0.010	0.010	mg/kg	E687/WT	19-Aug-2024	20-Aug-2024	1603143
Aroclor 1268	11100-14-4	<0.010	0.010	mg/kg	E687/WT	19-Aug-2024	20-Aug-2024	1603143
Polychlorinated biphenyls [PCBs], total	----	<0.030	0.030	mg/kg	E687/WT	19-Aug-2024	20-Aug-2024	1603143
Polychlorinated Biphenyls Surrogates								
Decachlorobiphenyl	2051-24-3	74.8	0.1	%	E687/WT	19-Aug-2024	20-Aug-2024	1603143
Tetrachloro-m-xylene	877-09-8	73.9	0.1	%	E687/WT	19-Aug-2024	20-Aug-2024	1603143

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

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QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **WT2423419**	Page	: 1 of 24
Client	: **GHD Limited**	Laboratory	: ALS Environmental - Waterloo
Contact	: Jennifer Balkwill	Account Manager	: Rick Hawthorne
Address	: 455 Phillip Street Waterloo ON Canada N2L 3X2	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	: 604 748 3661	Telephone	: +1 519 886 6910
Project	: 12642634-02	Date Samples Received	: 14-Aug-2024 13:37
PO	: 735-011200	Issue Date	: 22-Aug-2024 13:51
C-O-C number	: ----		
Sampler	: RD		
Site	: ----		
Quote number	: 12642634-02 _ COT - 735-011200		
No. of samples received	: 11		
No. of samples analysed	: 11		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- Laboratory Control Sample (LCS) outliers occur - please see following pages for full details.
- Matrix Spike outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Soil/Solid**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Laboratory Control Sample (LCS) Recoveries								
TCLP Extractables	QC-1604069-002	----	Hexachlorobutadiene, TCLP	87-68-3	E656	33.6 % RRQC	40.0-130%	Recovery less than lower control limit
TCLP Extractables	QC-1604069-002	----	Hexachloroethane, TCLP	67-72-1	E656	34.4 % RRQC	60.0-140%	Recovery less than lower control limit

Result Qualifiers

Qualifier	*Description*
RRQC	*Refer to report comments for information regarding this QC result.*

Matrix Spike (MS) Recoveries								
TCLP Extractables	WT2423419-011	TCLP	Hexachlorobutadiene, TCLP	87-68-3	E656	46.0 % RRQC	50.0-150%	Recovery less than lower data quality objective
TCLP Extractables	WT2423419-011	TCLP	Hexachloroethane, TCLP	67-72-1	E656	47.2 % RRQC	50.0-150%	Recovery less than lower data quality objective

Result Qualifiers

Qualifier	*Description*
RRQC	*Refer to report comments for information regarding this QC result.*

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Cyanides : WAD Cyanide (0.01M NaOH Extraction)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH01-24	E336A	14-Aug-2024	15-Aug-2024	14 days	2 days	✓	16-Aug-2024	14 days	1 days	✓
Cyanides : WAD Cyanide (0.01M NaOH Extraction)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH02-24	E336A	14-Aug-2024	15-Aug-2024	14 days	2 days	✓	16-Aug-2024	14 days	1 days	✓
Cyanides : WAD Cyanide (0.01M NaOH Extraction)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH03-24	E336A	14-Aug-2024	15-Aug-2024	14 days	2 days	✓	16-Aug-2024	14 days	1 days	✓
Cyanides : WAD Cyanide (0.01M NaOH Extraction)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH04-24	E336A	14-Aug-2024	17-Aug-2024	14 days	3 days	✓	20-Aug-2024	14 days	3 days	✓
Cyanides : WAD Cyanide (0.01M NaOH Extraction)										
Glass soil jar/Teflon lined cap [ON MECP]										
DUP-1	E336A	14-Aug-2024	17-Aug-2024	14 days	3 days	✓	20-Aug-2024	14 days	3 days	✓
Hydrocarbons : CCME PHC - F1 by Headspace GC-FID										
Glass soil methanol vial [ON MECP]										
BH01-24	E581.F1	14-Aug-2024	14-Aug-2024	14 days	1 days	✓	16-Aug-2024	40 days	1 days	✓
Hydrocarbons : CCME PHC - F1 by Headspace GC-FID										
Glass soil methanol vial [ON MECP]										
BH02-24	E581.F1	14-Aug-2024	15-Aug-2024	14 days	1 days	✓	16-Aug-2024	40 days	1 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Hydrocarbons : CCME PHC - F1 by Headspace GC-FID										
Glass soil methanol vial [ON MECP]										
BH03-24	E581.F1	14-Aug-2024	15-Aug-2024	14 days	1 days	✓	16-Aug-2024	40 days	1 days	✓
Hydrocarbons : CCME PHC - F1 by Headspace GC-FID										
Glass soil methanol vial [ON MECP]										
BH04-24	E581.F1	14-Aug-2024	15-Aug-2024	14 days	1 days	✓	16-Aug-2024	40 days	1 days	✓
Hydrocarbons : CCME PHC - F1 by Headspace GC-FID										
Glass soil methanol vial [ON MECP]										
DUP-1	E581.F1	14-Aug-2024	15-Aug-2024	14 days	1 days	✓	16-Aug-2024	40 days	1 days	✓
Hydrocarbons : CCME PHC - F1 by Headspace GC-FID										
Glass soil methanol vial [ON MECP]										
Trip Blank	E581.F1	14-Aug-2024	15-Aug-2024	14 days	1 days	✓	16-Aug-2024	40 days	1 days	✓
Hydrocarbons : CCME PHCs - F2-F4 by GC-FID (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH04-24	E601.SG-L	14-Aug-2024	18-Aug-2024	14 days	5 days	✓	20-Aug-2024	40 days	2 days	✓
Hydrocarbons : CCME PHCs - F2-F4 by GC-FID (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP]										
DUP-1	E601.SG-L	14-Aug-2024	18-Aug-2024	14 days	5 days	✓	20-Aug-2024	40 days	2 days	✓
Hydrocarbons : CCME PHCs - F2-F4 by GC-FID (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH01-24	E601.SG-L	14-Aug-2024	19-Aug-2024	14 days	6 days	✓	20-Aug-2024	40 days	1 days	✓
Hydrocarbons : CCME PHCs - F2-F4 by GC-FID (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH02-24	E601.SG-L	14-Aug-2024	19-Aug-2024	14 days	6 days	✓	20-Aug-2024	40 days	1 days	✓
Hydrocarbons : CCME PHCs - F2-F4 by GC-FID (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH03-24	E601.SG-L	14-Aug-2024	19-Aug-2024	14 days	6 days	✓	20-Aug-2024	40 days	1 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Boron-Hot Water Extractable by ICPOES										
Glass soil jar/Teflon lined cap [ON MECP] BH01-24	E487	14-Aug-2024	20-Aug-2024	180 days	6 days	✓	20-Aug-2024	180 days	0 days	✓
Metals : Boron-Hot Water Extractable by ICPOES										
Glass soil jar/Teflon lined cap [ON MECP] BH02-24	E487	14-Aug-2024	20-Aug-2024	180 days	6 days	✓	20-Aug-2024	180 days	0 days	✓
Metals : Boron-Hot Water Extractable by ICPOES										
Glass soil jar/Teflon lined cap [ON MECP] BH03-24	E487	14-Aug-2024	20-Aug-2024	180 days	6 days	✓	20-Aug-2024	180 days	0 days	✓
Metals : Boron-Hot Water Extractable by ICPOES										
Glass soil jar/Teflon lined cap [ON MECP] BH04-24	E487	14-Aug-2024	20-Aug-2024	180 days	7 days	✓	20-Aug-2024	180 days	0 days	✓
Metals : Boron-Hot Water Extractable by ICPOES										
Glass soil jar/Teflon lined cap [ON MECP] DUP-1	E487	14-Aug-2024	20-Aug-2024	180 days	7 days	✓	20-Aug-2024	180 days	0 days	✓
Metals : Mercury in Soil/Solid by CVAAS (<355 µm)										
Glass soil jar/Teflon lined cap [ON MECP] BH01-24	E510C	14-Aug-2024	20-Aug-2024	28 days	6 days	✓	20-Aug-2024	28 days	6 days	✓
Metals : Mercury in Soil/Solid by CVAAS (<355 µm)										
Glass soil jar/Teflon lined cap [ON MECP] BH02-24	E510C	14-Aug-2024	20-Aug-2024	28 days	6 days	✓	20-Aug-2024	28 days	6 days	✓
Metals : Mercury in Soil/Solid by CVAAS (<355 µm)										
Glass soil jar/Teflon lined cap [ON MECP] BH03-24	E510C	14-Aug-2024	20-Aug-2024	28 days	6 days	✓	20-Aug-2024	28 days	6 days	✓
Metals : Mercury in Soil/Solid by CVAAS (<355 µm)										
Glass soil jar/Teflon lined cap [ON MECP] BH04-24	E510C	14-Aug-2024	20-Aug-2024	28 days	6 days	✓	21-Aug-2024	28 days	7 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Soil/Solid by CVAAS (<355 µm)										
Glass soil jar/Teflon lined cap [ON MECP]										
DUP-1	E510C	14-Aug-2024	20-Aug-2024	28 days	6 days	✓	21-Aug-2024	28 days	7 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS (<355 µm)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH01-24	E440C	14-Aug-2024	20-Aug-2024	180 days	6 days	✓	20-Aug-2024	180 days	6 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS (<355 µm)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH02-24	E440C	14-Aug-2024	20-Aug-2024	180 days	6 days	✓	20-Aug-2024	180 days	6 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS (<355 µm)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH03-24	E440C	14-Aug-2024	20-Aug-2024	180 days	6 days	✓	20-Aug-2024	180 days	6 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS (<355 µm)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH04-24	E440C	14-Aug-2024	20-Aug-2024	180 days	6 days	✓	20-Aug-2024	180 days	7 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS (<355 µm)										
Glass soil jar/Teflon lined cap [ON MECP]										
DUP-1	E440C	14-Aug-2024	20-Aug-2024	180 days	6 days	✓	20-Aug-2024	180 days	7 days	✓
Metals : Sodium Adsorption Ratio (SAR) - 1:2 Soil:Water (Dry)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH01-24	E484	14-Aug-2024	20-Aug-2024	180 days	6 days	✓	20-Aug-2024	180 days	0 days	✓
Metals : Sodium Adsorption Ratio (SAR) - 1:2 Soil:Water (Dry)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH02-24	E484	14-Aug-2024	20-Aug-2024	180 days	6 days	✓	20-Aug-2024	180 days	0 days	✓
Metals : Sodium Adsorption Ratio (SAR) - 1:2 Soil:Water (Dry)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH03-24	E484	14-Aug-2024	20-Aug-2024	180 days	6 days	✓	20-Aug-2024	180 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Sodium Adsorption Ratio (SAR) - 1:2 Soil:Water (Dry)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH04-24	E484	14-Aug-2024	20-Aug-2024	180 days	7 days	✓	20-Aug-2024	180 days	0 days	✓
Metals : Sodium Adsorption Ratio (SAR) - 1:2 Soil:Water (Dry)										
Glass soil jar/Teflon lined cap [ON MECP]										
DUP-1	E484	14-Aug-2024	20-Aug-2024	180 days	7 days	✓	20-Aug-2024	180 days	0 days	✓
mSPLP VOCs : VOCs by Headspace GC-MS (ON mSPLP)										
Glass vial (sodium bisulfate)										
BH01-24-MSPLP	E619D	16-Aug-2024	19-Aug-2024	16 days	5 days	✓	19-Aug-2024	16 days	5 days	✓
mSPLP VOCs : VOCs by Headspace GC-MS (ON mSPLP)										
Glass vial (sodium bisulfate)										
BH02-24-MSPLP	E619D	16-Aug-2024	19-Aug-2024	16 days	5 days	✓	19-Aug-2024	16 days	5 days	✓
mSPLP VOCs : VOCs by Headspace GC-MS (ON mSPLP)										
Glass vial (sodium bisulfate)										
BH03-24-MSPLP	E619D	16-Aug-2024	19-Aug-2024	16 days	5 days	✓	19-Aug-2024	16 days	5 days	✓
mSPLP VOCs : VOCs by Headspace GC-MS (ON mSPLP)										
Glass vial (sodium bisulfate)										
BH04-24-MSPLP	E619D	16-Aug-2024	19-Aug-2024	16 days	5 days	✓	19-Aug-2024	16 days	5 days	✓
ON mSPLP Metal (target pH= 5) : Metals by CRC ICPMS (mSPLP)										
HDPE - total (lab preserved)										
BH01-24-MSPLP	E443	16-Aug-2024	19-Aug-2024	182 days	5 days	✓	19-Aug-2024	182 days	5 days	✓
ON mSPLP Metal (target pH= 5) : Metals by CRC ICPMS (mSPLP)										
HDPE - total (lab preserved)										
BH02-24-MSPLP	E443	16-Aug-2024	19-Aug-2024	182 days	5 days	✓	19-Aug-2024	182 days	5 days	✓
ON mSPLP Metal (target pH= 5) : Metals by CRC ICPMS (mSPLP)										
HDPE - total (lab preserved)										
BH03-24-MSPLP	E443	16-Aug-2024	19-Aug-2024	182 days	5 days	✓	19-Aug-2024	182 days	5 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
ON mSPLP Metal (target pH= 5) : Metals by CRC ICPMS (mSPLP)										
HDPE - total (lab preserved)										
BH04-24-MSPLP	E443	16-Aug-2024	19-Aug-2024	182 days	5 days	✓	19-Aug-2024	182 days	5 days	✓
ON mSPLP Metal (target pH= 5) : mSPLP Leachate Preparation (Metals, Inorganics, and SVOCs)										
Lab Split - Non-Volatile Leach: 14 day HT (e.g. CN, SVOC, NOx)										
BH01-24-MSPLP	EPP443	14-Aug-2024	16-Aug-2024	----	----		----	14 days	2 days	✓
ON mSPLP Metal (target pH= 5) : mSPLP Leachate Preparation (Metals, Inorganics, and SVOCs)										
Lab Split - Non-Volatile Leach: 14 day HT (e.g. CN, SVOC, NOx)										
BH02-24-MSPLP	EPP443	14-Aug-2024	16-Aug-2024	----	----		----	14 days	2 days	✓
ON mSPLP Metal (target pH= 5) : mSPLP Leachate Preparation (Metals, Inorganics, and SVOCs)										
Lab Split - Non-Volatile Leach: 14 day HT (e.g. CN, SVOC, NOx)										
BH03-24-MSPLP	EPP443	14-Aug-2024	16-Aug-2024	----	----		----	14 days	2 days	✓
ON mSPLP Metal (target pH= 5) : mSPLP Leachate Preparation (Metals, Inorganics, and SVOCs)										
Lab Split - Non-Volatile Leach: 14 day HT (e.g. CN, SVOC, NOx)										
BH04-24-MSPLP	EPP443	14-Aug-2024	16-Aug-2024	----	----		----	14 days	2 days	✓
ON mSPLP VOC (reagent water) : mSPLP Leachate Preparation (VOCs and Cyanide)										
Lab Split - ZHE Leach 14 day HT(eg. CN BTEX)										
BH01-24-MSPLP	EPP584	14-Aug-2024	16-Aug-2024	----	----		----	14 days	2 days	✓
ON mSPLP VOC (reagent water) : mSPLP Leachate Preparation (VOCs and Cyanide)										
Lab Split - ZHE Leach 14 day HT(eg. CN BTEX)										
BH02-24-MSPLP	EPP584	14-Aug-2024	16-Aug-2024	----	----		----	14 days	2 days	✓
ON mSPLP VOC (reagent water) : mSPLP Leachate Preparation (VOCs and Cyanide)										
Lab Split - ZHE Leach 14 day HT(eg. CN BTEX)										
BH03-24-MSPLP	EPP584	14-Aug-2024	16-Aug-2024	----	----		----	14 days	2 days	✓
ON mSPLP VOC (reagent water) : mSPLP Leachate Preparation (VOCs and Cyanide)										
Lab Split - ZHE Leach 14 day HT(eg. CN BTEX)										
BH04-24-MSPLP	EPP584	14-Aug-2024	16-Aug-2024	----	----		----	14 days	2 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH01-24	E100-L	14-Aug-2024	20-Aug-2024	30 days	6 days	✓	20-Aug-2024	30 days	7 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH02-24	E100-L	14-Aug-2024	20-Aug-2024	30 days	6 days	✓	20-Aug-2024	30 days	7 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH03-24	E100-L	14-Aug-2024	20-Aug-2024	30 days	6 days	✓	20-Aug-2024	30 days	7 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH04-24	E100-L	14-Aug-2024	20-Aug-2024	30 days	7 days	✓	20-Aug-2024	30 days	7 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP]										
DUP-1	E100-L	14-Aug-2024	20-Aug-2024	30 days	7 days	✓	20-Aug-2024	30 days	7 days	✓
Physical Tests : Ignitability (O. Reg. 347/558)										
Glass soil jar/Teflon lined cap [ON MECP]										
TCLP	E209	14-Aug-2024	----	----	----		15-Aug-2024	30 days	1 days	✓
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP]										
BH01-24	E144	14-Aug-2024	----	----	----		14-Aug-2024	----	1 days	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP]										
BH02-24	E144	14-Aug-2024	----	----	----		14-Aug-2024	----	1 days	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP]										
BH03-24	E144	14-Aug-2024	----	----	----		14-Aug-2024	----	1 days	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP]										
BH04-24	E144	14-Aug-2024	----	----	----		16-Aug-2024	----	3 days	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP]										
DUP-1	E144	14-Aug-2024	----	----	----		16-Aug-2024	----	3 days	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP]										
TCLP	E144	14-Aug-2024	----	----	----		16-Aug-2024	----	3 days	
Physical Tests : Moisture Content by Gravimetry										
Glass soil methanol vial [ON MECP]										
Trip Blank	E144	14-Aug-2024	----	----	----		16-Aug-2024	----	3 days	
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP]										
BH01-24	E108A	14-Aug-2024	15-Aug-2024	30 days	1 days	✓	20-Aug-2024	30 days	7 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP]										
BH02-24	E108A	14-Aug-2024	15-Aug-2024	30 days	1 days	✓	20-Aug-2024	30 days	7 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP]										
BH03-24	E108A	14-Aug-2024	15-Aug-2024	30 days	1 days	✓	20-Aug-2024	30 days	7 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP]										
BH04-24	E108A	14-Aug-2024	15-Aug-2024	30 days	2 days	✓	20-Aug-2024	30 days	7 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP]										
DUP-1	E108A	14-Aug-2024	15-Aug-2024	30 days	2 days	✓	20-Aug-2024	30 days	7 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Polychlorinated Biphenyls : PCB Aroclors by GC-MS										
Glass soil jar/Teflon lined cap [ON MECP] TCLP	E687	14-Aug-2024	19-Aug-2024	365 days	5 days	✓	20-Aug-2024	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs in Soil/solid by Hex:Ace GC-MS										
Glass soil jar/Teflon lined cap [ON MECP] BH04-24	E641A	14-Aug-2024	18-Aug-2024	60 days	5 days	✓	20-Aug-2024	40 days	2 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs in Soil/solid by Hex:Ace GC-MS										
Glass soil jar/Teflon lined cap [ON MECP] DUP-1	E641A	14-Aug-2024	18-Aug-2024	60 days	5 days	✓	20-Aug-2024	40 days	2 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs in Soil/solid by Hex:Ace GC-MS										
Glass soil jar/Teflon lined cap [ON MECP] BH01-24	E641A	14-Aug-2024	19-Aug-2024	60 days	6 days	✓	21-Aug-2024	40 days	2 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs in Soil/solid by Hex:Ace GC-MS										
Glass soil jar/Teflon lined cap [ON MECP] BH02-24	E641A	14-Aug-2024	19-Aug-2024	60 days	6 days	✓	21-Aug-2024	40 days	2 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs in Soil/solid by Hex:Ace GC-MS										
Glass soil jar/Teflon lined cap [ON MECP] BH03-24	E641A	14-Aug-2024	19-Aug-2024	60 days	6 days	✓	21-Aug-2024	40 days	2 days	✓
Speciated Metals : Hexavalent Chromium (Cr VI) by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH01-24	E532	14-Aug-2024	15-Aug-2024	30 days	2 days	✓	16-Aug-2024	7 days	1 days	✓
Speciated Metals : Hexavalent Chromium (Cr VI) by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH02-24	E532	14-Aug-2024	15-Aug-2024	30 days	2 days	✓	16-Aug-2024	7 days	1 days	✓
Speciated Metals : Hexavalent Chromium (Cr VI) by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH03-24	E532	14-Aug-2024	15-Aug-2024	30 days	2 days	✓	16-Aug-2024	7 days	1 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Speciated Metals : Hexavalent Chromium (Cr VI) by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH04-24	E532	14-Aug-2024	17-Aug-2024	30 days	3 days	✓	19-Aug-2024	7 days	2 days	✓
Speciated Metals : Hexavalent Chromium (Cr VI) by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
DUP-1	E532	14-Aug-2024	17-Aug-2024	30 days	3 days	✓	19-Aug-2024	7 days	2 days	✓
TCLP Extractables : BNA by GC-MS (TCLP)										
Amber glass/Teflon lined septa cap - SVOCs (sodium thiosulfate) [ON MECP]										
TCLP	E656	15-Aug-2024	19-Aug-2024	8 days	6 days	✓	20-Aug-2024	8 days	6 days	✓
TCLP Extractables : Fluoride by IC (TCLP)										
HDPE [ON MECP]										
TCLP	E240.F	15-Aug-2024	16-Aug-2024	29 days	2 days	✓	16-Aug-2024	29 days	2 days	✓
TCLP Extractables : Nitrate by IC (TCLP)										
HDPE [ON MECP]										
TCLP	E240.NO3	15-Aug-2024	16-Aug-2024	8 days	2 days	✓	16-Aug-2024	8 days	2 days	✓
TCLP Extractables : Nitrite by IC (TCLP)										
HDPE [ON MECP]										
TCLP	E240.NO2	15-Aug-2024	16-Aug-2024	8 days	2 days	✓	16-Aug-2024	8 days	2 days	✓
TCLP Extractables : PAHs by GC-MS (TCLP)										
Amber glass/Teflon lined cap (sodium bisulfate)										
TCLP	E644	15-Aug-2024	16-Aug-2024	15 days	3 days	✓	19-Aug-2024	40 days	3 days	✓
TCLP Extractables : Pyridine by GC-MS (TCLP)										
Amber glass/Teflon lined septa cap - SVOCs (sodium thiosulfate) [ON MECP]										
TCLP	E667A	15-Aug-2024	19-Aug-2024	8 days	5 days	✓	20-Aug-2024	8 days	6 days	✓
TCLP Extractables : WAD Cyanide (TCLP)										
HDPE-Total (Lab Preserved)										
TCLP	E337A	15-Aug-2024	16-Aug-2024	15 days	3 days	✓	16-Aug-2024	15 days	3 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
TCLP Metals : Mercury by CVAAS (TCLP)										
Glass vial - total (lab preserved) TCLP	E512	15-Aug-2024	16-Aug-2024	29 days	2 days	✓	16-Aug-2024	29 days	2 days	✓
TCLP Metals : Metals by CRC ICPMS (TCLP)										
HDPE - total (lab preserved) TCLP	E444	15-Aug-2024	16-Aug-2024	181 days	2 days	✓	16-Aug-2024	181 days	3 days	✓
TCLP Metals : TCLP Leachate Preparation (Metals, Inorganics, and SVOCs)										
Lab Split - Non-Volatile Leach: 14 day HT (e.g. CN, SVOC, NOx) TCLP	EPP444	14-Aug-2024	15-Aug-2024	----	----		----	14 days	1 days	✓
TCLP VOCs : VOCs by Headspace GC-MS (TCLP)										
Glass vial (sodium bisulfate) TCLP	E615B	15-Aug-2024	16-Aug-2024	15 days	2 days	✓	16-Aug-2024	15 days	2 days	✓
Volatile Organic Compounds : VOCs (Eastern Canada List) by Headspace GC-MS										
Glass soil methanol vial [ON MECP] BH01-24	E611D	14-Aug-2024	14-Aug-2024	14 days	1 days	✓	16-Aug-2024	40 days	1 days	✓
Volatile Organic Compounds : VOCs (Eastern Canada List) by Headspace GC-MS										
Glass soil methanol vial [ON MECP] BH02-24	E611D	14-Aug-2024	15-Aug-2024	14 days	1 days	✓	16-Aug-2024	40 days	1 days	✓
Volatile Organic Compounds : VOCs (Eastern Canada List) by Headspace GC-MS										
Glass soil methanol vial [ON MECP] BH03-24	E611D	14-Aug-2024	15-Aug-2024	14 days	1 days	✓	16-Aug-2024	40 days	1 days	✓
Volatile Organic Compounds : VOCs (Eastern Canada List) by Headspace GC-MS										
Glass soil methanol vial [ON MECP] BH04-24	E611D	14-Aug-2024	15-Aug-2024	14 days	1 days	✓	16-Aug-2024	40 days	1 days	✓
Volatile Organic Compounds : VOCs (Eastern Canada List) by Headspace GC-MS										
Glass soil methanol vial [ON MECP] DUP-1	E611D	14-Aug-2024	15-Aug-2024	14 days	1 days	✓	16-Aug-2024	40 days	1 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Volatile Organic Compounds : VOCs (Eastern Canada List) by Headspace GC-MS										
Glass soil methanol vial [ON MECP]										
Trip Blank	E611D	14-Aug-2024	15-Aug-2024	14 days	1 days	✓	16-Aug-2024	40 days	1 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
BNA by GC-MS (TCLP)	E656	1604069	1	1	100.0	5.0	✓
Boron-Hot Water Extractable by ICPOES	E487	1596486	2	34	5.8	5.0	✓
CCME PHC - F1 by Headspace GC-FID	E581.F1	1596542	2	39	5.1	5.0	✓
CCME PHCs - F2-F4 by GC-FID (Low Level)	E601.SG-L	1597646	2	35	5.7	5.0	✓
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	1596485	2	40	5.0	5.0	✓
Fluoride by IC (TCLP)	E240.F	1599677	1	7	14.2	5.0	✓
Hexavalent Chromium (Cr VI) by IC	E532	1596783	2	40	5.0	5.0	✓
Mercury by CVAAS (TCLP)	E512	1599521	1	10	10.0	5.0	✓
Mercury in Soil/Solid by CVAAS (<355 µm)	E510C	1596487	2	34	5.8	5.0	✓
Metals by CRC ICPMS (mSPLP)	E443	1602986	1	7	14.2	5.0	✓
Metals by CRC ICPMS (TCLP)	E444	1599537	1	10	10.0	5.0	✓
Metals in Soil/Solid by CRC ICPMS (<355 µm)	E440C	1596488	2	40	5.0	5.0	✓
Moisture Content by Gravimetry	E144	1596489	3	59	5.0	5.0	✓
Nitrate by IC (TCLP)	E240.NO3	1599678	1	7	14.2	5.0	✓
Nitrite by IC (TCLP)	E240.NO2	1599679	1	7	14.2	5.0	✓
PAHs by GC-MS (TCLP)	E644	1600366	1	6	16.6	5.0	✓
PAHs in Soil/solid by Hex:Ace GC-MS	E641A	1597647	2	35	5.7	5.0	✓
PCB Aroclors by GC-MS	E687	1603143	1	18	5.5	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received	E108A	1596483	2	40	5.0	5.0	✓
Pyridine by GC-MS (TCLP)	E667A	1603116	1	1	100.0	5.0	✓
Sodium Adsorption Ratio (SAR) - 1:2 Soil:Water (Dry)	E484	1596484	2	40	5.0	5.0	✓
VOCs (Eastern Canada List) by Headspace GC-MS	E611D	1596541	2	40	5.0	5.0	✓
VOCs by Headspace GC-MS (ON mSPLP)	E619D	1603208	1	9	11.1	5.0	✓
VOCs by Headspace GC-MS (TCLP)	E615B	1599615	1	7	14.2	5.0	✓
WAD Cyanide (0.01M NaOH Extraction)	E336A	1596780	2	40	5.0	5.0	✓
WAD Cyanide (TCLP)	E337A	1600322	1	7	14.2	5.0	✓
Laboratory Control Samples (LCS)							
BNA by GC-MS (TCLP)	E656	1604069	1	1	100.0	5.0	✓
Boron-Hot Water Extractable by ICPOES	E487	1596486	4	34	11.7	10.0	✓
CCME PHC - F1 by Headspace GC-FID	E581.F1	1596542	2	39	5.1	5.0	✓
CCME PHCs - F2-F4 by GC-FID (Low Level)	E601.SG-L	1597646	2	35	5.7	5.0	✓
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	1596485	4	40	10.0	10.0	✓
Fluoride by IC (TCLP)	E240.F	1599677	1	7	14.2	5.0	✓
Hexavalent Chromium (Cr VI) by IC	E532	1596783	4	40	10.0	10.0	✓
Mercury by CVAAS (TCLP)	E512	1599521	1	10	10.0	5.0	✓
Mercury in Soil/Solid by CVAAS (<355 µm)	E510C	1596487	4	34	11.7	10.0	✓

Matrix: **Soil/Solid**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Control Samples (LCS) - Continued							
Metals by CRC ICPMS (mSPLP)	E443	1602986	1	7	14.2	5.0	✓
Metals by CRC ICPMS (TCLP)	E444	1599537	1	10	10.0	5.0	✓
Metals in Soil/Solid by CRC ICPMS (<355 µm)	E440C	1596488	4	40	10.0	10.0	✓
Moisture Content by Gravimetry	E144	1596489	3	59	5.0	5.0	✓
Nitrate by IC (TCLP)	E240.NO3	1599678	1	7	14.2	5.0	✓
Nitrite by IC (TCLP)	E240.NO2	1599679	1	7	14.2	5.0	✓
PAHs by GC-MS (TCLP)	E644	1600366	1	6	16.6	5.0	✓
PAHs in Soil/solid by Hex:Ace GC-MS	E641A	1597647	2	35	5.7	5.0	✓
PCB Aroclors by GC-MS	E687	1603143	1	18	5.5	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received	E108A	1596483	2	40	5.0	5.0	✓
Pyridine by GC-MS (TCLP)	E667A	1603116	1	1	100.0	5.0	✓
Sodium Adsorption Ratio (SAR) - 1:2 Soil:Water (Dry)	E484	1596484	4	40	10.0	10.0	✓
VOCs (Eastern Canada List) by Headspace GC-MS	E611D	1596541	2	40	5.0	5.0	✓
VOCs by Headspace GC-MS (ON mSPLP)	E619D	1603208	1	9	11.1	5.0	✓
VOCs by Headspace GC-MS (TCLP)	E615B	1599615	1	7	14.2	5.0	✓
WAD Cyanide (0.01M NaOH Extraction)	E336A	1596780	2	40	5.0	5.0	✓
WAD Cyanide (TCLP)	E337A	1600322	1	7	14.2	5.0	✓
Method Blanks (MB)							
BNA by GC-MS (TCLP)	E656	1604069	1	1	100.0	5.0	✓
Boron-Hot Water Extractable by ICPOES	E487	1596486	2	34	5.8	5.0	✓
CCME PHC - F1 by Headspace GC-FID	E581.F1	1596542	2	39	5.1	5.0	✓
CCME PHCs - F2-F4 by GC-FID (Low Level)	E601.SG-L	1597646	2	35	5.7	5.0	✓
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	1596485	2	40	5.0	5.0	✓
Fluoride by IC (TCLP)	E240.F	1599677	1	7	14.2	5.0	✓
Hexavalent Chromium (Cr VI) by IC	E532	1596783	2	40	5.0	5.0	✓
Mercury by CVAAS (TCLP)	E512	1599521	1	10	10.0	5.0	✓
Mercury in Soil/Solid by CVAAS (<355 µm)	E510C	1596487	2	34	5.8	5.0	✓
Metals by CRC ICPMS (mSPLP)	E443	1602986	1	7	14.2	5.0	✓
Metals by CRC ICPMS (TCLP)	E444	1599537	1	10	10.0	5.0	✓
Metals in Soil/Solid by CRC ICPMS (<355 µm)	E440C	1596488	2	40	5.0	5.0	✓
Moisture Content by Gravimetry	E144	1596489	3	59	5.0	5.0	✓
Nitrate by IC (TCLP)	E240.NO3	1599678	1	7	14.2	5.0	✓
Nitrite by IC (TCLP)	E240.NO2	1599679	1	7	14.2	5.0	✓
PAHs by GC-MS (TCLP)	E644	1600366	1	6	16.6	5.0	✓
PAHs in Soil/solid by Hex:Ace GC-MS	E641A	1597647	2	35	5.7	5.0	✓
PCB Aroclors by GC-MS	E687	1603143	1	18	5.5	5.0	✓
Pyridine by GC-MS (TCLP)	E667A	1603116	1	1	100.0	5.0	✓
Sodium Adsorption Ratio (SAR) - 1:2 Soil:Water (Dry)	E484	1596484	2	40	5.0	5.0	✓
VOCs (Eastern Canada List) by Headspace GC-MS	E611D	1596541	2	40	5.0	5.0	✓

Matrix: **Soil/Solid**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Method Blanks (MB) - Continued							
VOCs by Headspace GC-MS (ON mSPLP)	E619D	1603208	1	9	11.1	5.0	✓
VOCs by Headspace GC-MS (TCLP)	E615B	1599615	1	7	14.2	5.0	✓
WAD Cyanide (0.01M NaOH Extraction)	E336A	1596780	2	40	5.0	5.0	✓
WAD Cyanide (TCLP)	E337A	1600322	1	7	14.2	5.0	✓
Matrix Spikes (MS)							
BNA by GC-MS (TCLP)	E656	1604069	1	1	100.0	5.0	✓
CCME PHC - F1 by Headspace GC-FID	E581.F1	1596542	2	39	5.1	5.0	✓
CCME PHCs - F2-F4 by GC-FID (Low Level)	E601.SG-L	1597646	2	35	5.7	5.0	✓
Fluoride by IC (TCLP)	E240.F	1599677	1	7	14.2	5.0	✓
Mercury by CVAAS (TCLP)	E512	1599521	1	10	10.0	5.0	✓
Metals by CRC ICPMS (mSPLP)	E443	1602986	1	7	14.2	5.0	✓
Metals by CRC ICPMS (TCLP)	E444	1599537	1	10	10.0	5.0	✓
Nitrate by IC (TCLP)	E240.NO3	1599678	1	7	14.2	5.0	✓
Nitrite by IC (TCLP)	E240.NO2	1599679	1	7	14.2	5.0	✓
PAHs by GC-MS (TCLP)	E644	1600366	1	6	16.6	5.0	✓
PAHs in Soil/solid by Hex:Ace GC-MS	E641A	1597647	2	35	5.7	5.0	✓
PCB Aroclors by GC-MS	E687	1603143	1	18	5.5	5.0	✓
Pyridine by GC-MS (TCLP)	E667A	1603116	1	1	100.0	5.0	✓
VOCs (Eastern Canada List) by Headspace GC-MS	E611D	1596541	2	40	5.0	5.0	✓
VOCs by Headspace GC-MS (ON mSPLP)	E619D	1603208	1	9	11.1	5.0	✓
VOCs by Headspace GC-MS (TCLP)	E615B	1599615	1	7	14.2	5.0	✓
WAD Cyanide (0.01M NaOH Extraction)	E336A	1596780	2	40	5.0	5.0	✓
WAD Cyanide (TCLP)	E337A	1600322	1	7	14.2	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L ALS Environmental - Waterloo	Soil/Solid	CSSS Ch. 15 (mod)/APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a soil sample that has been added in a defined ratio of soil to deionized water, then shaken well and allowed to settle. Conductance is measured in the fluid that is observed in the upper layer.
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received	E108A ALS Environmental - Waterloo	Soil/Solid	MECP E3530	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C) and is carried out in accordance with procedures described in the Analytical Protocol (prescriptive method). A minimum 10g portion of the sample, as received, is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil by centrifuging, settling, or decanting and then analyzed using a pH meter and electrode. This method is equivalent to ASTM D4972 and is acceptable for topsoil analysis.
Moisture Content by Gravimetry	E144 ALS Environmental - Waterloo	Soil/Solid	CCME PHC in Soil - Tier 1	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage.
Ignitability (O. Reg. 347/558)	E209 ALS Environmental - Waterloo	Soil/Solid	EPA 1030 (mod)	Ignitability is determined by placing a sample on a ceramic tile and formed into a test strip. One end of the strip is then heated with a torch. Any burn rate for non-metallic samples that exceeds 2.2 mm/sec is considered to have a positive result. For metals, a burn rate of more than 0.17 mm/sec is considered to have a positive result.
Fluoride by IC (TCLP)	E240.F ALS Environmental - Waterloo	Soil/Solid	EPA 1311/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining an extract produced by the Toxicity Characteristic Leachate Procedure (TCLP) as per EPA 1311, which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrite by IC (TCLP)	E240.NO2 ALS Environmental - Waterloo	Soil/Solid	EPA 1311/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining an extract produced by the Toxicity Characteristic Leachate Procedure (TCLP) as per EPA 1311, which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate by IC (TCLP)	E240.NO3 ALS Environmental - Waterloo	Soil/Solid	EPA 1311/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining an extract produced by the Toxicity Characteristic Leachate Procedure (TCLP) as per EPA 1311, which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
WAD Cyanide (0.01M NaOH Extraction)	E336A ALS Environmental - Waterloo	Soil/Solid	APHA 4500-CN I (mod)	Weak Acid Dissociable (WAD) cyanide is determined after extraction by Continuous Flow Analyzer (CFA) with in-line distillation followed by colourmetric analysis.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
WAD Cyanide (TCLP)	E337A ALS Environmental - Waterloo	Soil/Solid	APHA 4500-CN I (mod)	Weak Acid Dissociable (WAD) cyanide is determined after extraction by Continuous Flow Analyzer (CFA) with in-line distillation followed by colourmetric analysis.
Metals in Soil/Solid by CRC ICPMS (<355 µm)	E440C ALS Environmental - Waterloo	Soil/Solid	EPA 6020B (mod)	This method is intended to liberate metals that may be environmentally available. Samples are dried, then sieved through a 355 µm sieve, and digested with HNO3 and HCl. Dependent on sample matrix, some metals may be only partially recovered, including Al, Ba, Be, Cr, Sr, Ti, Tl, V, W, and Zr. Silicate minerals are not solubilized. Volatile forms of sulfur (including sulfide) may not be captured, as they may be lost during sampling, storage, or digestion. This method does not adequately recover elemental sulfur, and is unsuitable for assessment of elemental sulfur standards or guidelines. Analysis is by Collision/Reaction Cell ICPMS.
Metals by CRC ICPMS (mSPLP)	E443 ALS Environmental - Waterloo	Soil/Solid	EPA 6020B (mod)	An extract produced by the modified Simulated Precipitation Leachate Procedure (mSPLP) as per E9003 (ON MECP), is analyzed by Collision/Reaction Cell ICPMS.
Metals by CRC ICPMS (TCLP)	E444 ALS Environmental - Waterloo	Soil/Solid	EPA 1311/6020B (mod)	An extract produced by the Toxicity Characteristic Leachate Procedure (TCLP) as per EPA 1311 is analyzed by Collision/Reaction Cell ICPMS.
Sodium Adsorption Ratio (SAR) - 1:2 Soil:Water (Dry)	E484 ALS Environmental - Waterloo	Soil/Solid	SW846 6010C	A dried, disaggregated solid sample is extracted with deionized water, the aqueous extract is separated from the solid, acidified and then analyzed using a ICP/OES. The concentrations of Na, Ca and Mg are reported as per CALA requirements for calculated parameters. These individual parameters are not for comparison to any guideline.
Boron-Hot Water Extractable by ICPOES	E487 ALS Environmental - Waterloo	Soil/Solid	HW EXTR, EPA 6010B	A dried solid sample is extracted with calcium chloride, the sample undergoes a heating process. After cooling the sample is filtered and analyzed by ICP/OES. Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).
Mercury in Soil/Solid by CVAAS (<355 µm)	E510C ALS Environmental - Waterloo	Soil/Solid	EPA 200.2/1631 Appendix (mod)	Samples are sieved through a 355 µm sieve, and digested with HNO3 and HCl, followed by CVAAS analysis.
Mercury by CVAAS (TCLP)	E512 ALS Environmental - Waterloo	Soil/Solid	SW 846 -1311/245.1 CVAA ON TCLP LEACHATE	An extract produced by the Toxicity Characteristic Leachate Procedure (TCLP) as per EPA 1311 is analyzed by CVAAS.
Hexavalent Chromium (Cr VI) by IC	E532 ALS Environmental - Waterloo	Soil/Solid	APHA 3500-CR C	Instrumental analysis is performed by ion chromatography with UV detection.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
CCME PHC - F1 by Headspace GC-FID	E581.F1 ALS Environmental - Waterloo	Soil/Solid	CCME PHC in Soil - Tier 1	CCME Fraction 1 (F1) is analyzed by static headspace GC-FID. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law. Analytical methods for CCME Petroleum Hydrocarbons (PHCs) are validated to comply fully with the Reference Method for the Canada-Wide Standard for PHC. Test results are expressed on a dry weight basis. Unless qualified, all required quality control criteria of the CCME PHC method have been met, including response factor and linearity requirements.
CCME PHCs - F2-F4 by GC-FID (Low Level)	E601.SG-L ALS Environmental - Waterloo	Soil/Solid	CCME PHC in Soil - Tier 1	Sample extracts are subjected to in-situ silica gel treatment prior to analysis by GC-FID for CCME hydrocarbon fractions (F2-F4). Analytical methods for CCME Petroleum Hydrocarbons (PHCs) are validated to comply fully with the Reference Method for the Canada-Wide Standard for PHC. Test results are expressed on a dry weight basis. Unless qualified, all required quality control criteria of the CCME PHC method have been met, including response factor and linearity requirements.
VOCs (Eastern Canada List) by Headspace GC-MS	E611D ALS Environmental - Waterloo	Soil/Solid	EPA 8260D (mod)	Volatile Organic Compounds (VOCs) are analyzed by static headspace GC-MS. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.
VOCs by Headspace GC-MS (TCLP)	E615B ALS Environmental - Waterloo	Soil/Solid	EPA 8260D (mod)	Volatile Organic Compounds (VOCs) are analyzed by static headspace GC-MS. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.
VOCs by Headspace GC-MS (ON mSPLP)	E619D ALS Environmental - Waterloo	Soil/Solid	EPA 8260D (mod)	Volatile Organic Compounds (VOCs) are analyzed by static headspace GC-MS. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.
PAHs in Soil/solid by Hex:Ace GC-MS	E641A ALS Environmental - Waterloo	Soil/Solid	EPA 8270E (mod)	Polycyclic Aromatic Hydrocarbons (PAHs) are extracted with hexane/acetone and analyzed by GC-MS. If reported, IACR (index of additive cancer risk, unitless) and B(a)P toxic potency equivalent (in soil concentration units) are calculated as per CCME PAH Soil Quality Guidelines fact sheet (2010) or ABT1.
PAHs by GC-MS (TCLP)	E644 ALS Environmental - Waterloo	Soil/Solid	EPA 8270E (mod)	Polycyclic Aromatic Hydrocarbons (PAHs) are analyzed by GC-MS.
BNA by GC-MS (TCLP)	E656 ALS Environmental - Waterloo	Soil/Solid	EPA 8270E (mod)	BNA are analyzed by GC-MS.
Pyridine by GC-MS (TCLP)	E667A	Soil/Solid	EPA 8260D (mod)	Pyridine is analyzed by GC-MS.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
	ALS Environmental - Waterloo			
PCB Aroclors by GC-MS	E687 ALS Environmental - Waterloo	Soil/Solid	EPA 8270E (mod)	PCB Aroclors are analyzed by GC-MS
Nitrate and Nitrite (as N), (TCLP) (Calculation)	EC240.N+N ALS Environmental - Waterloo	Soil/Solid	EPA 300.0	Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).
F1-BTEX	EC580 ALS Environmental - Waterloo	Soil/Solid	CCME PHC in Soil - Tier 1	F1-BTEX is calculated as follows: F1-BTEX = F1 (C6-C10) minus benzene, toluene, ethylbenzene and xylenes (BTEX).
Sum F1 to F4 (C6-C50)	EC581 ALS Environmental - Waterloo	Soil/Solid	CCME PHC in Soil - Tier 1	Hydrocarbons, total (C6-C50) is the sum of CCME Fractions F1(C6-C10), F2(C10-C16), F3(C16-C34), and F4(C34-C50). F4G-sg is not used within this calculation due to overlap with other fractions.
F2 to F3 minus PAH	EC600 ALS Environmental - Waterloo	Soil/Solid	CCME PHC in Soil - Tier 1	F2-Naphthalene = CCME Fraction 2 (C10-C16) minus Naphthalene F3-PAH = CCME Fraction 3 (C16-C34) minus sPhenanthrene, Fluoranthene, Pyrene, Benz(a)anthracene, benzo(b+j)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-c,d)pyrene, and Dibenz(a,h)anthracene.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Leach 1:2 Soil:Water for pH/EC	EP108 ALS Environmental - Waterloo	Soil/Solid	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL	The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water.
Leach 1:2 Soil : 0.01CaCl2 - As Received for pH	EP108A ALS Environmental - Waterloo	Soil/Solid	MOEE E3137A	A minimum 10g portion of the sample, as received, is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil by centrifuging, settling or decanting and then analyzed using a pH meter and electrode.
Cyanide Extraction for CFA (0.01M NaOH)	EP333A ALS Environmental - Waterloo	Soil/Solid	ON MECP E3015 (mod)	Extraction for various cyanide analysis is by rotary extraction of the soil with 0.01M Sodium Hydroxide.
Digestion for Metals and Mercury (355 µm Sieve)	EP440C ALS Environmental - Waterloo	Soil/Solid	EPA 200.2 (mod)	Samples are sieved through a 355 µm sieve, and digested with HNO3 and HCl. This method is intended to liberate metals that may be environmentally available.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Boron-Hot Water Extractable	EP487 ALS Environmental - Waterloo	Soil/Solid	HW EXTR, EPA 6010B	A dried solid sample is extracted with weak calcium chloride, the sample undergoes a heating process. After cooling the sample is filtered and analyzed by ICP/OES. Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011)
Preparation of Hexavalent Chromium (Cr VI) for IC	EP532 ALS Environmental - Waterloo	Soil/Solid	EPA 3060A	Field moist samples are digested with a sodium hydroxide/sodium carbonate solution as described in EPA 3060A.
VOCs Methanol Extraction for Headspace Analysis	EP581 ALS Environmental - Waterloo	Soil/Solid	EPA 5035A (mod)	VOCs in samples are extracted with methanol. Extracts are then prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.
VOCs Preparation for Headspace Analysis (TCLP)	EP582 ALS Environmental - Waterloo	Soil/Solid	EPA 5021A (mod)	Liquid obtained after the TCLP process is prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.
VOCs Preparation for Headspace Analysis (mSPLP)	EP586 ALS Environmental - Waterloo	Soil/Solid	EPA 5021A (mod)	Liquid obtained after the mSPLP process is prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.
PHCs and PAHs Hexane-Acetone Tumbler Extraction	EP601 ALS Environmental - Waterloo	Soil/Solid	CCME PHC in Soil - Tier 1 (mod)	Samples are subsampled and Petroleum Hydrocarbons (PHC) and PAHs are extracted with 1:1 hexane:acetone using a rotary extractor.
PHCs and PAHs Extraction (TCLP)	EP602 ALS Environmental - Waterloo	Soil/Solid	EPA 3511 (mod)	Petroleum Hydrocarbons (PHCs) and Polycyclic Aromatic Hydrocarbons (PAHs) are extracted using a hexane liquid-liquid extraction.
BNA Extraction (TCLP)	EP656 ALS Environmental - Waterloo	Soil/Solid	EPA 3510C (mod)	SVOCs are extracted from aqueous sample using DCM liquid-liquid extraction.
Pesticides, PCB, PAH, and Neutral Extractable Chlorinated Hydrocarbons Extraction	EP660 ALS Environmental - Waterloo	Soil/Solid	EPA 3570 (mod)	A homogenized subsample is extracted with organic solvents using a mechanical shaker.
Pyridine Preparation (TCLP)	EP667A ALS Environmental - Waterloo	Soil/Solid	EPA 8260D (mod)	Aqueous sample is directly injected to a GC.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
mSPLP Leachate Preparation (Metals, Inorganics, and SVOCs)	EPP443 ALS Environmental - Waterloo	Soil/Solid	E9003	Preparation of the modified Synthetic Precipitation Leaching Procedure, ON MECP 2020 . A representative subsample of soil excluding stones and passed through a 9.5 mm sieve, (100 grams) is leached (18 ± 2 hours) with 2.0 liters of leaching fluid #2 (pH 5, 60:40 weight mixture of H2SO4:HNO3). The resulting slurry is filtered through a 0.6 - 0.8 um glass fiber filter for semi-volatile organics and for metals analysis, the leachate is filtered through a 0.45um metal free filter.
TCLP Leachate Preparation (Metals, Inorganics, and SVOCs)	EPP444 ALS Environmental - Waterloo	Soil/Solid	EPA 1311	Preparation of a Toxicity Characteristic Leaching Procedure (TCLP) solid sample involves particle size reduction, homogenization, then determination of appropriate extraction fluid. A measured portion of fresh subsample is placed in an extraction bottle with the appropriate extraction fluid then tumbled in a rotary extractor for 18+/- 2 hours at 23 +/- 2 C. The liquid leachate is filtered to separate from solids then bottled and prepared for analytical tests.
TCLP Leachate Preparation (VOCs)	EPP582 ALS Environmental - Waterloo	Soil/Solid	EPA 1311	An extract produced by the Toxicity Characteristic Leaching Procedure (TCLP) as per EPA 1311.
mSPLP Leachate Preparation (VOCs and Cyanide)	EPP584 ALS Environmental - Waterloo	Soil/Solid	E9003	The excess soil sample (25 grams) is leached in a Zero Headspace Extractor (ZHE) with 500 mL extraction fluid #3 (reagent water) for 18 ± 2 hours. Collect the filtered extract (0.6 - 0.8 um glass fiber) from the ZHE device. The sample is transferred into PTFE-lined septum-capped glass vials (with no headspace) for analysis of VOCs. A minimum of 50 mL leachate is collected in a glass or plastic container, preserved with sodium hydroxide to a pH >12 at the time of collection and submitted for cyanide analysis.

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QUALITY CONTROL REPORT

Work Order	: **WT2423419**	Page	: 1 of 38
Client	: GHD Limited	Laboratory	: ALS Environmental - Waterloo
Contact	: Jennifer Balkwill	Account Manager	: Rick Hawthorne
Address	: 455 Phillip Street Waterloo ON Canada N2L 3X2	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	: 604 748 3661	Telephone	: +1 519 886 6910
Project	: 12642634-02	Date Samples Received	: 14-Aug-2024 13:37
PO	: 735-011200	Date Analysis Commenced	: 14-Aug-2024
C-O-C number	: ----	Issue Date	: 22-Aug-2024 13:50
Sampler	: RD		
Site	: ----		
Quote number	: 12642634-02 _ COT - 735-011200		
No. of samples received	: 11		
No. of samples analysed	: 11		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
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Nik Perkio	Senior Analyst	Waterloo Metals, Waterloo, Ontario
Niral Patel		Waterloo Centralized Prep, Waterloo, Ontario
Robert Braun	Soils Team Supervisor	Waterloo Inorganics, Waterloo, Ontario

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Physical Tests (QC Lot: 1596483)											
WT2423278-001	Anonymous	pH (1:2 soil:CaCl2-aq)	----	E108A	0.10	pH units	7.78	7.75	0.386%	5%	----
Physical Tests (QC Lot: 1596485)											
WT2423278-001	Anonymous	Conductivity (1:2 leachate)	----	E100-L	5.00	µS/cm	0.288 mS/cm	313	8.32%	20%	----
Physical Tests (QC Lot: 1596489)											
WT2423278-001	Anonymous	Moisture	----	E144	0.25	%	15.5	15.6	0.577%	20%	----
Physical Tests (QC Lot: 1597643)											
WT2423344-006	Anonymous	Conductivity (1:2 leachate)	----	E100-L	5.00	µS/cm	0.370 mS/cm	369	0.271%	20%	----
Physical Tests (QC Lot: 1597645)											
WT2423344-001	Anonymous	pH (1:2 soil:CaCl2-aq)	----	E108A	0.10	pH units	8.01	8.03	0.249%	5%	----
Physical Tests (QC Lot: 1599874)											
WT2423678-001	Anonymous	Moisture	----	E144	0.25	%	13.5	12.6	7.17%	20%	----
Physical Tests (QC Lot: 1600128)											
WT2423335-001	Anonymous	Moisture	----	E144	0.25	%	69.7	71.3	2.18%	20%	----
Cyanides (QC Lot: 1596780)											
WT2423387-001	Anonymous	Cyanide, weak acid dissociable	----	E336A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
Cyanides (QC Lot: 1601471)											
WT2423390-001	Anonymous	Cyanide, weak acid dissociable	----	E336A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
Metals (QC Lot: 1596484)											
WT2423278-001	Anonymous	Calcium, soluble ion content	7440-70-2	E484	0.50	mg/L	4.21	4.51	6.88%	30%	----
		Magnesium, soluble ion content	7439-95-4	E484	0.50	mg/L	0.67	0.69	0.02	Diff <2x LOR	----
		Sodium, soluble ion content	17341-25-2	E484	0.50	mg/L	40.6	45.2	10.7%	30%	----
Metals (QC Lot: 1596486)											
WT2423278-001	Anonymous	Boron, hot water soluble	7440-42-8	E487	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
Metals (QC Lot: 1596487)											
WT2423278-001	Anonymous	Mercury	7439-97-6	E510C	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----
Metals (QC Lot: 1596488)											
WT2423278-001	Anonymous	Antimony	7440-36-0	E440C	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		Arsenic	7440-38-2	E440C	0.10	mg/kg	1.03	0.97	5.17%	30%	----
		Barium	7440-39-3	E440C	0.50	mg/kg	5.10	5.18	1.56%	40%	----
		Beryllium	7440-41-7	E440C	0.10	mg/kg	<0.10	0.10	0.002	Diff <2x LOR	----

Sub-Matrix: **Soil/Solid**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Metals (QC Lot: 1596488) - continued											
WT2423278-001	Anonymous	Boron	7440-42-8	E440C	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
		Cadmium	7440-43-9	E440C	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		Chromium	7440-47-3	E440C	0.50	mg/kg	4.98	5.01	0.472%	30%	----
		Cobalt	7440-48-4	E440C	0.10	mg/kg	1.40	1.32	5.54%	30%	----
		Copper	7440-50-8	E440C	0.50	mg/kg	2.85	2.94	0.09	Diff <2x LOR	----
		Lead	7439-92-1	E440C	0.50	mg/kg	1.90	2.07	0.18	Diff <2x LOR	----
		Molybdenum	7439-98-7	E440C	0.10	mg/kg	0.10	<0.10	0.006	Diff <2x LOR	----
		Nickel	7440-02-0	E440C	0.50	mg/kg	2.60	2.55	0.05	Diff <2x LOR	----
		Selenium	7782-49-2	E440C	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		Silver	7440-22-4	E440C	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		Thallium	7440-28-0	E440C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Uranium	7440-61-1	E440C	0.050	mg/kg	0.266	0.261	0.006	Diff <2x LOR	----
		Vanadium	7440-62-2	E440C	0.20	mg/kg	12.9	13.0	1.07%	30%	----
		Zinc	7440-66-6	E440C	2.0	mg/kg	6.5	7.0	0.4	Diff <2x LOR	----
Metals (QC Lot: 1597644)											
WT2423344-006	Anonymous	Calcium, soluble ion content	7440-70-2	E484	0.50	mg/L	4.60	4.40	4.44%	30%	----
		Magnesium, soluble ion content	7439-95-4	E484	0.50	mg/L	3.44	2.53	0.91	Diff <2x LOR	----
		Sodium, soluble ion content	17341-25-2	E484	0.50	mg/L	58.3	58.1	0.344%	30%	----
Metals (QC Lot: 1597648)											
WT2423355-001	Anonymous	Antimony	7440-36-0	E440C	0.10	mg/kg	4.33	4.50	3.85%	30%	----
		Arsenic	7440-38-2	E440C	0.10	mg/kg	12.8	13.1	1.63%	30%	----
		Barium	7440-39-3	E440C	0.50	mg/kg	236	224	5.37%	40%	----
		Beryllium	7440-41-7	E440C	0.10	mg/kg	0.56	0.54	0.02	Diff <2x LOR	----
		Boron	7440-42-8	E440C	5.0	mg/kg	12.8	13.8	1.0	Diff <2x LOR	----
		Cadmium	7440-43-9	E440C	0.020	mg/kg	0.854	0.870	1.86%	30%	----
		Chromium	7440-47-3	E440C	0.50	mg/kg	15.9	15.9	0.377%	30%	----
		Cobalt	7440-48-4	E440C	0.10	mg/kg	6.42	6.31	1.72%	30%	----
		Copper	7440-50-8	E440C	0.50	mg/kg	244	251	2.66%	30%	----
		Lead	7439-92-1	E440C	0.50	mg/kg	333	339	1.88%	40%	----
		Molybdenum	7439-98-7	E440C	0.10	mg/kg	1.64	1.68	2.32%	40%	----
		Nickel	7440-02-0	E440C	0.50	mg/kg	14.9	15.2	2.25%	30%	----
		Selenium	7782-49-2	E440C	0.20	mg/kg	4.25	4.54	6.64%	30%	----
		Silver	7440-22-4	E440C	0.10	mg/kg	0.47	0.50	0.03	Diff <2x LOR	----
		Thallium	7440-28-0	E440C	0.050	mg/kg	0.274	0.273	0.001	Diff <2x LOR	----

Sub-Matrix: **Soil/Solid**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Metals (QC Lot: 1597648) - continued											
WT2423355-001	Anonymous	Uranium	7440-61-1	E440C	0.050	mg/kg	0.477	0.510	6.70%	30%	----
		Vanadium	7440-62-2	E440C	0.20	mg/kg	23.6	23.3	1.15%	30%	----
		Zinc	7440-66-6	E440C	2.0	mg/kg	396	391	1.39%	30%	----
Metals (QC Lot: 1597649)											
WT2423355-001	Anonymous	Mercury	7439-97-6	E510C	0.0050	mg/kg	0.666	0.695	4.28%	40%	----
Metals (QC Lot: 1597650)											
WT2423419-004	BH04-24	Boron, hot water soluble	7440-42-8	E487	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
Speciated Metals (QC Lot: 1596783)											
WT2423387-001	Anonymous	Chromium, hexavalent [Cr VI]	18540-29-9	E532	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
Speciated Metals (QC Lot: 1601472)											
WT2423390-001	Anonymous	Chromium, hexavalent [Cr VI]	18540-29-9	E532	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
TCLP Extractables (QC Lot: 1599677)											
WT2423098-001	Anonymous	Fluoride, TCLP	16984-48-8	E240.F	10	mg/L	<10	<10	0	Diff <2x LOR	----
TCLP Extractables (QC Lot: 1599678)											
WT2423098-001	Anonymous	Nitrate (as N), TCLP	14797-55-8	E240.NO3	5.0	mg/L	<5.0	<5.0	0	Diff <2x LOR	----
TCLP Extractables (QC Lot: 1599679)											
WT2423098-001	Anonymous	Nitrite (as N), TCLP	14797-65-0	E240.NO2	5.0	mg/L	<5.0	<5.0	0	Diff <2x LOR	----
TCLP Extractables (QC Lot: 1600322)											
WT2423098-001	Anonymous	Cyanide, weak acid dissociable, TCLP	----	E337A	0.10	mg/L	<0.10	<0.10	0	Diff <2x LOR	----
TCLP Extractables (QC Lot: 1600366)											
WT2423098-001	Anonymous	Benzo(a)pyrene, TCLP	50-32-8	E644	0.20	µg/L	<0.00020 mg/L	<0.20	0	Diff <2x LOR	----
TCLP Extractables (QC Lot: 1603116)											
WT2423419-011	TCLP	Pyridine, TCLP	110-86-1	E667A	2.0	mg/L	<2.0	<2.0	0	Diff <2x LOR	----
TCLP Extractables (QC Lot: 1604069)											
WT2423419-011	TCLP	Dichlorophenol, 2,4-, TCLP	120-83-2	E656	5.0	µg/L	<0.0050 mg/L	<5.0	0	Diff <2x LOR	----
		Dinitrotoluene, 2,4-, TCLP	121-14-2	E656	4.0	µg/L	<0.0040 mg/L	<4.0	0	Diff <2x LOR	----
		Hexachlorobenzene, TCLP	118-74-1	E656	4.0	µg/L	<0.0040 mg/L	<4.0	0	Diff <2x LOR	----
		Hexachlorobutadiene, TCLP	87-68-3	E656	4.0	µg/L	<0.0040 mg/L	<4.0	0	Diff <2x LOR	----
		Hexachloroethane, TCLP	67-72-1	E656	4.0	µg/L	<0.0040 mg/L	<4.0	0	Diff <2x LOR	----
		Methylphenol, 2-, TCLP	95-48-7	E656	5.0	µg/L	<0.0050 mg/L	<5.0	0	Diff <2x LOR	----
		Methylphenol, 3+4-, TCLP	----	E656	10	µg/L	<0.010 mg/L	<10	0	Diff <2x LOR	----
		Nitrobenzene, TCLP	98-95-3	E656	4.0	µg/L	<0.0040 mg/L	<4.0	0	Diff <2x LOR	----
		Pentachlorophenol [PCP], TCLP	87-86-5	E656	5.0	µg/L	<0.0050 mg/L	<5.0	0	Diff <2x LOR	----

Sub-Matrix: **Soil/Solid**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
TCLP Extractables (QC Lot: 1604069) - continued											
WT2423419-011	TCLP	Tetrachlorophenol, 2,3,4,6-, TCLP	58-90-2	E656	5.0	µg/L	<0.0050 mg/L	<5.0	0	Diff <2x LOR	----
		Trichlorophenol, 2,4,5-, TCLP	95-95-4	E656	5.0	µg/L	<0.0050 mg/L	<5.0	0	Diff <2x LOR	----
		Trichlorophenol, 2,4,6-, TCLP	88-06-2	E656	5.0	µg/L	<0.0050 mg/L	<5.0	0	Diff <2x LOR	----
TCLP Metals (QC Lot: 1599521)											
WT2423378-001	Anonymous	Mercury, TCLP	7439-97-6	E512	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
TCLP Metals (QC Lot: 1599537)											
WT2423378-001	Anonymous	Arsenic, TCLP	7440-38-2	E444	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		Barium, TCLP	7440-39-3	E444	2.5	mg/L	<2.5	<2.5	0	Diff <2x LOR	----
		Boron, TCLP	7440-42-8	E444	0.50	mg/L	1.24	1.29	0.05	Diff <2x LOR	----
		Cadmium, TCLP	7440-43-9	E444	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
		Chromium, TCLP	7440-47-3	E444	0.25	mg/L	<0.25	<0.25	0	Diff <2x LOR	----
		Lead, TCLP	7439-92-1	E444	0.25	mg/L	<0.25	<0.25	0	Diff <2x LOR	----
		Selenium, TCLP	7782-49-2	E444	0.10	mg/L	<0.10	<0.10	0	Diff <2x LOR	----
		Silver, TCLP	7440-22-4	E444	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
		Uranium, TCLP	7440-61-1	E444	0.20	mg/L	<0.20	<0.20	0	Diff <2x LOR	----
TCLP VOCs (QC Lot: 1599615)											
WT2423098-001	Anonymous	Benzene, TCLP	71-43-2	E615B	5.0	µg/L	<0.0050 mg/L	<5.0	0	Diff <2x LOR	----
		Carbon tetrachloride, TCLP	56-23-5	E615B	25	µg/L	<0.025 mg/L	<25	0	Diff <2x LOR	----
		Chlorobenzene, TCLP	108-90-7	E615B	25	µg/L	<0.025 mg/L	<25	0	Diff <2x LOR	----
		Chloroform, TCLP	67-66-3	E615B	100	µg/L	<0.10 mg/L	<100	0	Diff <2x LOR	----
		Dichlorobenzene, 1,2-, TCLP	95-50-1	E615B	25	µg/L	<0.025 mg/L	<25	0	Diff <2x LOR	----
		Dichlorobenzene, 1,4-, TCLP	106-46-7	E615B	25	µg/L	<0.025 mg/L	<25	0	Diff <2x LOR	----
		Dichloroethane, 1,2-, TCLP	107-06-2	E615B	25	µg/L	<0.025 mg/L	<25	0	Diff <2x LOR	----
		Dichloroethylene, 1,1-, TCLP	75-35-4	E615B	25	µg/L	<0.025 mg/L	<25	0	Diff <2x LOR	----
		Dichloromethane, TCLP	75-09-2	E615B	100	µg/L	<0.10 mg/L	<100	0	Diff <2x LOR	----
		Methyl ethyl ketone [MEK], TCLP	78-93-3	E615B	100	µg/L	<0.10 mg/L	<100	0	Diff <2x LOR	----
		Tetrachloroethylene, TCLP	127-18-4	E615B	25	µg/L	<0.025 mg/L	<25	0	Diff <2x LOR	----
		Trichloroethylene, TCLP	79-01-6	E615B	25	µg/L	<0.025 mg/L	<25	0	Diff <2x LOR	----
		Vinyl chloride, TCLP	75-01-4	E615B	50	µg/L	<0.050 mg/L	<50	0	Diff <2x LOR	----
ON mSPLP Metal (target pH= 5) (QC Lot: 1602986)											
WT2423419-006	BH02-24-MSPLP	Antimony, mSPLP	7440-36-0	E443	0.00050	mg/L	<0.50 µg/L	<0.00050	0	Diff <2x LOR	----
		Arsenic, mSPLP	7440-38-2	E443	0.0010	mg/L	10.8 µg/L	0.0114	4.60%	25%	----
		Barium, mSPLP	7440-39-3	E443	0.002	mg/L	240 µg/L	0.228	5.17%	25%	----
		Beryllium, mSPLP	7440-41-7	E443	0.00050	mg/L	1.76 µg/L	0.00168	0.00008	Diff <2x LOR	----

Sub-Matrix: **Soil/Solid**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
ON mSPLP Metal (target pH= 5) (QC Lot: 1602986) - continued											
WT2423419-006	BH02-24-MSPLP	Boron, mSPLP	7440-42-8	E443	0.010	mg/L	14 µg/L	0.014	0.0002	Diff <2x LOR	----
		Cadmium, mSPLP	7440-43-9	E443	0.00010	mg/L	<0.10 µg/L	<0.00010	0	Diff <2x LOR	----
		Chromium, mSPLP	7440-47-3	E443	0.0050	mg/L	53.9 µg/L	0.0508	5.94%	25%	----
		Cobalt, mSPLP	7440-48-4	E443	0.0010	mg/L	9.2 µg/L	0.0090	1.84%	25%	----
		Copper, mSPLP	7440-50-8	E443	0.0050	mg/L	67.3 µg/L	0.0646	4.18%	25%	----
		Lead, mSPLP	7439-92-1	E443	0.0010	mg/L	16.6 µg/L	0.0156	6.04%	25%	----
		Molybdenum, mSPLP	7439-98-7	E443	0.00050	mg/L	<0.50 µg/L	0.00055	0.00005	Diff <2x LOR	----
		Nickel, mSPLP	7440-02-0	E443	0.0010	mg/L	43.8 µg/L	0.0408	7.07%	25%	----
		Selenium, mSPLP	7782-49-2	E443	0.0010	mg/L	<1.0 µg/L	<0.0010	0	Diff <2x LOR	----
		Silver, mSPLP	7440-22-4	E443	0.00025	mg/L	<0.25 µg/L	<0.00025	0	Diff <2x LOR	----
		Thallium, mSPLP	7440-28-0	E443	0.00050	mg/L	<0.50 µg/L	<0.00050	0	Diff <2x LOR	----
		Uranium, mSPLP	7440-61-1	E443	0.0020	mg/L	<2.0 µg/L	<0.0020	0	Diff <2x LOR	----
		Vanadium, mSPLP	7440-62-2	E443	0.00050	mg/L	67.0 µg/L	0.0656	2.15%	25%	----
		Zinc, mSPLP	7440-66-6	E443	0.0050	mg/L	91.8 µg/L	0.0891	2.98%	25%	----
mSPLP VOCs (QC Lot: 1603208)											
WT2423399-007	Anonymous	Bromomethane, mSPLP	74-83-9	E619D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		Carbon tetrachloride, mSPLP	56-23-5	E619D	0.20	µg/L	<0.20	<0.20	0	Diff <2x LOR	----
		Chloroform, mSPLP	67-66-3	E619D	1.00	µg/L	<1.00	<1.00	0	Diff <2x LOR	----
		Dibromoethane, 1,2-, mSPLP	106-93-4	E619D	0.20	µg/L	<0.20	<0.20	0	Diff <2x LOR	----
		Dichlorobenzene, 1,2-, mSPLP	95-50-1	E619D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		Dichlorobenzene, 1,4-, mSPLP	106-46-7	E619D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		Dichloroethane, 1,1-, mSPLP	75-34-3	E619D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		Dichloroethane, 1,2-, mSPLP	107-06-2	E619D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		Dichloroethylene, 1,1-, mSPLP	75-35-4	E619D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		Dichloroethylene, cis-1,2-, mSPLP	156-59-2	E619D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		Dichloroethylene, trans-1,2-, mSPLP	156-60-5	E619D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		Dichloropropane, 1,2-, mSPLP	78-87-5	E619D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		Dichloropropylene, cis-1,3-, mSPLP	10061-01-5	E619D	0.20	µg/L	<0.20	<0.20	0	Diff <2x LOR	----
		Dichloropropylene, trans-1,3-, mSPLP	10061-02-6	E619D	0.20	µg/L	<0.20	<0.20	0	Diff <2x LOR	----
		Tetrachloroethane, 1,1,1,2-, mSPLP	630-20-6	E619D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		Tetrachloroethane, 1,1,2,2-, mSPLP	630-20-6	E619D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		Tetrachloroethylene, mSPLP	127-18-4	E619D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		Trichloroethane, 1,1,2-, mSPLP	79-00-5	E619D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		Trichloroethylene, mSPLP	79-01-6	E619D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Volatile Organic Compounds (QC Lot: 1596541)											
WT2423271-001	Anonymous	Acetone	67-64-1	E611D	0.50	mg/kg	1.83	1.82	0.01	Diff <2x LOR	----
		Benzene	71-43-2	E611D	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----
		Bromodichloromethane	75-27-4	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Bromoform	75-25-2	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Bromomethane	74-83-9	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Carbon tetrachloride	56-23-5	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Chlorobenzene	108-90-7	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Chloroform	67-66-3	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Dibromochloromethane	124-48-1	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Dibromoethane, 1,2-	106-93-4	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Dichlorobenzene, 1,2-	95-50-1	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Dichlorobenzene, 1,3-	541-73-1	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Dichlorobenzene, 1,4-	106-46-7	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Dichlorodifluoromethane	75-71-8	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Dichloroethane, 1,1-	75-34-3	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Dichloroethane, 1,2-	107-06-2	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Dichloroethylene, 1,1-	75-35-4	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Dichloroethylene, cis-1,2-	156-59-2	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Dichloroethylene, trans-1,2-	156-60-5	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Dichloromethane	75-09-2	E611D	0.045	mg/kg	<0.045	<0.045	0	Diff <2x LOR	----
		Dichloropropane, 1,2-	78-87-5	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Dichloropropylene, cis-1,3-	10061-01-5	E611D	0.030	mg/kg	<0.030	<0.030	0	Diff <2x LOR	----
		Dichloropropylene, trans-1,3-	10061-02-6	E611D	0.030	mg/kg	<0.030	<0.030	0	Diff <2x LOR	----
		Ethylbenzene	100-41-4	E611D	0.015	mg/kg	<0.015	<0.015	0	Diff <2x LOR	----
		Hexane, n-	110-54-3	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Methyl ethyl ketone [MEK]	78-93-3	E611D	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		Methyl isobutyl ketone [MIBK]	108-10-1	E611D	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		Methyl-tert-butyl ether [MTBE]	1634-04-4	E611D	0.040	mg/kg	<0.040	<0.040	0	Diff <2x LOR	----
		Styrene	100-42-5	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Tetrachloroethane, 1,1,1,2-	630-20-6	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Tetrachloroethane, 1,1,2,2-	79-34-5	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Tetrachloroethylene	127-18-4	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Toluene	108-88-3	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Trichloroethane, 1,1,1-	71-55-6	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----

Sub-Matrix: **Soil/Solid**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Volatile Organic Compounds (QC Lot: 1596541) - continued											
WT2423271-001	Anonymous	Trichloroethane, 1,1,2-	79-00-5	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Trichloroethylene	79-01-6	E611D	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Trichlorofluoromethane	75-69-4	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Vinyl chloride	75-01-4	E611D	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		Xylene, m+p-	179601-23-1	E611D	0.030	mg/kg	<0.030	<0.030	0	Diff <2x LOR	----
		Xylene, o-	95-47-6	E611D	0.030	mg/kg	<0.030	<0.030	0	Diff <2x LOR	----
Volatile Organic Compounds (QC Lot: 1596602)											
WT2423411-001	Anonymous	Acetone	67-64-1	E611D	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		Benzene	71-43-2	E611D	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----
		Bromodichloromethane	75-27-4	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Bromoform	75-25-2	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Bromomethane	74-83-9	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Carbon tetrachloride	56-23-5	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Chlorobenzene	108-90-7	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Chloroform	67-66-3	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Dibromochloromethane	124-48-1	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Dibromoethane, 1,2-	106-93-4	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Dichlorobenzene, 1,2-	95-50-1	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Dichlorobenzene, 1,3-	541-73-1	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Dichlorobenzene, 1,4-	106-46-7	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Dichlorodifluoromethane	75-71-8	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Dichloroethane, 1,1-	75-34-3	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Dichloroethane, 1,2-	107-06-2	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Dichloroethylene, 1,1-	75-35-4	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Dichloroethylene, cis-1,2-	156-59-2	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Dichloroethylene, trans-1,2-	156-60-5	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Dichloromethane	75-09-2	E611D	0.045	mg/kg	<0.045	<0.045	0	Diff <2x LOR	----
		Dichloropropane, 1,2-	78-87-5	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Dichloropropylene, cis-1,3-	10061-01-5	E611D	0.030	mg/kg	<0.030	<0.030	0	Diff <2x LOR	----
		Dichloropropylene, trans-1,3-	10061-02-6	E611D	0.030	mg/kg	<0.030	<0.030	0	Diff <2x LOR	----
		Ethylbenzene	100-41-4	E611D	0.015	mg/kg	<0.015	<0.015	0	Diff <2x LOR	----
		Hexane, n-	110-54-3	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Methyl ethyl ketone [MEK]	78-93-3	E611D	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		Methyl isobutyl ketone [MIBK]	108-10-1	E611D	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----

Sub-Matrix: **Soil/Solid**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Volatile Organic Compounds (QC Lot: 1596602) - continued											
WT2423411-001	Anonymous	Methyl-tert-butyl ether [MTBE]	1634-04-4	E611D	0.040	mg/kg	<0.040	<0.040	0	Diff <2x LOR	----
		Styrene	100-42-5	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Tetrachloroethane, 1,1,1,2-	630-20-6	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Tetrachloroethane, 1,1,2,2-	79-34-5	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Tetrachloroethylene	127-18-4	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Toluene	108-88-3	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Trichloroethane, 1,1,1-	71-55-6	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Trichloroethane, 1,1,2-	79-00-5	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Trichloroethylene	79-01-6	E611D	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Trichlorofluoromethane	75-69-4	E611D	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Vinyl chloride	75-01-4	E611D	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		Xylene, m+p-	179601-23-1	E611D	0.030	mg/kg	<0.030	<0.030	0	Diff <2x LOR	----
		Xylene, o-	95-47-6	E611D	0.030	mg/kg	<0.030	<0.030	0	Diff <2x LOR	----
Hydrocarbons (QC Lot: 1596542)											
WT2423271-001	Anonymous	F1 (C6-C10)	----	E581.F1	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
Hydrocarbons (QC Lot: 1596603)											
WT2423411-001	Anonymous	F1 (C6-C10)	----	E581.F1	5.0	mg/kg	<5.0 µg/g	<5.0	0	Diff <2x LOR	----
Hydrocarbons (QC Lot: 1597646)											
WT2423344-001	Anonymous	F2 (C10-C16)	----	E601.SG-L	10	mg/kg	<10	<10	0	Diff <2x LOR	----
		F3 (C16-C34)	----	E601.SG-L	50	mg/kg	<50	<50	0	Diff <2x LOR	----
		F4 (C34-C50)	----	E601.SG-L	50	mg/kg	<50	<50	0	Diff <2x LOR	----
Hydrocarbons (QC Lot: 1603038)											
WT2423399-003	Anonymous	F2 (C10-C16)	----	E601.SG-L	10	mg/kg	<10	<10	0	Diff <2x LOR	----
		F3 (C16-C34)	----	E601.SG-L	50	mg/kg	<50	<50	0	Diff <2x LOR	----
		F4 (C34-C50)	----	E601.SG-L	50	mg/kg	<50	<50	0	Diff <2x LOR	----
Polycyclic Aromatic Hydrocarbons (QC Lot: 1597647)											
WT2423344-001	Anonymous	Acenaphthene	83-32-9	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Acenaphthylene	208-96-8	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Anthracene	120-12-7	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Benz(a)anthracene	56-55-3	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Benzo(a)pyrene	50-32-8	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Benzo(b+j)fluoranthene	n/a	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Benzo(g,h,i)perylene	191-24-2	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Benzo(k)fluoranthene	207-08-9	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----

Sub-Matrix: **Soil/Solid**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Polycyclic Aromatic Hydrocarbons (QC Lot: 1597647) - continued											
WT2423344-001	Anonymous	Chrysene	218-01-9	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Dibenz(a,h)anthracene	53-70-3	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Fluoranthene	206-44-0	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Fluorene	86-73-7	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Methylnaphthalene, 1-	90-12-0	E641A	0.030	mg/kg	<0.030	<0.030	0	Diff <2x LOR	----
		Methylnaphthalene, 2-	91-57-6	E641A	0.030	mg/kg	<0.030	<0.030	0	Diff <2x LOR	----
		Naphthalene	91-20-3	E641A	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Phenanthrene	85-01-8	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Pyrene	129-00-0	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
Polycyclic Aromatic Hydrocarbons (QC Lot: 1603037)											
WT2423399-003	Anonymous	Acenaphthene	83-32-9	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Acenaphthylene	208-96-8	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Anthracene	120-12-7	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Benz(a)anthracene	56-55-3	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Benzo(a)pyrene	50-32-8	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Benzo(b+j)fluoranthene	n/a	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Benzo(g,h,i)perylene	191-24-2	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Benzo(k)fluoranthene	207-08-9	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Chrysene	218-01-9	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Dibenz(a,h)anthracene	53-70-3	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Fluoranthene	206-44-0	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Fluorene	86-73-7	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Methylnaphthalene, 1-	90-12-0	E641A	0.030	mg/kg	<0.030	<0.030	0	Diff <2x LOR	----
		Methylnaphthalene, 2-	91-57-6	E641A	0.030	mg/kg	<0.030	<0.030	0	Diff <2x LOR	----
		Naphthalene	91-20-3	E641A	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Phenanthrene	85-01-8	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Pyrene	129-00-0	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
Polychlorinated Biphenyls (QC Lot: 1603143)											
WT2423393-001	Anonymous	Aroclor 1016	12674-11-2	E687	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Aroclor 1221	11104-28-2	E687	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Aroclor 1232	11141-16-5	E687	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Aroclor 1242	53469-21-9	E687	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Polychlorinated Biphenyls (QC Lot: 1603143) - continued											
WT2423393-001	Anonymous	Aroclor 1248	12672-29-6	E687	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Aroclor 1254	11097-69-1	E687	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Aroclor 1260	11096-82-5	E687	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Aroclor 1262	37324-23-5	E687	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		Aroclor 1268	11100-14-4	E687	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 1596485)						
Conductivity (1:2 leachate)	----	E100-L	5	µS/cm	<5.00	----
Physical Tests (QCLot: 1596489)						
Moisture	----	E144	0.25	%	<0.25	----
Physical Tests (QCLot: 1597643)						
Conductivity (1:2 leachate)	----	E100-L	5	µS/cm	<5.00	----
Physical Tests (QCLot: 1599874)						
Moisture	----	E144	0.25	%	<0.25	----
Physical Tests (QCLot: 1600128)						
Moisture	----	E144	0.25	%	<0.25	----
Cyanides (QCLot: 1596780)						
Cyanide, weak acid dissociable	----	E336A	0.05	mg/kg	<0.050	----
Cyanides (QCLot: 1601471)						
Cyanide, weak acid dissociable	----	E336A	0.05	mg/kg	<0.050	----
Metals (QCLot: 1596484)						
Calcium, soluble ion content	7440-70-2	E484	0.5	mg/L	<0.50	----
Magnesium, soluble ion content	7439-95-4	E484	0.5	mg/L	<0.50	----
Sodium, soluble ion content	17341-25-2	E484	0.5	mg/L	<0.50	----
Metals (QCLot: 1596486)						
Boron, hot water soluble	7440-42-8	E487	0.1	mg/kg	<0.10	----
Metals (QCLot: 1596487)						
Mercury	7439-97-6	E510C	0.005	mg/kg	<0.0050	----
Metals (QCLot: 1596488)						
Antimony	7440-36-0	E440C	0.1	mg/kg	<0.10	----
Arsenic	7440-38-2	E440C	0.1	mg/kg	<0.10	----
Barium	7440-39-3	E440C	0.5	mg/kg	<0.50	----
Beryllium	7440-41-7	E440C	0.1	mg/kg	<0.10	----
Boron	7440-42-8	E440C	5	mg/kg	<5.0	----
Cadmium	7440-43-9	E440C	0.02	mg/kg	<0.020	----
Chromium	7440-47-3	E440C	0.5	mg/kg	<0.50	----
Cobalt	7440-48-4	E440C	0.1	mg/kg	<0.10	----
Copper	7440-50-8	E440C	0.5	mg/kg	<0.50	----
Lead	7439-92-1	E440C	0.5	mg/kg	<0.50	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 1596488) - continued						
Molybdenum	7439-98-7	E440C	0.1	mg/kg	<0.10	----
Nickel	7440-02-0	E440C	0.5	mg/kg	<0.50	----
Selenium	7782-49-2	E440C	0.2	mg/kg	<0.20	----
Silver	7440-22-4	E440C	0.1	mg/kg	<0.10	----
Thallium	7440-28-0	E440C	0.05	mg/kg	<0.050	----
Uranium	7440-61-1	E440C	0.05	mg/kg	<0.050	----
Vanadium	7440-62-2	E440C	0.2	mg/kg	<0.20	----
Zinc	7440-66-6	E440C	2	mg/kg	<2.0	----
Metals (QCLot: 1597644)						
Calcium, soluble ion content	7440-70-2	E484	0.5	mg/L	<0.50	----
Magnesium, soluble ion content	7439-95-4	E484	0.5	mg/L	<0.50	----
Sodium, soluble ion content	17341-25-2	E484	0.5	mg/L	<0.50	----
Metals (QCLot: 1597648)						
Antimony	7440-36-0	E440C	0.1	mg/kg	<0.10	----
Arsenic	7440-38-2	E440C	0.1	mg/kg	<0.10	----
Barium	7440-39-3	E440C	0.5	mg/kg	<0.50	----
Beryllium	7440-41-7	E440C	0.1	mg/kg	<0.10	----
Boron	7440-42-8	E440C	5	mg/kg	<5.0	----
Cadmium	7440-43-9	E440C	0.02	mg/kg	<0.020	----
Chromium	7440-47-3	E440C	0.5	mg/kg	<0.50	----
Cobalt	7440-48-4	E440C	0.1	mg/kg	<0.10	----
Copper	7440-50-8	E440C	0.5	mg/kg	<0.50	----
Lead	7439-92-1	E440C	0.5	mg/kg	<0.50	----
Molybdenum	7439-98-7	E440C	0.1	mg/kg	<0.10	----
Nickel	7440-02-0	E440C	0.5	mg/kg	<0.50	----
Selenium	7782-49-2	E440C	0.2	mg/kg	<0.20	----
Silver	7440-22-4	E440C	0.1	mg/kg	<0.10	----
Thallium	7440-28-0	E440C	0.05	mg/kg	<0.050	----
Uranium	7440-61-1	E440C	0.05	mg/kg	<0.050	----
Vanadium	7440-62-2	E440C	0.2	mg/kg	<0.20	----
Zinc	7440-66-6	E440C	2	mg/kg	<2.0	----
Metals (QCLot: 1597649)						
Mercury	7439-97-6	E510C	0.005	mg/kg	<0.0050	----
Metals (QCLot: 1597650)						
Boron, hot water soluble	7440-42-8	E487	0.1	mg/kg	<0.10	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Speciated Metals (QCLot: 1596783)						
Chromium, hexavalent [Cr VI]	18540-29-9	E532	0.1	mg/kg	<0.10	----
Speciated Metals (QCLot: 1601472)						
Chromium, hexavalent [Cr VI]	18540-29-9	E532	0.1	mg/kg	<0.10	----
TCLP Extractables (QCLot: 1599677)						
Fluoride, TCLP	16984-48-8	E240.F	10	mg/L	<10	----
TCLP Extractables (QCLot: 1599678)						
Nitrate (as N), TCLP	14797-55-8	E240.NO3	5	mg/L	<5.0	----
TCLP Extractables (QCLot: 1599679)						
Nitrite (as N), TCLP	14797-65-0	E240.NO2	5	mg/L	<5.0	----
TCLP Extractables (QCLot: 1600322)						
Cyanide, weak acid dissociable, TCLP	----	E337A	0.1	mg/L	<0.10	----
TCLP Extractables (QCLot: 1600366)						
Benzo(a)pyrene, TCLP	50-32-8	E644	0.2	µg/L	<0.20	----
TCLP Extractables (QCLot: 1603116)						
Pyridine, TCLP	110-86-1	E667A	2	mg/L	<2.0	----
TCLP Extractables (QCLot: 1604069)						
Dichlorophenol, 2,4-, TCLP	120-83-2	E656	5	µg/L	<5.0	----
Dinitrotoluene, 2,4-, TCLP	121-14-2	E656	4	µg/L	<4.0	----
Hexachlorobenzene, TCLP	118-74-1	E656	4	µg/L	<4.0	----
Hexachlorobutadiene, TCLP	87-68-3	E656	4	µg/L	<4.0	----
Hexachloroethane, TCLP	67-72-1	E656	4	µg/L	<4.0	----
Methylphenol, 2-, TCLP	95-48-7	E656	5	µg/L	<5.0	----
Methylphenol, 3+4-, TCLP	----	E656	10	µg/L	<10	----
Nitrobenzene, TCLP	98-95-3	E656	4	µg/L	<4.0	----
Pentachlorophenol [PCP], TCLP	87-86-5	E656	5	µg/L	<5.0	----
Tetrachlorophenol, 2,3,4,6-, TCLP	58-90-2	E656	5	µg/L	<5.0	----
Trichlorophenol, 2,4,5-, TCLP	95-95-4	E656	5	µg/L	<5.0	----
Trichlorophenol, 2,4,6-, TCLP	88-06-2	E656	5	µg/L	<5.0	----
TCLP Metals (QCLot: 1599521)						
Mercury, TCLP	7439-97-6	E512	0.001	mg/L	<0.0010	----
TCLP Metals (QCLot: 1599537)						
Arsenic, TCLP	7440-38-2	E444	1	mg/L	<1.0	----
Barium, TCLP	7440-39-3	E444	2.5	mg/L	<2.5	----
Boron, TCLP	7440-42-8	E444	0.5	mg/L	<0.50	----
Cadmium, TCLP	7440-43-9	E444	0.05	mg/L	<0.050	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
TCLP Metals (QCLot: 1599537) - continued						
Chromium, TCLP	7440-47-3	E444	0.25	mg/L	<0.25	----
Lead, TCLP	7439-92-1	E444	0.25	mg/L	<0.25	----
Selenium, TCLP	7782-49-2	E444	0.1	mg/L	<0.10	----
Silver, TCLP	7440-22-4	E444	0.05	mg/L	<0.050	----
Uranium, TCLP	7440-61-1	E444	0.2	mg/L	<0.20	----
TCLP VOCs (QCLot: 1599615)						
Benzene, TCLP	71-43-2	E615B	5	µg/L	<5.0	----
Carbon tetrachloride, TCLP	56-23-5	E615B	25	µg/L	<25	----
Chlorobenzene, TCLP	108-90-7	E615B	25	µg/L	<25	----
Chloroform, TCLP	67-66-3	E615B	100	µg/L	<100	----
Dichlorobenzene, 1,2-, TCLP	95-50-1	E615B	25	µg/L	<25	----
Dichlorobenzene, 1,4-, TCLP	106-46-7	E615B	25	µg/L	<25	----
Dichloroethane, 1,2-, TCLP	107-06-2	E615B	25	µg/L	<25	----
Dichloroethylene, 1,1-, TCLP	75-35-4	E615B	25	µg/L	<25	----
Dichloromethane, TCLP	75-09-2	E615B	100	µg/L	<100	----
Methyl ethyl ketone [MEK], TCLP	78-93-3	E615B	100	µg/L	<100	----
Tetrachloroethylene, TCLP	127-18-4	E615B	25	µg/L	<25	----
Trichloroethylene, TCLP	79-01-6	E615B	25	µg/L	<25	----
Vinyl chloride, TCLP	75-01-4	E615B	50	µg/L	<50	----
ON mSPLP Metal (target pH= 5) (QCLot: 1602986)						
Antimony, mSPLP	7440-36-0	E443	0.0005	mg/L	<0.00050	----
Arsenic, mSPLP	7440-38-2	E443	0.001	mg/L	<0.0010	----
Barium, mSPLP	7440-39-3	E443	0.002	mg/L	<0.002	----
Beryllium, mSPLP	7440-41-7	E443	0.0005	mg/L	<0.00050	----
Boron, mSPLP	7440-42-8	E443	0.01	mg/L	<0.010	----
Cadmium, mSPLP	7440-43-9	E443	0.0001	mg/L	<0.00010	----
Chromium, mSPLP	7440-47-3	E443	0.005	mg/L	<0.0050	----
Cobalt, mSPLP	7440-48-4	E443	0.001	mg/L	<0.0010	----
Copper, mSPLP	7440-50-8	E443	0.005	mg/L	<0.0050	----
Lead, mSPLP	7439-92-1	E443	0.001	mg/L	<0.0010	----
Molybdenum, mSPLP	7439-98-7	E443	0.0005	mg/L	<0.00050	----
Nickel, mSPLP	7440-02-0	E443	0.001	mg/L	<0.0010	----
Selenium, mSPLP	7782-49-2	E443	0.001	mg/L	<0.0010	----
Silver, mSPLP	7440-22-4	E443	0.00025	mg/L	<0.00025	----
Thallium, mSPLP	7440-28-0	E443	0.0005	mg/L	<0.00050	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
ON mSPLP Metal (target pH= 5) (QCLot: 1602986) - continued						
Uranium, mSPLP	7440-61-1	E443	0.002	mg/L	<0.0020	----
Vanadium, mSPLP	7440-62-2	E443	0.0005	mg/L	<0.00050	----
Zinc, mSPLP	7440-66-6	E443	0.005	mg/L	<0.0050	----
mSPLP VOCs (QCLot: 1603208)						
Bromomethane, mSPLP	74-83-9	E619D	0.5	µg/L	<0.50	----
Carbon tetrachloride, mSPLP	56-23-5	E619D	0.2	µg/L	<0.20	----
Chloroform, mSPLP	67-66-3	E619D	1	µg/L	<1.00	----
Dibromoethane, 1,2-, mSPLP	106-93-4	E619D	0.2	µg/L	<0.20	----
Dichlorobenzene, 1,2-, mSPLP	95-50-1	E619D	0.5	µg/L	<0.50	----
Dichlorobenzene, 1,4-, mSPLP	106-46-7	E619D	0.5	µg/L	<0.50	----
Dichloroethane, 1,1-, mSPLP	75-34-3	E619D	0.5	µg/L	<0.50	----
Dichloroethane, 1,2-, mSPLP	107-06-2	E619D	0.5	µg/L	<0.50	----
Dichloroethylene, 1,1-, mSPLP	75-35-4	E619D	0.5	µg/L	<0.50	----
Dichloroethylene, cis-1,2-, mSPLP	156-59-2	E619D	0.5	µg/L	<0.50	----
Dichloroethylene, trans-1,2-, mSPLP	156-60-5	E619D	0.5	µg/L	<0.50	----
Dichloropropane, 1,2-, mSPLP	78-87-5	E619D	0.5	µg/L	<0.50	----
Dichloropropylene, cis-1,3-, mSPLP	10061-01-5	E619D	0.2	µg/L	<0.20	----
Dichloropropylene, trans-1,3-, mSPLP	10061-02-6	E619D	0.2	µg/L	<0.20	----
Tetrachloroethane, 1,1,1,2-, mSPLP	630-20-6	E619D	0.5	µg/L	<0.50	----
Tetrachloroethane, 1,1,2,2-, mSPLP	630-20-6	E619D	0.5	µg/L	<0.50	----
Tetrachloroethylene, mSPLP	127-18-4	E619D	0.5	µg/L	<0.50	----
Trichloroethane, 1,1,2-, mSPLP	79-00-5	E619D	0.5	µg/L	<0.50	----
Trichloroethylene, mSPLP	79-01-6	E619D	0.5	µg/L	<0.50	----
Volatile Organic Compounds (QCLot: 1596541)						
Acetone	67-64-1	E611D	0.5	mg/kg	<0.50	----
Benzene	71-43-2	E611D	0.005	mg/kg	<0.0050	----
Bromodichloromethane	75-27-4	E611D	0.05	mg/kg	<0.050	----
Bromoform	75-25-2	E611D	0.05	mg/kg	<0.050	----
Bromomethane	74-83-9	E611D	0.05	mg/kg	<0.050	----
Carbon tetrachloride	56-23-5	E611D	0.05	mg/kg	<0.050	----
Chlorobenzene	108-90-7	E611D	0.05	mg/kg	<0.050	----
Chloroform	67-66-3	E611D	0.05	mg/kg	<0.050	----
Dibromochloromethane	124-48-1	E611D	0.05	mg/kg	<0.050	----
Dibromoethane, 1,2-	106-93-4	E611D	0.05	mg/kg	<0.050	----
Dichlorobenzene, 1,2-	95-50-1	E611D	0.05	mg/kg	<0.050	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Volatile Organic Compounds (QCLot: 1596541) - continued						
Dichlorobenzene, 1,3-	541-73-1	E611D	0.05	mg/kg	<0.050	----
Dichlorobenzene, 1,4-	106-46-7	E611D	0.05	mg/kg	<0.050	----
Dichlorodifluoromethane	75-71-8	E611D	0.05	mg/kg	<0.050	----
Dichloroethane, 1,1-	75-34-3	E611D	0.05	mg/kg	<0.050	----
Dichloroethane, 1,2-	107-06-2	E611D	0.05	mg/kg	<0.050	----
Dichloroethylene, 1,1-	75-35-4	E611D	0.05	mg/kg	<0.050	----
Dichloroethylene, cis-1,2-	156-59-2	E611D	0.05	mg/kg	<0.050	----
Dichloroethylene, trans-1,2-	156-60-5	E611D	0.05	mg/kg	<0.050	----
Dichloromethane	75-09-2	E611D	0.045	mg/kg	<0.045	----
Dichloropropane, 1,2-	78-87-5	E611D	0.05	mg/kg	<0.050	----
Dichloropropylene, cis-1,3-	10061-01-5	E611D	0.03	mg/kg	<0.030	----
Dichloropropylene, trans-1,3-	10061-02-6	E611D	0.03	mg/kg	<0.030	----
Ethylbenzene	100-41-4	E611D	0.015	mg/kg	<0.015	----
Hexane, n-	110-54-3	E611D	0.05	mg/kg	<0.050	----
Methyl ethyl ketone [MEK]	78-93-3	E611D	0.5	mg/kg	<0.50	----
Methyl isobutyl ketone [MIBK]	108-10-1	E611D	0.5	mg/kg	<0.50	----
Methyl-tert-butyl ether [MTBE]	1634-04-4	E611D	0.04	mg/kg	<0.040	----
Styrene	100-42-5	E611D	0.05	mg/kg	<0.050	----
Tetrachloroethane, 1,1,1,2-	630-20-6	E611D	0.05	mg/kg	<0.050	----
Tetrachloroethane, 1,1,2,2-	79-34-5	E611D	0.05	mg/kg	<0.050	----
Tetrachloroethylene	127-18-4	E611D	0.05	mg/kg	<0.050	----
Toluene	108-88-3	E611D	0.05	mg/kg	<0.050	----
Trichloroethane, 1,1,1-	71-55-6	E611D	0.05	mg/kg	<0.050	----
Trichloroethane, 1,1,2-	79-00-5	E611D	0.05	mg/kg	<0.050	----
Trichloroethylene	79-01-6	E611D	0.01	mg/kg	<0.010	----
Trichlorofluoromethane	75-69-4	E611D	0.05	mg/kg	<0.050	----
Vinyl chloride	75-01-4	E611D	0.02	mg/kg	<0.020	----
Xylene, m+p-	179601-23-1	E611D	0.03	mg/kg	<0.030	----
Xylene, o-	95-47-6	E611D	0.03	mg/kg	<0.030	----
Volatile Organic Compounds (QCLot: 1596602)						
Acetone	67-64-1	E611D	0.5	mg/kg	<0.50	----
Benzene	71-43-2	E611D	0.005	mg/kg	<0.0050	----
Bromodichloromethane	75-27-4	E611D	0.05	mg/kg	<0.050	----
Bromoform	75-25-2	E611D	0.05	mg/kg	<0.050	----
Bromomethane	74-83-9	E611D	0.05	mg/kg	<0.050	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Volatile Organic Compounds (QCLot: 1596602) - continued						
Carbon tetrachloride	56-23-5	E611D	0.05	mg/kg	<0.050	----
Chlorobenzene	108-90-7	E611D	0.05	mg/kg	<0.050	----
Chloroform	67-66-3	E611D	0.05	mg/kg	<0.050	----
Dibromochloromethane	124-48-1	E611D	0.05	mg/kg	<0.050	----
Dibromoethane, 1,2-	106-93-4	E611D	0.05	mg/kg	<0.050	----
Dichlorobenzene, 1,2-	95-50-1	E611D	0.05	mg/kg	<0.050	----
Dichlorobenzene, 1,3-	541-73-1	E611D	0.05	mg/kg	<0.050	----
Dichlorobenzene, 1,4-	106-46-7	E611D	0.05	mg/kg	<0.050	----
Dichlorodifluoromethane	75-71-8	E611D	0.05	mg/kg	<0.050	----
Dichloroethane, 1,1-	75-34-3	E611D	0.05	mg/kg	<0.050	----
Dichloroethane, 1,2-	107-06-2	E611D	0.05	mg/kg	<0.050	----
Dichloroethylene, 1,1-	75-35-4	E611D	0.05	mg/kg	<0.050	----
Dichloroethylene, cis-1,2-	156-59-2	E611D	0.05	mg/kg	<0.050	----
Dichloroethylene, trans-1,2-	156-60-5	E611D	0.05	mg/kg	<0.050	----
Dichloromethane	75-09-2	E611D	0.045	mg/kg	<0.045	----
Dichloropropane, 1,2-	78-87-5	E611D	0.05	mg/kg	<0.050	----
Dichloropropylene, cis-1,3-	10061-01-5	E611D	0.03	mg/kg	<0.030	----
Dichloropropylene, trans-1,3-	10061-02-6	E611D	0.03	mg/kg	<0.030	----
Ethylbenzene	100-41-4	E611D	0.015	mg/kg	<0.015	----
Hexane, n-	110-54-3	E611D	0.05	mg/kg	<0.050	----
Methyl ethyl ketone [MEK]	78-93-3	E611D	0.5	mg/kg	<0.50	----
Methyl isobutyl ketone [MIBK]	108-10-1	E611D	0.5	mg/kg	<0.50	----
Methyl-tert-butyl ether [MTBE]	1634-04-4	E611D	0.04	mg/kg	<0.040	----
Styrene	100-42-5	E611D	0.05	mg/kg	<0.050	----
Tetrachloroethane, 1,1,1,2-	630-20-6	E611D	0.05	mg/kg	<0.050	----
Tetrachloroethane, 1,1,2,2-	79-34-5	E611D	0.05	mg/kg	<0.050	----
Tetrachloroethylene	127-18-4	E611D	0.05	mg/kg	<0.050	----
Toluene	108-88-3	E611D	0.05	mg/kg	<0.050	----
Trichloroethane, 1,1,1-	71-55-6	E611D	0.05	mg/kg	<0.050	----
Trichloroethane, 1,1,2-	79-00-5	E611D	0.05	mg/kg	<0.050	----
Trichloroethylene	79-01-6	E611D	0.01	mg/kg	<0.010	----
Trichlorofluoromethane	75-69-4	E611D	0.05	mg/kg	<0.050	----
Vinyl chloride	75-01-4	E611D	0.02	mg/kg	<0.020	----
Xylene, m+p-	179601-23-1	E611D	0.03	mg/kg	<0.030	----
Xylene, o-	95-47-6	E611D	0.03	mg/kg	<0.030	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Hydrocarbons (QCLot: 1596542)						
F1 (C6-C10)	----	E581.F1	5	mg/kg	<5.0	----
Hydrocarbons (QCLot: 1596603)						
F1 (C6-C10)	----	E581.F1	5	mg/kg	<5.0	----
Hydrocarbons (QCLot: 1597646)						
F2 (C10-C16)	----	E601.SG-L	10	mg/kg	<10	----
F3 (C16-C34)	----	E601.SG-L	50	mg/kg	<50	----
F4 (C34-C50)	----	E601.SG-L	50	mg/kg	<50	----
Hydrocarbons (QCLot: 1603038)						
F2 (C10-C16)	----	E601.SG-L	10	mg/kg	<10	----
F3 (C16-C34)	----	E601.SG-L	50	mg/kg	<50	----
F4 (C34-C50)	----	E601.SG-L	50	mg/kg	<50	----
Polycyclic Aromatic Hydrocarbons (QCLot: 1597647)						
Acenaphthene	83-32-9	E641A	0.05	mg/kg	<0.050	----
Acenaphthylene	208-96-8	E641A	0.05	mg/kg	<0.050	----
Anthracene	120-12-7	E641A	0.05	mg/kg	<0.050	----
Benz(a)anthracene	56-55-3	E641A	0.05	mg/kg	<0.050	----
Benzo(a)pyrene	50-32-8	E641A	0.05	mg/kg	<0.050	----
Benzo(b+j)fluoranthene	n/a	E641A	0.05	mg/kg	<0.050	----
Benzo(g,h,i)perylene	191-24-2	E641A	0.05	mg/kg	<0.050	----
Benzo(k)fluoranthene	207-08-9	E641A	0.05	mg/kg	<0.050	----
Chrysene	218-01-9	E641A	0.05	mg/kg	<0.050	----
Dibenz(a,h)anthracene	53-70-3	E641A	0.05	mg/kg	<0.050	----
Fluoranthene	206-44-0	E641A	0.05	mg/kg	<0.050	----
Fluorene	86-73-7	E641A	0.05	mg/kg	<0.050	----
Indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.05	mg/kg	<0.050	----
Methylnaphthalene, 1-	90-12-0	E641A	0.03	mg/kg	<0.030	----
Methylnaphthalene, 2-	91-57-6	E641A	0.03	mg/kg	<0.030	----
Naphthalene	91-20-3	E641A	0.01	mg/kg	<0.010	----
Phenanthrene	85-01-8	E641A	0.05	mg/kg	<0.050	----
Pyrene	129-00-0	E641A	0.05	mg/kg	<0.050	----
Polycyclic Aromatic Hydrocarbons (QCLot: 1603037)						
Acenaphthene	83-32-9	E641A	0.05	mg/kg	<0.050	----
Acenaphthylene	208-96-8	E641A	0.05	mg/kg	<0.050	----
Anthracene	120-12-7	E641A	0.05	mg/kg	<0.050	----
Benz(a)anthracene	56-55-3	E641A	0.05	mg/kg	<0.050	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Polycyclic Aromatic Hydrocarbons (QCLot: 1603037) - continued						
Benzo(a)pyrene	50-32-8	E641A	0.05	mg/kg	<0.050	----
Benzo(b+j)fluoranthene	n/a	E641A	0.05	mg/kg	<0.050	----
Benzo(g,h,i)perylene	191-24-2	E641A	0.05	mg/kg	<0.050	----
Benzo(k)fluoranthene	207-08-9	E641A	0.05	mg/kg	<0.050	----
Chrysene	218-01-9	E641A	0.05	mg/kg	<0.050	----
Dibenz(a,h)anthracene	53-70-3	E641A	0.05	mg/kg	<0.050	----
Fluoranthene	206-44-0	E641A	0.05	mg/kg	<0.050	----
Fluorene	86-73-7	E641A	0.05	mg/kg	<0.050	----
Indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.05	mg/kg	<0.050	----
Methylnaphthalene, 1-	90-12-0	E641A	0.03	mg/kg	<0.030	----
Methylnaphthalene, 2-	91-57-6	E641A	0.03	mg/kg	<0.030	----
Naphthalene	91-20-3	E641A	0.01	mg/kg	<0.010	----
Phenanthrene	85-01-8	E641A	0.05	mg/kg	<0.050	----
Pyrene	129-00-0	E641A	0.05	mg/kg	<0.050	----
Polychlorinated Biphenyls (QCLot: 1603143)						
Aroclor 1016	12674-11-2	E687	0.01	mg/kg	<0.010	----
Aroclor 1221	11104-28-2	E687	0.01	mg/kg	<0.010	----
Aroclor 1232	11141-16-5	E687	0.01	mg/kg	<0.010	----
Aroclor 1242	53469-21-9	E687	0.01	mg/kg	<0.010	----
Aroclor 1248	12672-29-6	E687	0.01	mg/kg	<0.010	----
Aroclor 1254	11097-69-1	E687	0.01	mg/kg	<0.010	----
Aroclor 1260	11096-82-5	E687	0.01	mg/kg	<0.010	----
Aroclor 1262	37324-23-5	E687	0.01	mg/kg	<0.010	----
Aroclor 1268	11100-14-4	E687	0.01	mg/kg	<0.010	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Target Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 1596483)									
pH (1:2 soil:CaCl2-aq)	----	E108A	----	pH units	7 pH units	100	98.0	102	----
Physical Tests (QCLot: 1596485)									
Conductivity (1:2 leachate)	----	E100-L	5	µS/cm	1410 µS/cm	94.6	90.0	110	----
Physical Tests (QCLot: 1596489)									
Moisture	----	E144	0.25	%	50 %	100	90.0	110	----
Physical Tests (QCLot: 1597643)									
Conductivity (1:2 leachate)	----	E100-L	5	µS/cm	1410 µS/cm	94.7	90.0	110	----
Physical Tests (QCLot: 1597645)									
pH (1:2 soil:CaCl2-aq)	----	E108A	----	pH units	7 pH units	100	98.0	102	----
Physical Tests (QCLot: 1599874)									
Moisture	----	E144	0.25	%	50 %	100.0	90.0	110	----
Physical Tests (QCLot: 1600128)									
Moisture	----	E144	0.25	%	50 %	99.8	90.0	110	----
Cyanides (QCLot: 1596780)									
Cyanide, weak acid dissociable	----	E336A	0.05	mg/kg	1.25 mg/kg	102	80.0	120	----
Cyanides (QCLot: 1601471)									
Cyanide, weak acid dissociable	----	E336A	0.05	mg/kg	1.25 mg/kg	90.8	80.0	120	----
Metals (QCLot: 1596484)									
Calcium, soluble ion content	7440-70-2	E484	0.5	mg/L	300 mg/L	102	80.0	120	----
Magnesium, soluble ion content	7439-95-4	E484	0.5	mg/L	50 mg/L	99.6	80.0	120	----
Sodium, soluble ion content	17341-25-2	E484	0.5	mg/L	50 mg/L	98.2	80.0	120	----
Metals (QCLot: 1596486)									
Boron, hot water soluble	7440-42-8	E487	0.1	mg/kg	2 mg/kg	107	70.0	130	----
Metals (QCLot: 1596487)									
Mercury	7439-97-6	E510C	0.005	mg/kg	0.1 mg/kg	110	80.0	120	----
Metals (QCLot: 1596488)									
Antimony	7440-36-0	E440C	0.1	mg/kg	100 mg/kg	111	80.0	120	----
Arsenic	7440-38-2	E440C	0.1	mg/kg	100 mg/kg	106	80.0	120	----
Barium	7440-39-3	E440C	0.5	mg/kg	25 mg/kg	102	80.0	120	----
Beryllium	7440-41-7	E440C	0.1	mg/kg	10 mg/kg	103	80.0	120	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report: Spike: Target Concentration	Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Metals (QCLot: 1596488) - continued									
Boron	7440-42-8	E440C	5	mg/kg	100 mg/kg	99.3	80.0	120	----
Cadmium	7440-43-9	E440C	0.02	mg/kg	10 mg/kg	99.2	80.0	120	----
Chromium	7440-47-3	E440C	0.5	mg/kg	25 mg/kg	99.6	80.0	120	----
Cobalt	7440-48-4	E440C	0.1	mg/kg	25 mg/kg	98.0	80.0	120	----
Copper	7440-50-8	E440C	0.5	mg/kg	25 mg/kg	99.2	80.0	120	----
Lead	7439-92-1	E440C	0.5	mg/kg	50 mg/kg	103	80.0	120	----
Molybdenum	7439-98-7	E440C	0.1	mg/kg	25 mg/kg	107	80.0	120	----
Nickel	7440-02-0	E440C	0.5	mg/kg	50 mg/kg	97.4	80.0	120	----
Selenium	7782-49-2	E440C	0.2	mg/kg	100 mg/kg	103	80.0	120	----
Silver	7440-22-4	E440C	0.1	mg/kg	10 mg/kg	90.5	80.0	120	----
Thallium	7440-28-0	E440C	0.05	mg/kg	100 mg/kg	101	80.0	120	----
Uranium	7440-61-1	E440C	0.05	mg/kg	0.5 mg/kg	92.3	80.0	120	----
Vanadium	7440-62-2	E440C	0.2	mg/kg	50 mg/kg	102	80.0	120	----
Zinc	7440-66-6	E440C	2	mg/kg	50 mg/kg	95.6	80.0	120	----
Metals (QCLot: 1597644)									
Calcium, soluble ion content	7440-70-2	E484	0.5	mg/L	300 mg/L	106	80.0	120	----
Magnesium, soluble ion content	7439-95-4	E484	0.5	mg/L	50 mg/L	103	80.0	120	----
Sodium, soluble ion content	17341-25-2	E484	0.5	mg/L	50 mg/L	102	80.0	120	----
Metals (QCLot: 1597648)									
Antimony	7440-36-0	E440C	0.1	mg/kg	100 mg/kg	109	80.0	120	----
Arsenic	7440-38-2	E440C	0.1	mg/kg	100 mg/kg	110	80.0	120	----
Barium	7440-39-3	E440C	0.5	mg/kg	25 mg/kg	102	80.0	120	----
Beryllium	7440-41-7	E440C	0.1	mg/kg	10 mg/kg	93.2	80.0	120	----
Boron	7440-42-8	E440C	5	mg/kg	100 mg/kg	95.2	80.0	120	----
Cadmium	7440-43-9	E440C	0.02	mg/kg	10 mg/kg	99.1	80.0	120	----
Chromium	7440-47-3	E440C	0.5	mg/kg	25 mg/kg	104	80.0	120	----
Cobalt	7440-48-4	E440C	0.1	mg/kg	25 mg/kg	102	80.0	120	----
Copper	7440-50-8	E440C	0.5	mg/kg	25 mg/kg	101	80.0	120	----
Lead	7439-92-1	E440C	0.5	mg/kg	50 mg/kg	104	80.0	120	----
Molybdenum	7439-98-7	E440C	0.1	mg/kg	25 mg/kg	106	80.0	120	----
Nickel	7440-02-0	E440C	0.5	mg/kg	50 mg/kg	101	80.0	120	----
Selenium	7782-49-2	E440C	0.2	mg/kg	100 mg/kg	106	80.0	120	----
Silver	7440-22-4	E440C	0.1	mg/kg	10 mg/kg	85.6	80.0	120	----
Thallium	7440-28-0	E440C	0.05	mg/kg	100 mg/kg	102	80.0	120	----
Uranium	7440-61-1	E440C	0.05	mg/kg	0.5 mg/kg	97.1	80.0	120	----
Vanadium	7440-62-2	E440C	0.2	mg/kg	50 mg/kg	105	80.0	120	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Target Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 1597648) - continued									
Zinc	7440-66-6	E440C	2	mg/kg	50 mg/kg	101	80.0	120	----
Metals (QCLot: 1597649)									
Mercury	7439-97-6	E510C	0.005	mg/kg	0.1 mg/kg	104	80.0	120	----
Metals (QCLot: 1597650)									
Boron, hot water soluble	7440-42-8	E487	0.1	mg/kg	2 mg/kg	106	70.0	130	----
Speciated Metals (QCLot: 1596783)									
Chromium, hexavalent [Cr VI]	18540-29-9	E532	0.1	mg/kg	0.8 mg/kg	107	80.0	120	----
Speciated Metals (QCLot: 1601472)									
Chromium, hexavalent [Cr VI]	18540-29-9	E532	0.1	mg/kg	0.8 mg/kg	93.9	80.0	120	----
TCLP Extractables (QCLot: 1599677)									
Fluoride, TCLP	16984-48-8	E240.F	10	mg/L	1 mg/L	103	70.0	130	----
TCLP Extractables (QCLot: 1599678)									
Nitrate (as N), TCLP	14797-55-8	E240.NO3	5	mg/L	2.5 mg/L	101	85.0	115	----
TCLP Extractables (QCLot: 1599679)									
Nitrite (as N), TCLP	14797-65-0	E240.NO2	5	mg/L	0.5 mg/L	103	85.0	115	----
TCLP Extractables (QCLot: 1600322)									
Cyanide, weak acid dissociable, TCLP	----	E337A	0.1	mg/L	6.25 mg/L	104	70.0	130	----
TCLP Extractables (QCLot: 1600366)									
Benzo(a)pyrene, TCLP	50-32-8	E644	0.2	µg/L	0.526 µg/L	102	60.0	140	----
TCLP Extractables (QCLot: 1603116)									
Pyridine, TCLP	110-86-1	E667A	2	mg/L	1 mg/L	101	70.0	130	----
TCLP Extractables (QCLot: 1604069)									
Dichlorophenol, 2,4-, TCLP	120-83-2	E656	5	µg/L	24 µg/L	98.6	60.0	140	----
Dinitrotoluene, 2,4-, TCLP	121-14-2	E656	4	µg/L	8 µg/L	122	50.0	150	----
Hexachlorobenzene, TCLP	118-74-1	E656	4	µg/L	8 µg/L	71.8	40.0	130	----
Hexachlorobutadiene, TCLP	87-68-3	E656	4	µg/L	8 µg/L	# 33.6	40.0	130	RRQC
Hexachloroethane, TCLP	67-72-1	E656	4	µg/L	8 µg/L	# 34.4	60.0	140	RRQC
Methylphenol, 2-, TCLP	95-48-7	E656	5	µg/L	24 µg/L	90.0	60.0	140	----
Methylphenol, 3+4-, TCLP	----	E656	10	µg/L	48 µg/L	94.2	60.0	140	----
Nitrobenzene, TCLP	98-95-3	E656	4	µg/L	8 µg/L	88.1	60.0	140	----
Pentachlorophenol [PCP], TCLP	87-86-5	E656	5	µg/L	24 µg/L	108	50.0	160	----
Tetrachlorophenol, 2,3,4,6-, TCLP	58-90-2	E656	5	µg/L	24 µg/L	123	60.0	140	----
Trichlorophenol, 2,4,5-, TCLP	95-95-4	E656	5	µg/L	24 µg/L	110	60.0	140	----
Trichlorophenol, 2,4,6-, TCLP	88-06-2	E656	5	µg/L	24 µg/L	99.7	60.0	140	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report: Spike: Target Concentration	Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
TCLP Metals (QCLot: 1599521)									
Mercury, TCLP	7439-97-6	E512	0.001	mg/L	0 mg/L	102	70.0	130	----
TCLP Metals (QCLot: 1599537)									
Arsenic, TCLP	7440-38-2	E444	1	mg/L	0.05 mg/L	102	70.0	130	----
Barium, TCLP	7440-39-3	E444	2.5	mg/L	0.012 mg/L	94.3	70.0	130	----
Boron, TCLP	7440-42-8	E444	0.5	mg/L	0.05 mg/L	97.4	70.0	130	----
Cadmium, TCLP	7440-43-9	E444	0.05	mg/L	0.005 mg/L	97.2	70.0	130	----
Chromium, TCLP	7440-47-3	E444	0.25	mg/L	0.012 mg/L	97.1	70.0	130	----
Lead, TCLP	7439-92-1	E444	0.25	mg/L	0.025 mg/L	101	70.0	130	----
Selenium, TCLP	7782-49-2	E444	0.1	mg/L	0.05 mg/L	97.5	70.0	130	----
Silver, TCLP	7440-22-4	E444	0.05	mg/L	0.005 mg/L	91.6	70.0	130	----
Uranium, TCLP	7440-61-1	E444	0.2	mg/L	0 mg/L	100	70.0	130	----
TCLP VOCs (QCLot: 1599615)									
Benzene, TCLP	71-43-2	E615B	5	µg/L	100 µg/L	95.8	70.0	130	----
Carbon tetrachloride, TCLP	56-23-5	E615B	25	µg/L	100 µg/L	100	60.0	140	----
Chlorobenzene, TCLP	108-90-7	E615B	25	µg/L	100 µg/L	93.1	70.0	130	----
Chloroform, TCLP	67-66-3	E615B	100	µg/L	100 µg/L	91.7	70.0	130	----
Dichlorobenzene, 1,2-, TCLP	95-50-1	E615B	25	µg/L	100 µg/L	96.4	70.0	130	----
Dichlorobenzene, 1,4-, TCLP	106-46-7	E615B	25	µg/L	100 µg/L	98.7	70.0	130	----
Dichloroethane, 1,2-, TCLP	107-06-2	E615B	25	µg/L	100 µg/L	91.8	70.0	130	----
Dichloroethylene, 1,1-, TCLP	75-35-4	E615B	25	µg/L	100 µg/L	97.6	70.0	130	----
Dichloromethane, TCLP	75-09-2	E615B	100	µg/L	100 µg/L	92.6	70.0	130	----
Methyl ethyl ketone [MEK], TCLP	78-93-3	E615B	100	µg/L	100 µg/L	85.8	50.0	150	----
Tetrachloroethylene, TCLP	127-18-4	E615B	25	µg/L	100 µg/L	99.5	70.0	130	----
Trichloroethylene, TCLP	79-01-6	E615B	25	µg/L	100 µg/L	95.6	70.0	130	----
Vinyl chloride, TCLP	75-01-4	E615B	50	µg/L	100 µg/L	114	60.0	130	----
ON mSPLP Metal (target pH= 5) (QCLot: 1602986)									
Antimony, mSPLP	7440-36-0	E443	0.0005	mg/L	0.05 mg/L	106	70.0	130	----
Arsenic, mSPLP	7440-38-2	E443	0.001	mg/L	0.05 mg/L	113	70.0	130	----
Barium, mSPLP	7440-39-3	E443	0.002	mg/L	0.012 mg/L	107	70.0	130	----
Beryllium, mSPLP	7440-41-7	E443	0.0005	mg/L	0.005 mg/L	98.9	70.0	130	----
Boron, mSPLP	7440-42-8	E443	0.01	mg/L	0.05 mg/L	98.2	70.0	130	----
Cadmium, mSPLP	7440-43-9	E443	0.0001	mg/L	0.005 mg/L	108	70.0	130	----
Chromium, mSPLP	7440-47-3	E443	0.005	mg/L	0.012 mg/L	109	70.0	130	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report: Spike Target Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
ON mSPLP Metal (target pH= 5) (QCLot: 1602986) - continued									
Cobalt, mSPLP	7440-48-4	E443	0.001	mg/L	0.012 mg/L	108	70.0	130	----
Copper, mSPLP	7440-50-8	E443	0.005	mg/L	0.012 mg/L	109	70.0	130	----
Lead, mSPLP	7439-92-1	E443	0.001	mg/L	0.025 mg/L	105	70.0	130	----
Molybdenum, mSPLP	7439-98-7	E443	0.0005	mg/L	0.012 mg/L	105	70.0	130	----
Nickel, mSPLP	7440-02-0	E443	0.001	mg/L	0.025 mg/L	107	70.0	130	----
Selenium, mSPLP	7782-49-2	E443	0.001	mg/L	0.05 mg/L	107	70.0	130	----
Silver, mSPLP	7440-22-4	E443	0.00025	mg/L	0.005 mg/L	102	70.0	130	----
Thallium, mSPLP	7440-28-0	E443	0.0005	mg/L	0.05 mg/L	104	70.0	130	----
Uranium, mSPLP	7440-61-1	E443	0.002	mg/L	0 mg/L	105	70.0	130	----
Vanadium, mSPLP	7440-62-2	E443	0.0005	mg/L	0.025 mg/L	110	70.0	130	----
Zinc, mSPLP	7440-66-6	E443	0.005	mg/L	0.025 mg/L	107	70.0	130	----
mSPLP VOCs (QCLot: 1603208)									
Bromomethane, mSPLP	74-83-9	E619D	0.5	µg/L	100 µg/L	87.4	70.0	130	----
Carbon tetrachloride, mSPLP	56-23-5	E619D	0.2	µg/L	100 µg/L	98.9	70.0	130	----
Chloroform, mSPLP	67-66-3	E619D	1	µg/L	100 µg/L	99.0	70.0	130	----
Dibromoethane, 1,2-, mSPLP	106-93-4	E619D	0.2	µg/L	100 µg/L	90.7	70.0	130	----
Dichlorobenzene, 1,2-, mSPLP	95-50-1	E619D	0.5	µg/L	100 µg/L	97.0	70.0	130	----
Dichlorobenzene, 1,4-, mSPLP	106-46-7	E619D	0.5	µg/L	100 µg/L	94.9	70.0	130	----
Dichloroethane, 1,1-, mSPLP	75-34-3	E619D	0.5	µg/L	100 µg/L	95.6	70.0	130	----
Dichloroethane, 1,2-, mSPLP	107-06-2	E619D	0.5	µg/L	100 µg/L	91.0	70.0	130	----
Dichloroethylene, 1,1-, mSPLP	75-35-4	E619D	0.5	µg/L	100 µg/L	97.9	70.0	130	----
Dichloroethylene, cis-1,2-, mSPLP	156-59-2	E619D	0.5	µg/L	100 µg/L	98.4	70.0	130	----
Dichloroethylene, trans-1,2-, mSPLP	156-60-5	E619D	0.5	µg/L	100 µg/L	95.8	70.0	130	----
Dichloropropane, 1,2-, mSPLP	78-87-5	E619D	0.5	µg/L	100 µg/L	89.4	70.0	130	----
Dichloropropylene, cis-1,3-, mSPLP	10061-01-5	E619D	0.2	µg/L	100 µg/L	84.6	70.0	130	----
Dichloropropylene, trans-1,3-, mSPLP	10061-02-6	E619D	0.2	µg/L	100 µg/L	83.9	70.0	130	----
Tetrachloroethane, 1,1,1,2-, mSPLP	630-20-6	E619D	0.5	µg/L	100 µg/L	96.1	70.0	130	----
Tetrachloroethane, 1,1,2,2-, mSPLP	630-20-6	E619D	0.5	µg/L	100 µg/L	82.4	70.0	130	----
Tetrachloroethylene, mSPLP	127-18-4	E619D	0.5	µg/L	100 µg/L	103	70.0	130	----
Trichloroethane, 1,1,2-, mSPLP	79-00-5	E619D	0.5	µg/L	100 µg/L	92.7	70.0	130	----
Trichloroethylene, mSPLP	79-01-6	E619D	0.5	µg/L	100 µg/L	106	70.0	130	----
Volatile Organic Compounds (QCLot: 1596541)									
Acetone	67-64-1	E611D	0.5	mg/kg	3.48 mg/kg	114	60.0	140	----
Benzene	71-43-2	E611D	0.005	mg/kg	3.48 mg/kg	92.2	70.0	130	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report: Spike: Target Concentration	Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Volatile Organic Compounds (QCLot: 1596541) - continued									
Bromodichloromethane	75-27-4	E611D	0.05	mg/kg	3.48 mg/kg	93.8	50.0	140	----
Bromoform	75-25-2	E611D	0.05	mg/kg	3.48 mg/kg	99.0	70.0	130	----
Bromomethane	74-83-9	E611D	0.05	mg/kg	3.48 mg/kg	76.8	50.0	140	----
Carbon tetrachloride	56-23-5	E611D	0.05	mg/kg	3.48 mg/kg	90.7	70.0	130	----
Chlorobenzene	108-90-7	E611D	0.05	mg/kg	3.48 mg/kg	92.4	70.0	130	----
Chloroform	67-66-3	E611D	0.05	mg/kg	3.48 mg/kg	94.3	70.0	130	----
Dibromochloromethane	124-48-1	E611D	0.05	mg/kg	3.48 mg/kg	96.7	60.0	130	----
Dibromoethane, 1,2-	106-93-4	E611D	0.05	mg/kg	3.48 mg/kg	98.1	70.0	130	----
Dichlorobenzene, 1,2-	95-50-1	E611D	0.05	mg/kg	3.48 mg/kg	92.9	70.0	130	----
Dichlorobenzene, 1,3-	541-73-1	E611D	0.05	mg/kg	3.48 mg/kg	92.2	70.0	130	----
Dichlorobenzene, 1,4-	106-46-7	E611D	0.05	mg/kg	3.48 mg/kg	91.2	70.0	130	----
Dichlorodifluoromethane	75-71-8	E611D	0.05	mg/kg	3.48 mg/kg	69.5	50.0	140	----
Dichloroethane, 1,1-	75-34-3	E611D	0.05	mg/kg	3.48 mg/kg	100	60.0	130	----
Dichloroethane, 1,2-	107-06-2	E611D	0.05	mg/kg	3.48 mg/kg	100	60.0	130	----
Dichloroethylene, 1,1-	75-35-4	E611D	0.05	mg/kg	3.48 mg/kg	88.4	60.0	130	----
Dichloroethylene, cis-1,2-	156-59-2	E611D	0.05	mg/kg	3.48 mg/kg	93.9	70.0	130	----
Dichloroethylene, trans-1,2-	156-60-5	E611D	0.05	mg/kg	3.48 mg/kg	92.1	60.0	130	----
Dichloromethane	75-09-2	E611D	0.045	mg/kg	3.48 mg/kg	93.5	70.0	130	----
Dichloropropane, 1,2-	78-87-5	E611D	0.05	mg/kg	3.48 mg/kg	95.8	70.0	130	----
Dichloropropylene, cis-1,3-	10061-01-5	E611D	0.03	mg/kg	3.48 mg/kg	94.6	70.0	130	----
Dichloropropylene, trans-1,3-	10061-02-6	E611D	0.03	mg/kg	3.48 mg/kg	94.7	70.0	130	----
Ethylbenzene	100-41-4	E611D	0.015	mg/kg	3.48 mg/kg	88.3	70.0	130	----
Hexane, n-	110-54-3	E611D	0.05	mg/kg	3.48 mg/kg	95.4	70.0	130	----
Methyl ethyl ketone [MEK]	78-93-3	E611D	0.5	mg/kg	3.48 mg/kg	108	60.0	140	----
Methyl isobutyl ketone [MIBK]	108-10-1	E611D	0.5	mg/kg	3.48 mg/kg	103	60.0	140	----
Methyl-tert-butyl ether [MTBE]	1634-04-4	E611D	0.04	mg/kg	3.48 mg/kg	94.2	70.0	130	----
Styrene	100-42-5	E611D	0.05	mg/kg	3.48 mg/kg	93.5	70.0	130	----
Tetrachloroethane, 1,1,1,2-	630-20-6	E611D	0.05	mg/kg	3.48 mg/kg	93.6	60.0	130	----
Tetrachloroethane, 1,1,2,2-	79-34-5	E611D	0.05	mg/kg	3.48 mg/kg	101	60.0	130	----
Tetrachloroethylene	127-18-4	E611D	0.05	mg/kg	3.48 mg/kg	90.2	60.0	130	----
Toluene	108-88-3	E611D	0.05	mg/kg	3.48 mg/kg	89.4	70.0	130	----
Trichloroethane, 1,1,1-	71-55-6	E611D	0.05	mg/kg	3.48 mg/kg	93.4	60.0	130	----
Trichloroethane, 1,1,2-	79-00-5	E611D	0.05	mg/kg	3.48 mg/kg	98.1	60.0	130	----
Trichloroethylene	79-01-6	E611D	0.01	mg/kg	3.48 mg/kg	92.1	60.0	130	----
Trichlorofluoromethane	75-69-4	E611D	0.05	mg/kg	3.48 mg/kg	82.2	50.0	140	----
Vinyl chloride	75-01-4	E611D	0.02	mg/kg	3.48 mg/kg	93.9	60.0	140	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Target Concentration	LCS	Low	High	Qualifier
Volatile Organic Compounds (QCLot: 1596541) - continued									
Xylene, m+p-	179601-23-1	E611D	0.03	mg/kg	6.95 mg/kg	89.3	70.0	130	----
Xylene, o-	95-47-6	E611D	0.03	mg/kg	3.48 mg/kg	89.5	70.0	130	----
Volatile Organic Compounds (QCLot: 1596602)									
Acetone	67-64-1	E611D	0.5	mg/kg	3.48 mg/kg	115	60.0	140	----
Benzene	71-43-2	E611D	0.005	mg/kg	3.48 mg/kg	95.6	70.0	130	----
Bromodichloromethane	75-27-4	E611D	0.05	mg/kg	3.48 mg/kg	107	50.0	140	----
Bromoform	75-25-2	E611D	0.05	mg/kg	3.48 mg/kg	89.0	70.0	130	----
Bromomethane	74-83-9	E611D	0.05	mg/kg	3.48 mg/kg	82.4	50.0	140	----
Carbon tetrachloride	56-23-5	E611D	0.05	mg/kg	3.48 mg/kg	94.8	70.0	130	----
Chlorobenzene	108-90-7	E611D	0.05	mg/kg	3.48 mg/kg	95.0	70.0	130	----
Chloroform	67-66-3	E611D	0.05	mg/kg	3.48 mg/kg	105	70.0	130	----
Dibromochloromethane	124-48-1	E611D	0.05	mg/kg	3.48 mg/kg	101	60.0	130	----
Dibromoethane, 1,2-	106-93-4	E611D	0.05	mg/kg	3.48 mg/kg	111	70.0	130	----
Dichlorobenzene, 1,2-	95-50-1	E611D	0.05	mg/kg	3.48 mg/kg	94.1	70.0	130	----
Dichlorobenzene, 1,3-	541-73-1	E611D	0.05	mg/kg	3.48 mg/kg	91.5	70.0	130	----
Dichlorobenzene, 1,4-	106-46-7	E611D	0.05	mg/kg	3.48 mg/kg	90.8	70.0	130	----
Dichlorodifluoromethane	75-71-8	E611D	0.05	mg/kg	3.48 mg/kg	59.7	50.0	140	----
Dichloroethane, 1,1-	75-34-3	E611D	0.05	mg/kg	3.48 mg/kg	88.2	60.0	130	----
Dichloroethane, 1,2-	107-06-2	E611D	0.05	mg/kg	3.48 mg/kg	113	60.0	130	----
Dichloroethylene, 1,1-	75-35-4	E611D	0.05	mg/kg	3.48 mg/kg	96.7	60.0	130	----
Dichloroethylene, cis-1,2-	156-59-2	E611D	0.05	mg/kg	3.48 mg/kg	104	70.0	130	----
Dichloroethylene, trans-1,2-	156-60-5	E611D	0.05	mg/kg	3.48 mg/kg	99.8	60.0	130	----
Dichloromethane	75-09-2	E611D	0.045	mg/kg	3.48 mg/kg	107	70.0	130	----
Dichloropropane, 1,2-	78-87-5	E611D	0.05	mg/kg	3.48 mg/kg	103	70.0	130	----
Dichloropropylene, cis-1,3-	10061-01-5	E611D	0.03	mg/kg	3.48 mg/kg	102	70.0	130	----
Dichloropropylene, trans-1,3-	10061-02-6	E611D	0.03	mg/kg	3.48 mg/kg	101	70.0	130	----
Ethylbenzene	100-41-4	E611D	0.015	mg/kg	3.48 mg/kg	88.4	70.0	130	----
Hexane, n-	110-54-3	E611D	0.05	mg/kg	3.48 mg/kg	80.9	70.0	130	----
Methyl ethyl ketone [MEK]	78-93-3	E611D	0.5	mg/kg	3.48 mg/kg	109	60.0	140	----
Methyl isobutyl ketone [MIBK]	108-10-1	E611D	0.5	mg/kg	3.48 mg/kg	99.2	60.0	140	----
Methyl-tert-butyl ether [MTBE]	1634-04-4	E611D	0.04	mg/kg	3.48 mg/kg	96.8	70.0	130	----
Styrene	100-42-5	E611D	0.05	mg/kg	3.48 mg/kg	91.2	70.0	130	----
Tetrachloroethane, 1,1,1,2-	630-20-6	E611D	0.05	mg/kg	3.48 mg/kg	94.6	60.0	130	----
Tetrachloroethane, 1,1,2,2-	79-34-5	E611D	0.05	mg/kg	3.48 mg/kg	110	60.0	130	----
Tetrachloroethylene	127-18-4	E611D	0.05	mg/kg	3.48 mg/kg	87.4	60.0	130	----
Toluene	108-88-3	E611D	0.05	mg/kg	3.48 mg/kg	89.3	70.0	130	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Target Concentration	LCS	Low	High	Qualifier
Volatile Organic Compounds (QCLot: 1596602) - continued									
Trichloroethane, 1,1,1-	71-55-6	E611D	0.05	mg/kg	3.48 mg/kg	99.0	60.0	130	----
Trichloroethane, 1,1,2-	79-00-5	E611D	0.05	mg/kg	3.48 mg/kg	110	60.0	130	----
Trichloroethylene	79-01-6	E611D	0.01	mg/kg	3.48 mg/kg	98.5	60.0	130	----
Trichlorofluoromethane	75-69-4	E611D	0.05	mg/kg	3.48 mg/kg	92.5	50.0	140	----
Vinyl chloride	75-01-4	E611D	0.02	mg/kg	3.48 mg/kg	94.7	60.0	140	----
Xylene, m+p-	179601-23-1	E611D	0.03	mg/kg	6.95 mg/kg	89.3	70.0	130	----
Xylene, o-	95-47-6	E611D	0.03	mg/kg	3.48 mg/kg	89.3	70.0	130	----
Hydrocarbons (QCLot: 1596542)									
F1 (C6-C10)	----	E581.F1	5	mg/kg	69.2 mg/kg	103	80.0	120	----
Hydrocarbons (QCLot: 1596603)									
F1 (C6-C10)	----	E581.F1	5	mg/kg	69.2 mg/kg	104	80.0	120	----
Hydrocarbons (QCLot: 1597646)									
F2 (C10-C16)	----	E601.SG-L	10	mg/kg	712 mg/kg	96.5	70.0	130	----
F3 (C16-C34)	----	E601.SG-L	50	mg/kg	1470 mg/kg	96.6	70.0	130	----
F4 (C34-C50)	----	E601.SG-L	50	mg/kg	796 mg/kg	87.9	70.0	130	----
Hydrocarbons (QCLot: 1603038)									
F2 (C10-C16)	----	E601.SG-L	10	mg/kg	712 mg/kg	110	70.0	130	----
F3 (C16-C34)	----	E601.SG-L	50	mg/kg	1470 mg/kg	103	70.0	130	----
F4 (C34-C50)	----	E601.SG-L	50	mg/kg	796 mg/kg	105	70.0	130	----
Polycyclic Aromatic Hydrocarbons (QCLot: 1597647)									
Acenaphthene	83-32-9	E641A	0.05	mg/kg	0.5 mg/kg	82.2	60.0	130	----
Acenaphthylene	208-96-8	E641A	0.05	mg/kg	0.5 mg/kg	83.4	60.0	130	----
Anthracene	120-12-7	E641A	0.05	mg/kg	0.5 mg/kg	79.2	60.0	130	----
Benz(a)anthracene	56-55-3	E641A	0.05	mg/kg	0.5 mg/kg	78.6	60.0	130	----
Benzo(a)pyrene	50-32-8	E641A	0.05	mg/kg	0.5 mg/kg	77.5	60.0	130	----
Benzo(b+j)fluoranthene	n/a	E641A	0.05	mg/kg	0.5 mg/kg	80.3	60.0	130	----
Benzo(g,h,i)perylene	191-24-2	E641A	0.05	mg/kg	0.5 mg/kg	83.9	60.0	130	----
Benzo(k)fluoranthene	207-08-9	E641A	0.05	mg/kg	0.5 mg/kg	85.7	60.0	130	----
Chrysene	218-01-9	E641A	0.05	mg/kg	0.5 mg/kg	87.2	60.0	130	----
Dibenz(a,h)anthracene	53-70-3	E641A	0.05	mg/kg	0.5 mg/kg	84.4	60.0	130	----
Fluoranthene	206-44-0	E641A	0.05	mg/kg	0.5 mg/kg	84.0	60.0	130	----
Fluorene	86-73-7	E641A	0.05	mg/kg	0.5 mg/kg	84.5	60.0	130	----
Indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.05	mg/kg	0.5 mg/kg	81.2	60.0	130	----
Methylnaphthalene, 1-	90-12-0	E641A	0.03	mg/kg	0.5 mg/kg	75.6	60.0	130	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Target Concentration	LCS	Low	High	Qualifier
Polycyclic Aromatic Hydrocarbons (QCLot: 1597647) - continued									
Methylnaphthalene, 2-	91-57-6	E641A	0.03	mg/kg	0.5 mg/kg	80.3	60.0	130	----
Naphthalene	91-20-3	E641A	0.01	mg/kg	0.5 mg/kg	74.9	60.0	130	----
Phenanthrene	85-01-8	E641A	0.05	mg/kg	0.5 mg/kg	79.7	60.0	130	----
Pyrene	129-00-0	E641A	0.05	mg/kg	0.5 mg/kg	81.4	60.0	130	----
Polycyclic Aromatic Hydrocarbons (QCLot: 1603037)									
Acenaphthene	83-32-9	E641A	0.05	mg/kg	0.5 mg/kg	97.3	60.0	130	----
Acenaphthylene	208-96-8	E641A	0.05	mg/kg	0.5 mg/kg	92.0	60.0	130	----
Anthracene	120-12-7	E641A	0.05	mg/kg	0.5 mg/kg	105	60.0	130	----
Benz(a)anthracene	56-55-3	E641A	0.05	mg/kg	0.5 mg/kg	92.6	60.0	130	----
Benzo(a)pyrene	50-32-8	E641A	0.05	mg/kg	0.5 mg/kg	84.7	60.0	130	----
Benzo(b+j)fluoranthene	n/a	E641A	0.05	mg/kg	0.5 mg/kg	93.9	60.0	130	----
Benzo(g,h,i)perylene	191-24-2	E641A	0.05	mg/kg	0.5 mg/kg	95.9	60.0	130	----
Benzo(k)fluoranthene	207-08-9	E641A	0.05	mg/kg	0.5 mg/kg	93.5	60.0	130	----
Chrysene	218-01-9	E641A	0.05	mg/kg	0.5 mg/kg	97.0	60.0	130	----
Dibenz(a,h)anthracene	53-70-3	E641A	0.05	mg/kg	0.5 mg/kg	94.6	60.0	130	----
Fluoranthene	206-44-0	E641A	0.05	mg/kg	0.5 mg/kg	93.5	60.0	130	----
Fluorene	86-73-7	E641A	0.05	mg/kg	0.5 mg/kg	92.5	60.0	130	----
Indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.05	mg/kg	0.5 mg/kg	92.0	60.0	130	----
Methylnaphthalene, 1-	90-12-0	E641A	0.03	mg/kg	0.5 mg/kg	93.8	60.0	130	----
Methylnaphthalene, 2-	91-57-6	E641A	0.03	mg/kg	0.5 mg/kg	103	60.0	130	----
Naphthalene	91-20-3	E641A	0.01	mg/kg	0.5 mg/kg	97.3	60.0	130	----
Phenanthrene	85-01-8	E641A	0.05	mg/kg	0.5 mg/kg	102	60.0	130	----
Pyrene	129-00-0	E641A	0.05	mg/kg	0.5 mg/kg	91.3	60.0	130	----
Polychlorinated Biphenyls (QCLot: 1603143)									
Aroclor 1016	12674-11-2	E687	0.01	mg/kg	0.012 mg/kg	85.9	60.0	140	----
Aroclor 1221	11104-28-2	E687	0.01	mg/kg	0.012 mg/kg	85.9	60.0	140	----
Aroclor 1232	11141-16-5	E687	0.01	mg/kg	0.012 mg/kg	85.9	60.0	140	----
Aroclor 1242	53469-21-9	E687	0.01	mg/kg	0.012 mg/kg	85.9	60.0	140	----
Aroclor 1248	12672-29-6	E687	0.01	mg/kg	0.012 mg/kg	69.4	60.0	140	----
Aroclor 1254	11097-69-1	E687	0.01	mg/kg	0.012 mg/kg	64.6	60.0	140	----
Aroclor 1260	11096-82-5	E687	0.01	mg/kg	0.012 mg/kg	71.1	60.0	140	----
Aroclor 1262	37324-23-5	E687	0.01	mg/kg	0.012 mg/kg	71.1	60.0	140	----
Aroclor 1268	11100-14-4	E687	0.01	mg/kg	0.012 mg/kg	71.1	60.0	140	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Soil/Solid**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Cyanides (QCLot: 1596780)										
WT2423387-001	Anonymous	Cyanide, weak acid dissociable	----	E336A	1.22 mg/kg	1.24 mg/kg	97.9	70.0	130	----
Cyanides (QCLot: 1601471)										
WT2423390-001	Anonymous	Cyanide, weak acid dissociable	----	E336A	1.15 mg/kg	1.27 mg/kg	90.4	70.0	130	----
TCLP Extractables (QCLot: 1599677)										
WT2423098-001	Anonymous	Fluoride, TCLP	16984-48-8	E240.F	20 mg/L	20 mg/L	101	50.0	140	----
TCLP Extractables (QCLot: 1599678)										
WT2423098-001	Anonymous	Nitrate (as N), TCLP	14797-55-8	E240.NO3	50.8 mg/L	50 mg/L	102	50.0	140	----
TCLP Extractables (QCLot: 1599679)										
WT2423098-001	Anonymous	Nitrite (as N), TCLP	14797-65-0	E240.NO2	10.3 mg/L	10 mg/L	103	50.0	140	----
TCLP Extractables (QCLot: 1600322)										
WT2423098-001	Anonymous	Cyanide, weak acid dissociable, TCLP	----	E337A	6.55 mg/L	6.25 mg/L	105	50.0	140	----
TCLP Extractables (QCLot: 1600366)										
WT2423098-001	Anonymous	Benzo(a)pyrene, TCLP	50-32-8	E644	0.55 µg/L	0.526 µg/L	104	50.0	140	----
TCLP Extractables (QCLot: 1603116)										
WT2423419-011	TCLP	Pyridine, TCLP	110-86-1	E667A	1.1 mg/L	1 mg/L	107	50.0	150	----
TCLP Extractables (QCLot: 1604069)										
WT2423419-011	TCLP	Dichlorophenol, 2,4-, TCLP	120-83-2	E656	25.2 µg/L	24 µg/L	105	50.0	150	----
		Dinitrotoluene, 2,4-, TCLP	121-14-2	E656	10.4 µg/L	8 µg/L	131	50.0	150	----
		Hexachlorobenzene, TCLP	118-74-1	E656	6.6 µg/L	8 µg/L	82.3	50.0	150	----
		Hexachlorobutadiene, TCLP	87-68-3	E656	3.7 µg/L	8 µg/L	46.0	50.0	150	RRQC
		Hexachloroethane, TCLP	67-72-1	E656	3.8 µg/L	8 µg/L	47.2	50.0	150	RRQC
		Methylphenol, 2-, TCLP	95-48-7	E656	22.3 µg/L	24 µg/L	93.1	50.0	150	----
		Methylphenol, 3+4-, TCLP	----	E656	48 µg/L	48 µg/L	99.7	50.0	150	----
		Nitrobenzene, TCLP	98-95-3	E656	8.3 µg/L	8 µg/L	104	50.0	150	----
		Pentachlorophenol [PCP], TCLP	87-86-5	E656	26.3 µg/L	24 µg/L	110	50.0	150	----
		Tetrachlorophenol, 2,3,4,6-, TCLP	58-90-2	E656	31.6 µg/L	24 µg/L	132	50.0	150	----
		Trichlorophenol, 2,4,5-, TCLP	95-95-4	E656	28.1 µg/L	24 µg/L	117	50.0	150	----
		Trichlorophenol, 2,4,6-, TCLP	88-06-2	E656	25.4 µg/L	24 µg/L	106	50.0	150	----
TCLP Metals (QCLot: 1599521)										
WT2423378-001	Anonymous	Mercury, TCLP	7439-97-6	E512	0.0027 mg/L	0.003 mg/L	89.1	50.0	140	----
TCLP Metals (QCLot: 1599537)										
WT2423378-001	Anonymous	Arsenic, TCLP	7440-38-2	E444	5.1 mg/L	5 mg/L	103	50.0	140	----
		Barium, TCLP	7440-39-3	E444	12.4 mg/L	12.5 mg/L	99.5	50.0	140	----

Sub-Matrix: **Soil/Solid**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
TCLP Metals (QCLot: 1599537) - continued										
WT2423378-001	Anonymous	Boron, TCLP	7440-42-8	E444	9.67 mg/L	10 mg/L	96.7	50.0	140	----
		Cadmium, TCLP	7440-43-9	E444	0.246 mg/L	0.25 mg/L	98.4	50.0	140	----
		Chromium, TCLP	7440-47-3	E444	1.25 mg/L	1.25 mg/L	99.8	50.0	140	----
		Lead, TCLP	7439-92-1	E444	9.94 mg/L	10 mg/L	99.4	50.0	140	----
		Selenium, TCLP	7782-49-2	E444	4.98 mg/L	5 mg/L	99.5	50.0	140	----
		Silver, TCLP	7440-22-4	E444	0.089 mg/L	0.1 mg/L	88.7	50.0	140	----
		Uranium, TCLP	7440-61-1	E444	5.10 mg/L	5 mg/L	102	50.0	140	----
TCLP VOCs (QCLot: 1599615)										
WT2423098-001	Anonymous	Benzene, TCLP	71-43-2	E615B	240 µg/L	250 µg/L	95.8	50.0	140	----
		Carbon tetrachloride, TCLP	56-23-5	E615B	238 µg/L	250 µg/L	95.1	50.0	140	----
		Chlorobenzene, TCLP	108-90-7	E615B	227 µg/L	250 µg/L	91.0	50.0	140	----
		Chloroform, TCLP	67-66-3	E615B	230 µg/L	250 µg/L	91.5	50.0	140	----
		Dichlorobenzene, 1,2-, TCLP	95-50-1	E615B	238 µg/L	250 µg/L	95.3	50.0	140	----
		Dichlorobenzene, 1,4-, TCLP	106-46-7	E615B	240 µg/L	250 µg/L	95.8	50.0	140	----
		Dichloroethane, 1,2-, TCLP	107-06-2	E615B	248 µg/L	250 µg/L	99.3	50.0	140	----
		Dichloroethylene, 1,1-, TCLP	75-35-4	E615B	238 µg/L	250 µg/L	95.2	50.0	140	----
		Dichloromethane, TCLP	75-09-2	E615B	240 µg/L	250 µg/L	95.5	50.0	140	----
		Methyl ethyl ketone [MEK], TCLP	78-93-3	E615B	250 µg/L	250 µg/L	99.6	50.0	140	----
		Tetrachloroethylene, TCLP	127-18-4	E615B	232 µg/L	250 µg/L	92.7	50.0	140	----
		Trichloroethylene, TCLP	79-01-6	E615B	228 µg/L	250 µg/L	91.1	50.0	140	----
		Vinyl chloride, TCLP	75-01-4	E615B	289 µg/L	250 µg/L	116	50.0	140	----
ON mSPLP Metal (target pH= 5) (QCLot: 1602986)										
WT2423419-006	BH02-24-MSPLP	Antimony, mSPLP	7440-36-0	E443	3.67 mg/L	5 mg/L	73.4	50.0	140	----
		Arsenic, mSPLP	7440-38-2	E443	5.04 mg/L	5 mg/L	101	50.0	140	----
		Barium, mSPLP	7440-39-3	E443	12.7 mg/L	12.5 mg/L	102	50.0	140	----
		Beryllium, mSPLP	7440-41-7	E443	0.236 mg/L	0.25 mg/L	94.3	50.0	140	----
		Boron, mSPLP	7440-42-8	E443	9.15 mg/L	10 mg/L	91.5	50.0	140	----
		Cadmium, mSPLP	7440-43-9	E443	0.257 mg/L	0.25 mg/L	103	50.0	140	----
		Chromium, mSPLP	7440-47-3	E443	1.30 mg/L	1.25 mg/L	104	50.0	140	----
		Cobalt, mSPLP	7440-48-4	E443	0.258 mg/L	0.25 mg/L	103	50.0	140	----
		Copper, mSPLP	7440-50-8	E443	2.56 mg/L	2.5 mg/L	102	50.0	140	----
		Lead, mSPLP	7439-92-1	E443	10.0 mg/L	10 mg/L	100	50.0	140	----
		Molybdenum, mSPLP	7439-98-7	E443	1.05 mg/L	1.25 mg/L	84.0	50.0	140	----
		Nickel, mSPLP	7440-02-0	E443	2.53 mg/L	2.5 mg/L	101	50.0	140	----
		Selenium, mSPLP	7782-49-2	E443	4.99 mg/L	5 mg/L	99.7	50.0	140	----
		Silver, mSPLP	7440-22-4	E443	0.0945 mg/L	0.1 mg/L	94.5	50.0	140	----
		Thallium, mSPLP	7440-28-0	E443	4.92 mg/L	5 mg/L	98.4	50.0	140	----
		Uranium, mSPLP	7440-61-1	E443	5.09 mg/L	5 mg/L	102	70.0	130	----
		Vanadium, mSPLP	7440-62-2	E443	0.767 mg/L	0.75 mg/L	102	50.0	140	----
		Zinc, mSPLP	7440-66-6	E443	10.2 mg/L	10 mg/L	102	50.0	140	----
mSPLP VOCs (QCLot: 1603208)										
WT2423399-007	Anonymous	Bromomethane, mSPLP	74-83-9	E619D	85.3 µg/L	100 µg/L	85.3	50.0	140	----
		Carbon tetrachloride, mSPLP	56-23-5	E619D	98.8 µg/L	100 µg/L	98.8	50.0	140	----

Sub-Matrix: **Soil/Solid**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
mSPLP VOCs (QCLot: 1603208) - continued										
WT2423399-007	Anonymous	Chloroform, mSPLP	67-66-3	E619D	98.6 µg/L	100 µg/L	98.6	50.0	140	----
		Dibromoethane, 1,2-, mSPLP	106-93-4	E619D	87.8 µg/L	100 µg/L	87.8	50.0	140	----
		Dichlorobenzene, 1,2-, mSPLP	95-50-1	E619D	96.4 µg/L	100 µg/L	96.4	50.0	140	----
		Dichlorobenzene, 1,4-, mSPLP	106-46-7	E619D	95.2 µg/L	100 µg/L	95.2	50.0	140	----
		Dichloroethane, 1,1-, mSPLP	75-34-3	E619D	94.5 µg/L	100 µg/L	94.5	50.0	140	----
		Dichloroethane, 1,2-, mSPLP	107-06-2	E619D	89.7 µg/L	100 µg/L	89.7	50.0	140	----
		Dichloroethylene, 1,1-, mSPLP	75-35-4	E619D	96.6 µg/L	100 µg/L	96.6	50.0	140	----
		Dichloroethylene, cis-1,2-, mSPLP	156-59-2	E619D	98.1 µg/L	100 µg/L	98.1	50.0	140	----
		Dichloroethylene, trans-1,2-, mSPLP	156-60-5	E619D	94.8 µg/L	100 µg/L	94.8	50.0	140	----
		Dichloropropane, 1,2-, mSPLP	78-87-5	E619D	88.4 µg/L	100 µg/L	88.4	50.0	140	----
		Dichloropropylene, cis-1,3-, mSPLP	10061-01-5	E619D	83.8 µg/L	100 µg/L	83.8	50.0	140	----
		Dichloropropylene, trans-1,3-, mSPLP	10061-02-6	E619D	81.8 µg/L	100 µg/L	81.8	50.0	140	----
		Tetrachloroethane, 1,1,1,2-, mSPLP	630-20-6	E619D	95.0 µg/L	100 µg/L	95.0	50.0	140	----
		Tetrachloroethane, 1,1,2,2-, mSPLP	630-20-6	E619D	81.3 µg/L	100 µg/L	81.3	50.0	140	----
		Tetrachloroethylene, mSPLP	127-18-4	E619D	102 µg/L	100 µg/L	102	50.0	140	----
		Trichloroethane, 1,1,2-, mSPLP	79-00-5	E619D	90.8 µg/L	100 µg/L	90.8	50.0	140	----
		Trichloroethylene, mSPLP	79-01-6	E619D	106 µg/L	100 µg/L	106	50.0	140	----
Volatile Organic Compounds (QCLot: 1596541)										
WT2423271-001	Anonymous	Acetone	67-64-1	E611D	2.70 mg/kg	2.29 mg/kg	118	50.0	140	----
		Benzene	71-43-2	E611D	2.22 mg/kg	2.29 mg/kg	97.0	50.0	140	----
		Bromodichloromethane	75-27-4	E611D	2.26 mg/kg	2.29 mg/kg	98.9	50.0	140	----
		Bromoform	75-25-2	E611D	2.35 mg/kg	2.29 mg/kg	103	50.0	140	----
		Bromomethane	74-83-9	E611D	1.92 mg/kg	2.29 mg/kg	84.1	50.0	140	----
		Carbon tetrachloride	56-23-5	E611D	2.18 mg/kg	2.29 mg/kg	95.6	50.0	140	----
		Chlorobenzene	108-90-7	E611D	2.19 mg/kg	2.29 mg/kg	95.8	50.0	140	----
		Chloroform	67-66-3	E611D	2.27 mg/kg	2.29 mg/kg	99.3	50.0	140	----
		Dibromochloromethane	124-48-1	E611D	2.34 mg/kg	2.29 mg/kg	102	50.0	140	----
		Dibromoethane, 1,2-	106-93-4	E611D	2.36 mg/kg	2.29 mg/kg	103	50.0	140	----
		Dichlorobenzene, 1,2-	95-50-1	E611D	2.20 mg/kg	2.29 mg/kg	96.4	50.0	140	----
		Dichlorobenzene, 1,3-	541-73-1	E611D	2.15 mg/kg	2.29 mg/kg	94.0	50.0	140	----
		Dichlorobenzene, 1,4-	106-46-7	E611D	2.13 mg/kg	2.29 mg/kg	93.3	50.0	140	----
		Dichlorodifluoromethane	75-71-8	E611D	2.13 mg/kg	2.29 mg/kg	93.4	50.0	140	----
		Dichloroethane, 1,1-	75-34-3	E611D	2.41 mg/kg	2.29 mg/kg	106	50.0	140	----
		Dichloroethane, 1,2-	107-06-2	E611D	2.43 mg/kg	2.29 mg/kg	106	50.0	140	----
		Dichloroethylene, 1,1-	75-35-4	E611D	2.18 mg/kg	2.29 mg/kg	95.2	50.0	140	----
		Dichloroethylene, cis-1,2-	156-59-2	E611D	2.26 mg/kg	2.29 mg/kg	98.7	50.0	140	----
		Dichloroethylene, trans-1,2-	156-60-5	E611D	2.22 mg/kg	2.29 mg/kg	97.0	50.0	140	----
		Dichloromethane	75-09-2	E611D	2.26 mg/kg	2.29 mg/kg	99.0	50.0	140	----
		Dichloropropane, 1,2-	78-87-5	E611D	2.32 mg/kg	2.29 mg/kg	101	50.0	140	----
		Dichloropropylene, cis-1,3-	10061-01-5	E611D	2.27 mg/kg	2.29 mg/kg	99.2	50.0	140	----
		Dichloropropylene, trans-1,3-	10061-02-6	E611D	2.27 mg/kg	2.29 mg/kg	99.2	50.0	140	----
		Ethylbenzene	100-41-4	E611D	2.09 mg/kg	2.29 mg/kg	91.7	50.0	140	----
		Hexane, n-	110-54-3	E611D	2.37 mg/kg	2.29 mg/kg	104	50.0	140	----
		Methyl ethyl ketone [MEK]	78-93-3	E611D	2.66 mg/kg	2.29 mg/kg	116	50.0	140	----

Sub-Matrix: **Soil/Solid**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Volatile Organic Compounds (QCLot: 1596541) - continued										
WT2423271-001	Anonymous	Methyl isobutyl ketone [MIBK]	108-10-1	E611D	2.54 mg/kg	2.29 mg/kg	111	50.0	140	----
		Methyl-tert-butyl ether [MTBE]	1634-04-4	E611D	2.26 mg/kg	2.29 mg/kg	99.0	50.0	140	----
		Styrene	100-42-5	E611D	2.25 mg/kg	2.29 mg/kg	98.3	50.0	140	----
		Tetrachloroethane, 1,1,1,2-	630-20-6	E611D	2.24 mg/kg	2.29 mg/kg	97.9	50.0	140	----
		Tetrachloroethane, 1,1,2,2-	79-34-5	E611D	2.44 mg/kg	2.29 mg/kg	107	50.0	140	----
		Tetrachloroethylene	127-18-4	E611D	2.12 mg/kg	2.29 mg/kg	92.7	50.0	140	----
		Toluene	108-88-3	E611D	2.12 mg/kg	2.29 mg/kg	92.8	50.0	140	----
		Trichloroethane, 1,1,1-	71-55-6	E611D	2.25 mg/kg	2.29 mg/kg	98.5	50.0	140	----
		Trichloroethane, 1,1,2-	79-00-5	E611D	2.36 mg/kg	2.29 mg/kg	103	50.0	140	----
		Trichloroethylene	79-01-6	E611D	2.20 mg/kg	2.29 mg/kg	96.1	50.0	140	----
		Trichlorofluoromethane	75-69-4	E611D	2.10 mg/kg	2.29 mg/kg	91.7	50.0	140	----
		Vinyl chloride	75-01-4	E611D	2.40 mg/kg	2.29 mg/kg	105	50.0	140	----
		Xylene, m+p-	179601-23-1	E611D	4.25 mg/kg	4.57 mg/kg	92.9	50.0	140	----
		Xylene, o-	95-47-6	E611D	2.13 mg/kg	2.29 mg/kg	93.2	50.0	140	----
Volatile Organic Compounds (QCLot: 1596602)										
WT2423411-001	Anonymous	Acetone	67-64-1	E611D	3.07 mg/kg	2.7 mg/kg	114	50.0	140	----
		Benzene	71-43-2	E611D	2.61 mg/kg	2.7 mg/kg	96.6	50.0	140	----
		Bromodichloromethane	75-27-4	E611D	2.84 mg/kg	2.7 mg/kg	105	50.0	140	----
		Bromoform	75-25-2	E611D	2.37 mg/kg	2.7 mg/kg	87.8	50.0	140	----
		Bromomethane	74-83-9	E611D	2.27 mg/kg	2.7 mg/kg	84.1	50.0	140	----
		Carbon tetrachloride	56-23-5	E611D	2.68 mg/kg	2.7 mg/kg	99.1	50.0	140	----
		Chlorobenzene	108-90-7	E611D	2.61 mg/kg	2.7 mg/kg	96.6	50.0	140	----
		Chloroform	67-66-3	E611D	2.86 mg/kg	2.7 mg/kg	106	50.0	140	----
		Dibromochloromethane	124-48-1	E611D	2.68 mg/kg	2.7 mg/kg	99.2	50.0	140	----
		Dibromoethane, 1,2-	106-93-4	E611D	2.91 mg/kg	2.7 mg/kg	108	50.0	140	----
		Dichlorobenzene, 1,2-	95-50-1	E611D	2.58 mg/kg	2.7 mg/kg	95.7	50.0	140	----
		Dichlorobenzene, 1,3-	541-73-1	E611D	2.60 mg/kg	2.7 mg/kg	96.3	50.0	140	----
		Dichlorobenzene, 1,4-	106-46-7	E611D	2.55 mg/kg	2.7 mg/kg	94.4	50.0	140	----
		Dichlorodifluoromethane	75-71-8	E611D	2.24 mg/kg	2.7 mg/kg	83.0	50.0	140	----
		Dichloroethane, 1,1-	75-34-3	E611D	2.45 mg/kg	2.7 mg/kg	90.7	50.0	140	----
		Dichloroethane, 1,2-	107-06-2	E611D	2.97 mg/kg	2.7 mg/kg	110	50.0	140	----
		Dichloroethylene, 1,1-	75-35-4	E611D	2.74 mg/kg	2.7 mg/kg	101	50.0	140	----
		Dichloroethylene, cis-1,2-	156-59-2	E611D	2.82 mg/kg	2.7 mg/kg	104	50.0	140	----
		Dichloroethylene, trans-1,2-	156-60-5	E611D	2.78 mg/kg	2.7 mg/kg	103	50.0	140	----
		Dichloromethane	75-09-2	E611D	2.90 mg/kg	2.7 mg/kg	108	50.0	140	----
		Dichloropropane, 1,2-	78-87-5	E611D	2.77 mg/kg	2.7 mg/kg	102	50.0	140	----
		Dichloropropylene, cis-1,3-	10061-01-5	E611D	2.58 mg/kg	2.7 mg/kg	95.7	50.0	140	----
		Dichloropropylene, trans-1,3-	10061-02-6	E611D	2.58 mg/kg	2.7 mg/kg	95.7	50.0	140	----
		Ethylbenzene	100-41-4	E611D	2.50 mg/kg	2.7 mg/kg	92.6	50.0	140	----
		Hexane, n-	110-54-3	E611D	2.38 mg/kg	2.7 mg/kg	87.9	50.0	140	----
		Methyl ethyl ketone [MEK]	78-93-3	E611D	2.69 mg/kg	2.7 mg/kg	99.4	50.0	140	----
		Methyl isobutyl ketone [MIBK]	108-10-1	E611D	2.40 mg/kg	2.7 mg/kg	88.9	50.0	140	----
		Methyl-tert-butyl ether [MTBE]	1634-04-4	E611D	2.64 mg/kg	2.7 mg/kg	97.8	50.0	140	----
		Styrene	100-42-5	E611D	2.46 mg/kg	2.7 mg/kg	91.3	50.0	140	----

Sub-Matrix: **Soil/Solid**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Volatile Organic Compounds (QCLot: 1596602) - continued										
WT2423411-001	Anonymous	Tetrachloroethane, 1,1,1,2-	630-20-6	E611D	2.59 mg/kg	2.7 mg/kg	95.9	50.0	140	----
		Tetrachloroethane, 1,1,2,2-	79-34-5	E611D	2.90 mg/kg	2.7 mg/kg	107	50.0	140	----
		Tetrachloroethylene	127-18-4	E611D	2.49 mg/kg	2.7 mg/kg	92.3	50.0	140	----
		Toluene	108-88-3	E611D	2.52 mg/kg	2.7 mg/kg	93.4	50.0	140	----
		Trichloroethane, 1,1,1-	71-55-6	E611D	2.78 mg/kg	2.7 mg/kg	103	50.0	140	----
		Trichloroethane, 1,1,2-	79-00-5	E611D	2.92 mg/kg	2.7 mg/kg	108	50.0	140	----
		Trichloroethylene	79-01-6	E611D	2.72 mg/kg	2.7 mg/kg	101	50.0	140	----
		Trichlorofluoromethane	75-69-4	E611D	2.74 mg/kg	2.7 mg/kg	101	50.0	140	----
		Vinyl chloride	75-01-4	E611D	2.89 mg/kg	2.7 mg/kg	107	50.0	140	----
		Xylene, m+p-	179601-23-1	E611D	5.07 mg/kg	5.4 mg/kg	93.9	50.0	140	----
		Xylene, o-	95-47-6	E611D	2.49 mg/kg	2.7 mg/kg	92.3	50.0	140	----
Hydrocarbons (QCLot: 1596542)										
WT2423271-001	Anonymous	F1 (C6-C10)	----	E581.F1	46.1 mg/kg	45.7 mg/kg	101	60.0	140	----
Hydrocarbons (QCLot: 1596603)										
WT2423411-001	Anonymous	F1 (C6-C10)	----	E581.F1	55.7 mg/kg	54 mg/kg	103	60.0	140	----
Hydrocarbons (QCLot: 1597646)										
WT2423344-001	Anonymous	F2 (C10-C16)	----	E601.SG-L	563 mg/kg	568 mg/kg	99.1	60.0	140	----
		F3 (C16-C34)	----	E601.SG-L	1200 mg/kg	1170 mg/kg	102	60.0	140	----
		F4 (C34-C50)	----	E601.SG-L	618 mg/kg	635 mg/kg	97.4	60.0	140	----
Hydrocarbons (QCLot: 1603038)										
WT2423399-003	Anonymous	F2 (C10-C16)	----	E601.SG-L	569 mg/kg	545 mg/kg	104	60.0	140	----
		F3 (C16-C34)	----	E601.SG-L	1180 mg/kg	1130 mg/kg	105	60.0	140	----
		F4 (C34-C50)	----	E601.SG-L	644 mg/kg	610 mg/kg	106	60.0	140	----
Polycyclic Aromatic Hydrocarbons (QCLot: 1597647)										
WT2423344-001	Anonymous	Acenaphthene	83-32-9	E641A	0.329 mg/kg	0.398 mg/kg	82.7	50.0	140	----
		Acenaphthylene	208-96-8	E641A	0.334 mg/kg	0.398 mg/kg	83.7	50.0	140	----
		Anthracene	120-12-7	E641A	0.328 mg/kg	0.398 mg/kg	82.3	50.0	140	----
		Benz(a)anthracene	56-55-3	E641A	0.312 mg/kg	0.398 mg/kg	78.2	50.0	140	----
		Benzo(a)pyrene	50-32-8	E641A	0.317 mg/kg	0.398 mg/kg	79.5	50.0	140	----
		Benzo(b+j)fluoranthene	n/a	E641A	0.326 mg/kg	0.398 mg/kg	82.0	50.0	140	----
		Benzo(g,h,i)perylene	191-24-2	E641A	0.333 mg/kg	0.398 mg/kg	83.7	50.0	140	----
		Benzo(k)fluoranthene	207-08-9	E641A	0.335 mg/kg	0.398 mg/kg	84.1	50.0	140	----
		Chrysene	218-01-9	E641A	0.341 mg/kg	0.398 mg/kg	85.7	50.0	140	----
		Dibenz(a,h)anthracene	53-70-3	E641A	0.344 mg/kg	0.398 mg/kg	86.5	50.0	140	----
		Fluoranthene	206-44-0	E641A	0.339 mg/kg	0.398 mg/kg	85.1	50.0	140	----
		Fluorene	86-73-7	E641A	0.341 mg/kg	0.398 mg/kg	85.6	50.0	140	----
		Indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.338 mg/kg	0.398 mg/kg	85.0	50.0	140	----
		Methylnaphthalene, 1-	90-12-0	E641A	0.311 mg/kg	0.398 mg/kg	78.0	50.0	140	----
		Methylnaphthalene, 2-	91-57-6	E641A	0.332 mg/kg	0.398 mg/kg	83.4	50.0	140	----
		Naphthalene	91-20-3	E641A	0.319 mg/kg	0.398 mg/kg	80.0	50.0	140	----
		Phenanthrene	85-01-8	E641A	0.331 mg/kg	0.398 mg/kg	83.2	50.0	140	----

Sub-Matrix: **Soil/Solid**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Polycyclic Aromatic Hydrocarbons (QCLot: 1597647) - continued										
WT2423344-001	Anonymous	Pyrene	129-00-0	E641A	0.332 mg/kg	0.398 mg/kg	83.3	50.0	140	----
Polycyclic Aromatic Hydrocarbons (QCLot: 1603037)										
WT2423399-003	Anonymous	Acenaphthene	83-32-9	E641A	0.347 mg/kg	0.383 mg/kg	90.6	50.0	140	----
		Acenaphthylene	208-96-8	E641A	0.344 mg/kg	0.383 mg/kg	89.6	50.0	140	----
		Anthracene	120-12-7	E641A	0.354 mg/kg	0.383 mg/kg	92.2	50.0	140	----
		Benz(a)anthracene	56-55-3	E641A	0.341 mg/kg	0.383 mg/kg	88.8	50.0	140	----
		Benzo(a)pyrene	50-32-8	E641A	0.310 mg/kg	0.383 mg/kg	80.8	50.0	140	----
		Benzo(b+j)fluoranthene	n/a	E641A	0.342 mg/kg	0.383 mg/kg	89.2	50.0	140	----
		Benzo(g,h,i)perylene	191-24-2	E641A	0.339 mg/kg	0.383 mg/kg	88.3	50.0	140	----
		Benzo(k)fluoranthene	207-08-9	E641A	0.347 mg/kg	0.383 mg/kg	90.6	50.0	140	----
		Chrysene	218-01-9	E641A	0.353 mg/kg	0.383 mg/kg	92.2	50.0	140	----
		Dibenz(a,h)anthracene	53-70-3	E641A	0.347 mg/kg	0.383 mg/kg	90.4	50.0	140	----
		Fluoranthene	206-44-0	E641A	0.340 mg/kg	0.383 mg/kg	88.7	50.0	140	----
		Fluorene	86-73-7	E641A	0.348 mg/kg	0.383 mg/kg	90.9	50.0	140	----
		Indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.336 mg/kg	0.383 mg/kg	87.6	50.0	140	----
		Methylnaphthalene, 1-	90-12-0	E641A	0.337 mg/kg	0.383 mg/kg	88.0	50.0	140	----
		Methylnaphthalene, 2-	91-57-6	E641A	0.366 mg/kg	0.383 mg/kg	95.6	50.0	140	----
		Naphthalene	91-20-3	E641A	0.351 mg/kg	0.383 mg/kg	91.7	50.0	140	----
		Phenanthrene	85-01-8	E641A	0.342 mg/kg	0.383 mg/kg	89.3	50.0	140	----
		Pyrene	129-00-0	E641A	0.335 mg/kg	0.383 mg/kg	87.4	50.0	140	----
Polychlorinated Biphenyls (QCLot: 1603143)										
WT2423393-001	Anonymous	Aroclor 1242	53469-21-9	E687	0.006 mg/kg	0.01 mg/kg	57.6	50.0	150	----
		Aroclor 1254	11097-69-1	E687	0.011 mg/kg	0.01 mg/kg	112	50.0	150	----
		Aroclor 1260	11096-82-5	E687	0.005 mg/kg	0.01 mg/kg	53.1	50.0	150	----
		Aroclor 1262	37324-23-5	E687	0.008 mg/kg	0.01 mg/kg	76.4	50.0	150	----
		Aroclor 1268	11100-14-4	E687	0.008 mg/kg	0.01 mg/kg	76.4	50.0	150	----

Qualifiers

Qualifier	Description
RRQC	*Refer to report comments for information regarding this QC result.*

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

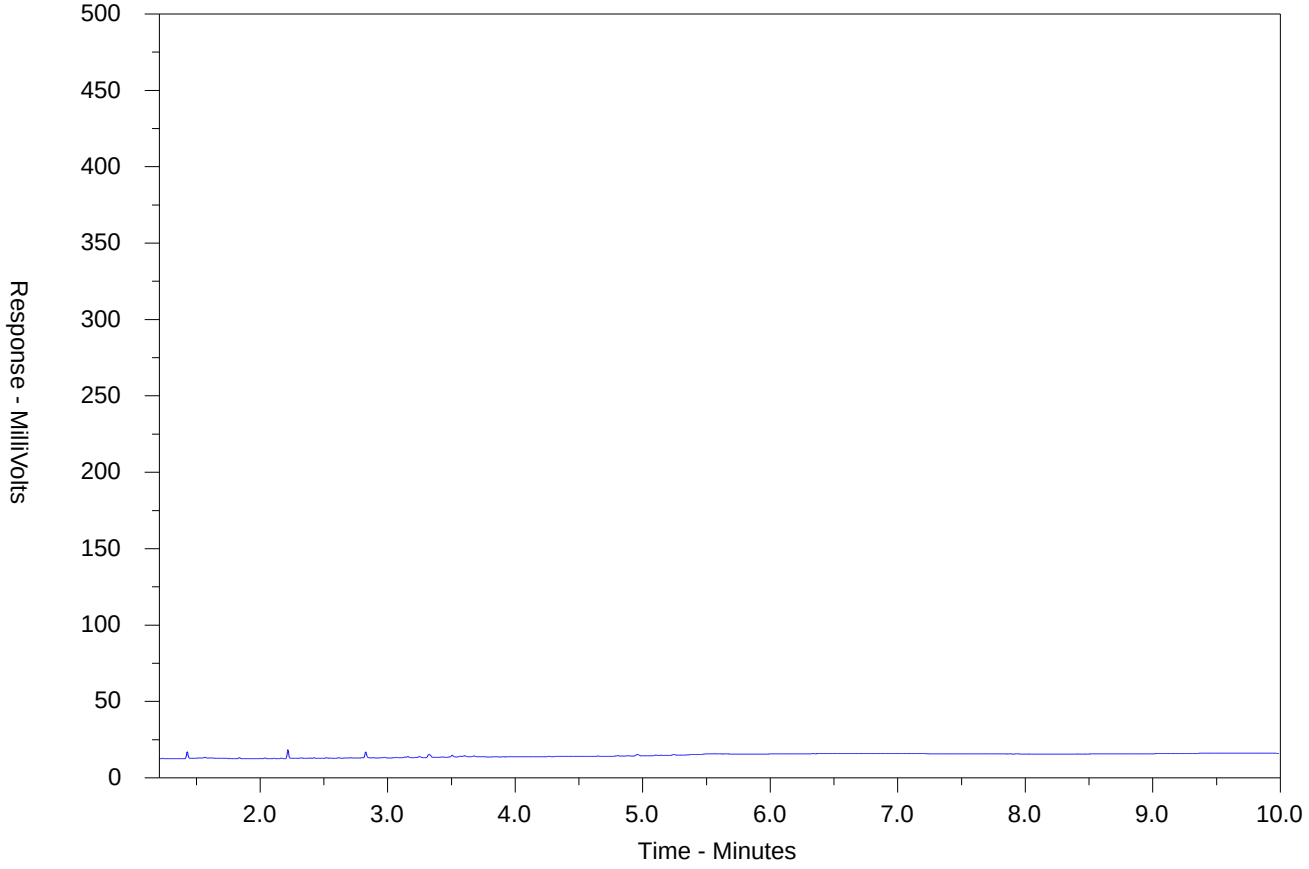
					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Physical Tests (QCLot: 1596485)									
QC-1596485-003	RM	Conductivity (1:2 leachate)	----	E100-L	3270 µS/cm	104	70.0	130	----
Physical Tests (QCLot: 1597643)									
QC-1597643-003	RM	Conductivity (1:2 leachate)	----	E100-L	3270 µS/cm	103	70.0	130	----
Metals (QCLot: 1596484)									
QC-1596484-003	RM	Calcium, soluble ion content	7440-70-2	E484	186 mg/L	100	70.0	130	----
QC-1596484-003	RM	Magnesium, soluble ion content	7439-95-4	E484	67.3 mg/L	102	70.0	130	----
QC-1596484-003	RM	Sodium, soluble ion content	17341-25-2	E484	120 mg/L	98.4	70.0	130	----
Metals (QCLot: 1596486)									
QC-1596486-003	RM	Boron, hot water soluble	7440-42-8	E487	1.72 mg/kg	130	60.0	140	----
Metals (QCLot: 1596487)									
QC-1596487-003	RM	Mercury	7439-97-6	E510C	0.068 mg/kg	109	70.0	130	----
Metals (QCLot: 1596488)									
QC-1596488-003	RM	Antimony	7440-36-0	E440C	24.8 mg/kg	105	70.0	130	----
QC-1596488-003	RM	Arsenic	7440-38-2	E440C	21.2 mg/kg	98.6	70.0	130	----
QC-1596488-003	RM	Barium	7440-39-3	E440C	788 mg/kg	102	70.0	130	----
QC-1596488-003	RM	Beryllium	7440-41-7	E440C	1.82 mg/kg	106	70.0	130	----
QC-1596488-003	RM	Cadmium	7440-43-9	E440C	2.15 mg/kg	97.0	70.0	130	----
QC-1596488-003	RM	Chromium	7440-47-3	E440C	56.9 mg/kg	97.0	70.0	130	----
QC-1596488-003	RM	Cobalt	7440-48-4	E440C	32 mg/kg	96.8	70.0	130	----
QC-1596488-003	RM	Copper	7440-50-8	E440C	969 mg/kg	101	70.0	130	----
QC-1596488-003	RM	Lead	7439-92-1	E440C	919 mg/kg	103	70.0	130	----
QC-1596488-003	RM	Molybdenum	7439-98-7	E440C	25.1 mg/kg	99.7	70.0	130	----
QC-1596488-003	RM	Nickel	7440-02-0	E440C	1000 mg/kg	96.4	70.0	130	----
QC-1596488-003	RM	Selenium	7782-49-2	E440C	1.04 mg/kg	97.5	60.0	140	----
QC-1596488-003	RM	Silver	7440-22-4	E440C	8.98 mg/kg	102	70.0	130	----
QC-1596488-003	RM	Thallium	7440-28-0	E440C	0.907 mg/kg	94.7	70.0	130	----
QC-1596488-003	RM	Uranium	7440-61-1	E440C	3.97 mg/kg	78.0	70.0	130	----
QC-1596488-003	RM	Vanadium	7440-62-2	E440C	66.2 mg/kg	97.9	70.0	130	----
QC-1596488-003	RM	Zinc	7440-66-6	E440C	828 mg/kg	95.4	70.0	130	----
Metals (QCLot: 1597644)									
QC-1597644-003	RM	Calcium, soluble ion content	7440-70-2	E484	186 mg/L	97.4	70.0	130	----
QC-1597644-003	RM	Magnesium, soluble ion content	7439-95-4	E484	67.3 mg/L	98.1	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Metals (QCLot: 1597644) - continued									
QC-1597644-003	RM	Sodium, soluble ion content	17341-25-2	E484	120 mg/L	94.2	70.0	130	----
Metals (QCLot: 1597648)									
QC-1597648-003	RM	Antimony	7440-36-0	E440C	24.8 mg/kg	94.6	70.0	130	----
QC-1597648-003	RM	Arsenic	7440-38-2	E440C	21.2 mg/kg	97.9	70.0	130	----
QC-1597648-003	RM	Barium	7440-39-3	E440C	788 mg/kg	102	70.0	130	----
QC-1597648-003	RM	Beryllium	7440-41-7	E440C	1.82 mg/kg	92.4	70.0	130	----
QC-1597648-003	RM	Cadmium	7440-43-9	E440C	2.15 mg/kg	102	70.0	130	----
QC-1597648-003	RM	Chromium	7440-47-3	E440C	56.9 mg/kg	98.4	70.0	130	----
QC-1597648-003	RM	Cobalt	7440-48-4	E440C	32 mg/kg	97.5	70.0	130	----
QC-1597648-003	RM	Copper	7440-50-8	E440C	969 mg/kg	110	70.0	130	----
QC-1597648-003	RM	Lead	7439-92-1	E440C	919 mg/kg	98.7	70.0	130	----
QC-1597648-003	RM	Molybdenum	7439-98-7	E440C	25.1 mg/kg	98.6	70.0	130	----
QC-1597648-003	RM	Nickel	7440-02-0	E440C	1000 mg/kg	96.0	70.0	130	----
QC-1597648-003	RM	Selenium	7782-49-2	E440C	1.04 mg/kg	104	60.0	140	----
QC-1597648-003	RM	Silver	7440-22-4	E440C	8.98 mg/kg	95.9	70.0	130	----
QC-1597648-003	RM	Thallium	7440-28-0	E440C	0.907 mg/kg	90.6	70.0	130	----
QC-1597648-003	RM	Uranium	7440-61-1	E440C	3.97 mg/kg	80.6	70.0	130	----
QC-1597648-003	RM	Vanadium	7440-62-2	E440C	66.2 mg/kg	97.7	70.0	130	----
QC-1597648-003	RM	Zinc	7440-66-6	E440C	828 mg/kg	97.4	70.0	130	----
Metals (QCLot: 1597649)									
QC-1597649-003	RM	Mercury	7439-97-6	E510C	0.068 mg/kg	104	70.0	130	----
Metals (QCLot: 1597650)									
QC-1597650-003	RM	Boron, hot water soluble	7440-42-8	E487	1.72 mg/kg	100	60.0	140	----
Speciated Metals (QCLot: 1596783)									
QC-1596783-003	RM	Chromium, hexavalent [Cr VI]	18540-29-9	E532	226 mg/kg	91.8	70.0	130	----
Speciated Metals (QCLot: 1601472)									
QC-1601472-003	RM	Chromium, hexavalent [Cr VI]	18540-29-9	E532	226 mg/kg	94.4	70.0	130	----

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: WT2423419-001-E601.SG-L
Client Sample ID: BH01-24



←F2→	←F3→	←F4→	
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizin hydrocarbon products that may be present in your sample.

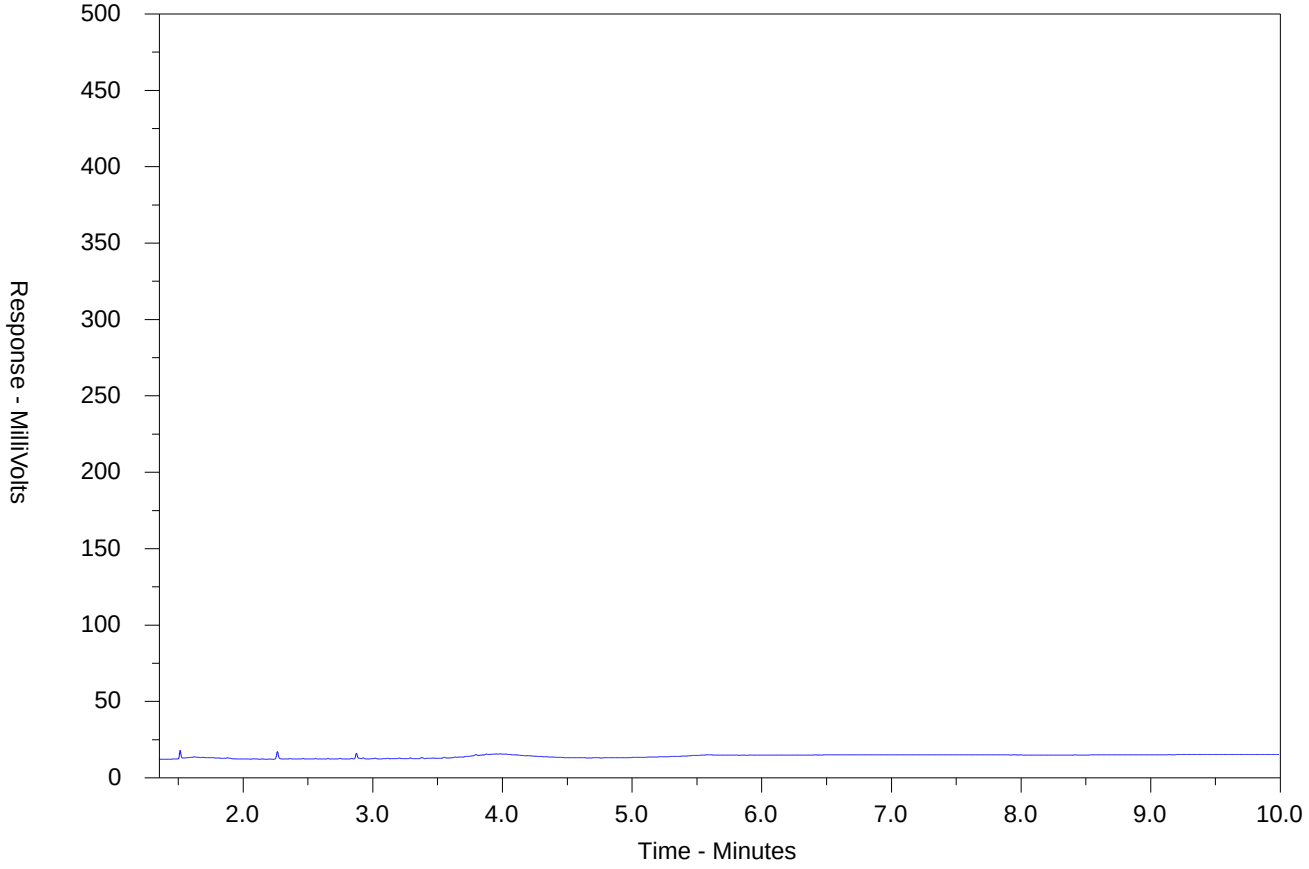
The scale at the bottom of the chromatogram indicates the approximate retention times of commo petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary betwee samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, th sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms fro common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: WT2423419-002-E601.SG-L
Client Sample ID: BH02-24



←F2→	←F3→	←F4→	
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizin hydrocarbon products that may be present in your sample.

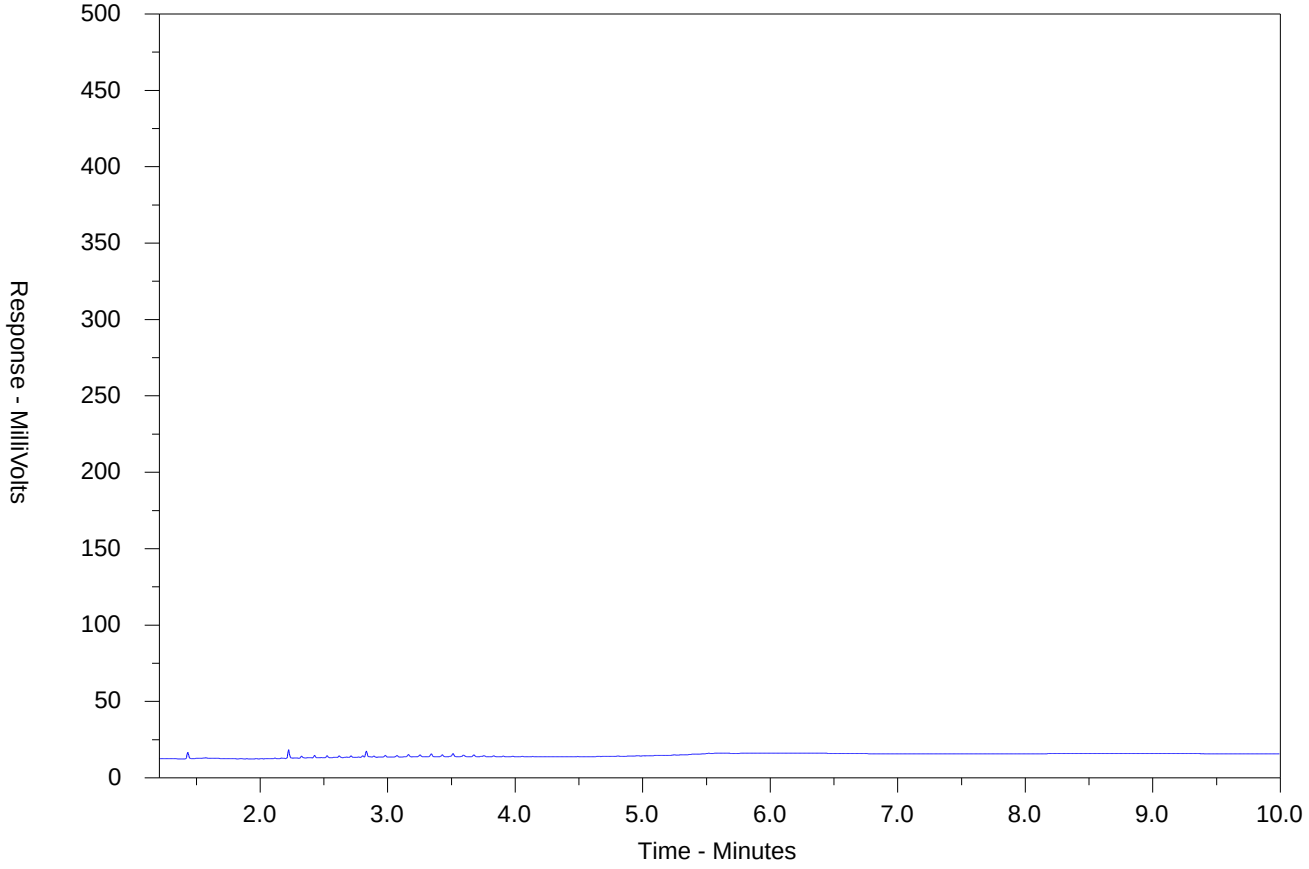
The scale at the bottom of the chromatogram indicates the approximate retention times of commo petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary betwee samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, th sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms fro common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: WT2423419-003-E601.SG-L
Client Sample ID: BH03-24



←F2→	←F3→	←F4→	
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizin hydrocarbon products that may be present in your sample.

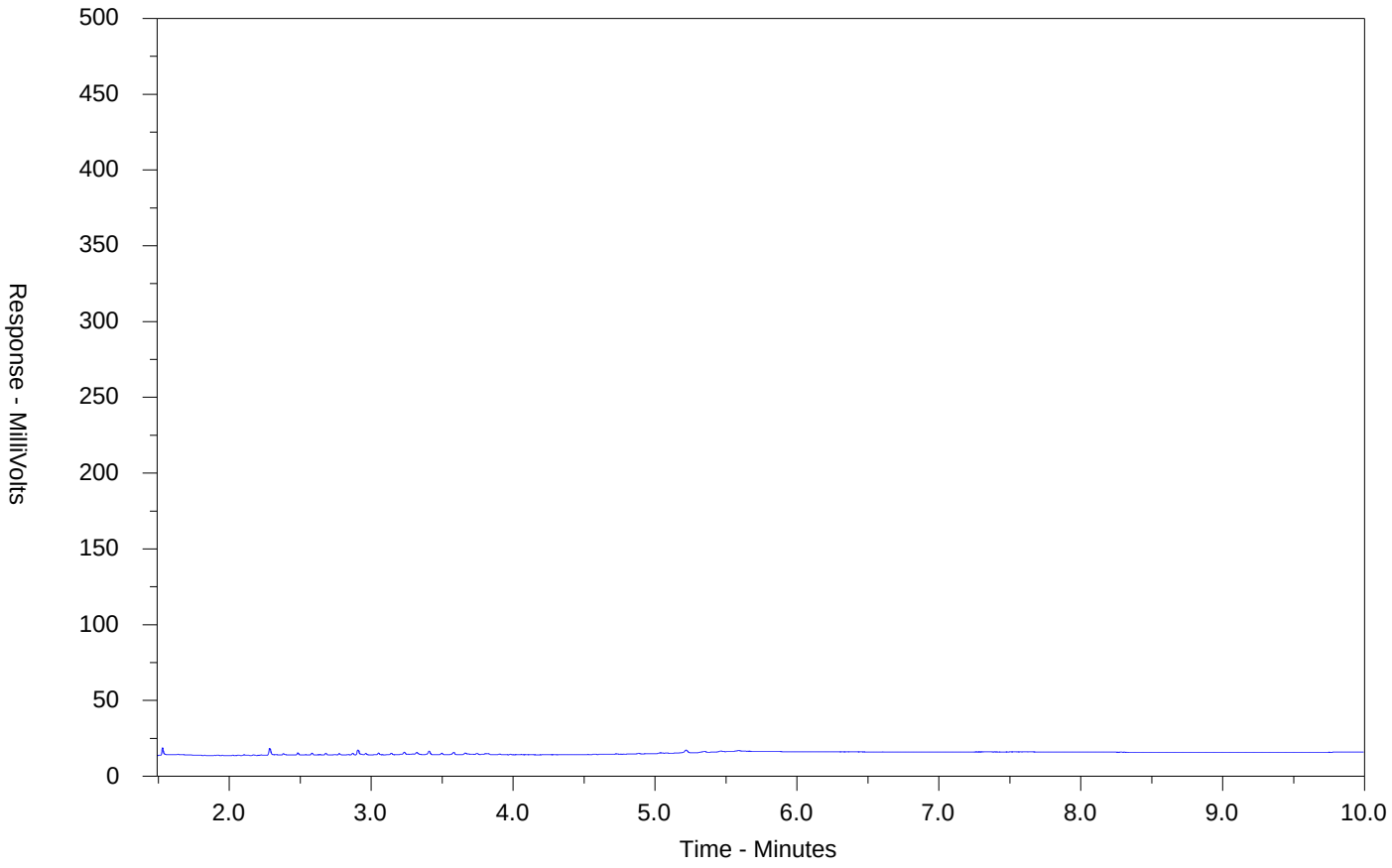
The scale at the bottom of the chromatogram indicates the approximate retention times of commo petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary betwee samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, th sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms fro common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: WT2423419-004-E601.SG-L
Client Sample ID: BH04-24



←F2→	←F3→	←F4→	
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

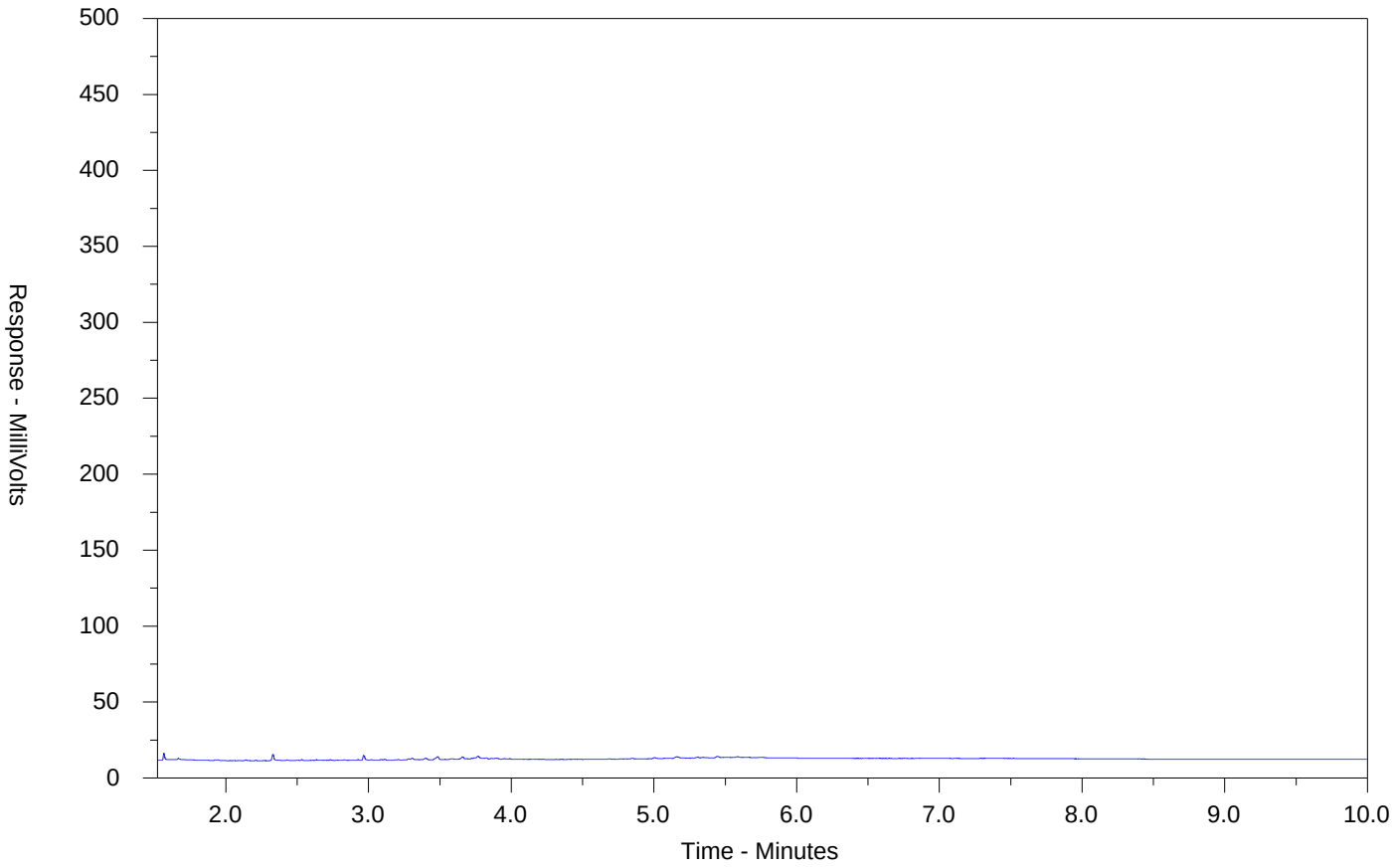
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: WT2423419-009-E601.SG-L
Client Sample ID: DUP-1



←F2→	←F3→	←F4→	
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

Chain of Custody (COC) / Analytical Request Form

COC Number: 20 -

Canada Toll Free: 1 800 668 9878

Page 1 of 2

www.alsglobal.com

Environmental Division Waterloo
Work Order Reference
WT2423419

Telephone : +1 519 886 6910

Report To	Contact and company name below will appear on the final report
Company:	GHD Ltd. (Acct GHDL100)
Contact:	Jennifer Balkwill
Phone:	519-884-0510
	Company address below will appear on the final report
Street:	455 Phillip St.
City/Province:	Waterloo, ON
Postal Code:	N2L 3X2
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☑ NO
Company:	GHD Ltd. (GHDL100)
Contact:	

Reports / Recipients

Select Report Format: ☑ PDF ☑ EXCEL ☑ EDD (DIGITAL)
Merge QC/QCI Reports with COA ☑ YES ☐ NO ☐ N/A
☐ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: Jennifer.Balkwill@ghd.com
Email 2: See SSOW/PO
Email 3:

Invoice Recipients

Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: accountspayableCDN@ghd.com
Email 2:

Turnaround Time (TAT) Requested

☑ Routine [R] if received by 3pm M-F - no surcharges apply
☐ 4 day [P4] if received by 3pm M-F - 20% rush surcharge minimu
☐ 3 day [P3] if received by 3pm M-F - 25% rush surcharge minimu
☐ 2 day [P2] if received by 3pm M-F - 50% rush surcharge minimu
☐ 1 day [E] if received by 3pm M-F - 100% rush surcharge minimu
☐ Same day [E2] if received by 10am M-S - 200% rush surcharge.
☐ Fees may apply to rush resuests on weekends, statutory holidays a routine tests

Date and Time Required for all E&P TATs:

For tests that can not be performed according to

Analysis Re

Indicate Filtered (F), Preserved (P) or Filtered a

Project Information

ALS Account # / Quote #:	WT2024GHDL1000131
Job #:	12642634-02 ~~WT2024GHDL1000131~~
PO / AFE:	735-011200
LSD:	

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#:
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Rick H

Sampler: RD

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	O.Reg 153 Metals and Inorganics	VOCs/F1-F4	PAHs	Trip Blank_VOCs/F1	TCLP Metals & Inorganics	TCLP VOCs	TCLP SVOCs	PCB bulk	Iso.Ab.Ind	O.Res 406 mSPLP(only)	SAMPLES ON HOLD	EXTENDED STORAGE REQUIF	SUSPECTED HAZARD (see not
	BH01-24	14-08-24	AM	SOIL	4	X	X	X										
	BH02-24	↓	↓	↓	4	X	X	X										
	BH03-24				4	X	X	X										
	BH04-24				4	X	X	X										
	BH01-24-mSPLP				2										X			
	BH02-24-mSPLP				2										X			
	BH03-24-mSPLP				2										X			
	BH04-24-mSPLP				2										X			
	DUP1				4	X	X	X										
	~~TCLP~~				~~4~~				~~X~~	~~X~~	~~X~~	~~X~~	~~X~~					
	TRIP BLANK								X									

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human consumption/ use? ☐ YES ☐ NO

Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)

SAMPLE RECEIPT DETAILS (lab use only)

Cooling Method: ☐ NONE ☒ ICE ☐ ICE PACKS ☐ FROZEN ☒ COOLING INITIATED

Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO

Cooler Custody Seals Intact: ☐ YES ☐ N/A Sample Custody Seals Intact: ☐ YES ☐ N/A

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
7.2	16.8			7.4			

SHIPMENT RELEASE (client use)

Released by: Ramin D. Date: Aug 14/24 Time: 12:00 PM

INITIAL SHIPMENT RECEPTION (lab use only)

Received by: Karan Date: 8/14/2024 Time: 13:37

FINAL SHIPMENT RECEPTION (lab use only)

Received by: LJ Date: Aug 14, 2024 Time: 17:20

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

AUG 2020 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

Chain of Custody (COC) / Analytical Request Form

COC Number: 20 -

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

Report To	Contact and company name below will appear on the final report
Company:	GHD Ltd. (Acct GHDL100)
Contact:	Jennifer Balkwill
Phone:	519-884-0510
	Company address below will appear on the final report
Street:	455 Phillip St.
City/Province:	Waterloo, ON
Postal Code:	N2L 3X2
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☑ NO
Company:	GHD Ltd. (GHDL100)
Contact:	

Reports / Recipients

Select Report Format: ☑ PDF ☑ EXCEL ☑ EDD (DIGITAL)

Merge QC/QCI Reports with COA ☑ YES ☐ NO ☐ N/A

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: Jennifer.Balkwill@ghd.com

Email 2: See SSOW/PO

Email 3:

Invoice Recipients

Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: accountspayableCDN@ghd.com

Email 2:

Turnaround Time (TAT) Requested

- ☒ Routine [R] if received by 3pm M-F - no surcharges apply
- ☐ 4 day [P4] if received by 3pm M-F - 20% rush surcharge minimum
- ☐ 3 day [P3] if received by 3pm M-F - 25% rush surcharge minimum
- ☐ 2 day [P2] if received by 3pm M-F - 50% rush surcharge minimum
- ☐ 1 day [E] if received by 3pm M-F - 100% rush surcharge minimum
- ☐ Same day [E2] if received by 10am M-S - 200% rush surcharge. Additional fees may apply to rush resuests on weekends, statutory holidays and non-routine tests

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm am/pm

For tests that can not be performed according to the TAT requested, you will be contacted.

AFFIX ALS BARCODE LABEL HERE (ALS use only)

Project Information

ALS Account # / Quote #:	WT2024GHDL1000131
Job #:	12642634-02
PO / AFE:	735-011200
LSD:	

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#:
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Rick H

Sampler: RD

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	TCLP Metals & Inorganics	TCLP VOCs	TCLP SVOCs	PCB bulk	Ignitability	O.Reg 406 mSPLP (Metals, VOCs)	SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)
	TCLP	14-08-24	AM	SOIL	4	X	X	X	X	X				

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human consumption/ use? ☐ YES ☐ NO

Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)

SAMPLE RECEIPT DETAILS (lab use only)

Cooling Method: ☐ NONE ☒ ICE ☐ ICE PACKS ☐ FROZEN ☑ COOLING INITIATED

Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO

Cooler Custody Seals Intact: ☐ YES ☐ N/A Sample Custody Seals Intact: ☐ YES ☐ N/A

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
				7.4			

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Rana D.	Date: Aug 14/24	Time: 12:30 pm	Received by:	Date:	Time:	Received by: LJ	Date: Aug 14, 2024	Time: 17:20

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.