Project Title

Tenant Fit Up for
Transport Canada
The Laura Secord Building
32 Church Street
St. Catharines, Ontario

Project Number

R.077633.042

Project Date

2016-10-11

END OF SECTION

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Contract Method.

.2 Work by others.

.3 Work sequence.

.4 Contractor use of premises.

.5 Owner occupancy.

.6 Alterations to existing building.

1.2 PRECEDENCE

.1 For Federal Government projects, Division 01 Sections take precedence over technical specification sections in other Divisions of this Project Manual.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work of this Contract comprises the renovation of existing areas within the Laura Secord Building, located at 32 Church Street in St. Catharines, Ontario.

1.4 CONTRACT METHOD

.1 Construct Work under lump sum contract.

1.5 COST BREAKDOWN

.1 Within five days of the kick-off meeting, provide a cost breakdown by Section aggregating contract amount.

.2 Contractor to submit a list of subcontractors as part of the bid submission by tender closing date for review and approval by the Owner.

1.6 WORK BY OTHERS

.1 Work of this Project must include provisions for coordinating electrical and furniture for workstations, identified in Contract Documents, for following principal items.
.1 Audio visual equipment.

1.6 WORK BY OTHERS (Cont'd)

.1 (Cont'd)
.2 Furniture.

.2 The Contractor shall for the purpose of the Ontario Occupational Health and Safety Act and Regulations for Construction Projects, and for the duration of the Work of the Contract:
.1 Assume the role of Constructor in accordance with the Authority Having Jurisdictions.

1.7 WORK SEQUENCE

.1 Construct Work in stages to accommodate Owner's continued use of premises during construction.

.2 Coordinate Progress Schedule with Departmental Representative during construction.

.3 Maintain fire access/control.

1.8 CONTRACTOR USE OF PREMISES

.1 Contractor shall limit use of premises for Work, for storage, and for access, to allow;
.1 Owner occupancy.
.2 Work by other contractors.

.2 Coordinate use of premises under direction of Departmental Representative.

.3 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

1.9 OWNER OCCUPANCY

.1 Owner will occupy premises during entire construction period for execution of normal operations.

.2 Cooperate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.

1.10 ALTERATIONS TO EXISTING BUILDING

.1 Provide new openings required in existing construction.

1.10 ALTERATIONS TO EXISTING BUILDING (Cont'd)

.2 Block in openings where items removed with material and finish to match existing adjoining construction.

.3 Undercut existing doors to clear new carpet.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not used.

END OF SECTION

PART 1 - GENERAL

1.1 ACCESS AND EGRESS

.1 Design, construct and maintain temporary "access to" and "egress from" work areas, including stairs, runways, ramps or ladders, independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations.

1.2 USE OF SITE AND FACILITIES

.1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.

.2 Maintain existing services to building and provide for personnel and vehicle access.

.3 Where security is reduced by work provide temporary means to maintain security.

.4 Departmental Representative will assign sanitary facilities for use by Contractor's personnel. Keep facilities clean.

.5 Use only elevators, existing in building for moving workers and material.
.1 Protect walls of passenger elevators, to approval of Departmental Representative prior to use.
.2 Accept liability for damage, safety of equipment and overloading of existing equipment.

.6 Closures: protect work temporarily until permanent enclosures are completed.

1.3 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

.1 Execute work with least possible interference or disturbance to building operations, occupants, and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.

1.4 EXISTING SERVICES

.1 Notify, Departmental Representative utility companies of intended interruption of services and obtain required permission.

.2 Where Work involves breaking into or connecting to existing services, give Departmental Representative 48 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum. Carry out interruptions after normal working hours of occupants, preferably on weekends.

.3 Provide for personnel traffic.

.4 Construct barriers in accordance with Section 01 56 00.

1.5 SPECIAL REQUIREMENTS

.1 Contractor submission requirements: Refer to the Document appended to this Section for the list of Contractor submissions required before work can begin on-Site.

.2 Construction hours for Work of this Project are as follows:
.1 Weekday construction hours: 6:00 a.m. to 6:00 p.m., Monday to Fridays.
.2 Weekend construction hours (demolition work and upgrades to dumbwaiter): Friday 5:00 p.m. to Monday 6:00 a.m.

.3 Perform the following work during weekend construction hours indicated above:
.1 Demolition of partitions in public areas of basement, ground and second floors.
.2 Demolition of existing floor slab and replacement with new slab.
.3 Painting at vestibule and repainting and making good areas that were damaged/affected as a result of Work of this Project.

.4 Submit schedule in accordance with Section 01 32 16.

.5 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.

1.5 SPECIAL REQUIREMENTS (Cont'd)

.6 Keep within limits of work and avenues of ingress and egress.

.7 Deliver materials outside of peak traffic hours 17:00 to 07:00 and 13:00 to 15:00 unless otherwise approved by Departmental Representative.

.8 Prior to cutting or drilling horizontal or vertical surfaces including concrete, concrete block or other structural substrate, determine location of reinforcing, service lines, pipes, conduits or other items by x-ray, ground penetrating radar or other appropriate method. Submit findings to Departmental Representative prior to cutting or drilling.

1.6 SECURITY

.1 PWGSC will provide commissionaires at PWGSC's cost for the course of the construction period.

.2 Security clearances:
.1 Personnel employed on this project will be subject to security check. Obtain clearance, as instructed, for each individual who will require to enter premises.
.2 Personnel will be checked daily at start of work shift and provided with pass which must be worn at all times. Pass must be returned at end of work shift and personnel checked out.

1.7 BUILDING SMOKING ENVIRONMENT

.1 Comply with smoking restrictions. Smoking is not permitted.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END OF SECTION

LIST OF CONTRACTOR SUBMISSIONS REQUIRED BEFORE WORK BEGINS ON-SITE

1. The winning general contractor to submit all necessary documentation for personnel screening (all contractors and sub-contractors are to be security cleared at once). Contractor is responsible to obtain necessary security clearance on time. Personnel who currently have security clearance have a faster chance of getting security screened than new applicants.

2. Contractor shall submit a draft schedule within ten days of award.

3. Cost breakdown: A cost breakdown shall be submitted within five days after the kick-off meeting

4. Cash Flow: A cash flow shall be submitted within five days after the kick-off meeting

5. Contractor shall submit a list of sub-contractors as part of the bid submission package by tender closing date.

6. Contractor shall submit the site specific safety plan, company’s safety program and policy within five working days after the kick-off meeting. Work on site can only begin when the site specific safely plan is approved by the Department.

7. Contractor shall submit the site specific environmental protection plan.

8. Contractor shall read and understand the contract conditions on the Invitation to Tender form. SACC manual can be found at :

   https://buyandsell.gc.ca/policy-and-guidelines/standard-acquisition-clauses-and-conditions-manual

PART 1 - GENERAL

1.1 ADMINISTRATIVE

.1 Schedule and administer project meetings throughout the progress of the work at the call of Departmental Representative.

.2 Prepare agenda for meetings.

.3 Distribute written notice of each meeting 4 days in advance of meeting date to Departmental Representative.

.4 Provide physical space and make arrangements for meetings.

.5 Preside at meetings.

.6 Record minutes of meetings. Include signficant proceedings and decisions. Identify actions by parties.

.7 Reproduce and distribute copies of minutes within three days after meetings and transmit to Departmental Representative, meeting participants and those not in attendance.

.8 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.2 PRECONSTRUCTION MEETING

.1 Within 15 days after award of Contract, request meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.

.2 Departmental Representative, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.

.3 Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.

.4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.

1.2 PRECONSTRUCTION MEETING (Cont'd)

.5 Agenda to include:
.1 Appointment of official representative of participants in the Work.
.2 Schedule of Work: in accordance with Section 01 32 16.
.3 Schedule of submission of shop drawings, samples, mock-ups, colour chips. Submit submittals in accordance with Section 01 33 00.
.4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00.
.5 Site security in accordance with Section 01 56 00.
.6 Health and safety in accordance with Section 01 35 29.
.7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
.8 Owner provided products.
.9 Record drawings and specifications in accordance with Sections 01 33 00 and 01 78 00.
.10 Maintenance manuals in accordance with Section 01 78 00.
.11 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00.
.12 Monthly progress claims, administrative procedures, photographs, hold backs.
.13 Appointment of inspection and testing agencies or firms.
.14 Insurances, transcript of policies.

1.3 PROGRESS MEETINGS

.1 During course of Work and two weeks prior to project completion, schedule progress meetings. every two weeks.

.2 Contractor, major Subcontractors involved in Work and Departmental Representative are to be in attendance.

.3 Notify parties minimum three days prior to meetings.

.4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within five days after meeting.

.5 Agenda to include the following:

1.3 PROGRESS MEETINGS (Cont'd)

.5 (Cont'd)

.1 Review, approval of minutes of previous meeting.

.2 Review of Work progress since previous meeting.

.3 Field observations, problems, conflicts.

.4 Problems which impede construction schedule.

.5 Review of off-site fabrication delivery schedules.

.6 Corrective measures and procedures to regain projected schedule.

.7 Revision to construction schedule.

.8 Progress schedule, during succeeding work period.

.9 Review submittal schedules: expedite as required.

.10 Maintenance of quality standards.

.11 Review proposed changes for affect on construction schedule and on completion date.

.12 Other business.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 DEFINITIONS

.1 Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.

.2 Bar Chart (GANTT Chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally Bar Chart should be derived from commercially available computerized project management system.

.3 Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.

.4 Construction Work Week: Monday to Friday, inclusive, will provide five day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.

.5 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.

.6 Master Plan: summary-level schedule that identifies major activities and key milestones.

.7 Milestone: significant event in project, usually completion of major deliverable.

.8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.

1.1 DEFINITIONS (Cont'd)

.9 Project Planning, Monitoring and Control System: overall system operated by Departmental Representative to enable monitoring of project work in relation to established milestones.

1.2 REQUIREMENTS

.1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.

.2 Plan to complete Work in accordance with prescribed milestones and time frame.

.3 Limit activity durations to maximum of approximately 10 working days, to allow for progress reporting.

.4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Certificate of Substantial Performance and Certificate of Completion as defined times of completion are of essence of this contract.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Submit to Departmental Representative within f ten working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.

.3 Submit Project Schedule to Departmental Representative within ten working days of receipt of acceptance of Master Plan.

1.4 MASTER PLAN

.1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).

.2 Departmental Representative will review and return revised schedules within 5 working days.

1.4 MASTER PLAN (Cont'd)

.3 Revise impractical schedule and resubmit within 5 working days.

.4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

1.5 PROJECT SCHEDULE

.1 Develop detailed Project Schedule derived from Master Plan.

.2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:

.1 Award.
.2 Shop Drawings, Samples.
.3 Permits.
.4 Mobilization.
.5 Interior alterations.
.6 Plumbing.
.7 Lighting.
.8 Electrical.
.9 Piping.
.10 Controls.
.11 Heating, Ventilating, and Air Conditioning.
.12 Millwork.
.13 Fire Systems.
.14 Testing and Commissioning.

1.6 PROJECT SCHEDULE REPORTING

.1 Update Project Schedule on weekly basis reflecting activity changes and completions, as well as activities in progress.

.2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

1.7 PROJECT MEETINGS

.1 Discuss Project Schedule at regular site meetings specified in Section 01 31 19, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.

.2 Weather related delays with their remedial measures will be discussed and negotiated.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not used.

END OF SECTION

PART 1 - GENERAL

1.1 ADMINISTRATIVE

.1 Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

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

.3 Present shop drawings, product data, samples and mock-ups in SI Metric units.

.4 Where items or information is not produced in SI Metric units converted values are acceptable.

.5 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.

.6 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.7 Verify field measurements and affected adjacent Work are co-ordinated.

.8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.

.9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.

1.1 ADMINISTRATIVE (Cont'd)

.10 Keep one reviewed copy of each submission on site.

.11 Submit number of hard copies specified for each type and format of submittal and also submit in electronic format as pdf files. Forward pdf, NMSEdit Professional spp, MS Word, MS Excel, and Autocad dwg files on USB compatible with PWGSC encryption requirements or through email or alternate electronic file sharing service such as ftp, as directed by Departmental Representative.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.

.2 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario of Canada.

.3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.4 Allow 5 working days for Departmental Representative's review of each submission.

.5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Amount. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.

1.2 SHOP DRAWINGS AND PRODUCT DATA (Cont'd)

.6 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.

.7 Accompany submissions with transmittal letter, in duplicate, containing:
- .1 Date.
- .2 Project title and number.
- .3 Contractor's name and address.
- .4 Identification and quantity of each shop drawing, product data and sample.
- .5 Other pertinent data.

.8 Submissions shall include:
- .1 Date and revision dates.
- .2 Project title and number.
- .3 Name and address of:
  - .1 Subcontractor.
  - .2 Supplier.
  - .3 Manufacturer.
- .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .5 Details of appropriate portions of Work as applicable:
  - .1 Fabrication.
  - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
  - .3 Setting or erection details.
  - .4 Capacities.
  - .5 Performance characteristics.
  - .6 Standards.
  - .7 Operating weight.
  - .8 Wiring diagrams.
  - .9 Single line and schematic diagrams.
  - .10 Relationship to adjacent work.

.9 After Departmental Representative's review, distribute copies.

.10 Submit three hard copies and one electronic copy of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.

1.2 SHOP DRAWINGS AND PRODUCT DATA (Cont'd)

.11 Submit three hard copies and one electronic copy of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
.1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
.2 Testing must have been within 3 years of date of contract award for project.

.12 Submit three hard copies and one electronic copy of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
.1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
.2 Certificates must be dated after award of project contract complete with project name.

.13 Submit three hard copies and one electronic copy of manufacturers instructions for requirements requested in specification Sections and as requested by Departmental Representative.
.1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.

.14 Submit three hard copies and one electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.

.15 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

.16 Submit three hard copies and one electronic copy of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.

.17 Supplement standard information to provide details applicable to project.

1.2 SHOP DRAWINGS AND PRODUCT DATA (Cont'd)

.18 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

.19 The review of shop drawings by Public Works and Government Services Canada (PWGSC) is for sole purpose of ascertaining conformance with general concept.

.1 This review shall not mean that PWGSC approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

.2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.3 SAMPLES

.1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.

.2 Deliver samples prepaid to Departmental Representative's site office.

.3 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.

.4 Where colour, pattern or texture is criterion, submit full range of samples.

1.3 SAMPLES (Cont'd)

.5 Adjustments made on samples by Departmental Representative are not intended to change Contract Amount. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.

.6 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.

.7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.4 MOCK-UPS

.1 Erect mock-ups in accordance with Section 01 45 00.

1.5 PHOTOGRAPHIC DOCUMENTATION

.1 Submit electronic and hard copy of colour digital photography in jpg format, standard resolution monthly with progress statement and as directed by Departmental Representative.

.2 Project identification: name and number of project and date of exposure indicated.

.3 Number of viewpoints: 4 locations.
.1 Viewpoints and their location as determined by Departmental Representative.

.4 Frequency of photographic documentation: weekly and as directed by Departmental Representative.

1.6 FEES, PERMITS AND CERTIFICATES

.1 Provide authorities having jurisdiction with information requested.

.2 Pay fees and obtain certificates and permits required.

.3 Furnish certificates and permits.

.4 Submit acceptable certificate stating that suspended ceiling systems provide adequate support for electrical fixtures, as required by current bulletin of Electrical Safety Authority (ESA).

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA): Canada
.1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.

.2 National Building Code 2015 (NBC):
.1 NBC 2015, Division B, Part 8 Safety Measures at Construction and Demolition Sites.

.3 National Fire Code 2015 (NFC):
.1 NFC 2015, Division B, Part 5 Hazardous Processes and Operations, subsection regarding Fire Safety Plan.

.4 Province of Ontario:
.1 Occupational Health and Safety Act Revised Statutes of Ontario 1990, Chapter O.1 as amended, and Regulations for Construction Projects, O. Reg. 213/91 as amended.
.2 O. Reg. 490/09, Designated Substances.
.3 Workplace Safety and Insurance Act, 1997.
.4 Municipal statutes and authorities.

.5 Treasury Board of Canada Secretariat (TBS):
.1 Treasury Board, Fire Protection Standard April 1, 2010 www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=17316&section=text.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Submit site-specific Health and Safety Plan, company's safety program and policy within 5 working days after kick-off meeting. Refer to Section 01 14 00 for additional requirements. Health and Safety Plan must include:
.1 Results of site specific safety hazard assessment.
.2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.

.3 Measures and controls to be implemented to address identified safety hazards and risks.

1.2 ACTION AND INFORMATIONAL SUBMITTALS (Cont'd)

.3 Provide a Fire Safety Plan, specific to the work location, in accordance with NBC, Division B, Article 8.1.1.1.3 prior to commencement of work. The plan shall be coordinated with, and integrated into, the existing Emergency Procedures and Evacuation Plan in place at the site. Departmental Representative will provide Emergency Procedures and Evacuation Plan. Deliver two copies of the Fire Safety Plan to the Departmental Representative not later than 14 days before commencing work.

.4 Contractor's and Sub-contractors' Safety Communication Plan.

.5 Contingency and Emergency Response Plan addressing standard operating procedures specific to the project site to be implemented during emergency situations. Coordinate plan with existing Emergency Response requirements and procedures provided by Departmental Representative.

.6 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within five days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within five days after receipt of comments from Departmental Representative.

.7 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.

.8 Submit names of personnel and alternates responsible for site safety and health.

.9 Submit records of Contractor's Health and Safety meetings when requested.

.10 Submit two copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative and authority having jurisdiction, weekly.

1.2 ACTION AND INFORMATIONAL SUBMITTALS (Cont'd)

.11 Submit two copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative, weekly.

.12 Submit copies of orders, directions or reports issued by health and safety inspectors of the authorities having jurisdiction.

.13 Submit copies of incident and accident reports.

.14 Submit Material Safety Data Sheets (MSDS).

.15 Submit Workplace Safety and Insurance Board (WSIB)- Experience Rating Report.

1.3 FILING OF NOTICE

.1 File Notice of Project with Provincial authorities prior to commencement of Work.

1.4 WORK PERMIT

.1 Obtain building permits related to project prior to commencement of Work.

.2 Obtain Hot Work Permit from Property Manager.

1.5 SAFETY ASSESSMENT

.1 Perform site specific safety hazard assessment related to project.

1.6 MEETINGS

.1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work.

1.7 REGULATORY REQUIREMENTS

.1 Comply with the Acts and regulations of the Province of Ontario.

.2 Comply with specified standards and regulations to ensure safe operations at site.

1.8 GENERAL REQUIREMENTS

.1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.

.2 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns either accepting or requesting improvements.

.3 Relief from or substitution for any portion or provision of minimum Health and Safety standards specified herein or reviewed site-specific Health and Safety Plan shall be submitted to Departmental Representative in writing.

1.9 COMPLIANCE REQUIREMENTS

.1 Comply with Ontario Occupational Health and Safety Act, R.S.O. 1990 Chapter 0.1, as amended.

1.10 RESPONSIBILITY

.1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

.2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

.3 Where applicable the Contractor shall be designated "Constructor", as defined by Occupational Health and Safety Act and Regulations for Construction Projects for the Province of Ontario.

1.11 UNFORSEEN HAZARDS

.1 Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of Work, immediately stop work and advise Departmental Representative verbally and in writing.

1.11 UNFORSEEN HAZARDS (Cont'd)

.2 Follow procedures in place for Employees Right to Refuse Work as specified in the Occupational Health and Safety Act for the Province of Ontario.

1.12 HEALTH AND SAFETY CO-ORDINATOR

.1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:

.1 Have working knowledge of occupational safety and health regulations.

.2 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.

.3 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.

.4 Be on site during execution of Work and report directly to and be under direction of site supervisor.

1.13 POSTING OF DOCUMENTS

.1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province of Ontario, and in consultation with Departmental Representative.

.1 Contractor's Safety Policy.

.2 Constructor's Name.

.3 Notice of Project.

.4 Name, trade, and employer of Health and Safety Representative or Joint Health and Safety Committee members (if applicable).

.5 Ministry of Labour Orders and reports.

.6 Occupational Health and Safety Act and Regulations for Construction Projects for Province of Ontario.

.7 Address and phone number of nearest Ministry of Labour office.

.8 Material Safety Data Sheets.

.9 Written Emeregency Response Plan.

.10 Site Specific Safety Plan.

.11 Valid certificate of first aider on duty.

.12 WSIB "In Case of Injury At Work" poster.

.13 Location of toilet and cleanup facilities.

1.14 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.

.2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.

.3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.

1.15 BLASTING

.1 Blasting or other use of explosives is not permitted.

1.16 POWDER ACTUATED DEVICES

.1 Use powder actuated devices only after receipt of written permission from Departmental Representative.

1.17 WORK STOPPAGE

.1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

.2 Assign responsibility and obligation to Health and Safety Coordinator to stop or start Work when, at Health and Safety Coordinator's discretion, it is necessary or advisable for reasons of health or safety. Departmental Representative may also stop Work for health and safety considerations.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not used.

END OF SECTION

PART 1 - GENERAL

1.1 SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Before commencing construction activities, submit Environmental Protection Plan for review and approval by the Departmental Representative.

.3 Environmental Protection Plan must include comprehensive overview of known or potential environmental issues to be addressed during construction.

.4 Address topics at level of detail commensurate with environmental issue and required construction tasks.

1.2 FIRES

.1 Fires and burning of rubbish on site is not permitted.

1.3 DISPOSAL OF WASTES

.1 Do not bury rubbish and waste materials.

.2 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

1.4 POLLUTION CONTROL

.1 Control emissions from equipment and plant in accordance with local authorities' emission requirements.

.2 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area.
.1 Provide temporary enclosures where required and as directed by Departmental Representative.

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

1.5 NOTIFICATION

.1 Departmental Representative will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, or permits.

.2 Contractor: after receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for approval by Departmental Representative.
.1 Take action only after receipt of written approval by Departmental Representative.

.3 Departmental Representative will issue stop order of work until satisfactory corrective action has been taken.

.4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES AND CODES

.1 Perform Work in accordance with National Building Code of Canada (NBC) 2015, National Fire Code of Canada (NFC) 2015 and Ontario Building Code (OBC) 2012, including all amendments up to bid closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply as directed by the Departmental Representative.

.2 Meet or exceed requirements of:
.1 Contract documents.
.2 Specified standards, codes and referenced documents.

1.2 HAZARDOUS MATERIAL DISCOVERY

.1 Stop work immediately and notify Departmental Representative if materials which may contain designated substances or PCB's, are discovered in course of work.

1.3 BUILDING SMOKING ENVIRONMENT

.1 Comply with smoking restrictions.

1.4 RELICS AND ANTIQUITIES

.1 Relics and antiquities, and items of historical or scientific interest such as cornerstones and contents, commemorative plaques, inscribed tables, and similar objects found on site shall remain the property of Parks Canada. Protect such articles and request directives from Departmental Representative.

1.5 IAQ - INDOOR AIR QUALITY

.1 Comply with CSA-Z204-94(R1999), Guideline for Managing Indoor Air Quality in Office Buildings and CSA B651-12.

1.6 ACCESSIBLE DESIGN

.1 Comply with CSA B651-12, Accessible Design for the Built Environment, unless specified otherwise. In any case of conflict or discrepancy between the building codes and CSA B651, the requirements of CSA B651 shall apply.

1.7 TAXES

.1 Pay applicable Federal, Provincial and Municipal taxes.

1.8 EXAMINATION

.1 Examine existing conditions and determine conditions affecting work.

.2 Conduct concrete floor moisture testing using Calcium Chloride moisture tests.
.1 Submit test results to Departmental Representative for approval prior to installing any flooring. Conduct one test per 100 m^2 of area being covered.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Inspection and testing, administrative and enforcement requirements.

.2 Tests and mix designs.

.3 Mock-ups.

.4 Equipment and system adjust and balance.

1.2 INSPECTION

.1 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.

.2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.

.3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.

.4 Departmental Representative may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, Contractor shall correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.

1.3 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies will be engaged by Departmental Representative for purpose of inspecting and/or testing portions of Work, above and beyond those required of the Contractor. Cost of such services will be borne by Departmental Representative.

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

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

.4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for retesting and reinspection.

1.4 ACCESS TO WORK

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

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

1.5 PROCEDURES

.1 Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.

.2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.

.3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.6 REJECTED WORK

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

.2 Make good other Contractor's work damaged by such removals or replacements promptly.

.3 If in opinion of Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Departmental Representative may deduct from Contract Amount difference in value between Work performed and that called for by Contract Documents, amount of which shall be determined by Departmental Representative.

1.7 REPORTS

.1 Submit 4 copies of inspection and test reports to Departmental Representative.

.2 Provide copies to Subcontractor of work being inspected or tested, manufacturer or fabricator of material being inspected or tested.

1.8 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as may be requested.

.2 The cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work shall be appraised by Departmental Representative and may be authorized as recoverable.

1.9 MOCK-UPS

.1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of all Sections required to provide mock-ups.

.2 Construct in all locations acceptable to Departmental Representative and as specified in specific Section.

1.9 MOCK-UPS (Cont'd)

.3 Prepare mock-ups for Departmental Representative's review with reasonable promptness and in an orderly sequence, so as not to cause any delay in Work.

.4 Failure to prepare mock-ups in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.

.5 If requested, Departmental Representative will assist in preparing a schedule fixing dates for preparation.

.6 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.

1.10 EQUIPMENT AND SYSTEMS

.1 Submit testing, adjusting and balancing reports for mechanical, electrical and building equipment systems.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

1.2 INSTALLATION AND REMOVAL

.1 Provide temporary utilities controls in order to execute work expeditiously.

.2 Remove from site all such work after use.

1.3 WATER SUPPLY

.1 Departmental Representative will supply potable water for construction use.

.2 Water supply to be metered and charged back to the Contractor based on their usage.

.3 Be responsible for the careful and reasonable use of supplied water.

1.4 TEMPORARY HEATING AND VENTILATION

.1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.

.2 Provide temporary heat and ventilation in enclosed areas as required to:
.1 Facilitate progress of Work.
.2 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
.3 Provide adequate ventilation to meet health regulations for safe working environment.

.3 Ventilating:
.1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
.2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
.3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.

1.4 TEMPORARY HEATING AND VENTILATION (Cont'd)

.3 (Cont'd)

.4 Ventilate storage spaces containing hazardous or volatile materials.

.5 Ventilate temporary sanitary facilities.

.6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.

.4 Permanent heating system of building, may be used when available. Be responsible for damage to heating system if use is permitted.

.5 On completion of Work for which permanent heating system is used, replace filters and clean service heating system as required.

.6 Pay costs for maintaining temporary heat, when using permanent heating system.

.7 Maintain strict supervision of operation of temporary heating and ventilating equipment to:

.1 Conform with applicable codes and standards.

.2 Enforce safe practices.

.3 Prevent abuse of services.

.4 Prevent damage to finishes.

.5 Vent direct-fired combustion units to outside.

.8 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.5 TEMPORARY POWER AND LIGHT

.1 Arrange for connection with appropriate utility company. Pay all costs for installation, maintenance and removal.

.2 Temporary power for electric equipment requiring in excess of above is responsibility of Contractor.

.3 Provide and maintain temporary lighting throughout project. Ensure level of illumination on all floors and stairs is not less than 162 lx.

1.5 TEMPORARY POWER AND LIGHT (Cont'd)

.4 Electrical power and lighting systems installed under this Contract may be used for construction requirements only with prior approval of Departmental Representative provided that guarantees are not affected. Make good damage to electrical system caused by use under this Contract. Replace lamps which have been used for more than 3 months.

1.6 FIRE PROTECTION

.1 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction and governing codes, regulations and bylaws.

.2 Burning rubbish and construction waste materials is not permitted on site.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Construction aids.

.2 Elevator use.

.3 Office and sheds.

.4 Parking.

.5 Project identification.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)
.1 CAN/CSA-Z321-96(R2006), Signs and Symbols for the Occupational Environment, withdrawn but still available from CSA, CCOHS and Techstreet.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

1.4 INSTALLATION AND REMOVAL

.1 Prepare site plan indicating proposed location and dimensions of area to be hoarded and used by Contractor, number of trailers to be used, avenues of ingress/egress to hoarded area and details of hoarding installation.

.2 Indicate use of supplemental or other staging area.

.3 Provide construction facilities in order to execute work expeditiously.

.4 Remove from site all such work after use.

1.5 HOISTING

.1 Provide, operate and maintain hoists/cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for use thereof.

1.5 HOISTING (Cont'd)

.2 Hoists/cranes shall be operated by qualified operator.

1.6 ELEVATORS

.1 Designated elevators may be used by construction personnel and for transporting of materials. Co-ordinate use with Departmental Representative.

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

1.7 SITE STORAGE/LOADING

.1 Confine work and operations of employees to areas defined by Contract Documents. Do not unreasonably encumber premises with products.

.2 Do not load or permit to load any part of Work with a weight or force that will endanger the Work.

1.8 CONSTRUCTION PARKING

.1 Parking will be permitted on site provided it does not disrupt performance of Work.

.2 Provide and maintain adequate access to project site.

.3 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractors' use of roads.

1.9 SECURITY

.1 Contractor shall pay for responsible security personnel to guard site and contents of site after working hours and during holidays.

1.10 OFFICES

.1 Provide location within existing building heated to 22°C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table.

.2 Provide a clearly marked and fully stocked first-aid case in a readily available location.

1.10 OFFICES (Cont'd)

.3 Subcontractors may provide their own offices as necessary. Direct location of these offices.

1.11 EQUIPMENT, TOOL AND MATERIALS STORAGE

.1 Provide and maintain, in a clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.

.2 Locate materials not required to be stored in weatherproof sheds on site in a manner to cause least interference with work activities.

1.12 SANITARY FACILITIES

.1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.

.2 Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition.

1.13 CONSTRUCTION SIGNAGE

.1 No other signs or advertisements, other than warning signs, are permitted on site.

.2 Signs and notices for safety and instruction shall be in both official languages. Graphic symbols shall conform to CAN/CSA-Z321.

.3 Maintain approved signs and notices in good condition for duration of project, and dispose of off site on completion of project or earlier if directed by Departmental Representative.

1.14 CLEAN-UP

.1 Remove construction debris, waste materials, packaging material from work site daily.

.2 Store materials resulting from demolition activities that are salvageable.

.3 Stack stored new or salvaged material.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Barriers.

.2 Environmental Controls.

1.2 INSTALLATION AND REMOVAL

.1 Provide temporary controls in order to execute Work expeditiously.

.2 Remove from site all such work after use.

1.3 HOARDING

.1 Erect temporary site enclosures using 38 x 89 mm construction grade lumber framing at 600 mm o.c. and 1200 x 2400 x 13 mm exterior grade fir plywood to CSA O121.

.2 Apply gypsum panels vertically flush and butt jointed.

.3 Paint public side of site enclosure in selected colours in accordance with Section 09 91 23. Maintain public side of enclosure in clean condition.

1.4 GUARD RAILS AND BARRICADES

.1 Provide secure, rigid guard rails and barricades around open shafts, open stair wells, and open edges of floors.

.2 Provide as required by governing authorities.

1.5 WEATHER ENCLOSURES

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

.2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.

1.6 DUST TIGHT SCREENS

.1 Provide dust tight screens or insulated partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.

.2 Maintain and relocate protection until such work is complete.

1.7 PROTECTION OF BUILDING FINISHES

.1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.

.2 Provide necessary screens, covers, and hoardings.

.3 Confirm with Departmental Representative locations and installation schedule 3 days prior to installation.

.4 Be responsible for damage incurred due to lack of or improper protection.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Product quality, availability, storage, handling, protection, and transportation.

.2 Manufacturer's instructions.

.3 Quality of Work, coordination and fastenings.

.4 Existing facilities.

1.2 REFERENCES

.1 Within text of specifications, reference may be made to reference standards.

.2 Conform to these standards, in whole or in part as specifically requested in specifications.

.3 If there is question as to whether any product or system is in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.

.4 The cost for such testing will be born by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.

.5 Conform to latest date of issue of referenced standards in effect on date of submission of Bids, except where specific date or issue is specifically noted.

1.3 QUALITY

.1 Products, materials, equipment and articles (referred to as products throughout specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of Products provided.

1.3 QUALITY (Cont'd)

.2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

.3 Should any dispute arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.

.4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout 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.

1.4 AVAILABILITY

.1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are foreseeable, notify Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

.2 In event of failure to notify Departmental Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Departmental Representative reserves right to substitute more readily available products of similar character, at no increase in Contract Amount or Contract Time.

1.5 METRIC SIZED MATERIALS

.1 SI metric units of measurement are used exclusively on the drawings and in the specifications for this project.

1.5 METRIC SIZED MATERIALS (Cont'd)

.2 The Contractor is required to provide metric products in the sizes called for in the Contract Documents except where a valid claim can be made that a particular product is not available on the Canadian market.

.3 Claims for exemptions from use of metric sized products shall be in writing and fully substantiated with supportive documentation. Promptly submit application to Departmental Representative for consideration and ruling. Non-metric sized products may not be used unless Contractor's application has been approved in writing by the Departmental Representative.

.4 Difficulties caused by the Contractor's lack of planning and effort to obtain modular metric sized products which are available on the Canadian market will not be considered sufficient reasons for claiming that they cannot be provided.

.5 Claims for additional costs due to provision of specified modular metric sized products will not be considered.

1.6 STORAGE, HANDLING AND PROTECTION

.1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.

.2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.

.3 Store products subject to damage from weather in weatherproof enclosures.

.4 Store cementitious products clear of earth or concrete floors, and away from walls.

.5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.

1.6 STORAGE, HANDLING AND PROTECTION (Cont'd)

.6 Store sheet materials, lumber and gypsum board on flat, solid supports and keep clear of ground. Slope to shed moisture.

.7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.

.8 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.

.9 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.7 TRANSPORTATION

.1 Pay costs of transportation of products required in performance of Work.

1.8 MANUFACTURER'S INSTRUCTIONS

.1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.

.2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative may establish course of action.

.3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Amount or Contract Time.

1.9 QUALITY OF WORK

.1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Departmental Representative if required Work is such as to make it impractical to produce required results.

.2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.

.3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.

1.10 CO-ORDINATION

.1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.

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

1.11 CONCEALMENT

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

.2 Before installation, inform Departmental Representative if there is interference. Install as directed by Departmental Representative.

1.12 REMEDIAL WORK

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

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

1.13 LOCATION OF FIXTURES

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

.2 Inform Departmental Representative of conflicting installation. Install as directed.

1.14 FASTENINGS

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

.2 Prevent electrolytic action between dissimilar metals and materials.

.3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.

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

.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.

1.15 FASTENINGS - EQUIPMENT

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

.2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No.304 stainless steel for exterior areas.

.3 Bolts may not project more than one diameter beyond nuts.

1.15 FASTENINGS - EQUIPMENT (Cont'd)

.4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.16 PROTECTION OF WORK IN PROGRESS

.1 Prevent overloading of any part of building. Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated without written approval of Departmental Representative.

1.17 EXISTING UTILITIES

.1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and/or building occupants.

.2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Field engineering survey services

1.2 SURVEY REQUIREMENTS

.1 Establish lines and levels, locate and lay out, by instrumentation.

.2 Establish lines and levels for mechanical and electrical work.

1.3 EXISTING SERVICES

.1 Before commencing work, establish location and extent of service lines in area of Work and notify Departmental Representative of findings.

.2 Remove abandoned service lines within 2 m of structures. Cap or otherwise seal lines at cut-off points as directed by Departmental Representative.

1.4 LOCATION OF EQUIPMENT AND FIXTURES

.1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.

.2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.

.3 Inform Departmental Representative of impending installation and obtain approval for actual location.

.4 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.

1.5 RECORDS

.1 Maintain a complete, accurate log of control and survey work as it progresses.

1.5 RECORDS (Cont'd)

.2 Record locations of maintained, re-routed and abandoned service lines.

1.6 SUBMITTALS

.1 On request of Departmental Representative, submit documentation to verify accuracy of field engineering work.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00.

.2 Submit written request in advance of cutting or alteration which affects:
- .1 Structural integrity of elements of project.
- .2 Integrity of moisture-resistant elements.
- .3 Efficiency, maintenance, or safety of operational elements.
- .4 Visual qualities of sight-exposed elements.
- .5 Work of Owner or separate contractor.

.3 Include in request:
- .1 Identification of project.
- .2 Location and description of affected Work.
- .3 Statement on necessity for cutting or alteration.
- .4 Description of proposed Work, and products to be used.
- .5 Alternatives to cutting and patching.
- .6 Effect on Work of Owner or separate contractor.
- .7 Written permission of affected separate contractor.
- .8 Date and time work will be executed.

1.2 MATERIALS

.1 Required for original installation.

.2 Change in Materials: Submit request for substitution in accordance with Section 01 33 00 and 01 61 00.

1.3 PREPARATION

.1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.

.2 After uncovering, inspect conditions affecting performance of Work.

1.3 PREPARATION (Cont'd)

.3 Beginning of cutting or patching means acceptance of existing conditions.

.4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.

1.4 EXECUTION

.1 Execute cutting, fitting, and patching to complete Work.

.2 Fit several parts together, to integrate with other Work.

.3 Uncover Work to install ill-timed Work.

.4 Remove and replace defective and non-conforming Work.

.5 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.

.6 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.

.7 Employ original installer to perform cutting and patching for moisture-resistant elements, and sight-exposed surfaces.

.8 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.

.9 Restore work with new products in accordance with requirements of Contract Documents.

.10 Submit proposed materials, finishes and installation method for patching to Departmental Representative for approval, prior to patching.

.11 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.

1.4 EXECUTION (Cont'd)

.12 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

.13 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material in accordance with Section 07 84 00, full thickness of the construction element.

.14 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse, recycling and composting in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Progressive cleaning.

.2 Final cleaning.

1.2 PROJECT CLEANLINESS

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Owner or other Contractors.

.2 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.

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

.4 Provide on-site containers for collection of waste materials and debris.

.5 Provide and use clearly marked separate bins for recycling. Refer to Section 01 74 20.

.6 Remove waste material and debris from site at end of each working day.

.7 Dispose of waste materials and debris off site.

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

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

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

1.2 PROJECT CLEANLINESS (Cont'd)

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

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

1.3 FINAL CLEANING

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

.2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.

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

.4 Remove waste products and debris other than that caused by Owner or other Contractors.

.5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.

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

.7 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.

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

.9 Clean lighting reflectors, lenses, and other lighting surfaces.

1.3 FINAL CLEANING (Cont'd)

.10 HEPA vacuum clean and dust building interiors, behind grilles, louvres and screens.

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

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

.13 Clean equipment and fixtures to a sanitary condition; clean or replace filters of mechanical equipment.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 CONSTRUCTION & DEMOLITION WASTE

.1 Carefully deconstruct and source separate materials/equipment and divert, from D&C waste destined for landfill to maximum extent possible. Target for this project is 75% diversion from landfill. Reuse, recycle, compost, anaerobic digest or sell material for reuse except where indicated otherwise. On site sales are not permitted.

.2 Source separate waste and maintain waste audits in accordance with the Environmental Protection Act, Ontario Regulation 102/94 and Ontario Regulation 103/94.
.1 Provide facilities for collection, handling and storage of source separated wastes.
.2 Source separate the following waste:
.1 Brick and portland cement concrete.
.2 Corrugated cardboard.
.3 Wood, not including painted or treated wood or laminated wood.
.4 Gypsum board, unpainted.
.5 Steel.

.3 Submit a waste reduction workplan indicating the materials and quantities of material that will be recycled and diverted from landfill.
.1 Indicate how material being removed from the site will be reused, recycled, or composted.

.4 Submit proof that all waste is being disposed of at a licensed land fill site or waste transfer site. A copy of the disposal/waste transfer site's license and a letter verifying that said landfill site will accept the waste must be supplied to Departmental Representative prior to removal of waste from the demolition site.

1.2 WASTE PROCESSING SITES

.1 Province of: Ontario.
.1 Ministry of Environment and Energy, 135 St. Clair Avenue West, Toronto, ON, M4V 1P5.
.2 Telephone: 800-565-4923 or 416-323-4321.
.3 Fax: 416-323-4682.

1.2 WASTE PROCESSING SITES (Cont'd)

.2 Recycling Council of Ontario: 215 Spadina Avenue, #225, Toronto, ON, M5T 2C7.
- .1 Telephone: 416-657-2797.
- .2 Fax: 416-960-8053.
- .3 Email: rco@rco.on.ca.
- .4 Internet: http://www.rco.on.ca/.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT

.1 Government Chief Responsibility for the Environment.

Province I	Address	General Inquiries	Fax
Ontario	Ministry of Environment and Energy 135 St Clair Avenue West Toronto, ON M4V 1P5	(416) 323-4321 (800) 565-4923	(416) 323-4682
	Environment Canada Toronto, ON	(416) 734-4494	

END OF SECTION

PART 1 - GENERAL

1.1 INSPECTION AND DECLARATION

.1 Contractor's Inspection: Contractor and all Subcontractors shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
.1 Notify Departmental Representative in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
.2 Request Departmental Representative's Inspection.

.2 Departmental Representative's Inspection: Departmental Representative and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor to correct Work accordingly.

.3 Completion: submit written certificate that following have been performed:
.1 Work has been completed and inspected for compliance with Contract Documents.
.2 Defects have been corrected and deficiencies have been completed.
.3 Equipment and systems have been tested, adjusted and balanced and are fully operational.
.4 Certificates required by PWGSC Fire Protection Engineer and Utility companies have been submitted.
.5 Operation of systems have been demonstrated to Owner's personnel.
.6 Work is complete and ready for final inspection.

.4 Final Inspection: when items noted above are completed, request final inspection of Work by Departmental Representative and Contractor. If Work is deemed incomplete by Departmental Representative, complete outstanding items and request reinspection.

1.2 CLEANING

.1 In accordance with Section 01 74 11.

1.2 CLEANING (Cont'd)

.2 Remove waste and surplus materials, rubbish and construction facilities from the site in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 As-built, samples, and specifications.

.2 Equipment and systems.

.3 Product data, materials and finishes, and related information.

.4 Operation and maintenance data.

.5 Spare parts, special tools and maintenance materials.

.6 Warranties and bonds.

.7 Final site survey.

1.2 SUBMISSION

.1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.

.2 Copy will be returned after final inspection, with Departmental Representative's comments.

.3 Revise content of documents as required prior to final submittal.

.4 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, four final copies of maintenance manuals and commissioning documentation in English and French.

.5 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.

.6 If requested, furnish evidence as to type, source and quality of products provided.

.7 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.

.8 Pay costs of transportation.

1.3 FORMAT

.1 Organize data in the form of an instructional manual.

.2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.

.3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.

.4 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.

.5 Arrange content by systems, under Section numbers and sequence of Table of Contents.

.6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.7 Text: Manufacturer's printed data, or typewritten data.

.8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

.9 Provide 1:1 scaled CAD files in dwg format. Forward pdf, NMSEdit Professional spp, MS Word, MS Excel, and Autocad dwg files on USB compatible with PWGSC encryption requirements or through email or alternate electronic file sharing service such as ftp, as directed by Departmental Representative.

1.4 CONTENTS - EACH VOLUME

.1 Table of Contents: provide title of project;
.1 Date of submission; names,
.2 Addresses, and telephone numbers of Contractor with name of responsible parties;
.3 Schedule of products and systems, indexed to content of volume.

.2 For each product or system:
.1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

1.4 CONTENTS - EACH VOLUME (Cont'd)

.3 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.

.4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00.

.6 Training: Refer to Section 01 79 00.

1.5 AS-BUILTS AND SAMPLES

.1 In addition to requirements in General Conditions, maintain at the site for Departmental Representativeone record copy of:
.1 Contract Drawings.
.2 Specifications.
.3 Amendments and addenda.
.4 Change Orders and other modifications to the Contract.
.5 Reviewed shop drawings, product data, and samples.
.6 Field test records.
.7 Inspection certificates.
.8 Manufacturer's certificates.

.2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.

.3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.

.4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.

.5 Keep record documents and samples available for inspection by Departmental Representative.

1.5 AS-BUILTS AND SAMPLES (Cont'd)

.6 Turn one set, paper copy and electronic copy, of AS-BUILT drawings and specifications over to Departmental Representative on completion of work. Submit files on USB compatible with PWGSC encryption requirements or through email or alternate electronic file sharing service such as ftp, as directed by Departmental Representative.

.7 If project is completed without significant deviations from Contract drawings and specifications submit to Departmental Representative one set of drawings and specifications marked "AS-BUILT".

1.6 RECORDING ACTUAL SITE CONDITIONS

.1 Record information on set of black line opaque drawings, and in copy of Project Manual, provided by Departmental Representative.

.2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.

.3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.

.4 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:
.1 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
.2 Field changes of dimension and detail.
.3 Changes made by change orders.
.4 Details not on original Contract Drawings.
.5 References to related shop drawings and modifications.

.5 Specifications: legibly mark each item to record actual construction, including:
.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
.2 Changes made by Amendments and change orders.

1.6 RECORDING ACTUAL SITE CONDITIONS (Cont'd)

.6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

1.7 FINAL SURVEY

.1 Submit final site survey information in accordance with Section 01 71 00, certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

1.8 EQUIPMENT AND SYSTEMS

.1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

.2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.

.3 Include installed colour coded wiring diagrams.

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

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

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

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

.8 Include sequence of operation by controls manufacturer.

1.8 EQUIPMENT AND SYSTEMS (Cont'd)

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

.10 Provide installed control diagrams by controls manufacturer.

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

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

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

.14 Include test and balancing reports as specified in Section 01 45 00.

.15 Additional requirements: As specified in individual specification sections.

1.9 MATERIALS AND FINISHES

.1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.

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

.3 Moisture-protection Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.4 Additional Requirements: as specified in individual specifications sections.

1.10 SPARE PARTS

.1 Provide spare parts, in quantities specified in individual specification sections.

1.10 SPARE PARTS (Cont'd)

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to location as directed; place and store.

.4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

1.11 MAINTENANCE MATERIALS

.1 Provide maintenance and extra materials, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to location as directed; place and store.

.4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

1.12 SPECIAL TOOLS

.1 Provide special tools, in quantities specified in individual specification section.

.2 Provide items with tags identifying their associated function and equipment.

.3 Deliver to location as directed; place and store.

.4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.

1.13 STORAGE, HANDLING AND PROTECTION

.1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.

.2 Store in original and undamaged condition with manufacturer's seal and labels intact.

.3 Store components subject to damage from weather in weatherproof enclosures.

.4 Store paints and freezable materials in a heated and ventilated room.

.5 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.

1.14 WARRANTIES AND BONDS

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

.2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

.3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work.

.4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Certificate of Substantial Performance is determined.

.5 Verify that documents are in proper form, contain full information, and are notarized.

.6 Co-execute submittals when required.

.7 Retain warranties and bonds until time specified for submittal.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Procedures for demonstration and instruction of equipment and systems to Owner's O&M personnel.

.2 O&M personnel includes property facility manager, building operators, maintenenace staff, security staff and technical specialists, as applicable.

1.2 DESCRIPTION

.1 Demonstrate operation and maintenance of equipment and systems to Departmental Representative's personnel two weeks prior to date of substantial performance.

.2 Departmental Representative will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times.

1.3 QUALITY CONTROL

.1 When specified in individual Sections, require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct Owner's personnel, and provide written report that demonstration and instructions have been completed.

.2 Submit training schedule of time and date for demonstration and training of each item of equipment and each system in accordance with the training plan four weeks prior to designated dates, for Departmental Representative's approval.

.3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.

.4 Report shall give time and date of each demonstration and training, with list of persons present.

1.4 CONDITIONS FOR DEMONSTRATIONS

.1 Equipment has been inspected and put into operation in accordance with appropriate Section.

.2 Testing, adjusting, and balancing has been performed and equipment and systems are fully operational.

.3 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.5 PREPARATION

.1 Verify that conditions for demonstration and instructions comply with requirements.

.2 Verify that designated O&M personnel are present.

1.6 DEMONSTRATION AND INSTRUCTIONS

.1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at agreed upon times, at the designated location.

.2 Instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.

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

.4 Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instructions.

.5 Refer to individual Sections for specific demonstration and training requirements.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes:
.1 This section is limited to portions of the Building Management Manual (BMM) provided to Departmental Representative by Contractor.

.2 Acronyms:
.1 BMM - Building Management Manual.
.2 Cx - Commissioning.
.3 HVAC - Heating, Ventilation and Air Conditioning.
.4 PI - Product Information.
.5 PV - Performance Verification.
.6 TAB - Testing, Adjusting and Balancing.
.7 WHMIS - Workplace Hazardous Materials Information System.

1.2 GENERAL REQUIREMENTS

.1 Standard letter size paper 216 mm x 279 mm.

.2 Methodology used to facilitate updating.

.3 Drawings, diagrams and schematics to be professionally developed.

.4 Electronic copy of data to be in a format accepted and approved by Departmental Representative.

1.3 APPROVALS

.1 Prior to commencement, co-ordinate requirements for preparation, submission and approval with Departmental Representative.

1.4 GENERAL INFORMATION

.1 Provide Departmental Representative the following for insertion into appropriate Part and Section of BMM:
.1 Complete list of names, addresses, telephone and fax numbers of Contractor, sub-contractors that participated in delivery of project - as indicated in Section 1.2 of BMM.

1.4 GENERAL INFORMATION (Cont'd)

.1 (Cont'd)

.2 Summary of architectural, structural, fire protection, mechanical and electrical systems installed and commissioned - as indicated in Section 1.4 of BMM.

.1 Including sequence of operation as finalized after commissioning is complete as indicated in Section 2.0 of BMM.

.3 Description of building operation under conditions of heightened security and emergencies as indicated in Section 2.0 of BMM.

.4 System, equipment and components Maintenance Management System (MMS) identification - Section 2.1 of BMM.

.5 Information on operation and maintenance of architectural systems and equipment installed and commissioned - Section 2.0 of BMM.

.6 Information on operation and maintenance of fire protection and life safety systems and equipment installed and commissioned - Section 2.0 of BMM.

.7 Information on operation and maintenance of mechanical systems and equipment installed and commissioned - Section 2.0 of BMM.

.8 Operating and maintenance manual - Section 3.2 of BMM.

.9 Final commissioning plan as actually implemented.

.10 Completed commissioning checklists.

.11 Commissioning test procedures employed.

.12 Completed Product Information (PI) and Performance Verification (PV) report forms, approved and accepted by Departmental Representative.

.13 Commissioning reports.

1.5 CONTENTS OF OPERATING AND MAINTENANCE MANUAL

.1 For detailed requirements refer to Section 01 78 00.

.2 Departmental Representative to review and approve format and organization within 12 weeks of award of contract.

.3 Include original manufactures brochures and written information on products and equipment installed on this project.

1.5 CONTENTS OF OPERATING AND MAINTENANCE MANUAL (Cont'd)

.4 Record and organize for easy access and retrieval of information contained in BMM.

.5 Include completed PI report forms, data and information from other sources as required.

.6 Inventory directory relating to information on installed systems, equipment and components.

.7 Approved project shop-drawings, product and maintenance data.

.8 Manufacturer's data and recommendations relating: manufacturing process, installation, commissioning, start-up, O&M, shutdown and training materials.

.9 Inventory and location of spare parts, special tools and maintenance materials.

.10 Warranty information.

.11 Inspection certificates with expiration dates, which require on-going re-certification inspections.

.12 Maintenance program supporting information including:
.1 Recommended maintenance procedures and schedule.
.2 Information to removal and replacement of equipment including, required equipment, points of lift and means of entry and egress.

1.6 LIFE SAFETY COMPLIANCE (LSC) MANUAL

.1 Samples of LSC Manual will be available from Departmental Representative.

.2 Content of Manual:
.1 All possible Emergency situations modes including: presence of fire and smoke, power failure, loss of water or pressure, chemical spills and refrigerant release.
.2 Failure of elevators and escalators.
.3 HVAC emergencies and fuel supply failures.
.4 Intrusion and security breach.
.5 Emergency provisions for natural disasters, bomb threats and other disruptive situations.

1.6 LIFE SAFETY COMPLIANCE (LSC) MANUAL (Cont'd)

.2 (Cont'd)

.6 Dedicated emergency generators for high security projects, medical facilities and computer systems.

.7 Emergency control procedures for fire, power and major equipment failure.

.8 Emergency contacts and numbers.

.9 Manual to be readily available and comprehensible to non-technical readers.

1.7 SUPPORTING DOCUMENTATION FOR INSERTION INTO SUPPORTING APPENDICES

.1 Provide Departmental Representative supporting documentation relating to installed equipment and system, including:

.1 General:

.1 Finalized commissioning plan.

.2 WHMIS information manual.

.3 Approved "as-built" drawings and specifications.

.4 Procedures used during commissioning.

.5 Cross-Reference to specification sections.

.2 Architectural and structural:

.1 Inspection certificates, construction permits.

.2 PV reports.

.3 Fire prevention, suppression and protection:

.1 Test reports.

.2 Smoke test reports.

.3 PV reports.

.4 Mechanical:

.1 Installation permits, inspection certificates.

.2 Piping pressure test certificates.

.3 Ducting leakage test reports.

.4 TAB and PV reports.

.5 Charts of valves and steam traps.

.6 Copies of posted instructions.

.5 Electrical:

.1 Installation permits, inspection certificates.

.2 TAB and PV reports.

.3 Electrical work log book.

.4 Charts and schedules.

.5 Locations of cables and components.

.6 Copies of posted instructions.

1.7 SUPPORTING DOCUMENTATION FOR INSERTION INTO SUPPORTING APPENDICES (Cont'd)

.1 (Cont'd)
.5 (Cont'd)

.2 Assist Departmental Representative with preparation of BMM.

1.8 LANGUAGE

.1 English and French Language to be in separate binders.

1.9 IDENTIFICATION OF FACILITY

.1 When submitting information to Departmental Representative for incorporation into BMM, use system for identification of documentation as indicated by the Departmental Representative.

1.10 USE OF CURRENT TECHNOLOGY

.1 Use current technology for production of documentation. Emphasis on ease of accessibility at all times, maintain in up-to-date state, compatibility with user's requirements.

.2 Obtain Departmental Representative's approval before starting Work.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Methods and procedures for deconstruction of structures and parts of structures.

1.2 REFERENCES

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

.2 Federal Legislation.
.1 Canadian Environmental Assessment Act (CEAA), 1992, c. 37.
.2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
.3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.3 DEFINITIONS

.1 Alternate Disposal: reuse and recycling of materials by designated facility, user or receiving organization which has valid Certificate of Approval to operate. Alternative to landfill disposal.

.2 Deconstruction: systematic dismantling of structure in a manner that achieves safe removal/disposal of hazardous materials and maximum salvage/recycling of materials.
.1 Ultimate objective is to recover potentially valuable resources while diverting from landfill what has traditionally been significant portion of waste system.

.3 Demolition: rapid destruction of structure with or without prior removal of hazardous materials.

.4 Hazardous Materials: dangerous substances, dangerous goods, hazardous commodities and hazardous products, including but not limited to: corrosive agents, flammable substances, ammunition, explosives, radioactive substances, or other material that can endanger human health, well being or environment if handled improperly.

1.3 DEFINITIONS (Cont'd)

.5 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.

.6 Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form.
.1 Recycling does not include burning, incinerating, or thermally destroying waste.

.7 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:
.1 Salvaging reusable materials from remodelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
.2 Returning reusable items including pallets or unused products to vendors.

.8 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.

.9 Source Separation: acts of keeping different types of waste materials separate, beginning from first time they became waste.

.10 Waste Management Coordinator (WMC): contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.

1.4 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00.

.2 Submit pre-demolition audit and deconstruction/disassembly plan prior to starting work in accordance with Section 01 33 00.

1.4 SUBMITTALS (Cont'd)

.3 Submit copies of receipts from authorized disposal sites and reuse and recycling facilities for material removed from site to Departmental Representative monthly upon request.
.1 Written authorization from Departmental Representative is required to deviate from facilities listed in Waste Reduction Workplan.

.4 Include following information:
.1 Time and date of removal.
.2 Description of materials.
.3 Quantity of material.
.4 Breakdown of reuse, recycling and landfill quantities.
.5 End destination of materials.

.5 Workers, haulers and subcontractors must possess current, applicable Certificates of Approval to remove, handle and dispose of wastes categorized Provincially and Municipally as hazardous.
.1 Provide proof of compliance within 24 hours upon written request of Departmental Representative.

1.5 QUALITY ASSURANCE

.1 Ensure Work is performed in compliance with CEPA, CEAA, TDGA, and applicable provincial regulations.

1.6 STORAGE, HANDLING AND PROTECTION

.1 Do in accordance with Section 01 61 00.

1.7 ENVIRONMENTAL REQUIREMENTS

.1 Do Work in accordance with Section 01 35 43.

1.8 SITE CONDITIONS

.1 Existing Conditions.

.1 Should materials resembling spray or trowel applied asbestos or other designated substances be encountered in course of deconstruction, stop work, take preventative measures, and notify Departmental Representative immediately. Do not proceed until written instructions have been received.

.2 Label and package component parts of mechanical and electrical material specified for salvage in accordance with Departmental Representative's instructions to prevent damage or loss.

.2 Protection.

.1 Prevent movement, settlement or damage of adjacent structures, services, and parts of existing structure to remain. Provide bracing as required. Repair damage caused by deconstruction as directed by Departmental Representative.

.2 Support affected structures and, if safety of structure being deconstructed or adjacent structures or services appear to be endangered, take preventative measures. Cease operations and immediately notify Departmental Representative.

.3 Prevent debris from blocking surface drainage system, elevators, mechanical and electrical systems.

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 Leave equipment and machinery running only while in use, except where extreme temperatures prohibit shutting down.

.2 Wherever possible, use water efficient wetting equipment/trucks/attachments when minimizing dust.

.3 Demonstrate that tools are being used in manner which allows for salvage of materials in best condition possible.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Do Work in accordance with Section 01 71 00.

.2 Disconnect and re-route electrical, telephone and communication service lines entering buildings to be deconstructed. Post warning signs on electrical lines and equipment which must remain energized to serve other products during period of demolition.

.3 Locate and protect utility lines. Do not disrupt active or energized utilities designated to remain undisturbed.

.4 Disconnect and cap designated mechanical services.
.1 Natural gas supply lines: remove in accordance with utility company requirements.
.2 Water lines: remove in accordance with requirements of authority having jurisdiction

3.2 DISASSEMBLY

.1 Materials removed from as a result of remedial demolition work are property of Contractor, unless otherwise indicated.

.2 Throughout course of deconstruction pay close attention to connections and material assemblies. Employ workmanship procedures which minimize damage to materials and equipment.

.3 Ensure workers and subcontractors are trained to carry out work in accordance with appropriate deconstruction techniques.

.4 Project supervisor with previous deconstruction experience must be present on site throughout project.

.5 Perform demolition with extreme care. Confine effects of demolition to those parts which are to be demolished.

.6 Perform work and prevent inconveniece to persons outside those parts which are to be demolished.

3.2 DISASSEMBLY (Cont'd)

.7 Deconstruct in accordance with CSA S350 and other applicable safety standards.

.8 Workers must utilize adequate fall protection where required by authorities having jurisdiction or where the Departmental Representative considers it necessary.

.9 Maintain structural integrity of structure.

.10 Systematically remove finishes, furnishings, and mechanical and electrical equipment as indicated.

.11 Carefully remove doors and frames from structure.

.12 Existing decommissioned dumbwaiter machinery at covered enclosed dumbwaiter to be removed.

.13 Disassemble non-loadbearing interior partitions and remove materials from structure.

.14 Disassemble in sequence: interior loadbearing partitions, floor finishes.

.15 Remove interior finishes, such as ceiling and floor finishes, where new finishes are indicated on the Contract Drawings.
.1 Removal of ceilings shall include complete removal including bulkheads and suspension system.
.2 Removal of adhesive applied finishes shall include complete removal to substrate including adhesive. Take adequate care to prevent damage to substrate.
.3 Remove existing floor finishes, include mortar bed, underlayment or other cleavage membranes, underpad, base, floor moulding and transition strips.

.16 Wherever possible, transfer material assemblies from heights to ground level for easier disassembly. Take appropriate measures to ensure safety.

.17 Separate from waste stream, material in condition suitable for reuse and/or recycling.

3.2 DISASSEMBLY (Cont'd)

.18 Remove and store materials to be salvaged, in manner to prevent damage.

.1 Store and protect in accordance with requirements for maximum preservation of material.

.2 Handle salvaged materials as new materials.

.3 Salvaged items must not be chipped, cracked, stained or damaged.

.4 Materials and items to be salvaged include the following:

.1 Exit bilingual exit signs.

.2 Fire hose cabinet (FHC).

.3 Acoustic tiles for reinstallation under Section 09 51 23.

.4 Existing window blinds to be removed, salvaged and returned to the Owner.

.5 Additional items as indicated on the drawings or by the Departmental Representative.

.19 Source separate for recycling materials that cannot be salvaged for reuse including wood, metal, and concrete.

.20 Remove materials that cannot be salvaged for reuse or recycling and dispose of in accordance with applicable codes at licensed facilities.

.21 Where existing materials are to be re-used in Work, use special care in removal, handling, storage and re-installation to assure proper function in completed work.

3.3 PROCESSING

.1 Designate location for processing of materials which eliminates double handling and provides adequate space to maintain efficient material flow.

.2 Denail, strip, and separate materials to ensure best possible condition of salvaged materials.

.3 Keep processing area clean and free of excess debris.

3.3 PROCESSING (Cont'd)

.4 Supply separate, marked disposal bins for categories of waste material. Do not remove bins from site until inspected and approved by Departmental Representative. Notify Departmental Representative prior to removal of bins from site.

.5 Separate processed materials into organized piles for stockpiling. Provide collection area for materials processed and designated for alternate disposal. Pile materials on pallets to facilitate transport to storage areas.

3.4 STOCKPILING

.1 Label stockpiles, indicating material type and quantity.

.2 Designate appropriate security resources/measures to prevent vandalism, damage and theft.

.3 Locate stockpiled materials convenient for use in new construction. Eliminate double handling wherever possible.

.4 Stockpile materials designated for alternate disposal in location which facilitates removal from site and examination by potential end markets, and which does not impede disassembly, processing, or hauling procedures.

3.5 REMOVAL FROM SITE

.1 Transport material designated for alternate disposal to facilities listed in waste reduction workplan and in accordance with applicable regulations. Do not deviate from facilities listed in waste reduction workplan without prior written authorization from Departmental Representative.

.2 Dispose of materials not designated for alternate disposal in accordance with applicable regulations. Disposal facilities must be approved of and listed in waste reduction workplan. Do not deviate from disposal facilities listed in waste reduction workplan without prior written authorization from Departmental Representative.

3.6 CLEANING AND RESTORATION

.1 Keep site clean and organized throughout deconstruction.

.2 Upon completion of project, remove debris, trim surfaces and leave work site clean.

.3 Upon completion of project, reinstate areas affected by Work to condition which existed prior to beginning of Work.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 American Wood Protection Association (AWPA):
- .1 AWPA P5-15, Standard for Waterborne Preservatives.
- .2 AWPA P8-14, Standard for Oil-Borne Preservatives.

.2 Canadian Standards Association (CSA):
- .1 CSA O80 Series-15, Consolidation, Wood Preservation.
- .2 CAN/CSA-O86-14, Consolidation, Engineering Design in Wood.
- .3 CSA O112 Series M1977(R2006), CSA Standards for Wood Adhesives.
- .4 CSA O121-08(R2013), Douglas Fir Plywood.

.3 National Building Code of Canada, NBC 2015.

.4 South Coast Air Quality Management District (SCAQMD):
- .1 SCAQMD Rule 1168-05, Adhesive and Sealant Applications, Amended January 7, 2005.

.5 National Lumber Grades Authority Standard Grading Rules for Canadian Lumber, 2014:
- .1 Special Product Standard SP-1.
- .2 Special Product Standard SP-2.

1.2 QUALITY ASSURANCE

.1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood in accordance with CSA and ANSI standards.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Wood: S-DRY, graded and stamped to National Lumber Grades Authority, Standard Grading Rules for Canadian Lumber, S4S.
- .1 Blocking, furring, strapping, curbs, nailers, bracing, and cants: spruce, pine or fir (SPF), 121d. and pine, 113d.

2.1 MATERIALS (Cont'd)

.2 Fastenings: to CAN/CSA-086.

.3 Field applied wood preservative: copper napthenate to AWPA P8, green colour.

.4 Preservative treated plywood: Douglas Fir to CSA O121, G1S good one side, pressure treated with CCA to CAN/CSA O80.9, minimum retention 4.0 kg/m^3 by assay.
.1 Preservative: chromated copper arsenate (CCA) to AWPA P5 as amended by CAN/CSA-O80-Series.

.5 Fire retardant treated plywood: Douglas Fir to CSA O121, G1S, fire retardant treated to CSA O80.27, maximum flame spread 25, maximum smoke developed 25.
.1 Backboard: Thickness as indicated, sanded, to Table E-1.

.6 Construction adhesive: to CSA O112 Series, cartridge loaded.
.1 Maximum allowable VOC limit 140 g/L.
.2 SCAQMD Rule 1168, Adhesives and Sealants Applications.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Apply wood preservative to wood in contact with concrete and masonry.

.2 Treat surfaces of pressure treated wood and plywood which are cut or bored after pressure treatment with field applied wood preservative.

.3 Set items in place plumb, straight and level to a tolerance of 1:600 and rigidly secure in place.

.4 Construct continuous members from pieces of longest practical length.

.5 Select exposed framing for appearance. Install lumber and panel materials so that grade-marks and other defacing marks are concealed or are removed by sanding where materials are left exposed.

3.1 INSTALLATION (Cont'd)

.6 Backboards:
.1 Install plywood backboards with short dimension mounted vertically, complete with 50 x 100 mm (2 x 4) spacers creating an 89 mm cavity. Run spacers vertically and stop above and below the plywood edges as indicated.
.2 Prime and paint fire retardant plywood panels as indicated and in accordance with Section 09 91 23.

3.2 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.
.1 Leave Work areas clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.3 PROTECTION

.1 Protect installed products and components from damage during during construction.

.2 Repair damage to adjacent materials caused by carpentry installation.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 American National Standards Institute/National Particleboard Association/National Electrical Maufacturers Association (ANSI/NPA/NEMA):
- .1 ANSI/BHMA A156.9-2015, Cabinet Hardware.
- .2 ANSI/BHMA A156.11-2014, Cabinet Locks.
- .3 ANSI/BHMA A156.16-2013, Auxiliary Hardware.

.2 Architectural Woodwork Manufacturers Association of Canada (AWMAC):
- .1 AWI/AWMAC/WI AWS, Edition 2-2014.

.3 Canadian Standards Association (CSA):
- .1 CSA B651-12, Accessible Design for the Built Environment.
- .2 CSA O112 Series M1977(R2006), CSA Standards for Wood Adhesives.
- .3 CSA O121-08(R2013), Douglas Fir Plywood.
- .4 CSA O153-13, Poplar Plywood.
- .5 CSA Z204-94(R1999), Guideline for Managing Indoor Air Quality in Office Buildings.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
- .1 Material Safety Data Sheets (MSDS).

.5 National Electrical Manufacturers Association (NEMA)
- .1 NEMA LD 3-2005, High-Pressure Decorative Laminates.

.6 National Lumber Grades Authority Standard Grading Rules for Canadian Lumber, 2014.

.7 South Coast Air Quality Management District (SCAQMD):
- .1 SCAQMD Rule 1168-05, Adhesive and Sealant Applications, Amended January 7, 2005.

1.2 IAQ - INDOOR AIR QUALITY

.1 Comply with CSA Z204, Guideline for Managing Indoor Air Quality in Office Buildings and CSA B651.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 and AWS Section 1.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for architectural woodwork and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Submit two copies of WHMIS MSDS.

.3 Shop Drawings:
.1 Indicate details of construction, profiles, jointing, fastening and other related details.
.1 Scales: profiles full size, details.
.2 Indicate materials, thicknesses, finishes and hardware.
.3 Indicate locations of service outlets in casework, typical and special installation conditions, and connections, attachments, anchorage and location of exposed fastenings.

.4 Samples:
.1 Submit for review and acceptance of each unit.
.2 Samples will be returned for inclusion into work.
.3 Submit duplicate samples of hardwood backing and plywood: sample size 300 x 300 mm.
.4 Submit duplicate samples of laminated plastic for colour selection.
.5 Submit duplicate samples of laminated plastic joints, edging, cutouts and postformed profiles.

.5 Certifications: submit AWMAC GIS certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
.1 Architectural woodwork shall be manufactured and/or installed to the current AWMAC Architectural Woodwork Standards and shall be subject to an inspection at the plant and/or site by an appointed AWMAC Certified Inspector.
.2 Inspection costs shall be included in the bid price for this project. Contact your local AWMAC Chapter for details of inspection costs.
.3 Shop drawings shall be submitted to the AWMAC Chapter office for review before work commences.

1.3 ACTION AND INFORMATIONAL SUBMITTALS (Cont'd)

.5 (Cont'd)

.4 Work that does not meet the AWMAC Architectural Woodwork Standards, as specified, shall be replaced, reworked and/or refinished by the architectural woodwork contractor, to the approval of AWMAC, at no additional cost to the. Departmental Representative.

.5 If the woodwork contractor is an AWMAC Manufacturer member in good standing, a two (2) year AWMAC Guarantee Certificate will be issued.

.6 The AWMAC Guarantee shall cover replacing, reworking and/or refinishing any deficient architectural woodwork due to faulty workmanship or defective materials supplied by the woodwork contractor, which may appear during a two (2) year period following the date of issuance.

.7 If the woodwork contractor is not an AWMAC Manufacturer member they shall provide the Departmental Representative with a two (2) year maintenance bond, in lieu of the AWMAC Guarantee Certificate, to the full value of the architectural woodwork contract.

1.4 ACCESSIBILITY

.1 Comply with CSA B651, Accessible Design for the Built Environment.

1.5 QUALITY ASSURANCE

.1 Perform work in accordance with AWMAC, Quality Standards, Premium Grade, except as indicated otherwise.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle architectural woodworking in accordance with Section 01 61 00 and AWMAC Quality Standard.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Concealed blocking and framing: S-DRY, graded and stamped to National Lumber Grades Authority, Standard Grading Rules for Canadian Lumber 2014, SPF, 121c. "STUD" and 101d. "D" FINISH.

.2 Exposed plywood:
.1 Hardwood plywood to AWI/AWMAC/WI AWS, Section 4 Sheet Products, Premium Grade.
.2 Wood veneer: Wood species and cut to match existing millwork and furniture.

.3 Concealed plywood: douglas fir to CSA 0121, Good One Side, urea formaldehyde free.

.4 High pressure decorative laminate (HDPL): to AWI/AWMAC/WI AWS, Section 4, and ANSI/NEMA LD3 as follows:
.1 Flatwork face sheet: 1.2 mm thick, heavy wear resistance.
.2 Vertical interior face sheets: 0.8 mm thick.
.3 Postformed face sheet: 0.8 mm thick.
.4 Backing sheet: Thickness to match face sheet, high pressure laminate, manufactured by same manufacturer as face sheet.
.5 Plastic laminate colours and finishes as follows:
.1 Countertop laminate: To match existing countertop laminate and existing colour 'Smoke Quarstone (6220-58)'.
.2 Millwork surfaces (Type 1): To match existing laminate type and existing colour 'Tan Echo (7941k-18)'.
.3 Millwork surfaces (Type 2): Cherry colouring and appearance of laminate to match existing furniture; type to be selected by the Departmental Representative.

.5 HDPL panel core: to AWI/AWMAC/WI AWS Section 4, 1.2.31 and 4.2c.
.1 Lumber core: poplar plywood to CSA 0153, Standard Construction, Interior Bond, BB Grade, urea formaldehyde free, unless otherwise indicated.

2.1 MATERIALS (Cont'd)

.6 Melamine TFM low pressure decorative laminate (LPDL): to AWI/AWMAC/WI Architectural Woodwork Standards, Section 4.
.1 Particleboard core to NPA A208.1, industrial grade, 720 kg/m^3, minimum 20% recycled content.
.2 Finish edges with 0.508 mm thick thin PVC to match melamine colour.
.3 Colour: White colour for use in interior of drawers and interiors of cabinets.

.7 Panel adhesive: to AWI/AWMAC/WI AWS Section 4, Ecologo certified.

.8 Sealant: In accordance with Section 07 90 00.

.9 Bituminous paint: acid and alkali resistant, Type 2, Ecologo certified.

.10 Construction adhesive: to CSA O112 Series, cartridge loaded.
.1 Maximum allowable VOC limit 140 g/L.
.2 SCAQMD Rule 1168, Adhesives and Sealants Applications.

2.2 HARDWARE

.1 Cabinet hinge: to ANSI/BHMA-A156.9, type B81602.

.2 Magnetic catch: to ANSI/BHMA-A156.9, type B13171, heavy duty.

.3 Recessed pull: to ANSI/BHMA-A156.9, type B02201, shape as approved by the Departmental Representative.

.4 Adjustable shelf standard: to ANSI/BHMA- A156.9, type B84061, surface application, open shelf rest type B84091.

.5 Drawer slide set: heavy duty to ANSI/BHMA-A156.9, type B05051, with zinc plate finish and AWI/AWMAC/WI AWS Section 10 and Appendix B Section 10-Casework, Drawer Slide Selection Guide, full extension, positive stop, self closing.
.1 AWS Heavy Duty:
.1 Static load capacity: 45.359 kg (100 lbs.) Commercial.
.2 Dynamic load capacity: 34.019 kg (75 lbs.) 50,000 cycles.

2.2 HARDWARE (Cont'd)

.5 (Cont'd)
.1 (Cont'd)

.6 Cam locks: to ANSI/BHMA-A156.11, key removable in locked and unlocked position, cam attached with screw or nut, type E07261, Grade 1.

.7 Coat hooks: to ANSI/BHMA-A156.16, type L13111.

.8 Closet bar: to ANSI/BHMA-A156.16, attached by surface screws, round type.

.9 Draw bolts: type recommended by laminated plastic manufacturer.

2.3 FABRICATION

.1 Finished millwork shall be free from bruises, blemishes, mineral marks, knots, shakes and other defects and shall be selected for uniformity in colour, grain and texture.

.2 Perform plastic laminate work in accordance with AWS Quality Standards and ANSI/NEMA LD3.

.3 Casework: to AWI/AWMAC/WI Architectural Woodwork Standards, Section 10, Type: High Pressure Decorative Laminate, Custom Grade: Section 10 and CSA B651.

.4 Countertops: to AWI/AWMAC/WI Architectural Woodwork Standards, Section 11 and Appendix B Section 11, Custom Grade, HDPL Option 6 post formed edge with coved splash and CSA B651.
.1 Sink cutouts: to 4.3.6 and radius corners to Appendix B.

.5 Shop assemble units in size to allow passage to installed location.

.6 Cover exposed faces and edges with laminated plastic where indicated.

.7 Shop apply laminated plastic with hairline joints, chamfer exposed edges.

.8 Apply bituminous paint to edge of cutouts in laminated plastic tops at sinks.

.9 HDPL covered shelves and shelf gables, unless otherwise indicated.

2.3 FABRICATION (Cont'd)

.10 Seal all surfaces for site finishing to WDI/AWMAC/WI AWS Section 5.

2.4 SHOP FINISHING

.1 Shop finish exposed hardwood backing materials with water based polyurethane to WDI/AWMAC/WI AWS Section 5, System 12.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for architectural woodwork installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 MILLWORK HARDWARE SCHEDULE

.1 Swinging cabinet doors:
.1 1 pair cabinet hinges.
.2 1 cabinet pull.
.3 1 magnetic catch.
.4 1 door lock.

.2 Drawers:
.1 1 drawer slide set.
.2 1 cabinet pull.
.3 1 drawer lock.

.3 Adjustable shelves:
.1 4 shelf standards.
.2 4 rests per shelf.

3.3 INSTALLATION

.1 Set items in place, plumb, straight and level to a tolerance of 1:400 and rigidly secure in place in accordance with AWI/AWMAC/WI Architectural Woodwork Standards.

.2 Completely assemble units.

.3 Join abutting laminated plastic tops with draw bolts.

.4 Apply sealant to junction of backsplash and adjacent wall finish in accordance with Section 07 90 00.

.5 Adjust hardware after cabinets installed for smooth effortless operation.

.6 Fastening:
.1 Coordinate wall securement, anchorage, and blocking for finish carpentry items.
.2 Position items of finished carpentry work accurately, level, plumb, true and fasten or anchor securely.
.3 Design and select fasteners to use to suit size and nature of components being joined. Use proprietary devices as recommended by manufacturer.
.4 Provide heavy duty fixture attachments for wall mounted cabinets.
.5 Set finishing nails to recieve filler. Where screws are used to secure members, countersink screw in round cleanly cut hole and plug with wood plug to match material being secured.

.7 Remove and replace damaged, marked, or stained finish carpentry.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.
.1 Leave Work areas clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

3.4 CLEANING (Cont'd)

.3 (Cont'd)

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

3.5 PROTECTION

.1 Protect installed products and components from damage during during construction.

.2 Repair damage to adjacent materials caused by architectural woodwork installation.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
.1 Material Safety Data Sheets (MSDS).

.2 Underwriter's Laboratories of Canada (ULC);
.1 CAN/ULC-S101-14, Standard Methods of Fire Endurance Tests of Building Construction and Materials.
.2 CAN/ULC-S102-11, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets.

.3 Quality assurance submittals: submit following in accordance with Section 01 45 00.
.1 Test Reports:
.1 Submit product data including certified copies of test reports verifying fireproofing applied to substrate as constructed on project will meet or exceed requirements of Specification.
.2 Submit test results in accordance with CAN/ULC-S101 for fire endurance and CAN/ULC-S102 for surface burning characteristics.
.3 For assemblies not tested and rated, submit proposals based on related designs using accepted fireproofing design criteria.
.2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.2 SUBMITTALS (Cont'd)

.3 (Cont'd)

.3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

.4 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.3 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: company specializing in sprayed-on fireproofing with 5 years documented experience and approved by manufacturer.

.2 All fire stopping material shall be from one manufacturer.

.3 All fire stopping installation work for entire project shall be by a single contractor experienced in firestopping. Individual disciplines shall NOT fire stop their own work.

.2 Site Meetings: as part of Manufacturer's Services described in PART 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.

.1 After delivery and storage of products, and when preparatory Work is complete but before installation begins.

.2 Twice during progress of Work at 25% and 60% complete.

.3 Upon completion of Work, after cleaning is carried out.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle materials in accordance with Section 01 61 00.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.3 Deliver packaged materials in original unopened containers, marked to indicate brand name, manufacturer, and ULC markings.

.2 Storage and Protection:

.1 Store materials indoors in dry location.

1.4 DELIVERY, STORAGE AND HANDLING (Cont'd)

.2 (Cont'd)

.2 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

.3 Damaged or opened containers will be rejected.

.4 Packaging to indicate shelf-life and materials to be applied prior to expiration of shelf-life.

.5 Provide temporary enclosures to prevent spray from contaminating air beyond application area.

.6 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of fireproofing materials.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

1.6 AMBIENT CONDITIONS

.1 At temperatures less than 5°C, ensure that 5°C air and substrate temperature is maintained during and for 24 hours after application. Ensure that natural ventilation to properly dry the fireproofing during and subsequent to its application is provided. In enclosed areas lacking openings for natural ventilation, ensure that interior air is circulated and exhausted to the outside.

.2 Maintain relative humidity within limits recommended fireproofing manufacturer.

.3 Ensure that natural ventilation to properly dry fireproofing during and subsequent to its application is provided.

.4 In enclosed areas lacking openings for natural ventilation, provide minimum of 4 air exchanges per hour by forced air circulation.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Sprayed fireproofing: ULC certified cementitious fireproofing qualified for use in ULC Designs specified and fungus resistant for 28 days.

.2 Curing compound: type recommended by fireproofing manufacturer, qualified for use in ULC Designs specified.

.3 Sealer: type recommended by fireproofing manufacturer, qualified for use in ULC Design specified.
.1 Colour: As selected by the Departmental Representative.

.4 Fireproofing: minimum dry density and cohesion/adhesion properties as follows:
.1 Fireproofing for structural components concealed above ceiling, or within wall, chase, or furred space: minimum applied dry density of 240 kg per cubic meter and cohesion/adhesion strength of 9.57 kPa.
.2 Fireproofing for exposed structural components, except where otherwise specified or indicated: minimum applied dry density of 350 kg per cubic meter and cohesion/adhesion strength of 20.83 kPa.
.3 Ensure spray-applied fireproofing: does not crack, spall or delaminate under downward deflection conditions over 3 m clear span.
.4 Minimum compressive strength: 48 kPa.
.5 Spray-Applied fireproofing material: not contribute to corrosion of test panels.
.6 Dust removal: not exceed 0.25 gram per square meter.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 PREPARATION

.1 Substrate: free of material, which would impair bond.

.2 Verify that painted substrates are compatible and have suitable bonding characteristics to receive fireproofing.

.3 Remove incompatible materials.

.4 Ensure that items required to penetrate fireproofing are placed before installation of fireproofing.

.5 Ensure that ducts, piping, equipment, or other items which would interfere with application of fireproofing are not positioned until fireproofing work is completed.

3.3 APPLICATION

.1 Apply bonding adhesive or primer to substrate if recommended by manufacturer.

.2 Apply fireproofing to correspond with tested assemblies, or acceptable calculation procedures to provide intended fire resistance ratings.

.3 Apply fireproofing over substrate, building up to required thickness to cover substrate with monolithic blanket of uniform density and texture.

.4 Apply fireproofing directly to open web joists without use of expanded lath.

.5 Tamp smooth, surfaces to provide dense, medium smooth surface.

.6 Apply curing compound to surface of cementitious fireproofing as required by manufacturer.

.7 Apply sealer to surface of cementitious fireproofing as required by manufacturer.

3.4 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:
.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

.2 Inspection and Site Tests:
.1 Inspection and testing of fireproofing will be carried out by Testing Laboratory designated by Departmental Representative.
.2 Departmental Representative will pay costs for testing, as specified in Section 01 29 83.

3.5 PATCHING

.1 Patch damage to fireproofing caused by testing or by other trades before fireproofing is concealed, or if exposed, before final inspection.

3.6 CLEANING

.1 Proceed in accordance with Section 01 74 11.

.2 Clean surfaces not indicated to receive fireproofing of sprayed material within 24 hours period after application.

.3 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
.1 Material Safety Data Sheets (MSDS).

.2 National Building Code of Canada, NBC 2015.

.3 Underwriter's Laboratories of Canada (ULC)
.1 CAN/ULC-S101-14, Standard Methods of for Fire Endurance Tests of Building Construction and Materials.
.2 CAN/ULC-S102-11, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
.3 CAN/ULC-S115-11, Standard Method of Fire Tests of Firestop Systems.

1.2 DEFINITIONS

.1 Fire Stop Material: device intended to close off opening or penetration during fire or materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including electrical outlet boxes along with their means of support through wall or floor openings.

.2 Single Component Fire Stop System: fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system.

.3 Multiple Component Fire Stop System: exact group of fire stop materials that are identified within Listed Systems Design to create on site fire stop system.

.4 Continuity of Fire Separations: NBC 2015, Division B, Parts 3.1.8 and 3.1.9.1, 9.10.9):
.1 Wall, partition or floor assemblies required to be a fire separation shall be: constructed as a continuous element; have a fire resistance rating; have openings protected by a closure; and have penetrations sealed by a firestop.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00.

.3 Shop Drawings:
.1 Submit shop drawings to show location, proposed material, reinforcement, anchorage, fastenings and method of installation.
.2 Construction details should accurately reflect actual job conditions.

.4 Quality assurance submittals: submit following in accordance with Section 01 45 00.
.1 Test reports: in accordance with CAN/ULC-S101 for fire endurance and CAN/ULC-S102 for surface burning characteristics.
.1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.
.2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
.3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.
.4 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.4 QUALITY ASSURANCE

.1 Qualifications:
.1 Installer: company specializing in fire stopping installations with 5 years documented experience and approved by manufacturer.
.2 All fire stopping material shall be from one manufacturer.

1.4 QUALITY ASSURANCE (Cont'd)

.1 (Cont'd)
.3 All fire stopping installation work for entire project shall be by a single contractor experienced in firestopping. Individual disciplines shall NOT fire stop their own work.

.2 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section, with contractor's representative and Departmental Representative in accordance with Section 01 31 19 to:
.1 Verify project requirements.
.2 Review installation and substrate conditions.
.3 Co-ordination with other building subtrades.
.4 Review manufacturer's installation instructions and warranty requirements.

.3 Site Meetings: as part of Manufacturer's Services described in PART 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.
.1 After delivery and storage of products, and when preparatory Work is complete, but before installation begins.
.2 Twice during progress of Work at 25% and 60% complete.
.3 Upon completion of Work, after cleaning is carried out.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:
.1 Deliver, store and handle materials in accordance with Section 01 61 00.
.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
.3 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer,and ULC markings.

.2 Storage and Protection:
.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

1.5 DELIVERY, STORAGE AND HANDLING (Cont'd)

.2 (Cont'd)
.2 Replace defective or damaged materials with new.

.3 Waste Management and Disposal:
.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Fire stopping and smoke seal systems: in accordance with CAN/ULC-S115.
.1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases in compliance with requirements of CAN/ULC-S115 and not to exceed opening sizes for which they are intended and conforming to specified special requirements described in PART 3.
.2 Fire stop system rating: F.

.2 Service penetration assemblies: systems tested to CAN/ULC-S115.

.3 Service penetration fire stop components: certified by test laboratory to CAN/ULC-S115.

.4 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.

.5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.

.6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.

.7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.

.8 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.

2.1 MATERIALS (Cont'd)

.9 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

.10 Sealants for vertical joints: non-sagging.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for firestopping installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.3 PREPARATION

.1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.
.1 Ensure that substrates and surfaces are clean, dry and frost free.

.2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.

.3 Maintain insulation around pipes and ducts penetrating fire separation.

3.3 PREPARATION (Cont'd)

.4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.4 INSTALLATION

.1 Install fire stopping and smoke seal material and components in accordance with manufacturer's certified tested system listing.

.2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.

.3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.

.4 Tool or trowel exposed surfaces to neat finish.

.5 Remove excess compound promptly as work progresses and upon completion.

3.5 SEQUENCES OF OPERATION

.1 Proceed with installation only when submittals have been reviewed by Departmental Representative.

.2 Install floor fire stopping before interior partition erections.

.3 Mechanical pipe insulation: certified fire stop system component.
.1 Ensure pipe insulation installation precedes fire stopping.

3.6 FIELD QUALITY CONTROL

.1 Inspections: notify Departmental Representative when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.

.2 Manufacturer's Field Services:

3.6 FIELD QUALITY CONTROL (Cont'd)

.2 (Cont'd)
.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.7 CLEANING

.1 Proceed in accordance with Section 01 74 11.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

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

.4 Progress Cleaning: Clean in accordance with Section 01 74 11.
.1 Leave Work areas clean at end of each day.

.5 Waste Management: Separate waste materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and disposeof materials at appropriate facility.

3.8 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by firestopping installation.

3.9 SCHEDULE

.1 Fire stop and smoke seal at:
.1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.

3.9 SCHEDULE (Cont'd)

.1 (Cont'd)

.2 Top of fire-resistance rated masonry and gypsum board partitions.

.3 Intersection of fire-resistance rated masonry and gypsum board partitions.

.4 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.

.5 Penetrations through fire-resistance rated floor slabs and ceilings.

.6 Openings and sleeves installed for future use through fire separations.

.7 Around mechanical and electrical assemblies penetrating fire separations.

.8 Rigid ducts: greater than 129 cm^2: fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 ASTM International (ASTM):
.1 ASTM C920-14a, Standard Specification for Elastomeric Joint Sealants.

.2 Environmental Choice Program (ECP):
.1 ECP/PCE-45-92, Sealants and Caulking.

1.2 ENVIRONMENTAL CHOICE PROGRAM

.1 Provide sealant products bearing the 'Ecologo' of the Environmental Choice Program, Department of the Environment, Canadian Environmental Protection Act, Environmental Choice Product Guidelines ECP/PCE-45-92 for Sealants and Caulking Compounds, except maximum VOC 60 g/L during application and curing.

.2 For primers and sealants, indicate VOC in g/L during application and curing.

1.3 PRODUCT DATA

.1 Submit manufacturer's literature indicating recommended surface preparation, sealant selection and primer for each substrate in accordance with Section 01 33 00.

PART 2 - PRODUCTS

2.1 SEALANTS

.1 Provide sealant products bearing Ecologo to ECP/PCE-45-92 with maximum VOC 60 g/L.

2.2 SEALANT MATERIAL DESIGNATIONS

.1 Silicones One Part 'Type A'.
.1 To ASTM C920, primerless, Type S, Grade NS, Class 50, SWRI validated.

.2 Silicones One Part 'Type B'.
.1 To ASTM C920, Type S, Grade NS, mildew resistant silicone.

.3 Acrylic Latex One Part 'Type C'.
.1 To CAN/CGSB-19.17-M90.

2.2 SEALANT MATERIAL DESIGNATIONS (Cont'd)

.4 Acoustical Sealant: In accordance with Section 09 21 16.

2.3 SEALANT SELECTION

.1 Perimeters of interior frames, as detailed and itemized: Designation: Type 'A'.

.2 Perimeter of fixtures (e.g. sinks): Designation: Type B.

.3 Between tile and adjacent materials: Designation: Type B.

.4 Exposed interior control joints in drywall: Designations: Types C.

2.4 JOINT CLEANER

.1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.

.2 Primer: to manufacturer's recommendations.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for sealant installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PREPARATION OF JOINT SURFACES

.1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.

.2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair work.

.3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.

.4 Ensure joint surfaces are dry and frost free.

.5 Prepare surfaces in accordance with manufacturer's directions.

3.3 PRIMING

.1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.4 BACKUP MATERIAL

.1 Apply bond breaker tape where required to manufacturer's instructions.

.2 Install joint filler to achieve correct joint depth and shape with approximately 30% compression.

3.5 MIXING

.1 Mix materials in accordance with sealant manufacturer's instructions.

3.6 APPLICATION

.1 Ventilate interior spaces during application and curing of sealants to maintain VOCs less than 50 g/l. Coordinate with building manager to ensure existing ventilation system or temporary ventilation supllies sufficient outside air.

.2 Sealant.

3.6 APPLICATION (Cont'd)

.2 (Cont'd)

.1 Protect installed work of other trades from staining or contamination.

.2 Apply sealant in accordance with manufacturer's application manual and written instructions. Maintain STC rating of assemblies.

.3 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint. remove tape after sealant applied.

.4 Apply sealant in continuous beads.

.5 Apply sealant using gun with proper size nozzle.

.6 Use sufficient pressure to fill voids and joints solid.

.7 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.

.8 Tool exposed surfaces before skinning begins to give slightly concave shape.

.3 Curing.

.1 Cure sealants in accordance with sealant manufacturer's instructions.

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

3.7 CLEANING

.1 Cleanup.

.1 Clean adjacent surfaces immediately and leave work neat and clean.

.2 Remove excess and droppings, using recommended cleaners as work progresses.

.3 Remove masking tape after initial set of sealant.

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

.1 Leave Work areas clean at end of each day.

.3 Final Cleaning: Upon completion, remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.4 Waste Management: Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

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

3.8 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by sealant installation.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 04 20 00: Building-in and grouting frames in masonry.

.2 Section 07 90 00: Caulking of joints between frames and other building components.

.3 Section 08 71 11: Hardware.

.4 Section 08 80 00: Glazing.

.5 Section 09 21 16: Building-in frames into steel stud walls.

.6 Section 26: Wiring for electronic hardware in steel doors and frames.

.7 Division 28: Security requirements in steel doors and frames, such as card readers.

1.2 REFERENCES

.1 American National Standards Institute (ANSI):
.1 ANSI/BHMA A156.16-2013, Auxiliary Hardware.

.2 American Society for Testing and Materials International (ASTM)
.1 ASTM A568/A568M-15, Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
.2 ASTM A653/A653M-15e1, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
.3 ASTM E90-09, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.3 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.4 Canadian Steel Door Manufacturers Association (CSDMA) www.csdma.org/english/publications.html
.1 Recommended Dimensional Standards For Commercial Steel Doors and Frames 2000.

1.2 REFERENCES (Cont'd)

.4 (Cont'd)
.2 Recommended Selection and Usage Guide for Commercial Steel Door and Frame Products 2009.
.3 Recommended Specifications for Sound Retardant Steel Doors and Frames 2006.

.5 National Fire Protection Association (NFPA)
.1 NFPA 80-2016, Standard for Fire Doors and Other Opening Protectives.
.2 NFPA 252-2012, Standard Methods of Fire Tests of Door Assemblies.

.6 Underwriters Laboratories Canada (ULC)
.1 CAN/ULC-S104-10, Standard Method For Fire Tests of Door Assemblies.
.2 CAN/ULC-S105-16, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN/ULC-S104.
.3 CAN/ULC-S702-14, Standard for Mineral Fibre Thermal Insulation for Buildings.

1.3 SUBMITTALS

.1 Submit product data sheets and shop drawings in accordance with Section 01 33 00.

.2 Acoustic door assemblies: submit manufacturer's data for tested assembly indicating assembly meets STC specified.

.3 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazing, louvres, and arrangement of hardware.

.4 Indicate each type of frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings and finishes.

1.4 QUALIFICATIONS

.1 The manufacturer of steel doors and frames supplied under this section will be a member of the CSDMA - Canadian Steel Door Manufacturers Association.

1.5 REQUIREMENTS OF REGULATORY AGENCIES

.1 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN/ULC-S104 or NFPA 252 for ratings specified or for ratings specified or indicated.

.2 Provide fire labelled frame products for those openings requiring fire protection ratings, as scheduled. Test products in strict conformance with CAN/ULC-S104 or NFPA 252 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00.

1.7 WASTE MANAGAMENT AND DISPOSAL

.1 Waste Management and Disposal:
.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Metal: tension levelled sheet steel to ASTM A568/A568M, Class 1, with ZF120 zinc coating on both sides designation to ASTM A653/A653M.

.2 Door cores:
.1 Continuous interlocking steel ribs: 0.9 mm thick continuous interlocking steel stiffeners at 150 mm O.C., securely welded to each face sheet 150 mm O.C. maximum.
.1 Voids between stiffeners Fibreglass: loose batt type, density: 24 kg/m^3 minimum, to CAN/ULC-S702, Type 1, Ecologo certified.
.2 Temperature Rise Rated (TRR): loose batt type, high density rock wool and proprietary adhesive to limit temperature rise on the 'unexposed' side of door to 250°C at time indicated on door schedule.

2.1 MATERIALS (Cont'd)

.3 Filler: polyester based.

.4 Primer: zinc rich, organic, ready mix to CAN/CGSB-1.181, Ecologo certified.

.5 Door bumpers: to ANSI/BHMA-A156.16, type L03011.

.6 Glass and glazing materials: In accordance with Section 08 80 00.

2.2 FABRICATION

.1 To Canadian Steel Door Manufacturers Association (CSDMA), "Recommended Specifications for Commercial Steel Doors and Frames", and "Recommended Dimensional Standards for Commercial Steel Doors and Frames" and CAN/ULC-S105 "Standard Specification for Fire Door Frames Meeting the Performance Required by CAN/ULC-S104".

.2 Doors: material thickness, opening classification and duty rating to CSDMA "Recommended Selection and Usage Guide For Commercial Steel Doors", hollow steel construction, filled with insulation, edges continuously welded or filled and sanded flush with no visible seams. Close bottom edge of doors where indicated.
.1 Typical door: as above except face sheets minimum 1.6 mm thick.

.3 Frames and screens: 1.6 mm steel, welded type. Anchors adjustable, type to suit each jamb condition.

.4 Sound retardant door and frame assembly: 44 mm thickness, unless otherwise indicated, to meet intended STC ratings when tested to ASTM E90, 61T/E90-66T, complete with frame, sound seals, threshold and automatic door bottom. Use only components that have been tested as an assembly and certified as to STC rating by independent laboratory tests.

.5 Glass mouldings: formed steel.

.6 Temperature rise limit times for fire doors shall be listed on the ULC label.

2.2 FABRICATION (Cont'd)

.7 Install 3 door bumpers on strike jamb of single doors and 2 bumpers at head of double doors.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for door and frame installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install frames, screens, and doors in accordance with reviewed shop drawings, manufacturer's written instructions and to meet Owner's security and acoustic requirements.

.2 Install frames, screens, and doors plumb, square and level in accordance with manufacturer's instructions and templates.

.3 Install labelled steel fire rated doors and frames to NFPA 80.

.4 Provide even margins between doors and jambs and doors and flooring as follows:
.1 Hinge side: 1.0 mm.
.2 Latch side and head: 1.5 mm.
.3 Flooring: 13 mm.

.5 Secure anchorages and connections to adjacent construction.

.6 Sound rated door and frame assemblies: Install sound rated doors and frames to achieve intended STC ratings.

3.2 INSTALLATION (Cont'd)

.7 Adjust doors installed for smooth effortless operation.

.8 Touch-up with primer scratched or damaged zinc finish.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.
.1 Leave Work areas clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

.1 Protect installed products and components from damage during during construction.

.2 Repair damage to adjacent materials caused by door and frame installation.

END OF SECTION

PART 1 - GENERAL

1.1 WARRANTY

.1 For wood doors specified in this Section 08 14 11 the 12 month warranty period prescribed in General Conditions GC3.13 is extended to three years.

1.2 REFERENCES

.1 American National Standards Institute (ANSI):
.1 ANSI/BHMA A156.16-2013, Auxiliary Hardware.

.2 American Society for Testing and Materials International (ASTM):
.1 ASTM E90-09, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.3 Architectural Woodwork Manufacturers Association of Canada (AWMAC):
.1 AWI/AWMAC/WI AWS, Edition 2-2014.

.4 Canadian Standards Association (CSA):
.1 CAN/CSA-O132.2 SERIES-90(R2003), Wood Flush Doors.

1.3 SUBMITTALS

.1 Submit product data sheets in accordance with Section 01 33 00.

.2 Acoustic door assemblies: submit manufacturer's data for tested assembly indicating assembly meets STC specified.

.3 Indicate thicknesses, core construction, veneers, finish, door sizes, quantities, fastenings, finishes, glazing, louvres and arrangement of hardware.

1.4 QUALITY ASSURANCE

.1 Perform work in accordance with AWMAC, Quality Standards, Premium Grade, except as indicated otherwise.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle wood doors in accordance with Section 01 61 00 and AWMAC Quality Standard amended as follows:
.1 Wrap wood doors individually in protective wrapping for shipment and Site storage.
.2 Handle wood doors carefully to prevent damage; replace damaged doors.
.3 Store doors flat on a dry, level surface. Ventilate and maintain recommended relative humidity before, during and after installation.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Waste Management and Disposal:
.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIALS AND FABRICATION

.1 Wood doors to CAN/CSA-0132.2 Series, flush:
.1 Interior Type II bond adhesive plywood faced, Grade 1 Premium, solid, mat-formed wood particleboard core, 35 mm hardwood stiles including 19 mm hardwood edge, 35 mm wood rails, solid wood lock reinforcing and glass mouldings.
.2 Dark cherry door facing and cut to match wood veneer of existing furniture, with natural varnish finish.

.2 Sound retardant door and frame assembly: 44 mm thickness, unless otherwie indicated, to meet intended STC ratings when tested to ASTM E90, 61T/E90-66T, complete with sound seals and automatic door bottom. Use only components that have been tested as an assembly and certified as to STC rating by independent laboratory tests.

.3 Door bumpers: to ANSI A156.16, type L03011.

.4 Metal frames: In accordance with Section 08 11 13.

.5 Glass and glazing materials: In accordance with Section 08 80 00.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for door installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install doors in accordance with CAN/CSA-O132.2 Series, Appendix A.

.2 Provide even margins between doors and jambs and doors and flooring as follows:
.1 Hinge side: 1.0 mm.
.2 Latch side and head: 1.5 mm.
.3 Flooring: 13 mm.

.3 Sound rated door and frame assemblies: Install sound rated doors and frames to achieve intended STC ratings.

.4 Adjust doors installed for smooth effortless operation.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.
.1 Leave Work areas clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

3.3 CLEANING (Cont'd)

.3 (Cont'd)

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

3.4 PROTECTION

.1 Protect installed products and components from damage during during construction.

.2 Repair damage to adjacent materials caused by door installation.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 08 11 13: Hollow metal doors and frames.

.2 Section 08 14 11: Hardware for wood doors.

.3 Division 26: Conduit and wiring for electrical hardware.

.4 Division 28: Card readers.

1.2 REFERENCES

.1 American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA):
.1 ANSI/BHMA-A156.1-13, Butts and Hinges.
.2 ANSI/BHMA-A156.4-13, Door Controls - Closers.
.3 ANSI/BHMA-A156.5-14, Cylinders and Input Devices for Locks.
.4 ANSI/BHMA-A156.6-15, Architectural Door Trim.
.5 ANSI/BHMA-A156.8-15, Door Controls - Overhead Stops and Holders.
.6 ANSI/BHMA- A156.13-12, Mortise Locks.
.7 ANSI/BHMA-A156.16-13, American National Standard for Auxiliary Hardware.
.8 ANSI/BHMA-A156.21-14, Thresholds.
.9 ANSI/BHMA-A156.28-13, Recommended Practices for Mechanical Keying Systems.
.10 ANSI/BHMA-A156.115-14, Hardware Preparation in Steel Doors or Steel Frames.
.11 ANSI/BHMA-A156.115W-06, Hardware Preparation in Wood Doors with Wood or Steel Frames.

.2 Canadian Standards Association (CSA):
.1 CSA B651-12, Accessible Design for the Built Environment.

.3 Canadian Steel Door Manufacturers Association (CSDMA).

.4 Door Hardware Institute (DHI).

.5 Underwriter's Laboratory (UL):
.1 UL 437-13, Standard for Key Locks.

1.3 PRODUCT DATA SHEETS

.1 Submit one copy of product data sheets in accordance with Section 01 33 00.

.2 Product data sheets shall consist of catalogue cuts, manufacturer's name and number, finish and reference identification to specified standard.

1.4 KEY SCHEDULE

.1 Submit key schedule for Owner's approval in accordance with Section 01 33 00 and additional keying requirements as outlined in this Section.

1.5 SCHEMATIC DIAGRAMS

.1 Submit schematic diagrams of electrical components for inclusion in maintenance manual specified in Section 01 33 00.

1.6 QUALITY ASSURANCE

.1 Standard hardware location dimensions in accordance with Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by CSDMA - Canadian Steel Door Manufacturers' Association and CSA B651, Accessible Design for the Built Environment.

.2 Use abbreviations and symbols recommended in "Abbreviations and Symbols as used in Architectural Door and Hardware Schedules and Specifications", published by the Door and Hardware Institute.

.3 Use hardware schedule format recommended in "Sequence and Format for the Hardware Schedule", published by the Door and Hardware Institute.

1.7 DEFINITIONS

.1 Master Key (MK):
.1 A key which operates all the master keyed locks or cylinders in a group, each lock or cylinder usually operated by its own change key.
.2 To combinate a group of locks or cylinders such that each is operated by its own key as well as by a master key for the entire group.

.2 Master Key System:
.1 Any keying arrangement which has two or more levels of keying.

1.7 DEFINITIONS (Cont'd)

.2 (Cont'd)
.2 A keying arrangement which has exactly two levels of keying.

.3 Grand Master Key (GMK): The key which operates two or more separate groups of locks, each operated by a different master key.

.4 Grand Master Key System: A master key system which has exactly three levels of keying.

.5 Great Grand Master Key (GGMK): The key which operates two or more separate groups of locks, which are each operated by a different grand master key.

.6 Great Grand Master Key System: A master key system which has exactly four levels of keying.

.7 Top Master Key (TMK): The highest level master key in a master key system.

1.8 REGULATORY REQUIREMENTS

.1 Use ULC listed and labelled hardware for doors in fire rated partitions and fire exits.

.2 Use UL 437 listed cylinders in locking devices to security rating indicated.

1.9 HARDWARE LIST

.1 Submit hardware schedule in accordance with Section 01 33 00.

.2 Submit literature cuts, indicating hardware proposed, including make, model, base material, function, ANSI Function where ANSI used in this specification, Grade, Type, Series, BHMA finish, trim, ULC listing, UL listing, manufacturer and other pertinent information. Indicate which model or accessory is being provided where more than one model or accessory appears on a page.

1.10 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

1.10 DELIVERY, STORAGE AND HANDLING (Cont'd)

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

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

.4 Storage and Handling Requirements:
.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect door hardware from nicks, scratches, and blemishes.
.3 Protect prefinished surfaces with wrapping.
.4 Replace defective or damaged materials with new.

.5 Packaging Waste Management: remove for reuse and return of pallets, crates, padding and packaging materials as specified in in accordance with Section 01 74 20.

1.11 WASTE DISPOSAL AND MANAGEMENT

.1 Separate waste materials for reuse, recycling, and composting in accordance with Section 01 74 20.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Dispose of corrugated cardboard, polystyrene plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

PART 2 - PRODUCTS

2.1 KEYING, ACCESSORIES AND FINISH

.1 Keying system requirements for this Project:
.1 Keying systems: to ANSI/BHMA-A156.28.
.2 All master keys to be stamped "Do not duplicate".
.3 Locks and cylinders to be construction master keyed.
.4 Provide:
.1 Three (3) master keys.
.2 Three (3) change keys per lock.

2.1 KEYING, ACCESSORIES AND FINISH (Cont'd)

.1 (Cont'd)

.5 Successful hardware supplier to submit key schedule to Owner for approval before proceeding with lock order. Final keying to be confirmed before shipping.

.6 Keys to be provided in individual envelopes, properly identified with door number,location and key coding.

.2 Provide accessories with hardware.

.3 Finish: As indicated in appended hardware schedule.

.4 Finish fasteners to match the exposed surface on which they appear.

.5 Provide temporary construction keying.

.6 Final keying: to ANSI/BHMA-A156.5, Grade 1.

.7 High security cylinder (mortise lock): Rated high security to UL 437 listed, material purchase by registered signatures only.

.8 Use lock and latch sets with solid metal, U shape, lever handles meeting requirements of CSA B651, Accessible Design for the Built Environment, clause 5.2.7 Door Hardware and Figure 20, unless specified otherwise.

.9 Provide lever handles of same style for bored and mortise locksets.

.10 Door prep: to ANSI/BHMA-A156.115 for steel doors and frames and ANSI/BHMA-A156.115-W for wood doors.

2.2 MATERIALS

.1 General: Provide all components and accessories as required for work of this Project.

.2 Hinge: to ANSI/BHMA-A156.1.

.3 Door closer: to ANSI/BHMA-A156.4.

.4 Overhead stop: to ANSI/BHMA- A156.8.

.5 Lock and latch set (mortised): to ANSI/BHMA-A156.13.

2.2 MATERIALS (Cont'd)

.6 Dead lock (mortised): to ANSI/BHMA-A156.5.

.7 High security dead lock (mortised): to ANSI/BHMA-A156.5, function indicated, dead bolt, UL 437 listed cylinder with guard, thumb turn.

.8 Electronic lock: Key card access.

.9 Door pull: to ANSI/BHMA-A156.6.

.10 Kick plate: to ANSI/BHMA-A156.6, stainless steel.

.11 Wall type door stop: to ANSI/BHMA-A156.16.

.12 Threshold: to ANSI/BHMA-A156.21.

.13 Door gasketing and automatic door bottoms: As scheduled and as required to meet intended STC ratings.

.14 Offset security astragal: 4.8 mm thick steel.

.15 Card reader: In accordance with Division 28.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 Furnish manufacturers' instructions for proper installation of each hardware component.

3.2 INSTALLATION

.1 Install hardware to standard hardware location dimensions in accordance with Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame Manufacturers' Association and to meet Owner's intended security requirements.

3.3 ADJUSTING

.1 Provide services of competent mechanic to inspect installation of hardware furnished under this Section and to supervise all adjustments (by the trade responsible for fixing) which are necessary to leave hardware in perfect working order.

.2 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.

.3 Lubricate hardware, operating equipment and other moving parts.

.4 Adjust door hardware to provide tight fit at contact points with frames.

3.4 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacture's instructions.

.3 Remove protective material from hardware items where present.

.4 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.5 HARDWARE SCHEDULE

.1 Hardware schedule: Refer to hardware schedule appended to this Section.

END OF SECTION

Renovation Transport Canada 32 Church Street

Hardware Group No. 01

For use on mark/door #(s):
D111

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HW HINGE	5BB1HW 114 X 102	652	IVE
1	EA	ELEC CLASSROOM LOCK	CO-200-MS-70-PR-TLR-PD	626	SCE
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	4011 ST-1544	689	LCN
1	EA	MOUNTING PLATE	4020-18	689	LCN
1	EA	KICK PLATE	CBH903 200 X 40MM LDW	630	CBH
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 02

For use on mark/door #(s):
D112 D117A D122

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
1	EA	HARDWARE	ALL HARDWARE TO BE RE-USED		UNK

Hardware Group No. 03

For use on mark/door #(s):
D117B

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
1	EA	UNICAN LOCK	TO BE RE-USED		UNK
1	EA	HARDWARE	BALANCE OF HARDWARE TO BE RE-USED		

Renovation Transport Canada 32 Church Street

Hardware Group No. 04

For use on mark/door #(s):
D113

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 114 X 102 NRP	652	IVE
1	EA	PASSAGE SET	L9010 03B	626	SCH
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	WALL STOP	WS406/407CVX	630	IVE
2	EA	GASKETING	119WB	B	ZER
1	EA	GASKETING	870AA	AA	ZER
1	EA	DOOR BOTTOM	365AA6	AA	ZER
1	EA	THRESHOLD	566A-MSLA-10	A	ZER
3	EA	SILENCER	SR64	GRY	IVE
1	EA	BUZZER	BY CONTRACTOR		UNK
1	EA	DOOR CONTACT	679-05HM	BLK	SCE

Note: When door is open door contact will send signal to ring bell at office area #111 as per electric drawings.

Hardware Group No. 05

For use on mark/door #(s):
D115

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 114 X 102	652	IVE
1	EA	CLASSROOM LOCK	L9070P 03B	626	SCH
1	EA	SURFACE CLOSER	4011	689	LCN
1	EA	WALL STOP	WS406/407CVX	630	IVE
2	EA	GASKETING	119WB	B	ZER
1	EA	GASKETING	870AA	AA	ZER
1	EA	DOOR BOTTOM	365AA6	AA	ZER
1	EA	THRESHOLD	566A-MSLA-10	A	ZER
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 06

For use on mark/door #(s):
D116

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HW HINGE	5BB1HW 114 X 114 NRP	652	IVE
1	EA	ELEC CLASSROOM LOCK	CO-200-MS-70-PR-TLR-PD	626	SCE
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	KICK PLATE	CBH903 200 X 40MM LDW	630	CBH
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

Renovation Transport Canada 32 Church Street

Hardware Group No. 07

For use on mark/door #(s):
D118

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 114 X 102	652	IVE
1	EA	PASSAGE SET	L9010 03B	626	SCH
1	EA	KICK PLATE	CBH903 200 X 40MM LDW	630	CBH
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 08

For use on mark/door #(s):
D123B

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 114 X 102	652	IVE
1	EA	MECH PUSHBUTTON LOCK	8146 SIMPLEX	626	KAB
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4011	689	LCN
1	EA	KICK PLATE	CBH903 200 X 40MM LDW	630	CBH
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

Note: Keypad Lock

Hardware Group No. 09

For use on mark/door #(s):
D123

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 114 X 102	652	IVE
1	EA	ELEC CLASSROOM LOCK	CO-200-MS-70-PR-TLR-PD	626	SCE
1	EA	SURFACE CLOSER	4011	689	LCN
1	EA	KICK PLATE	CBH903 200 X 40MM LDW	630	CBH
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	SMOKE SEAL	W-21 (1 X H, 2 X W)	BLK	KNC
3	EA	SILENCER	SR64	GRY	IVE

Renovation Transport Canada 32 Church Street

Hardware Group No. 10

For use on mark/door #(s):
D125

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 114 X 102	652	IVE
1	EA	PASSAGE SET	L9010 03B	626	SCH
1	EA	KICK PLATE	CBH903 200 X 40MM LDW	630	CBH
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

Miscellaneous Items

Qty		Description	Catalog Number	Finish	Mfr	Handing
1	EA	HANDHELD DEVICE	HHD KIT		SCE	
1	EA	MULTITECH READER	MT20	BLK	SCE	
1	EA	SOFTWARE	SXPR-SFT-1		SCE	

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 08 11 13: Glazing for hollow metal doors.

.2 Section 08 14 11: Glazing for wood doors.

.3 Section 08 87 54: Security glazing films.

1.2 REFERENCES

.1 ASTM International (ASTM):
.1 ASTM C542-05(2011), Standard Specification for Lock-Strip Gaskets.
.2 ASTM C920-14a, Standard Specification for Elastomeric Joint Sealants.
.3 ASTM D2240-15, Standard Test Method for Rubber Property - Durometer Hardness.

.2 Canadian General Standards Board (CGSB):
.1 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.

1.3 SUBMITTALS

.1 Submit one representative sample of glass in accordance with Section 01 33 00.

1.4 QUALITY ASSURANCE

.1 Installer's qualifications: Perform Work of this Section by a company that has a minimum of five years proven experience in the installation of glazing units of a similar size and nature.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

1.5 DELIVERY, STORAGE AND HANDLING (Cont'd)

.3 (Cont'd)

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect glazing and frames from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and returnof pallets, crates, padding and packaging materials in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Temperated safety glass: to CAN/CGSB-12.1-M, Type 2-tempered, Class B, clear, of thickness indicated.

.2 Setting blocks: neoprene, Shore "A" 80 durometer hardness to ASTM D2240, 100 x 6 mm x width to suit glass.

.3 Glazing tape: preformed butyl with continuous spacer, Shore "A" 10-15 durometer hardness, paper release, black colour, 3 x 9.5 mm.

.4 Gasket: black neoprene to ASTM C542, "U" cavity type with lock strip.

.5 Sealant: one part silicone to ASTM C920, Type S, Grade NS, Class 50.

.6 Security glass film: In accordance with Section 08 87 54.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

.1 Clean contact surfaces with solvent and wipe

.2 Seal porous glazing channels or recesses with

.3 Prime surfaces scheduled to receive sealant.

3.3 INSTALLATION

.1 Glass:
.1 Clean and dry surfaces.
.2 Apply glazing tape to fixed stops.
.3 Place setting blocks at 1/3 points.
.4 Set glass on setting blocks against tape.
.5 Apply glazing tape to glass.
.6 Install stops.
.7 Apply sealant behind stop and tool to smooth surface.
.8 Install glass in wood and hollow metal doors and screens, secure fastened and rigid.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.
.1 Leave Work area clean at end of each day.
.1 Remove traces of primer, caulking.
.2 Remove glazing materials from finish surfaces.
.3 Remove labels.
.4 Clean glass using approved non-abrasive cleaner in accordance with manufacturer's instructions.
.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 After installation, mark each light with an "X" by using removable plastic tape or paste.

3.5 PROTECTION (Cont'd)

.2 (Cont'd)

.1 Do not mark heat absorbing or reflective glass units.

.3 Repair damage to adjacent materials caused by glazing installation.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 08 80 00 - Glazing.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM):
.1 ASTM C1115-06(2011), Standard Specification for Dense Elastomeric Silicone Rubber Gaskets and Accessories.
.2 ASTM D882-12, Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
.3 ASTM D1044-13, Standard Test Method for Resistance of Transparent Plastics to Surface Abrasion.
.4 ASTM E84-16, Standard Test Method for Surface Burning Characteristics of Building Materials.
.5 ASTM F1233-08(2013), Test Method for Security Glazing Materials and Systems.

.2 Underwriters laboratories (UL):
.1 UL-972-06, Standard for Burglary Resisting Material.

.3 Underwriters laboratories of Canada(ULC):
.1 ULC S332-1993(R1998), Standard for Burglary Resistant Glazing Material.

1.3 DEFINITIONS

.1 For the purposes of this specification applying definitions follow:
.1 Safety: Reduction of risk of injury, loss or death due to accidental, natural or unintentional causes.
.2 Security: Reduction of risk of injury, loss or death due to intentional actions of others.

1.4 PERFORMANCE REQUIREMENTS

.1 Glazing and film to meet requirements of ULC S332, UL 972 or ASTM F1233 as indicated on Contract Drawings.

1.5 SAMPLES

.1 Submit samples in accordance with Section 01 33 00.

.2 Submit one representative sample of each type of security glazing film in accordance with Section 01 33 00. Submit one 100 x 100 mm sample of film installed on 7 mm thick clear plate glass. Submit 300 mm long sample of glazing film frame.

1.6 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00.

1.7 MAINTENANCE DATA

.1 Provide operation and maintenance data for window film for incorporation into manual specified in Section 01 78 00.

1.8 QUALITY ASSURANCE

.1 Qualifications of glazing film and frame applicator: trained, approved and certified by glazing film manufacturer. Submit proof of certification in writing to Departmental Representative in accordance with Sections 01 33 00 and 01 78 00.

.2 Glazing film inspection: manufacaturer's representative shall view the film at a distance of 3 m (10 feet) at angles up to 45 degrees from either side of the glass during regular daylight conditions (not in direct sunlight). To be accepted the film itself shall not appear distorted. Submit manufacturer's written inspection report to Departmental Representative in accordance with Sections 01 33 00 and 01 78 00.

1.9 TEST REPORTS

.1 Submit test reports from approved independent testing laboratories, certifying compliance with specifications, for film applied to glass.

1.10 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00.

.2 Provide and maintain dry, off-ground weatherproof storage.

.3 Store rolls of security film flat on cross supports. Do not stand rolls of film on end.

.4 Remove only in quantities required for same day use.

.5 Store materials in accordance with manufacturer's written instructions.

1.11 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20 and with Waste Reduction Workplan.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

1.12 ENVIRONMENTAL AND SAFETY REQUIREMENTS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of material safety data sheets acceptable to Canada Labour Code.

1.13 WARRANTY

.1 Work of this Section 08 87 54 the 12 months warranty period prescribed in GC3.13 of General Conditions is extended to 5 years.

.2 Ensure warranty includes items as follows:
.1 Maintain adhesion properties without blistering, bubbling or delaminating from glass.
.2 Maintain appearance without discolouration.
.3 Remove, replace and reapply defective materials.

1.13 WARRANTY (Cont'd)

.2 (Cont'd)

.4 In event of product failure under warranty terms, remove and re-apply film without glass replacement at no cost to Departmental Representative.

PART 2 - PRODUCTS

2.1 MANUFACTURER

.1 Use manufacturers who are members of International Window Film Association (IWFA).

2.2 MATERIALS

.1 Clear Security Film (Type 1): Multi-ply optically clear polyester film with factory applied adhesive between each layer, abrasion resistant coating and release liner.

.1 Number of laminations: 3.

.2 Total thickness of installed film: 0.31 mm.

.3 Elongation: to ASTM D882.

.4 Break strength: to ASTM D882.

.5 Young's Modulus: to ASTM D882.

.6 Tear resistance: to ASTM D1004.

.7 Abrasion resistance: ASTM D1044.

.8 Flammability: surface burn characteristics to ASTM E84.

.2 Reflective One-Way Security Film (Type 2): High reflection, mirror-like appearance.

.1 Flammability: surface burn characteristics to ASTM E84.

.2 For use at exam room whereby staff outside the room can view into room and room occupants view a mirrored surface.

.3 Adhesive: high mass pressure sensitive, acrylic base, as recommended by film manufacturer.

.4 Sealant: Type as recommended by film manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for glazing film installation in accordance with manufacturer's written instructions.

3.2 INSTALLERS

.1 Use only manufacturer authorized applicators who are also members of the International Window Film Association (IWFA) and have achieved accredited status as "Safety & Security Film Specialists".

3.3 PREPARATION

.1 Clean glass before beginning installation using neutral cleaning solution.

.2 Ensure no deleterious material adheres to glass by balding surface of glass using industrial razors.

.3 Ensure dust, grease, and chemical residue are removed from surface of glass before installation of film.

.4 Examine glass under natural daylight and identify cracks, blisters, bubbles, discoloration, edge defects or other anomalies that may cause, film to delaminate, or vision transparency or distortion problems. Report findings to Departmental Representative.

.5 Proceed with Work only after receipt of written approval from Departmental Representative.

.6 Before beginning Work, place absorbent material on window sill or at sash frame to absorb moisture accumulation generated by film application.

3.4 INSTALLATION

.1 Install security glazing films in accordance with manufacturer's written instructions and to meet Owner's security requirements and specified performance requirements.

.2 Cut film edges straight and square.

.3 Apply security film with adhesive to glass in accordance with manufacturer's written instructions.

.4 Place film without air bubbles, creases or visible distortion.

.5 Fit tight to glass perimeter with razor cut edge.

.6 Apply security sealant from perimeter of glass units in accordance with manufacturer's written instructions to achieve specified level of security.

.7 Use clean, clear water to remove protective water soluble coating on adhesive side of film.

.8 Use only water and film slip solution on glass to facilitate positioning of film.

.9 Ensure removal of excess water from between film and glass.

.10 Remove left over material form work area and return work area to original condition.

3.5 INSPECTION

.1 Return to work place after 30 days but no longer than 40 days for final cleaning and inspection of installed film.

.2 Ensure finished surface of film is vision free of blisters, bubbles, tears, scratches, edge defects, delaminating or vision distortion when viewed under natural daylight from 2.0 m minimum.

.3 Remove and replace film that continues to show blisters, bubbles, tears, scratches, edge defects or vision distortion in film when viewed under natural daylight from 2.0 m minimum after 30 day period.

3.6 FINAL CLEANING

.1 Wash both sides of each intended substrate and film using cleaning solution recommended by film manufacturer.

3.7 MAINTENANCE

.1 Follow manufacturers written instructions for care and maintenance of glass film.

.2 Use only cleaning solution recommended by manufacturer for regularly scheduled cleaning of glass film.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 ASTM International (ASTM):
.1 ASTM C475/C475M-15, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
.2 ASTM C840-13, Standard Specification for Application and Finishing of Gypsum Board.
.3 ASTM C1002-14, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
.4 ASTM C1047-14a, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
.5 ASTM C1396/C1396M-14a, Standard Specification for Gypsum Board.
.6 ASTM E90-09 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
.7 ASTM E2638-10 Standard Test Method for Objective Measurement of the Speech Privacy Provided by a Closed Room.

.2 Association of the Wall and Ceilings Industries International (AWCI):
.1 AWCI Levels of Gypsum Board Finish 101a-97.

.3 Canadian General Standards Board (CGSB):
.1 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.4 Underwriters' Laboratories of Canada (ULC):
.1 CAN/ULC-S102-10, Standard Method of Test of Surface Burning Characteristics of Building Materials and Assemblies.

1.2 DESIGN REQUIREMENTS

.1 Partition assembly to be both non-combustible construction and fire resistance rated.

.2 Minimum sound transmission rating of installed panel partition to meet intended STC ratings, tested to ASTM E90.

1.2 DESIGN REQUIREMENTS (Cont'd)

.3 Minimum speech privacy category SPC Standard Speech Security 70-75 tested to ASTM E2638.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for gypsum board assemblies and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:
.1 Submit for review and acceptance of each unit.
.2 Samples will be returned for inclusion into work.
.3 Submit duplicate 300 mm long samples of corner and casing beads and special trims.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store gypsum board assemblies materials level indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect gypsum board assemblies from nicks, scratches, and blemishes.
.3 Protect from weather, elements and damage from construction operations.
.4 Handle gypsum boards to prevent damage to edges, ends or surfaces.
.5 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding and packaging materials as specified in Waste Reduction Workplan in accordance with Section 01 74 20.

1.5 AMBIENT CONDITIONS

.1 Maintain temperature 10 degrees C minimum, 21 degrees C maximum for 48 hours prior to and during application of gypsum boards and joint treatment, and for 48 hours minimum after completion of joint treatment.

.2 Apply board and joint treatment to dry, frost free surfaces.

.3 Ventilation: ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Standard board and Type X: to ASTM C1396/C1396M, regular, 15.9 mm thickness, unless otherwise indicated, fire-rated where indicated and as required, 1200 mm wide x maximum practical length, ends square cut, edges squared.

.2 Moisture resistant backing board and coreboard: to ASTM C1396/C1396M regular, 15.9 mm thick, Type X, unless otherwise indicated, squared edges.

.3 Metal furring runners, hangers, tie wires, inserts, anchors: to ASTM C645.

.4 Drywall furring channels: 0.5 mm core thickness galvanized steel channels for screw attachment of gypsum board.

.5 Resilient clips: 0.5 mm base steel thickness galvanized steel for resilient attachment of gypsum board.

.6 Steel drill screws: to ASTM C1002.

.7 Laminating compound: as recommended by manufacturer, asbestos-free.

.8 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, zinc-coated by hot-dip process, 0.5 mm base thickness, perforated flanges, one piece length per location.

2.1 MATERIALS (Cont'd)

.9 Special trim pieces: to include, but not be limited to the following:
.1 Trim (Type 1): Zinc-coated steel, drywall reveal trim complete with holes and knurled surface for keying with finishing compound.

.10 Sealants: in accordance with Section 07 90 00.

.11 Polyethylene: to CAN/CGSB-51.34, Type 2.

.12 Joint compound: to ASTM C475/C475M, asbestos-free.

.13 Joint tape: to ASTM C475/C475M.
.1 Paper tape for standard gypsum board.

.14 Access doors: Supplied by other Sections for installation as part of the work of this Section.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for gypsum board assemblies installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 ERECTION

.1 Do application and finishing of gypsum board to ASTM C840 except where specified otherwise.

.2 Erect hangers and runner channels for suspended gypsum board ceilings to ASTM C840 except where specified otherwise.

3.2 ERECTION (Cont'd)

.3 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm aound perimeter of fixture.

.4 Install work level to tolerance of 1:1200.

.5 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, and grilles.

.6 Install furring channels parallel to, and at exact locations of steel stud partition header track.

.7 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.

.8 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.

.9 Install wall furring for gypsum board wall finishes to ASTM C840, except where specified otherwise.

.10 Furr openings and around built-in equipment, cabinets, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.

.11 Furr duct shafts, beams, columns, pipes and exposed services where indicated.

.12 Erect drywall resilient furring transversely across studs, spaced maximum 600 mm on centre and not more than 150 mm from ceiling/wall juncture. Secure to each support with drywall screw.

.13 Install continuous strip of gypsum board along base of partitions where resilient furring installed.

3.3 APPLICATION

.1 Apply gypsum board after bucks, anchors, blocking, sound attenuation, electrical and mechanical work have been approved.

3.3 APPLICATION (Cont'd)

.2 Apply single and double layer gypsum board as scheduled to metal furring or framing using screw fasteners. Where double layers of gypsum board are shown, screw first layer to studs and laminate the second layer to the first. Maximum spacing of screws 300 mm on centre.

.1 Single-Layer Application:

.1 Apply gypsum board on ceilings prior to application of walls to ASTM C840.

.2 Apply gypsum board vertically or horizontally, providing sheet lengths that will minimize end joints.

.2 Double-Layer Application:

.1 Install gypsum board for base layer and exposed gypsum board for face layer.

.2 Apply base layer to ceilings prior to base layer application on walls; apply face layers in same sequence. Offset joints between layers at least 250 mm.

.3 Apply base layers at right angles to supports unless otherwise indicated.

.4 Apply base layer on walls and face layers vertically with joints of base layer over supports and face layer joints offset at least 250 mm with base layer joints.

.3 Apply gypsum board to concrete or concrete block surfaces, where indicated, using laminating adhesive.

.1 Comply with gypsum board manufacturer's recommendations.

.2 Brace or fasten gypsum board until fastening adhesive has set.

.3 Mechanically fasten gypsum board at top and bottom of each sheet.

.4 Apply 12 mm diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, and ducts, in partitions where perimeter sealed with acoustic sealant.

.5 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.

3.3 APPLICATION (Cont'd)

.6 Install gypsum board on walls vertically to avoid end-butt joints. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs, except where local codes or fire-rated assemblies require vertical application.

.7 Install gypsum board with face side out.

.8 Do not install damaged or damp boards.

.9 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

3.4 INSTALLATION

.1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 150 mm on centre.

.2 Install casing beads around perimeter of suspended ceilings.

.3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.

.4 Construct control joints of preformed units set in gypsum board facing and supported independently on both sides of joint.

.5 Provide continuous polyethylene dust barrier behind and across control joints.

.6 Locate control joints where indicated and at changes in substrate construction.

.7 Install control joints straight and true.

.8 Construct expansion joints at building expansion and construction joints. Provide continuous dust barrier.

.9 Install expansion joint straight and true.

3.4 INSTALLATION (Cont'd)

.10 Splice corners and intersections together and secure to each member with 3 screws.

.11 Install access doors to electrical and mechanical fixtures specified in respective sections.
.1 Rigidly secure frames to furring or framing systems.

.12 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.

.13 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with AWCI Levels of Gypsum Board Finish:
.1 Levels of finish:
.1 Level 4: embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.

.14 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.

.15 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.

.16 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.17 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

.18 Mix joint compound slightly thinner than for joint taping.

.19 Apply thin coat to entire surface using trowel or drywall broad knife to fill surface texture differences, variations or tool marks.

3.4 INSTALLATION (Cont'd)

.20 Allow skim coat to dry completely.

.21 Remove ridges by light sanding or wiping with damp cloth.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.
.1 Leave Work area clean at end of each day.
.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.6 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by gypsum board assemblies installation.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 ASTM International (ASTM):
.1 ASTM A653/A653M-15e1, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
.2 ASTM C645-14e1, Standard Specification for Nonstructural Steel Framing Members.
.3 ASTM C920-14a, Standard Specification for Elastomeric Joint Sealants.
.4 ASTM E90-09, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
.5 ASTM E2638-10, Standard Test Method for Objective Measurement of the Speech Privacy Provided by a Closed Room.
.6 ASTM F1267-15, Standard Specification for Metal, Expanded, Steel.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
.1 Material Safety Data Sheets (MSDS).

.3 Underwriters Laboratories of Canada (ULC)
.1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.2 DESIGN REQUIREMENTS

.1 Partition assembly to be both non-combustible construction and fire resistance rated.

.2 Minimum sound transmission rating of installed panel partition to meet intended STC ratings, tested to ASTM E90.

.3 Minimum speech privacy category SPC Standard Speech Security 70-75 tested to ASTM E2638.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for metal framing and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:
.1 Submit duplicate 300 mm long samples of non-structural metal framing.
.2 Submit duplicate 300 mm x 300 mm samples of each steel blocking and security mesh.

1.4 QUALITY ASSURANCE

.1 Retain a Professional Engineer, licensed in the Province of Ontario, with experience in work of comparable complexity and scope, to perform the following services as part of work of this Section:
.1 Design of wall systems.
.2 Design of suspended gypsum board ceilings.
.3 Review, stamp, and sign shop drawings and design calculations.
.4 Conduct shop and on-site inspections, prepare and submit written inspection reports verifying that part of work is in accordance with Contract Drawings and reviewed shop drawings.

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

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

.4 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Section 01 31 19.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect metal framing from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return of packaging materials as specified in Waste Reduction Workplan in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Non-load bearing channel stud framing: to ASTM C645, 32 mm stud size, roll formed, hot dipped galvanized steel sheet, for screw attachment of gypsum board. Steel sheet thicknesses as follows:
.1 Typical: Minimum 0.53 mm (25 ga.).
.2 Partitions with security mesh: Minimum 0.91 mm (20 ga.).

.2 Floor and ceiling tracks: to ASTM C645, in widths to suit stud sizes, 32 mm flange height.

.3 Deflection track: ASTM C645, top runner with extra deep flanges, in thickness indicated for studs and in width to accommodate depth of studs.

.4 Metal channel stiffener: 1.4 mm thick cold rolled steel, coated with rust inhibitive coating.

2.1 MATERIALS (Cont'd)

.5 Acoustic insulation: mineral fibre batt, 40 kg/m^3, Ecologo certified, conforming to CAN/ULC-S102.

.6 Acoustical sealant: one part silicone to ASTM C920, primerless, Type S, Grade NS, Class 25, SWRI validated, Ecologo certified, maximum VOC 60 g/L.

.7 Mesh: Galvanized, flattened, expanded steel diamond mesh, conforming to ASTM F1267 and meeting the below criteria to provide maximum security level:
.1 Maximum opening at security mesh to be 14.3 mm width and 42.875 mm length.
.2 8.35 kg of uncoated weight per square metre.
.3 63% open area.

.8 Strap: 1.897 mm thick x 100 mm wide galvanized steel strap. Steel: minimum 25% recycled content.

.9 Sheet sheet blocking: Galvanized sheet steel, ASTM A653/A653M, Grade A, Z275, commercial quality zinc coating. 0.91 mm thick (20 ga.) thick for use as sheet blocking.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for non-structural metal framing application in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 ERECTION

.1 Align partition tracks at floor and ceiling and secure at 400 mm on centre maximum.

.2 Place studs vertically at scheduled spacing intervals and not more than 50 mm from abutting walls, and at each side of openings and corners.
.1 Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.

.3 Erect metal studding to tolerance of 1:1000.

.4 Attach studs to bottom track using screws.

.5 Provide galvanized sheet blocking in wall assemblies as scheduled.

.6 Security mesh:
.1 Prior to installing gypsum wallboard, install security mesh to partition framing from floor to underside of structure with self-drilling, self-tapping flat head metal screws and washers at 300 mm. o.c. at perimeter and field locations.
.2 Provide 38 mm end and side laps. Locate end laps over supporting members. Cut security mesh to suit partition framing.
.3 Accurately cut security mesh around duct openings and other penetrations and maintain security barrier.
.4 Provide additional framing as required to secure security mesh and maintain security barrier.
.5 Install security mesh at gypsum wall partitions at demising wall locations.

.7 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.

.8 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.

.9 Install heavy gauge single jamb studs at openings.

.10 Erect track at head of door/window openings and sills of sidelight/window openings to accommodate intermediate studs.

3.2 ERECTION (Cont'd)

.10 (Cont'd)
.1 Secure track to studs at each end, in accordance with manufacturer's instructions.
.2 Install intermediate studs above and below openings in same manner and spacing as wall studs.

.11 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.

.12 Provide 32 mm stud or furring channel secured between studs for attachment of fixtures behind lavatory basins, toilet and bathroom accessories, and other fixtures including grab bars and towel rails, attached to steel stud partitions.

.13 Install steel studs or furring channel between studs for attaching electrical and other boxes.

.14 Extend partitions to ceiling height except where noted otherwise on drawings.

.15 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs.
.1 Use 50 mm leg ceiling tracks.

.16 Install two continuous beads of acoustical sealant under studs and tracks around perimeter of sound control partitions.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by non-structural metal framing application.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 American National Standards (ANSI) for the Installation of Ceramic Tile/ Ceramic Tile Institute of America (CTIOA):

.1 ANSI A108/A118/A136.1-2014, Installation of Ceramic Tile.

.1 ANSI A108.1A, Installation of Ceramic Tile in Wet-Set Method, with Portland Cement Mortar.

.2 ANSI A108.1B, Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar.

.3 ANSI A108.1C, Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex Portland Cement Mortar.

.4 ANSI A108.4, Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile Setting Epoxy Adhesive.

.5 ANSI A108.5, Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.

.6 ANSI A108.6, Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and Grouting Epoxy.

.7 ANSI A108.8, Installation of Ceramic Tile with Chemical Resistant Furan Mortar and Grout.

.8 ANSI A108.9, Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout.

.9 ANSI A108.10, Installation of Grout in Tilework.

.10 ANSI A108.11, Interior Installation of Cementitious Backer Units.

.11 ANSI A118.1, Dry-Set Portland Cement Mortar.

.12 ANSI A118.3, Chemical Resistant Water Cleanable Tile-Setting and Grouting Epoxy and Water cleanable tile Setting Epoxy Adhesive.

.13 ANSI A118.4, Latex Portland Cement Mortar.

1.1 REFERENCE STANDARDS (Cont'd)

.1 (Cont'd)

.1 (Cont'd)

.14 ANSI A118.5, Chemical Resistant Furan Mortars and Grouts For Tile Installation.

.15 ANSI A118.6, Ceramic Tile Grouts.

.16 ANSI A118.8, Modified Epoxy Emulsion Mortar Grout.

.17 ANSI A118.9, Cementitious Backer Units.

.18 ANSI A136.1, Organic Adhesives for Installation of Ceramic Tile.

.2 ANSI A137.1-2012, American National Standard Specification for Ceramic Tile.

.2 International Standards Organization (ISO):

.1 ISO 13007- Part 1: 2014: Ceramic tiles -- Grouts and adhesives; performance requirements for tile adhesives.

.2 ISO 13007- Part 2: 2013: Ceramic tiles -- Grouts and adhesives; test methods for adhesives.

.3 ISO 13007- Part 3: 2010: Ceramic tiles -- Grouts and adhesives; terms, definitions and specifications for grouts.

.4 ISO 13007- Part 4: 2013: Ceramic tiles -- Grouts and adhesives; Test methods for grouts.

.3 American Society for Testing and Materials International (ASTM):

.1 ASTM C207-06(2011), Standard Specification for Hydrated Lime for Masonry Purposes.

.4 Canadian Standards Association (CSA International)

.1 CAN/CSA-A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.2 CAN/CSA-A179-14, Mortar and Grout for Unit Masonry.

.5 Terrazzo Tile and Marble Association of Canada (TTMAC) 1-800-201-8599, 905-660-9640, www.ttmac.com.

.1 Hard Surface Maintenance Guide.

.2 TTMAC Specification Guide 09 30 00 - Tile Installation Manual 2012/2014.

1.2 SUBMITTALS

.1 Submit TTMAC Installation Detail No. or Tile Council of America Installation Detail No. or shop drawing showing installation for each tile specified.

.2 Samples:
- .1 One full-size sample of tile to be used.
- .2 One 300 mm sample of trims to be used.

1.3 QUALIFICATIONS

.1 Use installation and grouting materials produced by a manufacturer that has been regularly engaged in producing these materials for a minimum of 10 years and has completed a minimum of 5 successful installations of this type, each at least five years old.

.2 Employ workmen with previous experience of more than 5 years in each different assembly specified.

.3 Provide references of 3 installations of similar type and size more than 3 years old for each assembly.

1.4 EXTRA MATERIALS

.1 Submit extra tile amounting to 3% of gross area covered, allowing proportionately for each pattern and type specified and which are part of the same production run as installed products. Store maintenance products as directed by the Departmental Representative.

PART 2 - PRODUCTS

2.1 MATERIAL

.1 Ceramic floor tile and base (CT):
- .1 Conforming to ANSI A137.1.
- .2 Tile types:.
  - .1 Backsplash tile at kitchenette (CWT): Tile type and size to be selected by the Departmental Representative.

2.1 MATERIAL (Cont'd)

.1 (Cont'd)

.2 (Cont'd)

.2 Porcelain tile floor (CT): Full body porcelain tile to match base building and adjacent tenant spaces, tile size of 300 mm x 600 mm, having a matte finish and to match existing colour 'Sediment'.

.3 Base: Base tile to match floor tile, height and profile to match existing bases.

.2 Portland cement: to CAN/CSA-A3001, type GU Normal, white at grout.

.3 Sand: to CSA A179.

.4 Hydrated Lime: to ASTM C207.

.5 Latex: formulated for use in cement mortar.

.6 Water: potable.

.7 Thin set bond coat (interior): dry set mortar, pre-mixed, thin set mortar formulated with Portland cement, sand and latex additive. Complying with ANSI A118.4 and ISO 13007.

.8 Floor, base and wall grout (thin set system): pre-mixed, dry set grout. Colour to match tile colour.

.9 Transition strips: Stainless steel edge protection, continuous at all exposed tile edges, depth as required to suit tile thickness.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

.1 Do not proceed with installation unless substrate is structurally sound, solid and well fastened.

.2 Surfaces must be clean and free from dust, dirt, oil, grease, paint, wax, sealers, curing compounds or any other substances which may reduce or prevent adhesion.

3.2 SYSTEM REQUIREMENTS

.1 Provide assemblies composed of compatible materials from the same manufacturer.

.2 The completed assembly will meet the service requrements Heavy Duty described in Handbook For Ceramic Tile Installation.

3.3 MIXING

.1 To ANSI A108.1A.

.2 Levelling coat (by volume):
.1 1 part portland cement.
.2 4 parts sand.
.3 1/10 part latex.
.4 1 part water (includes latex additive).
.5 Adjust water volume to suit water content of sand.

.3 Wall, mortar bed (by volume):
.1 1 part portland cement.
.2 1/5 to 1/2 parts hydrated lime.
.3 4 parts sand.
.4 1 part water.
.5 Adjust water volume to suit water content of sand.
.6 Latex, volume recommended by manufacturer.

.4 Floor, mortar bed (by volume):
.1 1 part portland cement.
.2 4 parts sand.
.3 1 part water.
.4 Adjust water volume to suit water and content of sand.
.5 Latex, volume recommended by manufacturer.

.5 Thin set bond coat and grout: dry set mortar; mix to manufacturer's instructions.

3.4 WORKMANSHIP

.1 Minimum surface and air temperature 12°C, before and during application and during curing period.

.2 Install trim to be placed under tile in locations indicated on drawings.

3.4 WORKMANSHIP (Cont'd)

.3 Provide back-buttering in addition to the usual notch-trowel-applied bond coat in the following applications:
.1 With rib-backed tiles and heavy lug-backed tiles.
.2 In hot, dry or windy weather or where motched mortar bed was prepared too far in advance.

.4 Backbuttering: remove residual dust, wipe the back of the tile with a damp cloth or sponge, apply a full coverage 2 mm thick coat of mortar, apply no more than 10-15 minutes before tiles are set so that both back-butter and mortar are wet at time of setting.

.5 Use Box Screed jig with large sized tiles which are not of uniform thickness.

.6 Trowel in one direction and press the tile into the mortar with a sliding motion perpendicular to the trowel ridges. Twist, vibrate or beat the tiles to compress the trowel ridges to comply with requirements of ANSI A108.5.

.7 Perimeter tile minimum 1/2 size.

.8 Cut tile around corners and built-in objects smooth, even, chip and split free.

.9 Accurately form intersections, corners and returns.

.10 Joints uniform:
.1 Walls: 1.5-3.0 mm wide.
.2 Floor tiles: 3.0-6.0 mm wide.

.11 Surfaces plumb, straight, true, even and flush to a tolerance of 1:1000.

.12 Replace broken or hollow sounding tile.

.13 Allow 24 hours before grouting.

.14 Fill joints solid with grout, free of voids, cracks, excess mortar or grout.

.15 Floors traffic free for 48 hours.

.16 Clean surfaces after curing.

3.5 SETTING BACK-BUTTERED TILE

.1 Firmly push, twist and immediately beat or vibrate the tiles or stone units.

3.6 FLOOR TILE

.1 Install in accordance with:
.1 TTMAC detail 311F Detail A Interior/Exterior.
.2 Bond coat and grout manufacturer's written instructions.

3.7 WALL TILE

.1 Install in accordance with:
.1 TTMAC details 319SR, B-Thin Set on Backer Unit/Board.
.2 Bond coat and grout manufacturer's written instructions.

3.8 EXPANSION AND CONTROL JOINTS

.1 Install movement joints in accordance with TTMAC detail 301MJ, applicable details and in accordance with joint manufacturer's recommendations and as follows:
.1 Interior: 4.8 m to 6 m each direction.
.2 Interior exposed to sunlight or moisture: 3.659 m to 4.878 m in both directions.
.3 Where tile abutts restraining surfaces (walls, pipes, ceilings and where changes occur in backing materials).

.2 Provide expansion joints where tile spans cold joints, construction joints, saw-cuts and seismic joints.

.3 Construct during installation of mortar beds and/or tile, rather than saw-cutting joints after installation.

3.9 CLEANING

.1 Clean off excess grout with soft burlap or sponge moistened with clean water.

.2 Polish wall tile after grout has cured in accordance with TTMAC recommendations in the Maintenance Guide; do not use acid for cleaning.

3.9 CLEANING (Cont'd)

.3 Re-point joints after cleaning as required to eliminate imperfections, then re-clean as necessary. Avoid scratching tile surfaces.

3.10 PROTECTION

.1 Protect tiled assemblies after final installation.

.2 Prevent direct impact, vibration and heavy hammering on adjacent and opposite walls for 24 hours minimum, after final installation.

.3 Cover work temporarily with building paper properly lapped and taped at joints until work has been approved by Departmental Representative.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM):
.1 ASTM C635/C635M-13a, Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
.2 ASTM C636/C636M-13, Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
.3 ASTM E84-16, Standard Test Method for Surface Burning Characteristics of Building Materials.
.4 ASTM E1264-14, Classification for Acoustical Ceiling Products.

.2 Underwriters Laboratories Canada (ULC):
.1 CAN/ULC S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.2 DESIGN REQUIREMENTS

.1 Design ceiling suspension systems in accordance with ASTM C636/C636M and manufacturer's printed directions.

.2 Design tile ceiling system for adequate support of electrical fixtures as required by the current bulletin of the Electrical Safety Authority. Acoustic panel system is not designed to carry the weight of electrical equipment.

.3 Design hanger anchor and entire suspension system static loading not to exceed 25% of their ultimate capacity including lighting fixture dead loads.

.4 Design tile suspension system to support weight of mechanical and electrical items such as air handling boots and lighting fixtures, and with adequate support to allow rotation/relocation of light fixtures. Acoustic panel system is not designed to carry the weight of mechanical and electrical equipment.

1.2 DESIGN REQUIREMENTS (Cont'd)

.5 Design subframing as necessary to accommodate, to avoid conflicts and interferences where ducts or equipment prevent regular spacing of hangers.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for acoustical suspension and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop drawings:
.1 Submit reflected ceiling plans for special grid patterns as indicated.
.2 Indicate lay-out, insert and hanger spacing and fastening details, access door dimensions, and locations and acoustical unit support at ceiling fixture.

.4 Samples:
.1 One full-size sample of each type of tile panels to be used.
.2 One of each type of suspension system members.

.5 Certificates: Submit certificate stating that suspended ceiling systems provide adequate support for electrical fixtures, as required by current bulletin of Electrical Inspection Department of Ontario Hydro.

.6 Closeout submittals:
.1 Operation and Maintenance Data: submit operation and maintenance data for acoustical suspension for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

1.4 DELIVERY, STORAGE AND HANDLING (Cont'd)

.3 Storage and Handling Requirements:
.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect acoustical ceiling tiles and tracks from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding and packaging materials in accordance with Section 01 74 20.

1.5 EXTRA MATERIALS

.1 Provide extra materials of acoustic units in accordance with Section 01 78 00.

.2 Provide acoustical units amounting to 2% of gross ceiling area for each pattern and type required for project.

.3 Extra materials to be from same production run as installed materials.

.4 Clearly identify each type of acoustic unit, including colour and texture.

.5 Deliver to Departmental Representative, upon completion of the work of this section.

.6 Store where directed by Departmental Representative.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Heavy duty system to ASTM C635/C635M as required to support intended loads.

.2 Acoustic ceiling tile (ACT):
.1 Conforming to ASTM E1264.
.2 Salvaged tiles: In accordance with Section 02 41 19. Coordinate with noted Section as required for reinstallation under work of this Section. Replace with new to match existing type if salvaged tiles are damaged and additional supply is required for reinstallation.

2.1 MATERIALS (Cont'd)

.2 (Cont'd)

.3 New tiles:

.1 New tiles to match existing corridor 004 at corridor 113 only and meet the following criteria:

.1 Conforming to ASTM E1264, Type III, Form 2, Pattern CD.

.2 Size: 600 mm x 1200 mm x 15 mm thick.

.3 Wet-formed mineral fibre with factory-applied latex paint.

.4 Fire performance: Conforming to ASTM E84 and CAN/ULC S102, flame spread rating of 25 or less and smoke developed index of 50 or less.

.5 Tile to have square edges, humidity and sag resistance and greater than 50% total recycled content.

.2 New tiles, typical: Mineral fibre tile sized at 600 x 1200 x 16 mm thick, flat, square edge, white colour, fissured pattern, maximum flame spread rating 25 to CAN/ULC-S102, STC minimum 35.

.3 Suspension system: non-fire rated, two directional exposed tee bar grid, including wall moulding.

.4 Exposed tee bar grid components for ceiling tile: cold rolled steel, zinc coated, shop painted, satin sheen, white, interlocking, main and cross tee of double web with rectangular bulb, depth governed by span, 25 mm exposed face.

.5 Hangers: 3.6 mm galvanized soft annealed steel wire.

.6 Accessories: splices, clips, wire ties, retainers and wall moulding flush, to complement suspension system components, as recommended by system manufacturer.

.7 Hold down clips: Manufacturer's standard clip for use with specified grid.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for acoustical ceiling tile and track installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

.1 Install new and modify existing acoustical ceilings in accordance with ASTM C636/C636M, reviewed shop drawings and manufacturer's written instructions.

.2 Install suspension system to manufacturer's instructions and Certification Organizations tested design requirements.

.3 Co-ordinate suspension system with related components.

.4 Do not erect ceiling suspension system until work above ceiling has been inspected and approved by Departmental Representative.

.5 Support suspension system main runners at 1200 mm oc maximum with hangers from structure. Assembly shall support super-imposed loads. Maximum permissible deflection, 1/360th of span to ASTM C635/C635M deflection test.

.6 Attach cross member to main runner to provide rigid assembly.

.7 Acoustic lay-in tiles:

3.2 INSTALLATION (Cont'd)

.7 (Cont'd)

.1 Install acoustic tiles in grid system openings supported by bottom flanges of members. Provide special shapes and sizes to provide a complete installation by cutting tile to fit into openings. Fit tile moderately tight between upright legs of members.

.2 Carefully cut and trim acoustic tiles to accommodate items piercing the finished ceiling plane.

.3 Cut acoustic units to fit adjacent work. Butt joints tight, terminate edges with moulding.

.4 Secure each panel into grid opening with concealed hold down clips.

.8 Install flush edge molding at junction of acoustic unit ceiling and other materials around entire length of joint.

3.3 CLEANING

.1 Cleaning:

.1 Leave work area clean at end of each day.

.2 Upon completion, remove surplus materials, rubbish, tools and equipment.

.3 Touch up scratches, abrasions, voids and other defects in painted surfaces.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

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

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by acoustical suspension installation.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 American Association of Textile Chemists and Colorists (AATCC):
.1 AATCC-134-2011, Electrostatic Propensity of Carpets.

.2 ASTM International (ASTM):
.1 ASTM F150-06(2013), Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring.
.2 ASTM F1066-04(2014)e1, Standard Specification for Vinyl Composition Floor Tile.
.3 ASTM F1861-08(2012)e1, Standard Specification for Resilient Wall Base.

.3 Canadian General Standards Board (CGSB):
.1 CGSB-25.20-95, Surface Sealer for Floors.

.4 Canadian Standards Association (CSA):
.1 CSA B651-12, Accessible Design for the Built Environment.

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
.1 Material Safety Data Sheets (MSDS).

.6 Scientific Certification Systems (SCS):
.1 SCS-EC10.2-2007, Indoor Air Quality Performance.

.7 Underwriter's Laboratories of Canada (ULC):
.1 CAN/ULC-S102.2-10, Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.

1.2 SUBMITTALS

.1 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 and acceptable to Labour Canada and acceptable to Labour Canada and Health Canada for primer, cement and adhesive. Indicate VOC content.

.2 Samples:
.1 Submit samples in accordance with Section 01 33 00.

1.2 SUBMITTALS (Cont'd)

.2 (Cont'd)

.2 Submit duplicate 300 x 300 mm sample pieces of tile material and 300 mm long base.

.3 Submit copy of flooring manufacturer's installation procedures in accordance with Section 01 33 00.

.4 Submit letter stating that the moisture content of concrete slab and the ph of the surface is within manufacturer's written guidelines for proposed flooring system.

.5 Do not proceed with flooring installation if the concrete slab moisture content is over 3.0 lbs/1000 S.F for vinyl. Contact the manufacturer's representative and inform the Departmental Representative immediately.

.6 Provide maintenance data for resilient flooring for incorporation into operation and maintenance manual specified in Section 01 78 00.

1.3 MAINTENANCE MATERIALS

.1 Provide lineal metres of resilient base of matching colour for each profile in addition to the resilient base required to complete the present installation.

.2 Submit extra 5% or to nearest full carton of each colour, pattern and type of flooring material required for maintenance use.

.3 Deliver to job site in boxes clearly marked with information on contents and include address and date of installation.

.4 Unload and store within building where directed by Departmental Representative.

1.4 AIR QUALITY

.1 Select materials and off gas flooring products off site in accordance with CSA B651, including Annex A Environmental Considerations, A.5 Indoor Air Quality and FloorScore certified to SCS-EC10.2.

.2 No detectable odour after installation from flooring, adhesive or accessories.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Vinyl composition tile (RF1), VCT:
.1 to ASTM F1066, Class 2 through pattern tile mottled, asbestos free, 305 x 305 x 3.17 mm, through grain construction.
.2 Colour: To be selected by the Departmental Representative from manufacturer's full colour range.
.3 For use at kitchenette and coat closet area.

.2 Static dissipative floor tile (RF2), VCT, static dissipative tile:
.1 to ASTM F1066, Class 2 through pattern tile mottled, asbestos free, 305 x 305 x 3.178 mm.
.2 Tested in accordance with ASTM F150:
.1 Static Propensity: less than 2 kV with conductive footwear per AATCC-134, at 20% relative humidity.
.2 Static decay: 5,000 volts to zero in less than 0.01 seconds per US Federal Test Method 101B, Method 4048 at 15% relative humidity.
.3 Electrical resistance: equal to or greater than 1 MOhms (>10^6 Ohms) & equal to or less than 1,000 MOhms (>10^9Ohms).
.4 Flame spread: 19 to CAN/ULC-S102.2.
.5 Smoke developed: 38 to CAN/ULC-S102.2.
.6 Grounding: 13 mm wide copper foil tape.
.3 Colour: To be selected by the Departmental Representative from manufacturer's full colour range.
.4 For use at LAN room only.

.3 Resilient base (RB):
.1 to ASTM F1861, Type TP rubber thermoplastic, Group 1 solid homegeneous, 100 mm high x 3 mm thick, continuous, Style A-Straight, preformed inside and outside corners.
.2 Colour: Colour to match 'Moon Rock (No. 29)'.
.3 For use at all VCT type locations.

.4 Primer, cement, and adhesives: type recommended by flooring and base manufacturers to suit substrate and installation, Ecologo certified.

2.1 MATERIALS (Cont'd)

.4 (Cont'd)
.1 Vinyl composite tile adhesive: zero VOC, low odour, no alcohol, glycol or amonia, Ecologo certified.
.2 Static dissipative tile: Water based, low VOC type as recommended by tile manufacturer to ensure proper adhesion.

.5 Sub-floor filler: premixed latex modified cement mixed with water to produce cementitious paste.

.6 Concrete floor sealer: to CAN/CGSB-25.20, Type 1.

.7 Wax and sealer: type recommended by flooring manufacturer.

.8 Reducing strip: same material as flooring.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for resilient flooring installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 SUB-FLOOR TREATMENT

.1 Remove ridges and bumps.

.2 Apply sub-floor filler to low spots and cracks to achieve floor level to a tolerance of 1:500, allow to cure.

.3 Prepare and seal porous and powdery concrete surfaces in accordance with flooring manufacturer's written instructions.

3.2 SUB-FLOOR TREATMENT (Cont'd)

.4 Remove dust, old adhesive, paint, dirt, wax, sealer and foreign matter from existing surfaces.

3.3 PREPARATION AND INSTALLATION

.1 Maintain room and material temperature at approximately 20°C for 3 days before laying, and minimum 2 days after laying.

.2 Test subfloor for moisture content in accordance with flooring manufacturer's instructions using the Vaprecision vapour emission test.
.1 Perform moisture condition test in each major area. A minimum of 1 test per 1000 sq. ft., prior to installation. Moisture condition shall not exceed 3 pounds per 1000 sq. ft. per 24 hour day in accordance with the Rubber Manufacturers Association Test Method. Do not proceed with work until results of moisture condition tests are acceptable.

.3 Do not proceed with work until results of moisture condition tests are acceptable.

.4 Prepare floor and install flooring in accordance with flooring manufacturer's instructions.

.5 Ground static dissipative flooring in accordance with manufacturer's written instructions.

.6 Roll surface with 45 kg roller.

.7 Wrap around straight base at external corners.

.8 Base joints at maximum length available or at internal or preformed corners.

.9 Install reducing strip at exposed edges, centre under doors at doorways.

3.4 CLEANING AND WAXING

.1 Clean, seal and wax flooring to manufacturer's instructions.

.2 Cleaning:
.1 Leave work area clean at end of each day.
.2 Upon completion, remove surplus materials, rubbish, tools and equipment.

3.4 CLEANING AND WAXING (Cont'd)

.2 (Cont'd)

.3 Touch up scratches, abrasions, voids and other defects in painted surfaces.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

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

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by resilient flooring installation.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 American Association of Textile Chemists and Colorists (AATCC):
.1 AATCC 16-2014, Colourfastness to Light: Xenon-Arc.
.2 AATCC-134-2011, Electrostatic Propensity of Carpets.
.3 AATCC 174-2011, Antimicrobial Activity Assessment of Carpets.

.2 American Society for Testing and Materials International, (ASTM):
.1 ASTM D1335-12, Standard Test Method for Tuft Bind of Pile Yarn Floor Coverings.
.2 ASTM E648-15e1, Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using A Radiant Heat Energy Source.
.3 ASTM E2471-05(2011)e1, Standard Test Method for Using Seeded-Agar for the Screening Assessment of Antimicrobial Activity in Carpets.

.3 Canadian General Standards Board (CGSB):
.1 CAN/CGSB-4.129-93, Carpet for Commercial Use.

.4 Contract Carpet Manual, Canadian Carpet Institute, (613) 232-7183.

.5 Carpet and Rug Institute www.carpet-rug.org and Canadian Carpet Institute, www.canadiancarpet.org.
.1 CRI Carpet Installation Standard 2011.

.6 Canadian Standards Association (CSA):
.1 CSA B651-12, Accessible Design for the Built Environment.

.7 Environmental Choice Program (ECP):
.1 ECP/PCE-44-92, Adhesives.

.8 Underwriters Laboratories Canada (ULC):
.1 CAN/ULC-S102.2-10, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.

1.2 PRODUCT DATA

.1 Submit product data sheet for each carpet tile, carpet tape or adhesive connector, accessory adhesive, concrete floor sealer, Ecologo products in accordance with Section 01 33 00.

.2 For accessory adhesives, indicate VOC in g/L during application and curing.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00.

.2 Indicate nap, open edges and other details required by Departmental Representative to clarify work.

1.4 SAMPLES

.1 Submit for Departmental Representative's review, duplicate full size samples of carpet tile in selected colours in accordance with Section 01 33 00.

1.5 DESIGN DATA, TEST REPORTS, CERTIFICATES, MANUFACTURER'S INSTRUCTIONS

.1 Submit evidence of prequalification compliance.

.2 Submit a report by an independent testing laboratory verifying tuft bind meets requirements specified when tested to ASTM D1335.

.3 Submit WHMIS MSDS - Material Safety Data Sheets acceptable to Labour Canada and Health Canada for carpet adhesive. Indicate VOC content.

1.6 MAINTENANCE DATA

.1 Provide maintenance data for carpet tile for incorporation into Operation and Maintenance Manual specified in Section 01 78 00.

1.7 MAINTENANCE MATERIALS

.1 Deliver extra 3% of each type, pattern and colour of carpet tile required for this project for maintenance use. Identify each roll. Store where directed.

.2 Maintenance materials to be full size piece of same production run as installed materials.

1.8 AIR QUALITY

.1 Off gas carpet products off site in accordance with CSA B651 including Annex A.

1.9 ENVIRONMENTAL CHOICE PROGRAM

.1 Provide accessory adhesive products bearing the 'Ecologo' of the Environmental Choice Program, Department of the Environment, Canadian Environmental Protection Act, Environmental Choice Product Guidelines ECP/PCE-44 for Adhesives.

1.10 QUALIFICATIONS

.1 Applied by installer trained and certified by carpet tile manufacturer for application of its products.

.2 Manufacturer's representative:
.1 Inspect substrate prior to commencement of work, during application of materials and upon completion of work.
.2 Provide technical assistance to the installer and assist where required in correct installation of carpet tile.

1.11 GUARANTEE

.1 Provide a manufacturer's written material guarantee stating that the carpet will remain free of manufacturing defects and deterioration for a period of twenty years. Non-pro-rated guarantee.

.2 Provide a manufacturer's written material guarantee stating that the carpet tile will remain free of manufacturing defects and deterioration for a period of fifteen years. Non-pro-rated guarantee.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Carpet tile and carpet base (CPT): to CAN/CGSB-4.129, to match existing modular carpet and meet the following criteria:
.1 Construction: Tufted textured loop construction.
.2 Dye method: 100% solution dyed.
.3 Dye lots: Mergeable.
.4 Size: 500 mm x 500 mm.
.5 Radiant panel: To ASTM E648, Class 1.
.6 Lightfastness: To AATCC 16-E, > 4.0 @ 60 AFU's.
.7 Static: To AATCC 134, < 3.0kV.
.8 Traffic classification: Severe.
.9 Fiber modification ratio: 1.7 to 1.9.
.10 Preservative efficacy: To AATCC 174 Parts 2 & 3, 99% reduction/no mold 7 days; to ASTM E2471, complete inhibition.
.11 Recycled content: Total recycled content of 51%.
.12 Tufted yarn weight: 576 g/sq.m.(17 oz/sq.yd).
.13 Pile height: 3.6 mm.
.14 Pile thickness: 2.5 mm.
.15 Pile density: 230.6 g/sq.m.
.16 Colour: To match existing colour 'Cross Section (No. 7768)'.
.17 Carpet base: To match carpet tile and existing height of carpet base.
.18 Carpet to be installed with tape or manufacturer's standard adhesive connectors. Adhesive not permitted for installation.

.2 Carpet tape or adhesive connectors: Types as recommended by carpet tile manufacturer.
.1 Clear polyester squares with small quantity of a pressure sensitive adhesive applied on one side of the polyester film.
.2 Connectors shall contain no liquid components and shall have "zero" calculated VOC's.

.3 Resilient accessory adhesive: water based.
.1 Acrylic release type: low VOC, recommended by accessory manufacturer.

2.1 MATERIALS (Cont'd)

.4 Reducing edge strips, thresholds: Nitrile rubber plasticized vinyl, 80-95 Shore A Durometer, adhesive as recommended by manufacturer.

.5 Sub-floor filler: premixed latex mixed with water to produce cementitious paste.

PART 3 - EXECUTION

3.1 SUB-FLOOR TREATMENT

.1 Remove ridges and bumps.

.2 Apply sub-floor filler to low spots and cracks to achieve floor level to a tolerance of 1:500; allow to cure.

.3 Remove dust, old adhesive, dirt, sealer and wax from existing surfaces.

3.2 INSTALLATION

.1 Prepare floor surfaces in accordance with CRI Carpet Installation Standard.

.2 Commence work after finishing work is completed.

.3 Install to CRI Carpet Installation Standard.

.4 Cut and fit around projections through floor.

.5 Finish installation to present smooth wearing surface free from burring or embedded foreign matter.

.6 HEPA Vacuum finished area with commercial grade vacuum with a beater bar head.

.7 Ensure colour, pattern and texture match within any one area.

.8 Fit carpet tile tight to abutting vertical surfaces.

3.3 CARPET TILE

.1 Install carpet tile in accordance with manufacturer's instructions with tape or adhesive connectors.

.2 Lay tiles with seams within manufacturer's tolerances.

.3 Adhesive connector method:
.1 Perimeter tiles shall be cut next to wall, where perimeter tile does not extend to a surface for butting.
.2 Lay anchor rows, placing adhesive anchor at every joint.
.3 Install remaining carpet using step method and placing an adhesive connector at every corner.

.4 Butt all carpet tiles to tight contact to make all joints as conspicuous as possible.

3.4 CARPET BASE

.1 Install carpet base to match adjacent carpet flooring.

.2 Bind exposed carpet base edge.

.3 Attach carpet to wall with connectors. Neatly fit against floor carpet.

3.5 CLEANING AND PROTECTION

.1 Vacuum carpets clean immediately after completion of installation. Protect traffic areas.

.2 Prohibit traffic on carpet until adhesive is cured.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Architectural Painting Specifications Manual, Master Painters Institute (MPI), 2014.

.2 Systems and Specifications Manual, SSPC Painting Manual, Volume Two, Society for Protective Coatings (SSPC).

.3 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings) of the Environmental Protection Agency (EPA).

.4 National Fire Code of Canada 2015 (NFC).

1.2 QUALITY ASSURANCE

.1 Contractor shall have a minimum of five years proven satisfactory experience. When requested, provide a list of last three comparable jobs including, job name and location, specifying authority, and project manager.

.2 Qualified journeymen who have a "Tradesman Qualification Certificate of Proficiency" shall be engaged in painting work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.

.3 Conform to latest MPI requirements for interior painting work including preparation and priming.

.4 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) shall be in accordance with MPI Painting Specification Manual "Approved Product" listing and shall be from a single manufacturer for each system used.

1.2 QUALITY ASSURANCE (Cont'd)

.5 Other paint materials such as linseed oil, shellac, turpentine, etc. shall be the highest quality product of an approved manufacturer listed in MPI Painting Specification Manual and shall be compatible with other coating materials as required.

.6 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Departmental Representative.

.7 Standard of Acceptance:
.1 Walls: No defects visible from a distance of 1000 mm at 90° to surface.
.2 Ceilings: No defects visible from floor at 45° to surface when viewed using final lighting source.
.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

1.3 ENVIRONMENTAL PERFORMANCE REQUIREMENTS

.1 Provide paint products meeting MPI "Environmentally Friendly" E2 or E3 ratings based on VOC (EPA Method 24) content levels.

.2 Where indoor air quality (odour) is a problem, use only MPI listed materials having a minimum E2 or E3 rating.

1.4 INSPECTION REQUIREMENTS

.1 Interior painting and decorating work shall be inspected by a Paint Inspection Agency (inspector) acceptable to the specifying authority and local Painting Contractor's Association. Painting contractor shall notify Paint Inspection Agency a minimum of one week prior to commencement of work and provide a copy of project painting specification, plans and elevation drawings (including pertinent details) as well as a Finish Schedule.

.2 Interior surfaces requiring painting shall be inspected by Paint Inspection Agency who shall notify Departmental Representative and General Contractor in writing of defects or problems, prior to commencing painting work, or after prime coat shows defects in substrate.

1.4 INSPECTION REQUIREMENTS (Cont'd)

.3 Where "special" painting, coating or decorating system applications (i.e. elastomeric coatings) or non-MPI listed products or systems are to be used, paint or coating manufacturer shall provide as part of this work, certification of surfaces and conditions for specific paint or coating system application as well as on site supervision, inspection and approval of their paint or coating system application as required at no additional cost to Owner.

1.5 SCHEDULING OF WORK

.1 Submit work schedule for various stages of painting to Departmental Representative for approval. Submit schedule minimum of 48 hours in advance of proposed operations.

.2 Obtain written authorization from Departmental Representative for any changes in work schedule.

.3 Schedule painting operations to prevent disruption of occupants in and about the building.

1.6 SUBMITTALS

.1 Submit product data and manufacturer's installation/application instructions for each paint and coating product to be used in accordance with Section 01 33 00.

.2 Submit WHMIS MSDS.- Material Safety Data Sheets in accordance with Section 01 33 00.

.3 Upon completion, submit records of products used. List products in relation to finish system and include the following:
.1 Product name, type and use.
.2 Manufacturer's product number.
.3 Colour numbers.
.4 MPI Environmentally Friendly classification system rating.
.5 Manufacturer's Material Safety Data Sheets (MSDS).

1.7 SAMPLES

.1 Submit full range colour sample chips in accordance with Section 01 33 00. Indicate where colour availability is restricted.

.2 Submit duplicate 200 x 300 mm sample panels of each paint finish with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards submitted on the following substrate materials:
.1 3 mm plate steel for finishes over metal surfaces.
.2 13 mm plywood for paint finishes over plywood substrates.
.3 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.

.3 When approved, sample panels shall become acceptable standard of quality for appropriate on-site surface with one of each sample retained on-site.

1.8 QUALITY CONTROL

.1 Provide mock-up in accordance with Section 01 45 00.

.2 When requested by Departmental Representative, prepare and paint designated surface, area, room or item (in each colour scheme) to requirements specified herein, with specified paint or coating showing selected colours, gloss/sheen, textures and workmanship to MPI Painting Specification Manual standards for review and approval. When approved, surface, area, room and/or items shall become acceptable standard of finish quality and workmanship for similar on-site work.

1.9 EXTRA MATERIALS

.1 Submit maintenance materials in accordance with Section 01 78 00.

.2 Submit one - one litre can of each type and colour of primer and finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

.3 Deliver to Contractor and store where directed.

1.10 DELIVERY, HANDLING AND STORAGE

.1 Deliver, store and handle materials in accordance with Section 01 61 00.

.2 Labels shall clearly indicate:
.1 Manufacturer's name and address.
.2 Type of paint or coating.
.3 Compliance with applicable standard.
.4 Colour number in accordance with established colour schedule.

.3 Remove damaged, opened and rejected materials from site.

.4 Provide and maintain dry, temperature controlled, secure storage.

.5 Observe manufacturer's recommendations for storage and handling.

.6 Store materials and supplies away from heat generating devices.

.7 Store materials and equipment in a well ventilated area with temperature range 7°C to 30°C.

.8 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.9 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Departmental Representative. After completion of operations, return areas to clean condition to approval of Departmental Representative.

.10 Remove paint materials from storage only in quantities required for same day use.

.11 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.

.12 Fire Safety Requirements:
.1 Provide one 9 kg Type ABC fire extinguisher adjacent to storage area.

1.10 DELIVERY, HANDLING AND STORAGE (Cont'd)

.12 (Cont'd)

.2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.3 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.11 SITE REQUIREMENTS

.1 Heating, Ventilation and Lighting:

.1 Ventilate enclosed spaces in accordance with Section 01 51 00.

.2 Perform no painting work unless adequate and continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above 10°C for 24 hours before, during and after paint application until paint has cured sufficiently.

.3 Where required, provide continuous ventilation for seven days after completion of application of paint.

.4 Coordinate use of existing ventilation system with Owner and ensure its operation during and after application of paint as required.

.5 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.

.6 Perform no painting work unless a minimum lighting level of 323 Lux is provided on surfaces to be painted. Adequate lighting facilities shall be provided by General Contractor.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Unless specifically pre-approved by the specifying body, Paint Inspection Agency and the applied product manufacturer, perform no painting work when:

.1 Ambient air and substrate temperatures are below 10°C.

1.11 SITE REQUIREMENTS (Cont'd)

.2 (Cont'd)

.1 (Cont'd)

.2 Substrate temperature is over 32°C unless paint is specifically formulated for application at high temperatures.

.3 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's prescribed limits.

.4 The relative humidity is above 85% or when the dew point is less than 3°C variance between the air/surface temperature.

.5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.

.2 Perform no painting work when the maximum moisture content of the substrate exceeds:

.1 15% for wood.

.2 12% for plaster and gypsum board.

.3 Test plaster surfaces for alkalinity as required.

.3 Surface and Environmental Conditions:

.1 Apply paint finish only in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint only to adequately prepared surfaces and to surfaces within moisture limits noted herein.

.3 Apply paint only when previous coat of paint is dry or adequately cured.

.4 Additional Interior Application Requirements:

.1 Apply paint finishes only when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.

.2 Apply paint in occupied facilities during silent hours only. Schedule operations to approval of Owner such that painted surfaces will have dried and cured sufficiently before occupants are affected.

1.12 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

.2 Paint, stain and wood preservative finishes and related materials (thinners, solvents, etc.,) 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.

.3 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.

.4 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

.5 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into ground the following procedures shall be strictly adhered to:

.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 an approved legal manner in accordance with hazardous waste regulations.

.5 Empty paint cans are to be dry prior to disposal or recycling (where available).

.6 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.

.7 Set aside and protect surplus and uncontaminated finish materials: Deliver to or arrange collection by organizations for verifiable re-use or re-manufacturing.

1.12 WASTE MANAGEMENT AND DISPOSAL (Cont'd)

.8 Close and seal tightly partly used sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.

.2 Paint materials for paint systems shall be products of a single manufacturer.

.3 Only qualified products with E2 or E3 "Environmentally Friendly" rating are acceptable for use on this project.

2.2 COLOURS

.1 Paint types and colours: Colours to match base building public areas and adjacent tenant spaces and are as listed below:
.1 PT1: To match colour 'Affinity - Thunder (AF-685)'.
.2 PT2: To match colour 'Affinity - Flint (AF-560)'.
.3 PT3: To match colour 'Chelsea Gray (HC-168)'.
.4 PT4: Colour to match existing light green colour (corridor that leads to Transport Canada space and attached to the public corridor 004).
.5 PT5: Two primer coats for demising wall at the unoccupied area (Suite C2).

.2 Second coat in a three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

.1 Perform colour tinting operations prior to delivery of paint to site. On-site tinting of painting materials is allowed only with Departmental Representative's written permission.

2.3 MIXING AND TINTING (Cont'd)

.2 Paste, powder or catalyzed paint mixes shall be mixed in strict accordance with manufacturer's written instructions.

.3 Where thinner is used, addition shall not exceed paint manufacturer's recommendations. Do not use kerosene or any such organic solvents to thin water-based paints.

.4 Thin paint for spraying according in strict accordance with paint manufacturer's instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Departmental Representative.

.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 shall be defined as the sheen rating of applied paint, in accordance with the following values:

.2 Gloss level ratings of painted surfaces shall be selected by the Departmental Representative.

PART 3 - EXECUTION

3.2 EXISTING CONDITIONS

.1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Departmental Representative damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

.2 Conduct moisture testing of surfaces to be painted using a properly calibrated electronic moisture meter, except test concrete floors for moisture using a simple "cover patch test" and report findings to Departmental Representative. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

3.2 EXISTING CONDITIONS (Cont'd)

.3 Maximum moisture content as follows:
.1 Plaster and Gypsum Board: 12%.
.2 Wood: 15%.

3.3 PROTECTION

.1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore such surfaces as directed by Departmental Representative.

.2 Protect items that are permanently attached such as Fire Labels on doors and frames.

.3 Protect factory finished products and equipment.

.4 Protect building occupants in and about the building.

.5 Removal of electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings shall be done prior to undertaking any painting operations by General Contractor. Items shall be securely stored and re-installed after painting is completed by General Contractor.

.6 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.

.7 As painting operations progress, place "WET PAINT" signs in occupied areas to approval of Departmental Representative.

3.4 CLEANING AND PREPARATION

.1 Clean and prepare surfaces in accordance with MPI Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:
.1 Remove dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths.

3.4 CLEANING AND PREPARATION (Cont'd)

.1 (Cont'd)

.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. However, minimize the use of kerosene or any such organic solvents to clean up water-based paints.

.2 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

.3 Where possible, prime surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.

.1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.

.2 Apply wood filler to nail holes and cracks.

.3 Tint filler to match stains for stained woodwork.

.4 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

.5 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes.

3.4 CLEANING AND PREPARATION (Cont'd)

.6 Touch up of shop primers with primer as specified in applicable section. Major touch-up including cleaning and painting of field connections, welds, rivets, nuts, washers, bolts, and damaged or defective paint and rusted areas, shall be by supplier of fabricated material.

.7 Do not apply paint until prepared surfaces have been accepted by Departmental Representative.

3.5 APPLICATION

.1 Method of application to be as approved by the Departmental Representative. Apply paint by brush,roller, or spray application. Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and Roller Application:
.1 Apply paint in a uniform layer using brush and/or roller of types suitable for application.
.2 Work paint into cracks, crevices and corners.
.3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
.4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces shall be free of roller tracking and heavy stipple unless approved by Departmental Representative.
.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 properly 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 a uniform layer, with overlapping at edges of spray pattern.

3.5 APPLICATION (Cont'd)

.3 (Cont'd)

.4 Brush out immediately all runs and sags.

.5 Use brushes 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 and only when specifically authorized by the Departmental Representative.

.5 Apply coats of paint as a 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 surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.

.9 Finish inside of cupboards and cabinets as specified for outside surfaces.

.10 Finish closets and alcoves as specified for adjoining rooms.

.11 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.6 MECHANICAL/ ELECTRICAL EQUIPMENT

.1 Unless otherwise specified, paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as noted otherwise.

.2 Boiler room, mechanical and electrical rooms: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.

3.6 MECHANICAL/ ELECTRICAL EQUIPMENT (Cont'd)

.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 FIELD QUALITY CONTROL

.1 Field inspection of painting operations to be carried out be independent inspection firm as designated by Departmental Representative.

.2 Advise Departmental Representative when surfaces and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.

.3 Co-operate with inspection firm and provide access to areas of work.

3.8 RESTORATION

.1 Clean and re-install all 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 Departmental Representative. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Departmental Representative.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 National Fire Code - 2015.

.2 National Fire Protection Association (NFPA)
.1 NFPA 10-2013, Standard for Portable Fire Extinguishers.

.3 National Building Code - 2015.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's printed product literature and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

PART 2 - PRODUCTS

2.1 MULTI-PURPOSE DRY CHEMICAL EXTINGUISHERS

.1 Cartridge operated type with hose and shut-off nozzle, ULC labelled for A, B and C class protection.
.1 Size 2.25.

2.2 EXTINGUISHER BRACKETS

.1 Type recommended by extinguisher manufacturer.

2.3 CABINETS

.1 Recessed/Semi-recessed type as indicated and suit site condition, constructed of 1.6 mm thick steel, 180 degrees opening door of 2.5 mm thick steel with latching device.

.2 Cabinet to maintain fire resistive rating of construction in which they occur.

.3 Cabinet door: with 5 mm full glass panel.

.4 Finish:
.1 Tub: prime coated.

2.4 IDENTIFICATION

.1 Identify extinguishers in accordance with recommendations of NFPA 10 and CAN/ULC-S508.

.2 Attach bilingual tag or label to extinguishers, indicating month and year of installation. Provide space for service dates.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install or mount extinguishers in cabinets or on brackets in accordance with NFPA 10 and National Fire Code.

.2 Install sign as required to meet National Fire Code and match existing buildings.

END OF SECTION

PART 1 - GENERAL

1.1 CERTIFICATES

.1 Submit manufacturer's certificates in accordance with Sections 01 33 00 and 01 78 00, stating that products are in accordance with this specification.

1.2 DELIVERY, STORAGE AND HANDLING

.1 Package or crate, and brace products to prevent damage or distortion of equipment during shipment and handling. Label packages and crates and protect finish surfaces by sturdy wrappings or equivalent protection.

1.3 SCHEDULING

.1 Provide equipment or its parts ready for installation in accordance with construction schedule. Verify required delivery date sufficiently before delivery to ensure that construction is not delayed.

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 Equipment, general:

.1 Provide reinforcing and anchorage for built-in products.

.2 Insulate between dissimilar materials, and metal and masonry, to prevent electrolysis.

.3 Equipment shall include all electrical components required by jurisdictional authorities, and to protect the equipment from damage during operation.

.4 Equipment shall include all components, connections, devices and controls required to make it fully and safely operable.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Before installation commences, ensure that mounting devices, members and surfaces are satisfactory for fitting and adequate for securing of work.

.2 Take site measurements of construction to which work of this Section must conform, and through which access must be made, before work is delivered to the site, to ensure that adaptation is not required which would result in construction delay.

3.2 INSTALLATION

.1 Obtain from manufacturer or supplier, anchorage information, roughing-in dimensions, templates and service requirements for installation of work of this Section. Also obtain assistance from manufacturer or supplier, for the setting of anchorage devices, and construction of other work incorporated with equipment specified in this Section in order that they function as intended.

.2 Install work to meet manufacturer's recommended specifications, true, tightly fitted and level or flush to adjacent surfaces, as suitable for installation.

.3 Work shall include rough hardware, fastenings and other items necessary for secure installation.

.4 Use only fastenings suitable for materials.

.5 Install equipment with connections provided as required for plumbing and electrical services. Coordinate with Divisions as required for work of this Section.

.6 Lubricate equipment as specified by equipment manufacturer.

.7 Clean and polish all surfaces that are exposed to view from any location on completion of installation.

3.2 INSTALLATION (Cont'd)

.8 Owner supplied and Contractor installed items:

.1 Ceiling mounted retractable photograph backdrop.

.2 Any additional items as indicated by the Departmental Representative.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Aluminum Association Designation System for Aluminum Finishes (AA):
.1 AA DAF 45-2003(R2009), Designation for Aluminum Finishes.

.2 ASTM International (ASTM):
.1 ASTM G154-12a, Standard Practice for Operating Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials.

.3 Underwriters' Laboratories of Canada (ULC):
.1 CAN/ULC-S109-03, Flame Tests of Flame-Resistant Fabrics and Films.

1.2 PRODUCT DATA SHEETS AND SAMPLES

.1 Submit product data sheets in accordance with Sections 01 33 00 and 01 78 00.

.2 Indicate, by large scale details, anchorage, assembly, materials, components, finishes, and perimeter construction conditions.

.3 Submit duplicate samples of fabric 900 x 900 mm in accordance with Sections 01 33 00 and 01 78 00.

.4 Submit a report by an independent testing laboratory verifying fabric meets flammability and smoke requirements.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Waste Management and Disposal:
.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Aluminum: extruded aluminum to Aluminum Association Alloy 6063-T5, finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes DAF 45, finish to match window shade metal components of the base building. Mill finish for concealed metal.

.2 Drive chain: 4.2 mm stainless steel bead chain formed in a continuous loop, 40 kg test breaking strength tested with a Dillon Tester.

.3 Fabric: Vinyl coated polyester, minimum 0.46 mm thick, warp ends straight, no weave distortion, flat, dimensionally stable, basket weave design, and meeting the following requirements:

.1 Openness Factor: To match openness factor of existing base building window shades.

.2 U.V. Deterioration tested in accordance with ASTM G154 (OUV 500 sunfade hours):

.1 Fade: None.

.2 Tensile Retention 96%.

.3 Flammability tested in accordance with:

.1 CAN/ULC-S109, vertical burn: Pass. Fabric shall be certified by an independent laboratory to pass specified standard.

.4 Colour:

.1 Fabric colour to match base building colour of shades.

.2 Shade fabric shall be from same dye lot.

.5 Fabric shall be sealed under heat and pressure to retain weave pattern, with additional heat seal at sides, to prevent fraying and to eliminate rough edges.

2.2 FABRICATION

.1 Fabricate window shade unit, with end bracket, fabric tube, fabric, external hem bar, bottom base and fascia as a single fully assembled unit capable of being mounted or de-mounted without disassembly, similar to shade units in the base building.

2.2 FABRICATION (Cont'd)

.2 End brackets: two piece ABS construction with 68 mm dia. nylon sprocket riding on a silicone based lubricant.

.3 Fabric tube: Minimum 1.52 mm aluminum tube with 3 continuous 4.82 mm internal fins set at 120 degree spacing.

.4 Lift mechanism: 3.61 mm extruded hexagonal aluminum core with a coil surround of spring steel, factory set tension with external adjustment to compensate for wear, built in shock absorption system, finger tip control.

.5 Fascia: Minimum 1.7 mm extruded aluminum fascia, profile to accept attachment of end brackets.

.6 Hem bar: extruded aluminum channel, single length for each shade panel complete with plastic end caps, colour to match fabric.

.7 Mounting bracket: extruded aluminum, 2 piece, L-shaped, pre-drilled, integral screw slot for attachment of end cap.

.8 Provide stops at highest and lowest shade positions to prevent over winding and unrolling.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for window shade installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Mount shades at six (6) intended existing windows with concealed fastening.

.2 Install shades in accordance with reviewed shop drawings and manufacturer's written instructions.

.3 Install shades plumb, true, square, straight and level in proper planes, complete with all fascias/soffits, trims, bars and accessories.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.
.1 Leave Work areas clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

.1 Protect installed products and components from damage during during construction.

.2 Repair damage to adjacent materials caused by door installation.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME).
.1 ANSI/ASME B16.24-2001(2016), Cast Copper Alloy Pipe Flanges and Flanged Fittings.
.2 ANSI B16.18-01 (R2012), Cast Copper Alloy Solder Joint Pressure Fittings.
.3 ANSI/ASME B16.22-01 (R2013), Wrought Copperand Copper Alloy Solder Joint Pressure Fittings.

.2 ASTM International Inc. (ASTM)
.1 ASTM A307-14, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
.2 ASTM B88M-14, Standard Specification for Seamless Copper Water Tube (Metric).

.3 American Water Works Association (AWWA)
.1 AWWA C111/A21.11-12, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.4 Canadian Standards Association (CSA International)
.1 CSA B242-05(R2016), Groove and Shoulder Type Mechanical Pipe Couplings.

.5 Department of Justice Canada (Jus)
.1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).

.6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
.1 Material Safety Data Sheets (MSDS).

.7 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
.1 MSS-SP-67-2011, Butterfly Valves.
.2 MSS-SP-70-2011, Gray Iron Gate Valves, Flanged and Threaded Ends.
.3 MSS-SP-71-2011, Gray Iron Swing Check Valves, Flanged and Threaded Ends.
.4 MSS-SP-80-2013, Bronze Gate, Globe, Angle and Check Valves.

.8 National Research Council (NRC)/Institute for Research in Construction
.1 NRCC 47668, National Plumbing Code of Canada (NPC) - 2015.

1.1 REFERENCES (Cont'd)

.9 Transport Canada (TC)
.1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Provide manufacturer's printed product literature and datasheets for insulation and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00.

PART 2 - PRODUCTS

2.1 PIPING

.1 Domestic hot, cold and recirculation systems, within building.
.1 Above ground: copper tube, hard drawn, type L: to ASTM B88M.
.2 Buried or embedded: copper tube, soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints.

2.2 FITTINGS

.1 Cast bronze threaded fittings, Class 125 : to ASME B16.15.

.2 Cast copper, solder type: to ASME B16.18.

.3 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.

2.3 JOINTS

.1 Rubber gaskets, latex-free 1.6 mm thick: to ANSI/AWWA C111/A21.11.

.2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.

2.3 JOINTS (Cont'd)

.3 Solder: 95/5 tin copper alloy.

.4 Teflon tape: for threaded joints.

.5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM flush seal gasket.

.6 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.

2.4 BALL VALVES

.1 NPS 2 and under, screwed:
.1 Class 150.
.2 Bronze body, as specified in Section 23 05 23.01.

.2 NPS 2 and under, soldered:
.1 To ANSI/ASME B16.18, Class 150.
.2 Bronze body, chrome plated brass stainless steel ball, PTFE adjustable packing, brass gland and PTFE Bunan seat, steel lever handle, with NPT to copper adaptors as specified Section 23 05 23.01.

PART 3 - EXECUTION

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install in accordance with NPC, and local authority having jurisdiction.

.2 Assemble piping using fittings manufactured to ANSI standards.

.3 Install CWS piping below and away from HWS and HWC and other hot piping so as to maintain temperature of cold water as low as possible.

.4 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

3.2 INSTALLATION (Cont'd)

.5 Buried tubing:
.1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.
.2 Bend tubing without crimping or constriction. Minimize use of fittings.

3.3 VALVES

.1 Isolate equipment, fixtures and branches with ball valves.

3.4 PRESSURE TESTS

.1 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

3.5 DISINFECTION

.1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction and approval of Departmental Representative.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 ASTM International Inc.
- .1 ASTM B32-08 (2014), Standard Specification for Solder Metal.
- .2 ASTM B306-13, Standard Specification for Copper Drainage Tube (DWV).
- .3 ASTM C564-14, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

.2 Canadian Standards Association (CSA International).
- .1 CSA B64-1972(R1996), Service Pipe, Waste Pipe, Traps, Bends and Accessories.
- .2 CSA B70-12, Cast Iron Soil Pipe, Fittings and Means of Joining.
- .3 CAN/CSA-B125.3-12, Plumbing Fittings.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

.1 Above ground sanitary storm and vent Type DWV to: ASTM B306.
- .1 Fittings.
  - .1 Cast brass: to CAN/CSA-B125.3.
  - .2 Wrought copper: to CAN/CSA-B125.3.
- .2 Solder: tin-lead, 50:50, type 50A.

2.2 CAST IRON PIPING AND FITTINGS

.1 Buried sanitary storm and vent minimum NPS 3, to: CSA B70, with one layer of protective coating of.

2.2 CAST IRON PIPING AND FITTINGS (Cont'd)

.1 (Cont'd)
.1 Joints:
.1 Mechanical joints:
.1 Neoprene or butyl rubber compression gaskets: to CSA B70. ASTM C564 or
.2 Stainless steel clamps.
.2 Hub and spigot:
.1 Caulking lead: to CSA B67.
.2 Cold caulking compounds.
.2 Above ground sanitary storm and vent: to CSA B70.
.1 Joints:
.1 Hub and spigot:
.1 Caulking lead: to CSA B67.
.2 Mechanical joints:
.1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

PART 3 - EXECUTION

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install in accordance with National Plumbing Code, Provincial Plumbing Code and local authority having jurisdiction.

3.3 TESTING

.1 Pressure test buried systems before backfilling.

.2 Hydraulically test to verify grades and freedom from obstructions.

3.4 PERFORMANCE VERIFICATION

.1 Cleanouts:
.1 Ensure accessible and that access doors are correctly located.
.2 Open, cover with linseed oil and re-seal.
.3 Verify that cleanout rods can probe as far as the next cleanout, at least.

3.4 PERFORMANCE VERIFICATION (Cont'd)

.2 Test to ensure traps are fully and permanently primed.

.3 Ensure that fixtures are properly anchored, connected to system and effectively vented.

.4 Affix applicable label (sanitary, vent, etc.) c/w directional arrows every floor or 4.5 m (whichever is less).

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes:
.1 Materials and installation for plumbing specialties and accessories.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM).
.1 ASTM A126-04(2014), Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
.2 ASTM B62-15, Standard Specification for Composition Bronze or Ounce Metal Castings.

.2 Health Canada/Workplace Hazardous
.1 Material Safety Data Sheets (MSDS).

.3 NPC 2015.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's printed product literature, specifications and datasheet for fixtures and equipment.
.2 Indicate dimensions, construction details and materials for specified items.

PART 2 - PRODUCTS

2.1 FLOOR DRAINS

.1 Floor Drains - Finished area "FD-1"
.1 All epoxy coated cast iron body with reversible clamp device and adjustable diameter 127 mm stainless steel 12 mm thick strainer, secured with stainless steel screws, 100 mm throat on strainer. In quarry or mosaic tiled areas provide square 150 mm x 150 mm stainless steel square 12 mm thick strainer.

2.2 CLEANOUTS

.1 Cleanout Plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.

.2 Access Covers:

.1 Wall Access: face or wall type, polished nickel bronze or stainless steel square and or roundcover with flush head securing screws, bevelled edge frame complete with anchoring lugs.

.2 Floor Access: rectangular round cast iron body and frame with adjustable secured nickel bronze top cast box with anchor lugs and:

.1 Plugs: bolted bronze with neoprene gasket.

.2 Cover for Unfinished Concrete Floors: cast iron nickel bronze round or square, gasket, vandal-proof screws.

.3 Cover for Terrazzo Finish: polished nickel bronze brass with recessed cover for filling with terrazzo, vandal-proof locking screws.

.4 Cover for Tile and Linoleum Floors: polished nickel bronze with recessed cover for linoleum or tile infill, complete with vandal-proof locking screws.

.5 Cover for Carpeted Floors: polished nickel bronze with deep flange cover for carpet infill, complete with carpet retainer vandal-proof locking screws.

2.3 WATER HAMMER ARRESTORS

.1 Stainless steel Copper construction, bellows piston type: to PDI-WH201.

2.4 VACUUM BREAKERS

.1 Breakers: to CSA B64 Series, vacuum breaker atmospheric hose connection laboratory faucet intermediate.

2.5 TRAP SEAL PRIMERS

.1 Brass, with integral vacuum breaker, NPS 1/2 solder ends, NPS 1/2 drip line connection.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 INSTALLATION

.1 Install in accordance with National Plumbing Code of Canada provincial codes, and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

3.3 CLEANOUTS

.1 Install cleanouts at base of soil and waste stacks, and rainwater leaders, at locations required code, and as indicated.

.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.

3.4 WATER HAMMER ARRESTORS

.1 Install on branch supplies to fixtures or group of fixtures where indicated.

3.5 TRAP SEAL PRIMERS

.1 Install for floor drains and elsewhere, as indicated.

.2 Install on cold water supply to nearest frequently used plumbing fixture, in concealed space, to Departmental Representative.

.3 Install soft copper plastic tubing to floor drain.

3.6 TESTING AND ADJUSTING

.1 Testing and Adjusting as per following:
- .1 Timing:
  - .1 After start-up deficiencies rectified.
  - .2 Floor drains:
    - .1 Verify operation of trap seal primer.

3.6 TESTING AND ADJUSTING (Cont'd)

.1 (Cont'd)

.1 (Cont'd)

.2 Prime, using trap primer. Adjust flow rate to suit site conditions.

.3 Check operations of flushing features.

.4 Check security, accessibility, removeability of strainer.

.5 Clean out baskets.

.3 Vacuum breakers, backflow preventers:

.1 Test tightness, accessibility for O&M of cover and of valve.

.2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.

.3 Verify visibility of discharge from open ports.

.4 Access doors:

.1 Verify size and location relative to items to be accessed.

.5 Cleanouts:

.1 Verify covers are gas-tight, secure, yet readily removable.

.6 Water hammer arrestors:

.1 Verify proper installation of correct type of water hammer arrester.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)
.1 CAN/CSA-B45 Series-02(R2013), Plumbing Fixtures.
.2 CSA B125.3-12, Plumbing Fittings.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Provide manufacturer's printed product literature and datasheets for fixtures, and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data in accordance with Section 01 78 00.

.2 Include:
.1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

.1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.

.2 Trim, fittings: manufacture in accordance with CSA B125.3.

.3 Exposed plumbing brass to be chrome plated.

2.1 MANUFACTURED UNITS (Cont'd)

.4 Number, locations: architectural drawings to govern.

.5 Stainless steel counter-top sinks - Barrier Free

.1 S-1: single compartment, Single Bowl Countertop Mount Sink, 3 holes, 203 mm center, 511 mm wide x 522 mm long x 127 mm high deep, counter mounted, backledge, grade 18-10 20 GA. 0.9 mm type 302 stainless steel, self-rimming, satin finish rim and bowls, mounting kit provided, fully undercoated to reduce condensation and resonance, factory applied rim seal, 89 mm crumb cup waste assembly with 38 mm tailpiece.

.6 Faucet

.1 chrome plated finish, 203 mm centerset, lead free ECAST brass construction, volume control and Hot Water Limit Stop cartridge, 5.7 LPM pressure compensating Laminar Flow (non-aerating) outlet, 241 mm projection cast brass spout, lever handle.

.7 Below Deck Mechanical Water Mixing Valve

.1 bronze body, temperature adjusting dial, 10 mm inlets and outlet compression fittings, high temperature thermostatic limit stop, shut-off with automatic reset when temperature exceeds 48.8°C, integral checks, offer temperature range from full cold through 46°C. Provide tee, adaptors and flex. copper tubing to suit installation. Provide tempered water to hot side of faucet.

.8 Faucet Supplies

.1 chrome plated finish polished brass, commercial duty 1/4 turn ball valve angle stops, 13 mm I.D. Inlet x 127 mm horizontal extension tubes, combination V.P. Loose key handles, escutcheon and flexible copper risers.

.2 P-Trap,heavy cast brass body, with slip nut, 38 mm box flange.

.9 Sanitary Covering vandal-resistant

.1 flexible seamless moulded closed-cell PVC resin, formulated with anti-microbial additive to limit the growth of fungus and bacteria, to exposed piping (to protect against heat/contusions) as per local codes.

2.2 JANITOR SINK

.1 Mop Sink JS-1: Floor Mounted
.1 Mop Sink: 610 mm x 610 mm x 305 mm deep, floor mounted, Precast Terrazzo, with one piece stainless steel cast integral cap on all four sides and Integral Cast Brass Drain with S.S strainer, 75 mm outlet. Provide "p" Trap.
.2 Faucet: C.P. 203mm C.C., adjustable 208mm - 330mm wall mounted, solid cast brass lead-free body, vandal-resistant, 8.3 LPM pressure compensating flow aerator outlet, 1/4 turn ceramic disc valve cartridges, cast brass lever handles, body mounted vacuum breaker, integral stops, pail hook and wall brace.
.3 S.S. Bracket 915 mm hose with coupling.
.4 S.S. Mop Hanger triple.
.5 S.S. Back Splash Panels number of panels to suit installation.

PART 3 - EXECUTION

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Mounting heights:
.1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified.

.2 Provide new isolating valves for the sink being replaced

3.3 ADJUSTING

.1 Conform to water conservation requirements specified this section.

.2 Adjustments:
.1 Adjust water flow rate to design flow rates.
.2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.

.3 Checks:
.1 Aerators: operation, cleanliness.

3.3 ADJUSTING (Cont'd)

.3 (Cont'd)

.2 Vacuum breakers, backflow preventers: operation under all conditions.

END OF SECTION

PART 1 - GENERAL

1.1 USE OF SYSTEMS

.1 Use of new and or existing permanent heating and ventilating systems for supplying temporary heat or ventilation is permitted only under the following conditions:

.1 Entire system is complete, pressure tested, cleaned, flushed out.

.2 Specified water treatment system has been commissioned, water treatment is being continuously monitored.

.3 Building has been closed in, areas to be heated/ventilated are clean and will not thereafter be subjected to dust-producing processes.

.4 There is no possibility of damage from any cause.

.5 Return systems have approved filters over all openings, inlets, outlets.

.6 All systems will be:

.1 operated as per manufacturer's recommendations or instructions.

.2 operated by Contractor.

.3 monitored continuously by Contractor.

.7 Warranties and guarantees are not thereby relaxed.

.8 Regular preventive and all other manufacturers recommended maintenance routines are performed by Contractor at his own expense and under supervision of Departmental Representative.

.9 Before static completion, entire system to be refurbished, cleaned internally and externally, restored to "as- new" condition, filters in air systems replaced.

.2 Filters referred to herein are over and above those specified elsewhere in this specification.

.3 Exhaust systems are not included in any approvals for temporary heating ventilation.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not used.

END OF SECTION

PART 1 - GENERAL

1.1 EQUIPMENT LIST

.1 Complete list of equipment and materials to be used on this project and forming part of bid documents by adding manufacturer's name, model number and details of materials, and submit for approval.

.2 Submit for approval within 10 days after Award of Contract.

1.2 TRIAL USAGE

.1 Departmental Representative Owner may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

1.3 PROTECTION OF OPENINGS

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

1.4 PAINTING

.1 Prime and touch up marred finished paintwork to match original.

.2 Restore to new condition, finishes which have been damaged too extensively to be merely primed and touched up.

1.5 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTIONS

.1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.2 Where specified elsewhere in Mechanical Divisions, manufacturers to provide demonstrations and instructions.

.3 Use operation and maintenance manual, as-built drawings, audio visual aids, etc. as part of instruction materials.

1.5 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTIONS (Cont'd)

.4 Instruction duration time requirements as specified in appropriate sections.

.5 Where deemed necessary, Departmental Representative Owner may record these demonstrations on video tape for future reference.

1.6 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00.

.2 Operation and maintenance manual to be approved by, and final copies deposited with, Departmental Representative before final inspection.

.3 Operation data to include:
.1 Control schematics for each system including environmental controls.
.2 Description of each system and its controls.
.3 Description of operation of each system at various loads together with reset schedules and seasonal variances.
.4 Operation instruction for each system and each component.
.5 Description of actions to be taken in event of equipment failure.
.6 Valves schedule and flow diagram.
.7 Colour coding chart.

.4 Maintenance data shall include:
.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
.2 Data to include schedules of tasks, frequency, tools required and task time.

.5 Performance data to include:
.1 Equipment manufacturer's performance data sheets with point of operation as left after commissioning is complete.
.2 Equipment performance verification test results.
.3 Special performance data as specified elsewhere.
.4 Testing, adjusting and balancing reports as specified in Section 23 05 93.

1.6 CLOSEOUT SUBMITTALS (Cont'd)

.6 Approvals:
.1 Submit 2 copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless so directed by Departmental Representative.
.2 Make changes as required and re-submit as directed by Departmental Representative.

.7 Additional data:
.1 Prepare and insert into operation and maintenance manual when need for same becomes apparent during demonstrations and instructions specified above.

1.7 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00.

.2 Shop drawings and product data shall show:
.1 Mounting arrangements.
.2 Operating and maintenance clearances. eg. access door swing spaces.

.3 Shop drawings and product data shall be accompanied by:
.1 Detailed drawings of bases, supports, and anchor bolts.
.2 Acoustical sound power data, where applicable.
.3 Points of operation on performance curves.
.4 Manufacturer to certify as to current model production.
.5 Certification of compliance to applicable codes.

.4 In addition to transmittal letter referred to in Section 01 33 00: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

1.8 CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

1.9 AS-BUILT DRAWINGS

.1 Site records:
.1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of the work. Mark there on all changes as work progresses and as changes occur. This shall include changes to existing mechanical systems, control systems and low voltage control wiring.
.2 On a weekly basis, transfer information to reproducibles, revising reproducibles to show all work as actually installed.
.3 Use different colour waterproof ink for each service.
.4 Make available for reference purposes and inspection at all times.

.2 As-built drawings:
.1 Prior to start of Testing, Adjusting and Balancing (TAB), finalize production of as-built drawings.
.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (date).
.3 Submit to Departmental Representative for approval and make corrections as directed.
.4 TAB to be performed using as-built drawings.
.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.3 Submit copies of as-built drawings for inclusion in final TAB report.

.4 as-built drawings for inclusion in final TAB report.

.5 As-built drawings shall be all converted to AutoCAD with PWGSC layering system.

.6 Submit as-built AutoCAD and PDF CD/DVD/Flash Drive. Allow for minimum two (2) sets.

.7 All TAB reports shall be in PDF format and copied to CD/DVD/Flash Drive and folder prints.

1.10 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

.2 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.

.3 Dispose of unused paint material at official hazardous material collections site approved by Departmental Representative.

.4 Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in other locations where it will pose health or environmental hazard.

.5 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.6 Dispose of corrugated cardboard, polystyrene, plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

1.11 EXAM SITE

.1 Examine the site and the local conditions and Conditions affecting the work during tender process. Examine carefully the Architectural, Structural, and Mechanical, Electrical and all other drawings and the complete specifications to ensure that the work can be satisfactorily carried out as shown.

.2 Before commencing work, examine the work of the other Divisions and report at once any defect or interference affecting the work, the completion, or the guarantee of the work of this Division. No allowance will be made later for any expenses incurred through the failure to make these examinations or to report any such discrepancies in writing to the Department Representative.

1.12 CODES, PERMITS FEES AND CONNECTIONS

.1 Conform to Federal, Provincial and Municipal regulations and perform work in accordance with requirements of By Laws and Regulations in force in area where the building is to be erected.

1.12 CODES, PERMITS FEES AND CONNECTIONS (Cont'd)

.2 Apply for, obtain, and pay for permits, fees and service connections for the work of this Division and the inspections required by Authorities having jurisdiction in the area where the building is to be erected.

.3 For information, a specific code or standard might be mentioned. This information must not be taken as the only code or standard applicable.

.4 When part of equipment does not bear the required UL label, the contractor shall obtain UL approval on site, when that part of the equipment is an electric component, a special approval shall be obtained and the Contractor shall pay the applicable fees.

.5 Furnish necessary certificates as evidence that the work installed conforms with laws and regulations of Authorities having jurisdiction. Changes in work requested by an Authority having jurisdiction shall be carried out without charge.

.6 Apply to TSSA for high pressure application. Ensure all systems are tested to TSSA satisfaction.

1.13 INSTALLATION OF WORK

.1 Coordinate with other trades and schedule all work to suit the date for the substantial performance established in the construction contract.

.2 Furnish items to be "built up" in ample time and give necessary information and assistance in connection with the building in of the same.

.3 Provide drawings showing all sleeving and openings required. Notify the Construction Manager of the size and location of recesses, openings and chases before walls, floors, etc., are erected.

.4 Proceed with the work as quickly as practical so that construction may be completed in as short a time as possible and in accordance with the building schedule. Ensure that all health, safety and environmental conditions are maintained.

1.13 INSTALLATION OF WORK (Cont'd)

.5 Ensure that all equipment and material is ordered in time to meet the building schedule. Provide a schedule of equipment deliveries to the Construction Manager within the time limit stipulated.

.6 Furnish promptly information required for the construction schedule.

.7 Manufactured products supplied with instructions for their installation shall be installed in strict accordance with those instructions.

1.14 WORK IN EXISTING BUILDINGS

.1 Mechanical contractor to provide temporary filters for existing return air intake on each floor. Replace as required during construction

.2 Prior to working on any of exiting systems, contact building operators and provide with at least five (5) working days days notice

.3 Do not disturb any hydraulic piping without through examination to ensure it is safe and empty. Ensure isolating valves are operational prior to carrying out any work.

.4 Freeze lines if required to make required connections.

1.15 SLEEVES

.1 Use cast iron sleeve or steel pipe sleeves with annular fin continuously welded at midpoint.

.2 For pipes passing through roofs, use cast iron sleeves with caulking recess and flashing clamp device. Anchor sleeves in roof construction; caulk between sleeve recess and pipe; fasten roof flashing to clamp device; make water tight durable joint.

.3 Fill voids around pipes
.1 For sleeves and pipe in foundation walls and below grade floors, provide "link seal@ clamp manufactured by Thunderline or Innerlynx.

1.15 SLEEVES (Cont'd)

.3 (Cont'd)

.2 Where sleeves pass through walls or floors, caulk space between insulation and sleeve or between pipe (duct) and sleeve with waterproof fire retardant non hardening mastic. Seal space at each end of sleeve with waterproof, fire retardant, non hardening mastic.

.3 Ensure no contact between copper tube or pipe and ferrous sleeve.

.4 Fill future use sleeves with easily removable fire stop filler.

.5 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint.

.4 All sleeves shall be as detailed on drawings.

.5 All sleeve locations including dimensions shall be submitted to the Department Representative.

1.16 TESTS

.1 Do not insulate or conceal work until tested and approved. Follow construction schedule and arrange for tests.

.2 Inform the Department Representative when tests will be conducted. All tests are to be documented test results submitted and included in the maintenance manuals. Refer to attached Appendix A for the format to be utilized for the test reports.

.3 Bear costs including retesting and making good.

.4 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 CURBS AND SLEEPERS

.1 Prefabricated curbs for mechanical equipment will be provided by Mechanical contractor. Built up curbs and sleepers will be supplied and installed under work of other sections, except as specified herein and noted on the drawings

.2 It shall be the responsibility of the Mechanical Trade to supply detailed requirements for curbs, including their locations, sizes and materials to be used, and loads imposed on the curbs.

.3 Curbs are required for roof mounted equipment, surrounding holes where groups of pipes and/or ducts pass through equipment room floors, and where indicated on the Drawings.

.4 Roof curbs shall be minimum 300 mm height above finished roof.

.5 Curbs around holes in equipment room floors shall be concrete or steel, extending at least 150 mm above finished floor. Make watertight connection between curb and floor.

.6 Fill spaces between curbs and pipes and ducts with glass fibre material. Caulk with fire resistant waterproof compound to make watertight connection.

.7 Sleepers shall be provided for the equipment installed outdoor without a roof curb. Sleepers shall be constructed of pressure treated lumber and shall be covered by 18-gauge steel cladding, primed and painted unless otherwise noted on the drawings.

3.2 CUTTING AND PATCHING

.1 Cutting and patching shall be in accordance with General and Supplementary Conditions and the following:

.1 No openings shall be permitted through the completed structure without the written approval of the Department Representative. Any openings which are required through the completed structure must be clearly and accurately shown on a copy of the structural drawings. Exact locations, elevations and size of the proposed opening must be identified and submitted to the Department Representative for review, well in advance of doing the work.

.2 All cutting and patching shall be done by the trades specializing in the materials to be cut and is covered by the appropriate Divisions of this specification. Prepare drawings in conjunction with all trades concerned, showing sleeves and openings for passage through structure and all insert sizes and locations. Where this information is not furnished in time, the Subtrades contractor for this Division shall bear the cost of all sleeving, provision for inserts, cutting and patching.

.3 Should any cutting and/or repairing of finished surfaces be required, the Subtrades contractor for this Division shall employ the particular trades engaged on the site for this type of work to do such cutting and/or repairing. Obtain the approval of the Department Representative before doing any cutting. In the event that tradesmen required for particular cutting and/or repairing are not already on the site, bring to the site tradesmen to do this work. Refer to front end document for scope of work associated with cutting and patching.

.4 Supporting members of any floor, wall or the building structure shall be cut only in such a location and manner as approved by the Department Representative in writing.

.5 Contractor to submit detail location of all cores drilling prior to start of the work.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 CONNECTIONS TO EQUIPMENT

.1 In accordance with manufacturer's instructions unless otherwise indicated.

.2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.

.3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.3 CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.

.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, components.

3.4 DRAINS

.1 Install piping with grade in direction of flow except as indicated.

.2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.

.3 Pipe each drain valve discharge separately to above floor drain. Discharge to be visible.

.4 Drain valves: NPS 3/4 gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

3.5 AIR VENTS

.1 Install manual air vents at high points in piping systems.

.2 Install isolating valve at each automatic air valve.

.3 Install drain piping to approved location and terminate where discharge is visible.

3.6 DIELECTRIC COUPLINGS

.1 General: compatible with system, to suit pressure rating of system.

.2 Locations: where dissimilar metals are joined.

.3 NPS 2 and under: isolating unions or bronze valves.

.4 Over NPS 2: isolating flanges.

3.7 PIPEWORK INSTALLATION

.1 Screwed fittings jointed with Teflon tape.

.2 Protect openings against entry of foreign material.

.3 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.

.4 Assemble piping using fittings manufactured to ANSI standards.

.5 Saddle type branch fittings may be used on mains if branch line is no larger than half size of main.
.1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.

.6 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

.7 Install concealed pipework to minimize furring space, maximize headroom, conserve space.

.8 Slope piping, except where indicated, in direction of flow for positive drainage and venting.

.9 Ream pipes, remove scale and other foreign material before assembly.

.10 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.11 Valves:
.1 Install in accessible locations.
.2 Remove interior parts before soldering.
.3 Install with stems above horizontal position unless otherwise indicated.
.4 Valves accessible for maintenance without removing adjacent piping.

3.8 SLEEVES

.1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, and elsewhere as indicated.

.2 Material: Schedule 40 black steel pipe.

3.8 SLEEVES (Cont'd)

.3 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.

.4 Installation:
.1 Concrete, masonry walls, concrete floors on grade: terminate flush with finished surface.
.2 Other floors: terminate 25 mm above finished floor.
.3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.

3.9 PREPARATION FOR FIRE STOPPING

.1 Material and installation within annular space between pipes, ducts, insulation and adjacent fire separation to Section 07 84 00.

.2 Uninsulated unheated pipes not subject to movement: No special preparation.

.3 Uninsulated heated pipes subject to movement: wrap with non-combustible smooth material to permit pipe movement without damaging fires topping material or installation.

.4 Insulated pipes and ducts: ensure integrity of insulation and vapour barriers.

3.10 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

.1 Advise Departmental Representative 48 hours minimum prior to performance of pressure tests.

.2 Pipework: test as specified in relevant sections of heating, ventilating and air conditioning work.

.3 Maintain specified test pressure without loss for four(4)hours minimum unless specified for longer period of time in relevant mechanical sections.

.4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.

.5 Conduct tests in presence of Departmental Representative.

3.10 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK (Cont'd)

.6 Pay costs for repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.

.7 Insulate or conceal work only after approval and certification of tests by Departmental Representative.

3.11 EXISTING SYSTEMS

.1 Connect into existing piping systems at times approved by Departmental Representative.

.2 Request written approval 10 days minimum, prior to commencement of work.

.3 Be responsible for damage to existing plant by this work.

.4 Ensure daily clean-up of existing areas.

.5 Ensure existing isolating valves do hold. Allow for freezing the pipes where required

3.12 CLEANING

.1 Clean in accordance with Section 01 74 01.
.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society of Mechanical Engineers (ASME)
.1 ASME B31.1-2012, Power Piping.

.2 ASTM International
.1 ASTM A125-96 (2013)e1, Standard Specification for Steel Springs, Helical, Heat-Treated.
.2 ASTM A307-10, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
.3 ASTM A563-07a (2014), Standard Specification for Carbon and Alloy Steel Nuts.

.3 Factory Mutual (FM)

.4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
.1 MSS SP 58-2009, Pipe Hangers and Supports - Materials, Design and Manufacture.
.2 MSS SP 69-2003, Pipe Hangers and Supports - Selection and Application.
.3 MSS SP 89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.

.5 Underwriter's Laboratories of Canada (ULC)
.1 CAN/ULC-C203

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Provide manufacturer's printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

.1 Design Requirements:
.1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
.2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP 58.
.3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
.4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

2.2 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with MSS SP 58 and ASME B31.1.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.3 PIPE HANGERS

.1 Finishes:
.1 Pipe hangers and supports: galvanized or painted with zinc-rich paint after manufacture.
.2 Use electro-plating galvanizing processhot dipped galvanizing process.
.3 Ensure steel hangers in contact with copper piping are copper plated or epoxy coated.

.2 Upper attachment structural: suspension from lower flange of I-Beam:
.1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.

2.3 PIPE HANGERS (Cont'd)

.2 (Cont'd)

.1 (Cont'd)

.1 Rod: 9 mm UL listed 13 mm FM approved.

.2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed FM approved to MSS-SP 58 and MSS-SP 69.

.3 Upper attachment structural: suspension from upper flange of I-Beam:

.1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed FM approved to MSS SP 69.

.2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed FM approved.

.4 Upper attachment to concrete:

.1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.

.2 Concrete inserts: wedge shaped body with knockout protector plateUL listed FM approved to MSS SP 69.

.5 Hanger rods: threaded rod material to MSS SP 58:

.1 Ensure that hanger rods are subject to tensile loading only.

.2 Provide linkages where lateral or axial movement of pipework is anticipated.

.3 Do not use 22 mm or 28 mm rod.

.6 Pipe attachments: material to MSS SP 58:

.1 Attachments for steel piping: carbon steel black galvanized.

.2 Attachments for copper piping: copper plated black steel.

.3 Use insulation shields for hot pipework.

.4 Oversize pipe hangers and supports.

2.4 INSULATION PROTECTION SHIELDS

.1 Insulated cold piping:
.1 64 kg/m³ density insulation plus insulation protection shield to: MSS SP 69, galvanized sheet carbon steel. Length designed for maximum 3 m span.

.2 Insulated hot piping:
.1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP 69.

2.5 OTHER EQUIPMENT SUPPORTS

.1 Provide support for air cooled condenser on the roof to manufacture's recommendation.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install in accordance with:
.1 Manufacturer's instructions and recommendations.

.2 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

3.2 INSTALLATION (Cont'd)

.3 Use approved constant support type hangers where:
.1 Vertical movement of pipework is 13 mm or more,
.2 Transfer of load to adjacent hangers or connected equipment is not permitted.

.4 Use variable support spring hangers where:
.1 Transfer of load to adjacent piping or to connected equipment is not critical.
.2 Variation in supporting effect does not exceed 25 % of total load.

3.3 HANGER SPACING

.1 Copper piping: up to NPS 1/2: every 1.5 m.

.2 Within 300 mm of each elbow.

Maximum Pipe Size : NPS	Maximum Spacing Steel	Maximum Spacing Copper
up to 1-1/4	2.4 m	1.8 m

.3 Pipework greater than NPS 12: to MSS SP 69.

3.4 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

3.5 FINAL ADJUSTMENT

.1 Adjust hangers and supports:
.1 Ensure that rod is vertical under operating conditions.
.2 Equalize loads.

.2 C-clamps:
.1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.3 Beam clamps:
.1 Hammer jaw firmly against underside of beam.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA)
.1 CAN/CSA-B149.1-10(R2015), Natural Gas and Propane Installation Code.

.2 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.
.2 CAN/CGSB-24.3-92, Identification of Piping Systems.

1.2 SUBMITTALS

.1 Product Data: submit product data for each item specified.

.2 Submittals: in accordance with Section 01 33 00.

PART 2 - PRODUCTS

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers raised or recessed.

.3 Information to include, as appropriate:
.1 Equipment: manufacturer's name, model, size, serial number, capacity.
.2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM

.1 Colours:
.1 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

.2 Construction:
.1 3 mm thick laminated plastic or white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

2.2 SYSTEM (Cont'd)

.3 (Cont'd)

.1 Conform to following table:

Size # mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

.2 Use maximum of 25 letters/numbers per line.

.4 Identification for PWGSC Preventive Maintenance Support System (PMSS):

.1 Use arrangement of Main identifier, Source identifier, Destination identifier.

.2 Equipment in Mechanical Room:

.1 Main identifier: size #9.

.2 Source and Destination identifiers: size #6.

.3 Terminal cabinets, control panels: size #5.

.3 Equipment elsewhere: sizes as appropriate.

2.3 EXISTING IDENTIFICATION SYSTEMS

.1 Apply existing identification system to new work.

.2 Where existing identification system does not cover for new work, use identification system specified this section.

.3 Before starting work, obtain written approval of identification system from Departmental Representative.

2.4 IDENTIFICATION OF PIPING SYSTEMS

.1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB-24.3 except where specified otherwise.

2.4 IDENTIFICATION OF PIPING SYSTEMS (Cont'd)

.2 Pictograms:
.1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.

.3 Legend:
.1 Block capitals to sizes and colours listed in CAN/CGSB-24.3.

.4 Arrows showing direction of flow:
.1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.
.2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.
.3 Use double-headed arrows where flow is reversible.

.5 Extent of background colour marking:
.1 To full circumference of pipe or insulation.
.2 Length to accommodate pictogram, full length of legend and arrows.

.6 Materials for background colour marking, legend, arrows:
.1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.
.2 Other pipes: pressure sensitive plastic-coated cloth vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C.

.7 Colours and Legends:
.1 Where not listed, obtain direction from Departmental Representative.
.2 Colours for legends, arrows: to following table:

Background colour:	Legend, arrows:
Yellow	BLACK
Green	WHITE
Red	WHITE

2.4 IDENTIFICATION OF PIPING SYSTEMS (Cont'd)

.7 (Cont'd)

.3 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend
City water	Green	CITY WATER
Hot water heating supply	Yellow	HEATING SUPPLY
Hot water heating return	Yellow	HEATING RETURN
Refrigeration suction	Yellow	REF. SUCTION
Refrigeration liquid	Yellow	REF. LIQUID
Refrigeration hot gas	Yellow	REF. HOT GAS

2.5 IDENTIFICATION DUCTWORK SYSTEMS

.1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.

.2 Colours: back, or co-ordinated with base colour to ensure strong contrast.

2.6 VALVES, CONTROLLERS

.1 Brass tags with 12 mm stamped identification data filled with black paint.

.2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

2.7 CONTROLS COMPONENTS IDENTIFICATION

.1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.

.2 Inscriptions to include function and (where appropriate) fail-safe position.

2.8 LANGUAGE

.1 Identification in English.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

.2 Provide ULC and or CSA registration plates as required by respective agency.

.3 Identify systems, equipment to conform to PWGSC PMSS.

3.3 NAMEPLATES

.1 Locations:
.1 In conspicuous location to facilitate easy reading and identification from operating floor.

.2 Standoffs:
.1 Provide for nameplates on hot and/or insulated surfaces.

.3 Protection:
.1 Do not paint, insulate or cover.

3.4 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.

.2 Adjacent to each change in direction.

.3 At least once in each small room through which piping or ductwork passes.

.4 On both sides of visual obstruction or where run is difficult to follow.

.5 On both sides of separations such as walls, floors, partitions.

3.4 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS (Cont'd)

.6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.

.7 At beginning and end points of each run and at each piece of equipment in run.

.8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.

.9 Identification easily and accurately readable from usual operating areas and from access points.

.1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

.1 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 QUALIFICATIONS OF TAB PERSONNEL

.1 Names of personnel it is proposed to perform TAB to be submitted to and approved by Departmental Representative within 90 days of award of contract.

1.3 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads.

.2 Adjust and regulate equipment and systems so as to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.

1.4 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to be to satisfaction of authority having jurisdiction.

1.5 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule so as to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.6 PRE-TAB REVIEW

.1 Review contract documents before project construction is started and confirm in writing to Departmental Representative adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.

1.7 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in Mechanical Divisions.

1.8 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required by Departmental Representative for verification of TAB reports.

1.9 START OF TAB

.1 Notify Departmental Representative seven (7) days prior to start of TAB.

.2 Start TAB when building is essentially completed, including:

.3 Installation of ceilings, doors, windows, other construction affecting TAB.

.4 Application of weatherstripping, sealing, caulking.

.5 All provisions for TAB installed and operational.

1.10 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:
.1 HVAC systems: plus 5%, minus 5 %.

1.11 ACCURACY TOLERANCES

.1 Measured values to be accurate to within plus or minus 5% of actual values.

1.12 INSTRUMENTS

.1 Prior to TAB, submit to Departmental Representative list of instruments to be used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate within three (3)months of TAB. Provide certificate of calibration to Departmental Representative.

1.13 SUBMITTALS

.1 Submit, prior to commencement of TAB:

.2 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.14 PRELIMINARY TAB REPORT

.1 Submit for checking and approval of Departmental Representative, prior to submission of formal TAB report, sample of rough TAB sheets. Include:
.1 Details of instruments used.
.2 Details of TAB procedures employed.
.3 Calculations procedures.
.4 Summaries.

1.15 TAB REPORT

.1 Format to be in accordance with referenced standard.

.2 TAB report to show results in SI units and to include:
.1 Project record drawings.
.2 System schematics.

.3 Submit 6 copies of TAB Report to Departmental Representative for verification and approval, in English in D-ring binders, complete with index tabs.

1.16 VERIFICATION

.1 Reported results subject to verification by Departmental Representative.

1.16 VERIFICATION (Cont'd)

.2 Provide manpower and instrumentation to verify all 30% reported results.

.3 Bear costs to repeat TAB as required to satisfaction of Departmental Representative.

1.17 SETTINGS

.1 After TAB is completed to satisfaction of Departmental Representative, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.

.2 Permanently mark settings to allow restoration at any time during life of facility. Markings not to be eradicated or covered in any way.

1.18 COMPLETION OF TAB

.1 TAB to be considered complete when final TAB Report received and approved by Departmental Representative.

1.19 AIR SYSTEMS

.1 Standard: TAB to be to most stringent of this section or TAB standards of AABC NEBB SMACNA.

.2 Review specified standards and report to Departmental Representative in writing all proposed procedures which vary from standard.

.3 Pre-demolition: Visit site and prepare a "pre-construction status for areas" included in the renovation work. The report shall be submitted to the Department Representative prior to start of the work, TAB contractor to me asure unit flows at following locations:
.1 Immediately after the fan
.2 Status of pressure drops in the air handler as described in 1.19.6 . Simulate design conditions by running air handlers at full load.
.3 Filter status
.4 Flows in main br nches feeding the ar eas included in this project.

.4 Post-Construction
.1 Balance VAV boxes and diffusers as per mechanical drawings.
.2 Repeat TAB measurement carried out during pre-demolition mode .

1.19 AIR SYSTEMS (Cont'd)

.4 (Cont'd)
.3 Provide commentary on main changes such as filter status etc.

.5 During construction coordinate location and installation of TAB devices, equipment, accessories, measurement parts and fittings.

.6 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

.7 Locations of equipment measurements: To include, but not be limited to, following as appropriate:
.1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.
.2 At controllers, controlled device.

.8 Locations of systems measurements to include, but not be limited to, following as appropriate: Main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.20 OTHER TAB REQUIREMENTS

.1 General requirements applicable to work specified this paragraph:
.1 Qualifications of TAB personnel: as for air systems specified this section.

1.21 POST-OCCUPANCY TAB

.1 Participate in systems checks twice during Warranty Period - #1 approximately 3 months after acceptance and #2 within one (1)month of termination of Warranty Period.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not used.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Definitions:

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - means "not concealed" as previouslydefined.

.3 Insulation systems - insulation material, fasteners, jackets, and other accessories.

.2 TIAC Codes: Definidtion

.1 CRD: Code Round Ductwork,

.2 CRF: Code Rectangular Finish.

.3 For other code references refer to other sections.

.2 Reference Standards:

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ANSI/ASHRAE/IES 90.1-2016, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 ASTM International Inc.

.1 ASTM B209M-14, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

.2 ASTM C411-11, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.3 ASTM C449-13, Standard Specification for Mineral Fiber-Hydraulic- Setting Thermal Insulating and Finishing Cement.

.4 ASTM C547-15, Standard Specification for Mineral Fiber Pipe Insulation.

.5 ASTM C553-13, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.6 ASTM C612-14, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

.7 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with without factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this Section).

1.1 REFERENCES (Cont'd)

.2 (Cont'd)

.2 (Cont'd)

.8 TIAC Code C-2: Mineral fibre blanket to ASTM C553 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for duct insulation, and include product characteristics, performance criteria, physical size, finish and limitations.

.1 Description of equipment giving manufacturer's name, type, model, year and capacity.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list.

.3 Manufacturers' Instructions:

.1 Provide manufacture's written duct insulation jointing recommendations. and special handling criteria, installation sequence, and cleaning procedures.

1.3 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, qualified to standards member of TIAC.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address and ULC markings.

1.4 DELIVERY, STORAGE AND HANDLING (Cont'd)

.3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets crates paddling and packaging materials in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 FIRE AND SMOKE RATING

.1 To CAN/ULC-S102:
- .1 Maximum flame spread rating: 25.
- .2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335.

.3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with without factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this Section).

.4 TIAC Code C-2: Mineral fibre blanket to ASTM C553 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).
- .1 Mineral fibre: to ASTM C553.
- .2 Jacket: to CGSB 51-GP-52Ma.
- .3 Maximum "k" factor: to ASTM C553.

2.3 ACCESSORIES

.1 Vapour retarder lap adhesive:
- .1 Water based, fire retardant type, compatible with insulation.

.2 Indoor Vapour Retarder Finish:
- .1 Vinyl emulsion type acrylic, compatible with insulation.

.3 Tape: self-adhesive, aluminum, or reinforced, 50 mm wide minimum.

.4 Contact adhesive: quick-setting

.5 Tie wire: 1.5 mm stainless steel.

2.3 ACCESSORIES (Cont'd)

.6 Banding: 19 mm wide, 0.5 mm thick stainless steel.

.7 Fasteners: 4 mm diameter pins with35 mm diameter clips, length to suit thickness of insulation.

PART 3 - EXECUTION

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturers instructions and as indicated.

.3 Use two (2)layers with staggered joints when required nominal thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
.1 Ensure hangers, and supports are outside vapour retarder jacket.

.5 Hangers and supports in accordance with Section 23 05 29.

.6 Fasteners: install at 300 mm on centre in horizontal and vertical directions, minimum 2 rows each side.

3.3 DUCTWORK INSULATION SCHEDULE

.1 Insulation types and thicknesses: conform to following table:

	TIAC Code	Vapour Retarder	Thickness (mm)
Rectangular cold and dual temperature supply air ducts	C-1	yes	50

supply air ducts			
Round cold and dual temperatire supply air ducts	C-2	yes	50
Acoustically lined ducts	none		

3.4 CLEANING

.1 Clean in accordance with Section 01 74 11.
.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.3 Repair existing insulation where new work has been carried out. Replace damaged insulation.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes:
.1 Thermal insulation for piping and piping accessories in commercial type applications.

.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
.1 ASHRAE 90.1-2013, Energy Standard for Buildings Except Low-Rise Residential Buildings (ANSI approved; IESNA co-sponsored.

.2 American Society for Testing and Materials International (ASTM)
.1 ASTM C335/C335M-10e1, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
.2 ASTM C547-15, Standard Specification for Mineral Fiber Pipe Insulation.
.3 ASTM C921-10(2015), Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.3 Canadian General Standards Board (CGSB)
.1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
.2 CAN/CGSB-51.53-95, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
.1 Material Safety Data Sheets (MSDS).

.5 Manufacturer's Trade Associations
.1 Thermal Insulation Association of Canada (TIAC): Mechanical Insulation Best Practice Guide(Revised 2005).

.6 Underwriters' Laboratories of Canada (ULC)
.1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.

1.2 REFERENCES (Cont'd)

.6 (Cont'd)
.2 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
.3 CAN/ULC-S702-09, Thermal Insulation, Mineral Fibre, for Buildings
.4 ULC-S702.2-10, Standard for Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

1.3 DEFINITIONS

.1 For purposes of this section:
.1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
.2 "EXPOSED" - will mean "not concealed" as specified.

.2 TIAC ss:
.1 CRF: Code Rectangular Finish.
.2 CPF: Code Piping Finish.

1.4 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00. Include product characteristics, performance criteria, and limitations.

.3 Shop Drawings:
.1 Submit shop drawings in accordance with Section 01 33 00.

1.5 QUALITY ASSURANCE

.1 Qualifications:
.1 Installer: specialist in performing work of this Section, and have at least three (3) years successful experience in this size and type of project, qualified to standards member of TIAC.

.2 Health and Safety:
.1 Do construction occupational health and safety in accordance with Section 01 35 29.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:
.1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00.
.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
.3 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Storage and Protection:
.1 Protect from weather, construction traffic.
.2 Protect against damage.
.3 Store at temperatures and conditions required by manufacturer.

.3 Waste Management and Disposal:
.1 Refer to Section 01 74 20.

PART 2 - PRODUCTS

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102.
.1 Maximum flame spread rating: 25.
.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre specified includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335.

.3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.
.1 Mineral fibre: to CAN/ULC-S702.
.2 Maximum "k" factor: to CAN/ULC-S702.

.4 TIAC Code A-6: flexible unicellular tubular elastomer.

2.3 INSULATION SECUREMENT

.1 Tape: self-adhesive, aluminum, plain reinforced, 50 mm wide minimum.

.2 Contact adhesive: quick setting.

.3 Canvas adhesive: washable.

.4 Tie wire: 1.5 mm diameter stainless steel.

.5 Bands: stainless steel, 19 mm wide, 0.5 mm thick.

2.4 VAPOUR RETARDER LAP ADHESIVE

.1 Water based, fire retardant type, compatible with insulation.

2.5 INDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

2.6 OUTDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: fibrous glass, untreated 305 g/m^2.

2.7 JACKETS

.1 Polyvinyl Chloride (PVC):
.1 One-piece moulded type and sheet to CAN/CGSB-51.53 with pre-formed shapes as required.
.2 Colours: to match adjacent finish paint by Departmental Representative.
.3 Minimum service temperatures: -20 degrees C.
.4 Maximum service temperature: 65 degrees C.
.5 Moisture vapour transmission: 0.02 perm.
.6 Thickness: mm.
.7 Fastenings:
.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
.2 Tacks.
.3 Pressure sensitive vinyl tape of matching colour.
.8 Special requirements:
.1 Indoor:.

2.7 JACKETS (Cont'd)

.1 (Cont'd)
.8 (Cont'd)
.2 Outdoor: UV rated material at least 0.5 mm thick.

.2 ABS Plastic:
.1 One-piece moulded type and sheet with pre-formed shapes as required.
.2 Colours: to match adjacent finish paint by Departmental Representative.
.3 Minimum service temperatures: -40 degrees C.
.4 Maximum service temperature: 82 degrees C.
.5 Moisture vapour transmission: 0.012 perm.
.6 Thickness: 0.75 mm.
.7 Fastenings:
.1 Solvent weld adhesive compatible with insulation to seal laps and joints.
.2 Tacks.
.3 Pressure sensitive vinyl tape of matching colour.
.8 Locations:
.1 For outdoor use ONLY.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 PRE-INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.

.2 Surfaces clean, dry, free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturers instructions and this specification.

3.3 INSTALLATION (Cont'd)

.3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Install hangers, supports outside vapour retarder jacket.

3.3 INSTALLATION (Cont'd)

.5 Supports, Hangers:
.1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

.1 Application: at expansion joints, valves, primary flow measuring elements flanges and unions at equipment.

.2 Design: to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.

.3 Insulation:
.1 Insulation, fastenings and finishes: same as system.
.2 Jacket: aluminum SS PVC ABS high temperature fabric.

3.5 INSTALLATION OF ELASTOMERIC INSULATION

.1 Insulation to remain dry. Overlaps to manufacturers instructions. Ensure tight joints.

.2 Provide vapour retarder as recommended by manufacturer.

3.6 PIPING INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.

.2 TIAC Code: A-1.
.1 Securements: SS wire bands Tape at 300 mm on centre.
.2 Seals: lap seal adhesive, lagging adhesive.
.3 Installation: TIAC Code 1501-H.

.3 TIAC Code: A-3.
.1 Securements: SS wire bands Tape at 300 mm on centre.
.2 Seals: VR lap seal adhesive, VR lagging adhesive.
.3 Installation: TIAC Code: 1501-C.

.4 TIAC Code: A-6.
.1 Insulation securements:.

3.6 PIPING INSULATION SCHEDULES (Cont'd)

.4 (Cont'd)
.2 Seals: lap seal adhesive, lagging adhesive.
.3 Installation: TIAC Code:.

.5 TIAC Code: C-2 with without vapour retarder jacket.
.1 Insulation securements:.
.2 Seals: lap seal adhesive, lagging adhesive.
.3 Installation: TIAC Code: 1501-C.

.6 TIAC Code: A-2.
.1 Insulation securements:.
.2 Seals: lap seal adhesive, lagging adhesive.
.3 Installation: TIAC Code: 1501-H.

.7 Thickness of insulation as listed in following table.
.1 Run-outs to individual units and equipment not exceeding 4000 mm long.
.2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Temp degrees C	TIAC Code	Pipe sizes (NPS) (mm)		and insulation thickness
			Run out	to 1	1-1/4
Condensate Drain		A- 3	25	25	25
Hot water Heating	60 - 94	A- 1	25	38	38
Hot water Heating	up to 59	A- 1	25	25	25
Refrigerant hot gas liquid suction	4 - 13	A- 6	25	25	25

3.6 PIPING INSULATION SCHEDULES (Cont'd)

Refrigerant below gas liquid suction	below	A- 6	25	25	38
Domestic Hot Water		A-1	25	25	25
Domestic Cold Water		A-3	25	25	25

.8 Finishes:
.1 Exposed indoors: canvas aluminum SS PVC jacket.
.2 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.
.3 Outdoors: water-proof ABS jacket.
.4 Finish attachments: SS screws bands, at 150 mm on centre. Seals: wing closed.
.5 Installation: to appropriate TIAC code CRF/1 through CPF/5.

3.7 CLEANING

.1 Proceed in accordance with Section 01 74 11-Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society of Mechanical Engineers (ASME)
.1 ASME B16.22-13, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
.2 ASME B16.24-11, Cast Copper Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500.
.3 ASME B16.26-11 , Cast Copper Alloy Fittings for Flared Copper Tubes.
.4 ASME B31.5-13 , Refrigeration Piping and Heat Transfer Components.

.2 American Society for Testing and Materials International (ASTM)
.1 ASTM A307-14, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
.2 ASTM B280-16, Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

.3 Canadian Standards Association (CSA International)
.1 CSA B52-13, Mechanical Refrigeration Code

.4 Environment Canada (EC
.1 EPS 1/RA/1 96, Environmental Code of Practice for the Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

1.2 SUBMITTALS

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

.2 Product Data:
.1 Submit manufacturer's printed product literature, specifications and datasheet for piping, fittings and equipment.

1.2 SUBMITTALS (Cont'd)

.3 Shop Drawings:

.1 Submit show drawings in accordance with Section 01 33 00 of the specification.

.2 The routing of the refrigerant piping is shown on the drawings with approximate sizing for coordination purposes only.

.3 The Refrigeration Sub-Contractor shall be responsible for final designing of the refrigeration piping system as follows;

.1 Ensure that, as a minimum, oil is returned to the compressor at the same rate as it is leaving.

.2 Design discharge and suction lines to maximum 1.2 deg C change in saturation temperature corresponding to the associated pressure drop for the provided refrigerant. Include calculations with the shop drawings.

.3 Design liquid lines to maximum 0.6 deg C change in saturation temperature corresponding to the associated pressure drop for the provided refrigerant. Include calculations with the shop drawings.

.4 Multi-stage compressor and/or multi-compressor machines shall have suction and discharge piping sized adequately to ensure oil return at minimum load conditions. Include calculations with the shop drawings.

.5 Design discharge and suction piping to a maximum of 4000fpm velocity. Minimum discharge velocity of 5 m/s - 7.62 m/s for vertical up-flow risers, a double riser can be introduced should the pressure drop in the vertical riser increase the beyond acceptable range. Double risers shall be trapped at the bottom and an inverted trap at the top of the large riser only.

.6 Minimum velocity for horizontal discharge lines shall be 2.54 m/s, and shall be sloped min 1% in the direction of refrigerant flow. Show refrigerant velocities on the schematic drawing to be submitted with the shop drawing.

1.2 SUBMITTALS (Cont'd)

.3 (Cont'd)

.3 (Cont'd)

.7 Design liquid line piping with minimum pressure drop to avoid the formation of flash gas. Velocity in liquid lines should not exceed 1.52 m/s. Provide a solenoid valve before the evaporator to prevent liquid siphoning into the evaporator during system shut-down. Show refrigerant velocities on the schematic drawing to be submitted with the shop drawing.

.8 The Mechanical Contractor shall submit isometric drawings showing the refrigerant pipe sizes, lengths, velocities and accompanying calculations. Revision to the pipe sizing from the sizes shown on the drawings shall be at no cost to the project.

.4 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.6 Instructions: submit manufacturer's installation instructions.

1.3 CLOSEOUT SUBMITTALS

.1 Closeout submittals: Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 .

.2 Include detailed as-built conditions.

.3 Test certificates.

1.4 QUALITY ASSURANCE

.1 Pre-Installation Meeting:

.1 Convene pre-installation meeting prior to beginning work of this Section in accordance with Construction Schedule.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00.

PART 2 - PRODUCTS

2.1 TUBING

.1 TUBING Processed for refrigeration installations, deoxidized, dehydrated and sealed.
.1 Hard copper tube: Type L to ASTM B280, type ACR.
.2 Annealed copper: to ASTM B280, with minimum wall thickness as per CSA B52 and ASME B31.5.

2.2 TRAPS

.1 Service: design pressure 4137 kPa and temperature 121°C.

.2 Construction: Wrought copper P-Traps.

2.3 FITTINGS

.1 Service: design pressure 4147 kPa and temperature 121 degrees C.

.2 Brazed:
.1 Fittings: wrought copper to ASME B16.22.
.2 Joints: silver solder, 15% Ag 80% Cu-5%P or copper phosphorous, 95% Cu 5%P and non corrosive flux.

.3 Flanged:
.1 Bronze or brass, to ASME B16.24, Class 300.
.2 Gaskets: non-metallic, suitable for service.
.3 Bolts, nuts and washers: to ASTM A307, heavy series.

.4 Flared:
.1 Bronze or brass, for refrigeration, to ASME B16.26.

2.4 PIPE SLEEVES

.1 Hard copper or steel, sized to provide 6 mm clearance around between sleeve and un-insulated pipe or between sleeve and insulation.

2.5 REFRIGERATION ACCESSORIES

.1 Supply and install all necessary refrigeration accessories in the refrigeration piping, including, but not limited to the following.

.1 Vibration absorbers shall be provided to isolate compressor vibration from the discharge and suction piping. Absorbers shall be all bronze bellows construction with braided wire exterior jacket. Clamp the refrigerant piping to a secure surface upstream of the suction absorber(s) and downstream of the discharge absorber(s). All refrigerant lines shall be secured with uni-strut type channel and neoprene sleeved clamps.

.2 Liquid line filter drier adequately sized to prevent flash gas and/or excessive pressure drop. Filter drier shall be removable core type for liquid lines 22mm and larger.

.3 Liquid line sight glass shall be full size in liquid lines 50 mm and smaller and installed as close as practical to the condenser or receiver and preferably in a vertical portion of piping. By-pass sight glasses in liquid lines 50 mm and smaller will not be accepted. Sight Glasses shall have integral moisture indicator.

2.6 VALVES

.1 22 mm and under: Class 500, 3.5 Mpa, globe or angle non directional type, diaphragm, packless type, with forged brass body and bonnet, moisture proof seal for below freezing applications, brazed connections.

.2 Over 22 mm: Class 375, 2.5 Mpa, globe or angle type, diaphragm, packless type, back seating, cap seal, with cast bronze body and bonnet, moisture proof seal for below freezing applications, brazed connections.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

.2 All labour on system shall be by certified refrigeration mechanics.

3.2 GENERAL

.1 Install in accordance with CSA B52, EPS1/RA/1 and ASME B31.5.

3.3 BRAZING PROCEDURES

.1 Bleed inert gas into pipe during brazing.

.2 Remove valve internal parts, solenoid valve coils, sight glass.

.3 Do not apply heat near expansion valve and bulb.

3.4 PIPING INSTALLATION

.1 General:

.1 Soft annealed copper tubing: bend without crimping or constriction Hard drawn copper tubing: do not bend. Minimize use of fittings.

.2 Horizontal suction lines shall be sloped toward compressor to insure oil return.

.3 Install 10 mm diameter shraeder valves in the refrigeration piping in mechanical room, on the suction, discharge and liquid lines for servicing purposes use.

.4 All field installed refrigeration piping shall be brazed. Dry Nitrogen shall be used to purge the piping prior to and during brazing to avoid oxidization within the refrigeration piping.

.5 Ensure valves and accessories are protected during brazing as to not be damaged by the heat required for brazing. Improperly protected and damaged accessories and valves will be removed and replaced.

.6 95-5 Sil-fos or equal shall be used to braze refrigerant piping. Lead based soft solder will not be accepted.

3.4 PIPING INSTALLATION (Cont'd)

.1 (Cont'd)
.7 Provide hangers, vibration isolators and seismic bracing in accordance with Section 23 05 48.

.2 Hot gas lines:
.1 Pitch at least 1:240 down in direction of flow to prevent oil return to compressor during operation.
.2 Provide trap at base of risers greater than 2400 mm high and at each 7600 mm thereafter.
.3 Provide inverted deep trap at top of risers.
.4 Provide double risers for compressors having capacity modulation.
.1 Large riser: install traps as specified above.
.2 Small riser: size for 5.1 m/s at minimum load. Connect upstream of traps on large riser.

3.5 PRESSURE AND LEAK TESTING

.1 Close valves on factory charged equipment and other equipment not designed for test pressures.

.2 Leak test to CSA B52 before evacuation to 2MPa and 1MPa on high and low sides respectively for minimum of 24 hours. Test Procedure: build pressure up to 35 kPa with refrigerant gas on high and low sides. Supplement with nitrogen to required test pressure.

.3 Under no circumstances shall the refrigerant compressor be used to evacuate the system. The evacuation shall be accomplished by the use of a vacuum pump at an ambient temperature not less than 35°F (1.7°C) to ensure removal of all moisture and non condensable gases.

.4 Test each joint in the refrigeration piping for leaks using at least one of the following methods;
.1 Bubble test
.2 Electronic leak detector
.3 Halide leak detector
.4 Ultrasonic leak detector

.5 Repair all leaks and repeat the pressure test until the system holds pressure.

3.6 FIELD QUALITY CONTROL

.1 Site Tests/Inspection:
.1 Close service valves on factory charged equipment.

.2 Ambient temperatures to be at least 13 degrees C for at least 12 hours before and during dehydration.

.3 Use copper lines of largest practical size to reduce evacuation time.

.4 Use two stage vacuum pump with gas ballast on 2nd stage capable of pulling 5Pa absolute and filled with dehydrated oil.

.5 Measure system pressure with vacuum gauge. Take readings with valve between vacuum pump and system closed.

.6 Triple evacuate system components containing gases other than correct refrigerant or having lost holding charge as follows:
.1 Twice to 14 Pa absolute and hold for 4 h.
.2 Break vacuum with refrigerant to 14 kPa.
.3 Final to 5 Pa absolute and hold for at least 12 h.
.4 Isolate pump from system, record vacuum and time readings until stabilization of vacuum.
.5 Submit test results to Departmental Representative.

.7 Charging:
.1 Charge system through filter drier and charging valve on high side. Low side charging not permitted.
.2 Liquid charging the system to initially charge the system is acceptable. Only liquid charge the system through the liquid line valve.
.3 With compressors off, charge only amount necessary for proper operation of system. If system pressures equalize before system is fully charged, close charging valve and start up. With unit operating, add remainder of charge to system.
.4 Re purge charging line if refrigerant container is changed during charging process.
.5 All refrigerant required for re charging the system shall be new, non-recovered refrigerant, provided by the mechanical contractor. Certified recycled refrigerant is acceptable.

3.6 FIELD QUALITY CONTROL (Cont'd)

.8 Checks:
.1 Make checks and measurements as per manufacturer's operation and maintenance instructions.
.2 Record and report measurements to Departmental Representative.

.9 Manufacturer's Field Services:
.1 Have manufacturer of products, supplied under this Section, review Work involved in the handling, installation/application, protection and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of Work with Contract.
.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
.3 Schedule site visits, to review Work, at stages listed:
.1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.
.2 Four times
.1 One at the start-up, one during progress of Work at 25% and 60% complete.
.2 And one upon completion of the Work, after cleaning is carried out.
.4 Obtain reports, within one of review, and submit, immediately, to Departmental Representative.

.10 Insulate liquid and suction lines in their entirety. The insulation shall be continuous through all pipe supports and fittings to provide a vapour seal. Refer to Section 23 07 15.

3.7 TSSA INSPECTION

.1 The mechanical contractor shall arrange for and pay for the cost of TSSA inspection if required.

3.8 DEMONSTRATION

.1 Instructions:

3.8 DEMONSTRATION (Cont'd)

.1 (Cont'd)
.1 Post instructions in frame with glass cover in accordance with Section 01 78 00 Closeout Submittals and CSA B52.

3.9 CLEANING

.1 Proceed in accordance with Section 01 74 11 .

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.10 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:
.1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes:
.1 Materials and installation of low-pressure metallic ductwork, joints and accessories.

1.2 REFERENCES

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

.2 ASTM International.
.1 ASTM A480/A480M-16a, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
.2 ASTM A635/A635M-15, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled.
.3 ASTM A653/A653M-15e1, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.3 Department of Justice Canada (Jus).
.1 Canadian Environmental Protection Act (CEPA), 1999, c. 33 .

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
.1 Material Safety Data Sheets (MSDS).

.5 National Fire Protection Association (NFPA).
.1 NFPA 90A-2015, Standard for the Installation of Air-Conditioning and Ventilating Systems.
.2 NFPA 90B-2015, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

.6 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition 2005.
.2 SMACNA HVAC Air Duct Leakage Test Manual, 1985, 1st Edition.
.3 SMACNA IAQ Guidelines for Occupied Buildings Under Construction 2nd edition 2007; ANSI/SMACNA 008-2008.

1.3 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 01 33 00.

.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets for the following:
.1 Sealants.
.2 Tape.
.3 Proprietary Joints.

1.4 QUALITY ASSURANCE

.1 Certification of Ratings:
.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.
.2 During construction meet or exceed the requirements of SMACNA IAQ Guidelines for Occupied Buildings under Construction.

PART 2 - PRODUCTS

2.1 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
500	C
250	C
125	C

.2 Seal classification:
.1 Class C: transverse joints and connections made air tight with sealant tape or combination thereof. Longitudinal seams unsealed.
.2 Unsealed seams and joints.

2.2 SEALANT

.1 Sealant: oil resistant, water borne, polymer type flame resistant duct sealant. Temperature range of minus 30°C to plus 93°C.

2.3 TAPE

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.4 DUCT LEAKAGE

.1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

2.5 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radiused elbows.
.1 Rectangular: standard radius radius with single thickness turning vanes Centreline radius: 1.5 times width of duct.
.2 Round: smooth radius. Centreline radius: 1.5 times diameter.

.3 Branches:
.1 Rectangular main and branch: with radius on branch 1.5 times width of duct 45 degrees entry on branch.
.2 Round main and branch: enter main duct at 45 degrees with conical connection.
.3 Provide volume control damper in branch duct near connection to main duct.
.4 Main duct branches: with splitter damper.

.4 Transitions:
.1 Diverging: 20 degrees maximum included angle.
.2 Converging: 30 degrees maximum included angle.

.5 Offsets:
.1 Full radiused elbows as indicated.

2.6 GALVANIZED STEEL

.1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating, minimum 30% recycled content.

.2 Thickness, fabrication and reinforcement: to SMACNA.

.3 Joints: to SMACNA.

2.7 HANGERS AND SUPPORTS

.1 Hangers and Supports: in accordance with Section 23 05 29.

.1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.

.1 Maximum size duct supported by strap hanger: 500.

.2 Hanger configuration: to ASHRAE and SMACNA.

.3 Hangers: galvanized steel angle with galvanized steel rods to ASHRAE and SMACNA following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10

.4 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.2 For steel joist:manufactured joist clamp.

.3 For steel beams: manufactured beam clamps:

PART 3 - EXECUTION

3.1 GENERAL

.1 Do work in accordance with NFPA 90A, NFPA 90B ASHRAE and SMACNA.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.

.1 Insulate strap hangers 100 mm beyond i.sulated duct. Ensure diffuser is fully seated

3.2 HANGERS

.1 Strap hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

3.2 HANGERS (Cont'd)

.3 Hanger spacing: in accordance with SMACNA as follows:

Duct Size (mm)	Spacing (mm)
to 1500	3000

3.3 SEALING AND TAPING

.1 Apply sealant to outside of joint to manufacturer's recommendations.

.2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturers recommendations.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Sheet Metal and Air Conditioning National Association (SMACNA)
.1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-2005.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Section 01 74 20.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Manufacture to SMACNA standards.

2.2 SPLITTER DAMPERS

.1 Of same material as duct but one sheet metal thickness heavier, with appropriate stiffening.

.2 Single thickness construction.

.3 Control rod with locking device and position indicator.

.4 Rod configuration to prevent end from entering duct.

.5 Pivot: piano hinge.

.6 Folded leading edge.

2.3 SINGLE BLADE DAMPERS

.1 Of same material as duct, but one sheet metal thickness heavier. V-groove stiffened.

.2 Size and configuration to recommendations of SMACNA, except maximum height 100 mm.

2.3 SINGLE BLADE DAMPERS (Cont'd)

.3 Locking quadrant with shaft extension to accommodate insulation thickness.

.4 Inside and outside nylon end bearings.

.5 Channel frame of same material as adjacent duct, complete with angle stop.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install where indicated and required for balancing.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 For supply, return and exhaust systems, locate balancing dampers in each branch duct.

.4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.

.5 All dampers to be vibration free.

.6 Ensure damper operators are observable and accessible.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 National Fire Protection Association (NFPA)
.1 NFPA 90A-15, Standard for the Installation of Air Conditioning and Ventilating Systems.

.2 Underwriters Laboratories of Canada (ULC)
.1 CAN/ULC-S112-10, Standard Test Method of Fire Test of Fire Damper Assemblies.
.2 CAN/ULC-S112.2-07, Standard Method of Fire Test of Ceiling Fire Stop Flap Assemblies.
.3 ULC-S505-2013, Standard for Fusible Links for Fire Protection Service.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for fire and smoke dampers and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Indicate the following:
.1 Fire dampers.
.2 Smoke dampers.
.3 Fire stop flaps.
.4 Operators.
.5 Fusible links.
.6 Design details of break-away joints.
.3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

1.4 DELIVERY, STORAGE AND HANDLING (Cont'd)

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 FIRE DAMPERS

.1 Fire dampers: arrangement Type B, listed and bear label of ULC,conform to ULJ55 meet requirements of provincial fire authority, Fire Commissioner of Canada, and NFPA 90A authorities having jurisdiction. Fire damper assemblies fire tested in accordance with CAN/ULC-S112.

.2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.
.1 Fire dampers: 1-1/2 hour fire rated unless otherwise indicated.
.2 Fire dampers: automatic operating type and have dynamic rating suitable for maximum air velocity and pressure differential to which it will be subjected.

.3 Top hinged: offset single damper, round or square; multi-blade hinged or interlocking type; sized to maintain full duct cross section as indicated.

.4 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.

.5 40 x 40 x 3 mm retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.

2.1 FIRE DAMPERS (Cont'd)

.6 Equip fire dampers with steel sleeve or frame installed disruption ductwork or impair damper operation.

.7 Equip sleeves or frames with perimeter mounting angles attached on both sides of wall or floor opening. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce ceiling to conform with ULC.

.8 Design and construct dampers to not reduce duct or air transfer opening cross-sectional area.

.9 Dampers shall be installed so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition of floor slab depth or thickness.

.10 Unless otherwise indicated, the installation details given in SMACNA Install Fire Damp HVAC and in manufacturer's instructions for fire dampers shall be followed.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for fire and smoke damper installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install in accordance with NFPA 90A and in accordance with conditions of ULC listing.

3.2 INSTALLATION (Cont'd)

.2 Maintain integrity of fire separation.

.3 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.

.4 Install access door adjacent to each damper.

.5 Co-ordinate with installer of fire stopping.

.6 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.

.7 Install break-away joints of approved design on each side of fire separation.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 National Fire Protection Association (NFPA)
.1 NFPA 90A-2015, Installation of Air Conditioning and Ventilating Systems.
.2 NFPA 90B-2015, Installation of Warm Air Heating and Air Conditioning Systems.

.2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2005.

.3 Underwriter's Laboratories of Canada (ULC)
.1 CAN/ULC-S110-13, Fire Tests for Air Ducts.
.2 UL 181-2013, Factory Made Air Ducts and Connectors.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00.

.2 Indicate the following:
.1 Thermal properties.
.2 Friction loss.
.3 Acoustical loss.
.4 Leakage.
.5 Fire rating.

1.3 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Section 01 74 20.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Factory fabricated to CAN/ULC-S110.

2.1 GENERAL (Cont'd)

.2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.

.3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

2.2 METALLIC ACOUSTIC INSULATED

.1 Type 5: Spiral wound, flexible perforated aluminum with factory applied 37 mm thick flexible glass fibre thermal insulation and sleeved by aluminum foil and Type M vapour barrier.

.2 Performance:
.1 Factory tested to 3 kPa without leakage.
.2 Maximum relative pressure drop coefficient:
.3 Acoustical performance: Minimum attenuation (dB/m) to following table:

	Frequency (Hz)				
Duct Diam:	125	250	500	1000	2000
100	0.6	3	12	27	0
150	1.2	3	12	22	27
200	2.0	5	12	19	20
300	2.4	5	12	16	15

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

.1 Install in accordance with: CAN/ULC-S110, UL 181 NFPA 90A, NFPA 90B and SMACNA.

.2 Use type 5 throughout.

.3 Connections:
.1 Duct Sizes 300 mm and Under:
.1 Provide a minimum of three (3) #8 sheet metal screws equally spaced to hold the flexible duct.
.2 Duct sizes above 300 mm:
.1 Provide a minimum of five (5) #8 sheet metal screws equally spaced to hold the flexible duct.
.3 Screws shall be located at least 12 mm from the end of the duct.

3.1 DUCT INSTALLATION (Cont'd)

.3 (Cont'd)

.4 The collar to which the flexible duct is attached shall be a minimum 50 mm in length.

.5 Cover entire joint with tape and seal as specified in Section 23 31 13.01 - Low Pressure to 500 PA .

.4 Supports:

.1 Support shall be in accordance with SMACNA.

.2 The maximum amount of sag for flexible duct shall not exceed 12 mm per foot. Provide additional supports as required.

.5 Length:

.1 Maximum length of flexible duct: 3000 mm.

.2 Minimum length of flexible duct connecting to ceiling diffusers shall be 1800 mm.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 ASTM International
.1 ASTM C423-09a, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
.2 ASTM C916-14, Standard Specification for Adhesives for Duct Thermal Insulation.
.3 ASTM C1071-16, Standard specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).
.4 ASTM C1338-14, Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.
.5 ASTM G21-15, Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

.2 National Fire Protection Association (NFPA)
.1 NFPA 90A-15, Standard for the Installation of Air Conditioning and Ventilating Systems.
.2 NFPA 90B-15, Standard for the Installation of Warm Air Heating and Air Conditioning Systems.

.3 North American Insulation Manufacturers Association (NAIMA)
.1 NAIMA AH116-2002, Fibrous Glass Duct Construction Standards.

.4 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)
.1 SMACNA, HVAC Duct Construction Standards, Metal and Flexible-2005.
.2 SMACNA IAQ Guideline for Occupied Buildings Under Construction-2007.

.5 Underwriter's Laboratories of Canada (ULC)
.1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for duct liners and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for duct liners for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store materials indoors and in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect duct liners from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 DUCT LINER

.1 General:
.1 Mineral Fibre duct liner: air surface coated mat facing.
.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50 when tested in accordance with CAN/ULC-S102 and NFPA 90A and NFPA 90B.

.2 Rigid:
.1 Use on flat surfaces.

2.1 DUCT LINER (Cont'd)

.2 (Cont'd)

.2 25 mm thick, to ASTM C1071 Type 2, fibrous glass rigid board duct liner.

.3 Density: 48 kg/m^3 minimum.

.4 Thermal resistance to be minimum 0.76 (m^2. degrees C)/W for 25 mm thickness 1.15 (m^2.degrees C)/W for 38 mm thickness 1.53 (m^2.degrees C)/W for 50 mm thickness when tested in accordance with ASTM C177, at 24 degrees C mean temperature.

.5 Maximum velocity on faced air side: 20.3 m/s.

.6 Minimum NRC of 0.70 at 25 mm thickness based on Type A mounting to ASTM C423.

2.2 ADHESIVE

.1 Adhesive: to NFPA 90A and NFPA 90B and ASTM C916.

.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 29 degrees C to plus 93 degrees C.

.3 Water-based fire retardant type.

2.3 FASTENERS

.1 Weld pins 2.0 mm diameter, length to suit thickness of insulation.

2.4 JOINT TAPE

.1 Poly-Vinyl treated open weave fiberglass membrane 50 mm wide.

2.5 SEALER

.1 Meet requirements of NFPA 90A and NFPA 90B.

.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 68 degrees C to plus 93 degrees C.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for duct liner installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

3.2 GENERAL

.1 Do work in accordance with SMACNA HVAC Duct Construction Standard except as specified otherwise.

.2 Line inside of ducts where indicated.

.3 Duct dimensions, as indicated, are clear inside duct lining.

3.3 DUCT LINER

.1 Install in accordance with manufacturer's recommendations, and as follows:
.1 Fasten to interior sheet metal surface with 100% coverage of adhesive to ASTM C916.
.1 Exposed leading edges and transverse joints to be factory coated or coated with adhesive during fabrication.
.2 In addition to adhesive, install weld pins not less than 2 rows per surface and not more than 425 mm on centres to compress duct liner sufficiently to hold it firmly in place.
.1 Spacing of mechanical fasteners in accordance with SMAC HVAC Duct Construction Standard.
.2 In systems, where air velocities exceeds 20.3 m/s, install galvanized sheet metal noising to leading edges of duct liner.

3.4 JOINTS

.1 Seal butt joints, exposed edges, weld pin and clip penetrations and damaged areas of liner with joint tape and sealer. Install joint tape in accordance with manufacturer's written recommendations, and as follows:
   .1 Bed tape in sealer.
   .2 Apply 2 coats of sealer over tape.

.2 Replace damaged areas of liner at discretion of Departmental Representative.

.3 Protect leading and trailing edges of duct sections with sheet metal nosing having 15 mm overlap and fastened to duct.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 American National Standards Institute (ANSI)
.1 ANSI/ASHRAE 51-2007/AMCA 210-07, Laboratory Methods of Testing Fans for Rating.

.2 National Fire Protection Association (NFPA)
.1 NFPA 90A-15, Installation of Air Conditioning and Ventilating Systems.

.3 International Organization of Standardization (ISO)
.1 ISO 3741:2010, Acoustics-Determination of Sound Power Levels of Noise Sources Using Sound Pressure - Precision Methods for Reverberation Rooms.

.4 Underwriter's Laboratories (UL)

.5 UL 181-2013, Factory-Made Air Ducts and Air Connectors.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00.

.2 Indicate the following:
.1 Capacity.
.2 Pressure drop.
.3 Noise rating.
.4 Leakage.

1.3 TEST REPORTS

.1 To ANSI/ASHRAE 51/AMCA 210. Submit published test data on DIN (Direct Internal Noise), in accordance with ISO 3741 made by independent testing agency for 0, 2.5 and 6 m/s branch velocity or inlet velocity. Sound power level with minimum inlet pressure of 0.5 kPa in accordance with ISO 3741 for 2nd through 7th octave band, also made by independent testing agency. Pressure loss through silencer shall not exceed 60% of inlet velocity pressure maximum.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 33 00.

1.5 CERTIFICATION

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from certified ADC (Air Diffusion Council) testing agency signifying adherence to codes and standards.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

.1 Terminal units of the same type to be product of one manufacturer.

2.2 ELECTRONIC VARIABLE AIR VOLUME BOXES

.1 Terminal units of the same type to be product of one manufacturer

.2 Units: Pressure independent volume regulator type.

.3 Low pressure systems of single duct type with variable volume control and housed within sound attenuating box.

.4 Casing: 0.89 mm minimum thickness galvanized steel insulated with minimum of 25 mm thick thermal foil faced and acoustic insulation which complies with UL-181 and NFPA 90A. Any cut edges of fiberglass exposed to the airstream shall be covered with metal angles and end caps so there is no exposed fiberglass in the air stream

.5 The primary air valve damper shall be heavy gauge metal, with peripheral gasket, pivoted in self-lubricating bearings. In full closed position, air leakage past the closed damper shall not exceed 2% of the nominal catalog rating at 747 Pa inlet static pressure, as rated by ARI Standard 880. An opposed blade primary air damper and DDC motor operator shall vary primary air in response to a signal. Damper operation shall be demonstrated to be closed to minimum position before heating is activated. No overlap under any circumstances shall be allowed. Damper shall be located inside unit. Damper connection to operating shaft shall be a positive mechanical connection.

2.2 ELECTRONIC VARIABLE AIR VOLUME BOXES (Cont'd)

.6 The air flow sensor shall be of cross configuration located at the inlet of the assembly. The sensor shall have twelve total pressure sensing ports and a centre averaging chamber designed to accurately average the flow across the inlet of the assembly. Sensor shall provide accuracy within 5% with a 90 deg sheet metal elbow directly at the inlet of the assembly. The air flow sensor shall amplify the sensed air flow signal.

.7 Factory preset maximum and minimum air volume setting being field adjustable, and duct collars. Leakage through casing not to exceed 2% of design volume with 750 kPa upstream and 0 kPa downstream of regulator while maintaining flow regulation within 5% of setting as rated by ARI Standard 880.

.8 At an inlet velocity of 10.2 m/s pressure drop for cfm range of box shall not exceed 27 Pa.
.1 Radiated: 35 NC.
.2 Discharge: 36 NC. Based on room absorption of 10 db, and an inlet static pressure of 375 Pa.

.9 Provide minimum 915mm attenuator for discharge of every box. Attenuator shall have interior lining as previously specified, of 25 mm for its entire length.

.10 Provide terminal units with air volumes of 900 cfm or more with additional 600mm silencer section.

.11 In fully closed position, air leakage through damper shall not exceed 2% of catalogued rating at 750 Pa.

.12 Schedule: as indicated on the drawings.

.13 All digital controls including motor, transducer, controller, etc. to be supplied and installed by the BAS/ EMCS Control Contractor on site.

.14 Existing units are all manufactured by E.H. Price model number SDV5000. New units provided shall provide same level of performance as existing terminal boxes.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install in accordance with manufacturers recommendations.

.2 Support independently of ductwork.

.3 Install with at least 1000 mm of flexible inlet ducting and minimum of four duct diameters of straight inlet duct, same size as inlet.

.4 Locate so that controls, dampers and access panels are easily accessible.

END OF SECTION

PART 1 - GENERAL

1.1 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00.

.2 Indicate the following:
- .1 Capacity.
- .2 Throw and terminal velocity.
- .3 Noise criteria.
- .4 Pressure drop.
- .5 Neck velocity.

1.2 CERTIFICATIONS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Section 01 74 20.

PART 2 - PRODUCTS

2.1 GENERAL

.1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.

.2 Frames:
- .1 Full perimeter gaskets.
- .2 Plaster frames where set into plaster or gypsum board and as specified.
- .3 Concealed fasteners.

.3 Concealed manual volume control damper operators.

.4 Colour: To match existing.

2.2 MANUFACTURED UNITS

.1 Grilles, registers and diffusers of same generic type to be product of one manufacturer.

2.3 RETURN AND EXHAUST GRILLES AND REGISTERS

.1 General: with opposed blade dampers.

.2 Type RB: steel aluminum, 25 mm border, single 0 45° deflection, vertical face bars.

.3 Egg crate shall be suitable for T-bar lay-in. Supplied units shall match existing in colour and appearance.

.4 Type RC: steel aluminum, 25 mm border, 25 x 25 mm egg crate type face bars. Finish: Off-white.

2.4 DIFFUSERS

.1 General: volume control dampers with flow straightening devices and blank-off quadrants and gaskets.

.2 Steel, square multi-pattern lay-in and or surface mounted. Finish: off-white.

.3 Diffusers to match existing in shape and colour existing ones are E.H.Price 610 x 610, SCDA-B12 - Type 3 frame; suitable for narrow (15 mm) T.

2.5 LINEAR GRILLES

.1 Bar core type with margin as indicated no margin.

.2 Plaster frame, mitred end, sealing strip and accessories as indicated. Finish: off-white.

.3 Air volume control damper with concealed adjustment.

.4 Prior to ordering, visit the site to ensure new diffusers match existing ones and are suitable for type of T-bar being supplied.

.5 Diffusers to match existing in shape and colour existing ones. E.H.Price Model SDS-B12.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

3.1 INSTALLATION (Cont'd)

.2 Refer to Architectural and Electrical drawings and coordinate with drawing , electrical and architectural drawings.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 American National Standards Institute/Air Conditioning and Refrigeration Institute (ANSI/ARI)
.1 ANSI/ARI 210/240-2008, Unitary Air Conditioning and Air-Source Heat Pump Equipment.

.2 American National Standards Institute/American Society of Heating, Refrigeration and Air Conditioning Engineers (ANSI/ASHRAE)
.1 ANSI/ASHRAE 15-2013, Safety Standard for Refrigeration Systems.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
.1 Indicate on drawings:
.1 Dimension
.2 Fan
.3 Capacity
.4 Electrical and control drawings.

.4 Submit in accordance with Section 01 33 00.

.5 Operation and Maintenance Data: submit operation and maintenance data for heat pumps for incorporation into manual.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

1.3 DELIVERY, STORAGE AND HANDLING (Cont'd)

.3 (Cont'd)

.1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect heat pumps from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 DESCRIPTION

.1 The units shall be listed by Electrical Laboratories (ETL) and bear the cETL label.

.2 The system will be produced in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.

2.2 REFRIGERANTS

.1 Type of Refrigerant: R-410A.

2.3 SYSTEM DESCRIPTION

.1 The variable capacity air conditioning system shall be Inverter Driven (heat / cool) split system as specified. The system shall consist of an indoor evaporator exclusively matched to an outdoor variable speed rotary compressor condensing unit.

.2 The outdoor unit shall be configured for horizontal discharge airflow and complete with a variable speed condenser fan using a single phase power supply.

.3 Typical cooling mode operation range shall be between -10 deg C DB and 46 deg C DB, and -15 deg C DB to 25 deg C DB for the heating mode.

.4 Provide an ultra-low ambient kit to permit unit operation in cooling mode down to -40 deg C.

2.3 SYSTEM DESCRIPTION (Cont'd)

.5 The system shall be designed to operate with a maximum refrigerant pipe length of 98.4 feet, with 65.6 feet maximum vertical difference, and without any oil traps or additional equipment.

.6 Maximum noise of the indoor unit shall not exceed NC 30 operating at high speed.

2.4 INDOOR UNIT

.1 The indoor unit shall be factory assembled and pre-wired with all necessary electronic and refrigerant controls. Both liquid and suction lines must be individually insulated between the outdoor and indoor units.

.2 The indoor unit shall have a white, "flat screen" finish.

.3 The drain and refrigerant piping on wall mounted units shall be accessible from six (6) positions for flexible installation (right side, right back, and right bottom; and left side, left back, and left bottom.

.4 The cabinet shall include an "intelligent-eye" motion sensor capable of setting back the set point temperature for energy savings. This feature may be disengaged on the wireless remote controller.

.5 The evaporator fan shall be statically and dynamically balanced. Motor shall have permanent lubricated bearings and offer up to five speed settings.

.6 Auto-swing louver shall automatically adjustable the air flow pattern (both vertically and horizontally).

.7 The filter shall be mildew proof, washable.

.8 The evaporator coil shall be nonferrous, with aluminum fin on a copper tube heat exchanger. All tube joints shall be brazed with silver alloy or phoscopper. All coils shall be factory pressure tested. A condensate pan shall be provided under the coil with a drain connection.

.9 Provide a condensate pump (shipped loose) for field installation.

2.5 CONDENSING UNIT

.1 The outdoor unit shall be completely weatherproof and corrosion resistant. The unit shall be constructed from rust-proofed mild steel panels coated with a baked enamel finish.

.2 The fan shall be a direct drive, propeller type fan. The motor shall be inverter driven with permanently lubricated bearings

.3 A fan guard shall be provided on the outdoor unit to prevent contact with fan operation.

.4 The outdoor coil shall have nonferrous construction with a corrugated fin tube.

.5 The compressor shall be rotary swing inverter-driven compressor. Compressor safeties shall include internal thermal overload protection. Refrigeration specialties shall include an accumulator, refrigerant metering device and a four-way reversing valve.

2.6 ELECTRICAL

.1 The outdoor unit shall be powered with 208-230 volts, 1 phase, 60 hertz power. The indoor unit shall receive 208-230 volt, 1 phase, 60 hertz power fed from the outdoor unit.

2.7 CONTROLS

.1 The unit shall be provided with a wired wall mounted thermostat. It shall be configurable for Automatic Operation, Dry Operation and Fan Only Operation.

.2 The controller shall be native BACnet. The intent is to control the unit as a supplementary cooling unit via BAS system. AS a minimum the BAS shall be able to turn the unit ON/OFF. Refer to drawings and section 159001 for details.

.3 The controller shall consist of an On/Off power switch, mode selector, silent button (for outdoor unit), fan setting, swing louver, On/Off timer setting, temperature adjustment, metric or imperial temperature display, "Intelligent Eye" sensor, HOME - LEAVE mode and a rapid heat / cool mode (high power mode).

2.7 CONTROLS (Cont'd)

.4 Silent operation shall reduce the sound level of the outdoor unit by slowing down the inverter driven condenser fan.

.5 High power mode shall provide rapid cool down or heating to achieve maximum desired temperature in the shortest allowable time period.

.6 The indoor unit microprocessor shall receive and process commands via wall mounted/ return air temperature and indoor coil temperature sensors enabled by commands from BAS and/or wall mounted thermostat.

2.8 ACCESSORIES

.1 Unit shall be provided with a condensate pump (shipped loose) for field installation the following field installed accessories.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for heat pumps installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install where indicated and in accordance with manufacturer's instructions.

.2 Installation shall be carried out by trained and manufactures' approved technician.

.3 Install outdoor units on roof on concrete pavers or as directed by the manufacturer.

3.2 INSTALLATION (Cont'd)

.4 Secure with hold-down bolts in accordance with manufacturer's recommendations.

.5 Level unit with fans running.

.6 Make piping connections. Nothing to obstruct ready access to components or to prevent removal of components for servicing.

.7 For ceiling hung installations, provide a reinforced steel framework to adequately support all unit sections.

.8 Provide certified wiring schematics to the electrical division for associated equipment and controls.

.9 Provide all necessary control wiring as recommended by the manufacturer. Carry out all control wiring between the outdoor condenser and indoor unit, and between the indoor unit and thermostat

.10 High/low pressure gas line, liquid and suction lines must be individually insulated between the outdoor and indoor units.

.11 The unit supplier shall size all refrigerant piping. No additional monies will be paid for upsizing the line sizes shown on the drawings.

.12 Mechanical contractor shall provide any additional refrigerant required over and beyond the initial charge.

3.3 DRAIN PANS

.1 Install so that no water can accumulate. Arrange easy access for cleaning.

.2 Include internal or external trap for proper draining as per manufacture's recommendation.

.3 Install condensate line to closest rain water leader in the building.

3.4 START-UP AND COMMISSIONING

.1 Have manufacturer certify installation.

.2 Have manufacturer present during start-up tests and start up units and certify performance.

3.4 START-UP AND COMMISSIONING (Cont'd)

.3 Submit written start-up and commissioning reports to Departmental Representative.

.4 Refer to front end document for third party commissioning.

3.5 CLOSEOUT ACTIVITIES

.1 Manufacturer to deliver verbal, and written instructions to operating personnel.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section01 74 11.

3.7 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by heat pumps installation.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 Provide as an extention to the existing system a Siemens Buildings Technologies Building Automation System (BAS) utilizing Distributed Digital Control (DDC) to serve new mechanical and associated systems as described on the drawings and in this specification.

.2 Provide all labour, materials, products, equipment and services to supply, install and commission the electronic control and monitoring system with electronic as specified in this Section of the Specification.

.3 Provide all computer hardware and software, operator input/output communication devices, communication units, communication interface to digital system controllers, field sensors and controls as required to meet the specified performance.

.4 Supply and install controllers for new variable terminal units. Refer to Section 23 36 00.

.5 Provide all wiring, labour, including calibration, commissioning, software programming and data base generation, generation of colour graphics and additional work necessary to provide a complete and fully operating system.

.6 Provide 120 Volt, 20 amp circuits to field panels and other devices requiring a main supply from circuits supplied by Division 26.

.7 Install and wire control wiring associated with split unit. Refer to Section 23 81 41.

1.2 GENERAL SYSTEM REQUIREMENTS

.1 Provide a single architecture common data base microprocessor based electronic control and monitoring BAS system for air handling equipment, heating and cooling and other specified systems employing distributed processing and direct digital control (DDC) with electronic sensing and electronic actuation to conform with the specification requirements. The BAS shall consist of the following:

.1 DDC Controllers

.2 Application Specific Controllers.

1.3 SHOP DRAWINGS

.1 Submit within 4 weeks of contract award, all Shop Drawings, diagrams, schedules and equipment and software data sheets as may be deemed necessary by the Departmental Representative in order to ensure the intention of the Specification and schedule of work are being met.

1.4 DOCUMENTATION

.1 Provide prior to project completion 3 sets of maintenance documentation of a standard which would enable the Owner to undertake planned maintenance, repair, calibration and other adjustments as may be necessary from time to time, on any component provided under this Contract without additional documentation being required and without assistance from others.

PART 2 - PRODUCTS

2.1 TEMPERATURE SENSORS

.1 All space sensors shall be RTD or thermistor type temperature detectors. Sensors shall be provided with vented protective covers, mounted 1500mm from floor level.

2.2 DIFFERENTIAL PRESSURE SENSORS

.1 Differential pressure sensors shall be provided for water differential pressure air and static pressure applications. The differential pressure range shall be selected to match the application. Select materials suitable for the measured variable, i.e. water and air, and to withstand a minimum of twice the normal pressure.

.2 Each sensor shall be provided with an industry standard 4-20mA transmitter, mounted at the sensor. The transmitter and sensor shall have a combined accuracy of <+/- 1.0% full scale. Setra C-264 or equivalent is acceptable.

2.3 CURRENT SWITCHES

.1 Provide solid state current DC switches with LED which operate when the level sensed by an internal current transformer exceeds the threshold value set by a four-turn adjustment.

.2 The switch shall be capable of open-collector transistor outputs, capable of 150 mA dc continuous, 500 mA momentary. Maximum permissible voltage between output and common in off state is 30 VDC. Maximum voltage drop at 150 mA is 0.8 volts.

2.4 NAMEPLATES

.1 Duct and pipe mounted sensors and panels shall be provided with minimum size 75x25x3.2 mm lamacoid nameplates, clearly identifying the equipment and functions with letter and number designation. Nameplates shall be mechanically secured and listed in the Operating and Maintenance manual.

2.5 NETWORKING COMMUNICATIONS

.1 The design of BAS shall allow the co-existence of new BACnet DDC Controllers with existing Siemens Apogee DDC Controllers in the same network.

2.6 DDC CONTROLLER FLOOR LEVEL NETWORK

.1 This level communication shall support a family of application specific controllers and shall communicate with the peer-to-peer network through BACnet DDC Controllers for transmission of global data.

2.7 DDC CONTROLLERS

.1 HVAC DDC Controllers shall be a 32-bit stand-alone, multi tasking, multi user, real time digital control processors consisting of modular hardware with plug in enclosed processors.

.2 Each HVAC DDC Controller shall have sufficient memory to support its own operating system and databases, including:
.1 Control processes

.3 Energy management applications

.4 Alarm management applications including custom alarm messages for each level alarm for each point in the system.

.5 Historical/trend data for points specified

.6 Maintenance support applications

.7 HVAC DDC Controllers shall provide a RS 232C serial data communication port for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals.

.8 HVAC DDC Controllers shall provide local LED status indication for each digital input and output for constant, up to date verification of all point conditions without the need for an operator I/O device.

2.8 APPLICATION SPECIFIC CONTROLLER

.1 Each DDC Controller shall be able to extend its performance and capacity through the use of emote application specific controllers (ASCs) through Floor Level LAN Device Networks.

2.9 TERMINAL EQUIPMENT CONTROLLER

.1 Provide for control of each piece of equipment, including, but not limited to, the following:

2.9 TERMINAL EQUIPMENT CONTROLLER (Cont'd)

.1 (Cont'd)
.1 Controllers shall include all point inputs and outputs necessary to perform the specified control sequences. Analog outputs shall be industry standard signals such as 24V floating control, allowing for interface to a variety of modulating actuators. Terminal controllers utilizing proprietary control signals and actuators shall not be acceptable. As an alternative, provide DDC Controllers or other TEC's with industry standard outputs for control of all terminal equipment.
.2 Each controller performing space temperature control shall be provided with a matching room temperature sensor. The sensor may be either RTD or thermistor type providing the minimum performance requirements of +/- .6 deg. C accuracy, operating in the range of 2 to 46 deg.C , adjustable between 2 to 30 deg. C.

2.10 OPERATOR WORKSTATION

.1 Tie-in any new controllers to the existing Apogee Insight Server. Distribute all new graphics and software to the existing Operator Workstation.

.2 Follow the existing format of graphics and interface new and relocated space terminal units.

PART 3 - EXECUTION

3.1 SEQUENCING

.1 General
.1 Sequencing of operations for new systems will be as described in this section, and control drawings.

.2 VAV BOXES - Typical
.1 Sequence of operation remains the same.

.3 VAV boxes with Supplementary Cooling
.1 The supplementary cooling units are provided with controllers which are BACnet and shall be connected to the BAS system
.2 The intent is to initiate unit start-up when the VAV box is at its maximum position and room is not maintained.

3.1 SEQUENCING (Cont'd)

.3 (Cont'd)

.3 BAS shall initiate the unit start-up and unit controller shall maintain space temp. set point.

.1 Upon initiation of the supplementary cooling operation, the terminal units associated with the space remains 100% open.

.2 If the supplementary cooling is not operational for a period of 10 minutes (operator adjustable); BAS shall modulate VAV box controller to maintain room temperature. There shall be a lag of 10 minutes prior to start-up of the supplementary cooling unit.

.3 Under other conditions heating mode and when the room is satisfied; VAV box and perimeter heating sequence of operation remains status quo.

.4 VAV/Fan Powered Box Terminal Unit with Perimeter Heating - Typical for two - Connect the new thermostat to existing perimeter wall fin valve. Provide new accessories as required. Programming and set up to be similar to existing - Applicable to Room 125. Modify control wiring and connect terminal unit to perimeter heating system - Applicable to Room 111.

.5 Lan Room

.1 Provide temperature sensor to monitor room temperature and connect to BAS for monitoring.

3.2 INSTALLATION

.1 Cooperate with the air and water balance technicians during the balancing of the system.

.2 Install equipment so as to allow for easy maintenance access and such that it does not interfere in any way with access to adjacent equipment and personnel traffic in the surrounding space.

3.3 CONTROL WIRING

.1 Supply and install wiring as required for the automatic control system. Install wiring in EMT conduit in mechanical rooms and other areas susceptible to damage where exposed. Plenum cable is acceptable in concealed spaces such as ceilings. Control wiring must comply with all requirements of Division 26.

3.4 TRAINING

.1 The Contractor shall provide two (2) hours training during normal working hours, a competent instructor to give full instruction to designated personnel in the adjustment, operation and maintenance of the system installed.

3.5 ADJUSTMENTS SERVICE & WARRANTY

.1 Adjust and set thermostats, temperature sensors, damper operators, relays and other components to proper settings to give required performance. Cooperate with other sections during testing and balancing of each mechanical system to ensure each total system operates to approval.

.2 Temperature control system and specified herein shall be warranted free from defects in materials and workmanship and shall be serviced without charge (except for damage from lack of maintenance of other causes) for one year after date of start of lien period. If, within this period, any equipment herein described is proved to be defective in workmanship or materials, it shall be replaced or repaired without charge.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Adhere to the latest Canadian Standards Association (CSA International)
.1 CSA-C22.1-15, Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations.
.2 CAN3-C235-83 (2015), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.2 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
.1 Material Safety Data Sheets (MSDS).

.3 The Ontario Electrical Safety Code,26th edition/2015 and all bulletins (Ontario).

.4 Electrical Safety Authority (ESA) requirements and local applicable codes and regulations.

1.2 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Language operating requirements: provide identification nameplates and labels for control items in English.

1.3 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00.

.2 Product Data: submit WHMIS MSDS.

.3 Shop drawings:
.1 Submit 6 number of copies of drawings and product data to authority having jurisdiction.
.2 If changes are required, notify Departmental Representative of these changes before they are made.

1.3 SUBMITTALS (Cont'd)

.4 Quality Control: in accordance with Section 01 45 00.
.1 Provide CSA certified equipment and material.
.2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for special approval before delivery to site.
.3 Submit test results of installed electrical systems and instrumentation.
.4 Permits and fees: in accordance with General Conditions of contract. Pay associated fees. Departmental Representative will provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost.
.5 Submit, upon completion of Work, load balance report as described in PART 3 - Load Balance.
.6 Submit certificate of acceptance from Electrical Safety Authority having jurisdiction upon completion of Work to Departmental Representative.

1.4 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00.

.2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices as per the conditions of Provincial Act respecting manpower vocational training and qualification.
.1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
.2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

.3 Site Meetings:
.1 In accordance with Section 01 31 19.

.4 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Material Delivery Schedule: provide Departmental Representative with schedule within weeks after award of Contract.

.2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

1.6 SYSTEM STARTUP

.1 Instruct Departmental Representative and operating personnel in operation, care and maintenance of systems, system equipment and components.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

.1 Provide material and equipment in accordance with Section 01 61 00.

.2 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - Submittals.

.3 Factory assemble control panels and component assemblies.

2.2 WARNING SIGNS

.1 Warning signs: in accordance with requirements of authority having jurisdiction.

2.3 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.4 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates and labels as follows:

2.4 EQUIPMENT IDENTIFICATION (Cont'd)

.1 (Cont'd)

.1 Nameplates: plastic laminate 3 mm thick plastic engraving sheet, matt white finish face, black core, mechanically attached with self tapping screws.

.2 Sizes as follows:

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.

.3 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.

.4 Allow for minimum of twenty-five (25) letters per nameplate and label.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY No. " as directed by Departmental Representative.

.7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.8 Terminal cabinets and pull boxes: indicate system and voltage.

2.4 EQUIPMENT IDENTIFICATION (Cont'd)

.9 Transformers: indicate capacity, primary and secondary voltages.

2.5 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA-C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

2.6 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.3 Colours: 25 mm wide prime colour and 20mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue

2.7 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

2.8 DISTRIBUTION SYSTEM

.1 120/208V, 3 phase, 4W, 60 Hz.

.2 Inform other Divisions of electrical system characteristics.

2.9 WIRING SYSTEM

.1 Power and lighting circuits in EMT and/or described in other sections.

.2 Use heavy wall rigid conduit where required by codes.

.3 RW-90, XLPE insulated wire for panel feeder and branch circuits, GTF insulated wire for final fixture connection.

.4 #12 AWG minimum wire size, #10 AWG or larger shall be stranded.

.5 Copper conductors.

.6 Size branch circuits and panel feeders for maximum 2% voltage drop.

.7 Provide insulated green ground conductor in all EMT conduits.

.8 Provide nylon insulated bushings on the ends of all conduits in junction boxes, pullboxes, panelboards, etc.

.9 Minimum size conduit for lighting and power circuits is 21 mm.

2.10 GROUNDING

.1 Ground equipment with approved conductors and connectors.

.2 Make tests required by code and authorities having jurisdiction.

2.11 MOTOR AND CONTROL WIRING

.1 Provide wiring and connections for motors and electrical equipment supplied under other Divisions.

.2 Mechanical Divisions shall wire control circuits 50 volts and under.

2.12 PANELBOARD

.1 Provide panelboard of the circuit breaker type.

.2 Install branch circuit breakers shown on panel schedule.

.3 Panel to be in dead front metal cabinet with hinged door and catches.

.4 Breakers: toggle type, bolt-on, quick-make, quick-break, 40°C ambient temperature compensated and trip-free of operating handles on overloads.

.5 Lock-on handle devices for breakers not controlling lighting. 2P and 3P breakers to be with single handle common trip type.

.6 Typed directory card showing load supplied by each circuit, mounted inside cabinet door.

.7 Mount panel at 1500 mm above finished floor with the top of panel not higher than 2000 mm.

.8 Copper bus with neutral of same ampere rating as mains.

.9 Provide two 27 mm spare empty conduits from recessed panels into ceiling space above panel and terminate in an accessible location.

2.13 OUTLET BOXES

.1 Light fixture outlet boxes: standard, octagonal or square as required.

.2 Switch outlet boxes: standard, single or ganged as required.

.3 Receptacle outlet boxes: standard.

.4 Steel construction.

.5 Standard FS conduit fittings for surface mounted outlets in exposed areas.

2.14 SWITCHES

.1 Specification grade, toggle type, 20 amps, 120V back and side wired, chrome plated yoke, silver cadmium oxide contacts, switch mechanism on neoprene cushion.

2.14 SWITCHES (Cont'd)

.2 Locate switches on latch side of door, 1.5 m above finished floor unless noted otherwise.

2.15 RECEPTACLES

.1 Specification grade, 15 amp, 125 volt, AC, 'U' ground parallel blade slots, triple wiping contacts, double grounding terminals, break-off feature for separate feeds, built-in strap in plastic moulded body and back and side wiring terminals.

.2 Locate receptacles 400 mm above finished floor unless noted otherwise.

.3 Provide outlets with various configurations as indicated on electrical drawings.

2.16 COVER PLATES

.1 Common cover plate at ganged outlet boxes. Split plates not allowed.

2.17 FIXTURE MOUNTING

.1 Provide mounting and supports required for safe installation to Departmental Representative's satisfaction.

2.18 LIGHTING FIXTURES

.1 Provide lighting fixtures with lamps as illustrated in electrical standard details.

.2 Shop drawings to consist of catalogue cuts and photometric data from an independent test lab.

2.19 FLUORESCENT FIXTURES

.1 Ballast: electronic high power factor, energy saving type automatic resetting, thermal protection, pressure sensitive capacitor protection, lowest sound level available.

.2 Body: minimum 0.952 mm thick (20 gauge) steel, white baked enamel finish, reflectance value minimum 85%.

.3 Lens: 100% pure acrylic, low brightness, sparkling crystal prismatic pattern, maximum efficiency, and direct glare control. ULC certified.

2.19 FLUORESCENT FIXTURES (Cont'd)

.4 CSA rated for continuous row mounting.

2.20 LAMPS

.1 Fluorescent lamps: 1220 mm length unless specified otherwise, bi-pin, rapid start, premium grade, 18,000 hour life expectancy, 3,200 initial lumen output, cool/warm white.

2.21 DISCONNECT SWITCHES

.1 Heavy duty, quick-make, quick-break.

.2 Enclosure EEMAC 1R for interiors.

2.22 TELEPHONE SYSTEM

.1 Empty conduit system and outlets.

.2 E.M.T. conduit from terminal board/telephone closet to outlets unless indicated otherwise.

.3 Fish wire in each conduit.

.4 Co-ordinate with the Departmental Representative.

2.23 FIRE ALARM SYSTEMS

.1 Refer to Section 28 31 00.

2.24 DATA SYSTEM

.1 Empty conduit system and outlets.

.2 E.M.T. conduit from terminal board/data closet to outlets unless indicated otherwise.

.3 Fish wire in each conduit.

.4 Co-ordinate with the Departmental Representative.

2.25 WORK IN EXISTING BUILDING

.1 The Work of the specification shall be read in conjunction with and be governed by the requirements with this section.

2.25 WORK IN EXISTING BUILDING (Cont'd)

.2 Maintain life safety systems to all existing buildings at all times during construction.

.3 Maintain electrical continuity to all portions of existing building during all work. Submit letter to Departmental Representative requesting off-hours shut-down. Provide all temporary power and wiring required to achieve this.

2.26 ELECTRICAL COMMISSIONING

.1 Related Sections

.1 This section of the Specification shall be read in conjunction with and be governed by the requirements of Division 01.

2.27 SUMMARY OF COMMISSIONING

.1 Commissioning (Cx) is a systematic quality process of ensuring that building systems perform and interact according to the Departmental Representative's and the Design Engineers' Project Requirements and contract documents.

.2 Desired Outcomes

.1 A commissioned building provided optimized energy and occupant comfort, and sets the stage for minimal operation and maintenance costs. It serves as a tool for both the Departmental Representative and the Contractor to minimize post-occupancy remedial work.

.3 Commissioning Goals

.1 The Commissioning Process for a project typically focuses on systems and assemblies having to do with the performance objectives meeting the Departmental Representative's Project Requirements (OPR). Contractors, associated Sub-Contractors, equipment and material Suppliers are to support and ensure the requirements for commissioning are met in their respective work.

2.28 DEFINITIONS

.1 Departmental Representative's Project Requirements (OPR) Project Requirements (OPR)

2.28 DEFINITIONS (Cont'd)

.1 (Cont'd)

.1 The documentation of the functional performance requirements of the facility and the Departmental Representative's expectations of how it will be used and expectations of how it will be used and operated. This document is analogous to what has traditionally been referred to as the Departmental Representative's Program.

.2 Basis of Design (BOD)

.1 A project-specific s et of assumptions and design parameters for system and product selections to meet the OPR and applicable regulatory requirements.

.3 Commissioning Agent (CxA)

.1 An Departmental Representative's designated member, not otherwise designated member, not otherwise associated with the Architectural and Engineering Teams or the Contractor's Team. The CxA facilitates and coordinates the commissioning activities. Involvement of CxA shall not void any guarantees or warranties nor shall it relieve the Contractor of any contractual responsibilites.

.4 Deficiency/Issue

.1 A condition in the installation or function of a component or system that is not in compliance with the construction contract documents and/or Departmental Representative's requirements.

.5 Start-up/Pre-Functional The initial starting or activating of dynamic equipment, including the checkout of components and devices and completing static installation checklists.

.6 Functional Performance Testing (FPT)

.1 Testing performed by the Construction Team to verify that specific components, assemblies, systems, and integrated systems function and perform in accordance with the Departmental Representative's objectives and objectives and the contract documents. Tests are generally performed after the Contractor's start-up and initial checkouts are completed.

2.29 COMMISSIONING PLAN

.1 The CxA will develop a Commissioning Plan unique to the project.

.2 The Commissioning Plan identifies the strategies, aspects, and responsibilities within the commissioning process for all project team members.

.3 The Commissioning Plan contains the following information:

.1 Commissioning Program Overview
- .1 Goals and objectives
- .2 General project information
- .3 Systems to be commissioned.

.2 Commissioning Team
- .1 Team members, roles, and responsibilites.
- .2 Communication protocol, coordination, meetings, and management.

.3 Commissioning Process Activities
- .1 Documenting the Departmental Representative's project requirements. project requirements.
- .2 Preparing the basis of design.
- .3 Developing systems functional performance test procedures.
- .4 Verifying systems performance.
- .5 Reporting deficiencies and the resolution process.

.4 List of systems and assemblies to be commissioned.

.5 The Contractor and the Sub-Contractors shall carryout commissioning activities as per the Commissioning Plan.

2.30 COMMISSIONING DOCUMENTATION

.1 The Commissioning Process includes a significant documentation and paper component. Commissioning documents include but are not limited to:

.1 Drawings and Specifications.

.2 Shop Drawings.

.3 Pre-Functional Check Sheets.

.4 OEM/Contractor Start Up/Test Forms and Records.

.5 As Built Drawings.

.6 Functional Performance Test Plans and Results.

PART 3 - EXECUTION

3.1 GENERAL

.1 Turnover all existing equipment that is no longer required to the Departmental Representative. Remove from site any equipment that the Departmental Representative may decide upon. Package all HID fixtures individually.

.2 Protect all removed (to be retained) equipment from damage. Replace damaged equipment.

.3 Provide temporary power feeder from new electrical room to existing 600A service until permanent feeder is installed.

3.2 COMMISSIONING PROCESS

.1 Commissioning Meetings

.1 Commissioning during the Construction Phase begins with a team kick off meeting, conducted by the CxA, where the Commissioning Plan is reviewed with the Commissioning Team and roles and responsibilities are clarified. Additional meetings will be held throughout construction, to be conducted by the CxA with the Commissioning Team and if required with other necessary parties attending (for example, a supplier of a product or system), to plan, scope, coordinate, and schedule ongoing commissioning activities and resolve issues / problems. The commissioning meetings will normally be at the call of the CxA in coordination with the Commissioning Team.

.2 Pre-Functional Verification

.1 The Electrical Contractor will develop the Pre-Functional Check Sheets and provide to the Commissioning Agent for review. These pre-functional check sheets are to be completed by the Contractor during their normal installation and start up process.

3.2 COMMISSIONING PROCESS (Cont'd)

.2 (Cont'd)

.2 The equipment start up shall be in accordance with all related specifications and OEM requirements. The installing Contractor or Sub-Contractor shall under their own direction, plan, execute and document the installation verification and perform start up and checkout. The Contractor needs to verify that other building systems being installed will not compromise the operation and functional performance of the commissioned systems.

.3 Notify the CxA a minimum of two (2) weeks in advance of equipment and system start up and/or installation verification testing. The CxA verifies the Contractor completed check sheets, checks installation and the startup checks/documentation.

.4 Evaluation of the results will be conducted by the CxA. The CxA will evaluate whether the installed systems meet the criteria for the project.

.3 Functional Performance Testing

.1 All Pre-Functional Check sheets and Processes shall be completed and signed off by the CxA prior to starting equipment or system Functional Performance Testing

.2 Systems functional performance testing occurs once all system components are installed, energized, programmed, and otherwise ready for operation.

.4 Testing includes each process in the sequence of operation under central and packaged equipment control.

.5 Systems performance testing relies on the testing procedures developed by the CxA specifically for the systems to be tested.

.6 All equipment / systems shall be functionally tested by the Contractor and Subs prior to demonstration to the CxA. It is the responsibility of the Contractor and Subs to ensure all equipment /systems are functioning properly according to the contract documents before this demonstration occurs.

3.2 COMMISSIONING PROCESS (Cont'd)

.7 The Contractor is required to demonstrate functional performance to the CxA, as required by the CxA. The CxA will evaluate whether the system performance meets the criteria set forth by contract documents and the Departmental Representative's project requirements.

.8 Evaluation of the results will be conducted by the CxA. The CxA will evaluate whether the installed systems meet the criteria for the project.

3.3 SYSTEMS TO BE COMMISSIONED

.1 Lighting and Electrical Distributions.

.2 Life Safety.
NOTE: These systems contain components and individual pieces of equipment. This equipment will require specific commissioning activities.

3.4 ELECTRICAL CONTRACTOR RESPONSIBILITIES

.1 The Contractor shall be responsible for the commissioning process detailed here and in the Electrical Specifications sections.

.2 The Contractor shall coordinate and cooperate with the General and Mechanical Contractor as detailed in the specification sections of the Mechanical and Electrical Specifications.

.3 The Contractor shall only utilize employees with previous experience in testing procedures as they relate to a particular subject.

.4 The Contractor shall hire the Manufacturers' technicians who will conduct tests on their equipment.

.5 Provide a schedule showing commissioning activities and milestones and allow adequate time for testing, commissioning and re-work if required.

.6 Explain and ensure the Sub-Contractors understand commissioning requirements.

3.4 ELECTRICAL CONTRACTOR RESPONSIBILITIES (Cont'd)

.7 Establish and keep separate record of tests, during construction and the post construction phase.

.8 Understand quality standards contained in the specifications and ensure by inspections, review by others and testing that they are being met by the Sub-Contractors.

.9 Arrange samples, test equipment, etc., required by specifications.

.10 Ensure Sub-Contractors' testing is performed and complete prior to turnover.

.11 Develop Pre-Functional Check Sheets.

.12 Completion of Pre-Functional Check Sheets and Functional Performance Test Plans.

3.4 ELECTRICAL CONTRACTOR RESPONSIBILITIES (Cont'd)

Commissioning Team Roles and Responsibilities

Commissioning Activities and Milestones	OEM(s)	Contractor(s)	Consultant(s) Departmental Representative & Designers	Commissioning Agent(CxA)
Commissioning Plan		Provides input re: schedule	Reviews	Reviews Develops
Briefing Contractors Milestones		Participates	Attends	Attends Briefs
Pre-Functional Check Sheets		Develops/ Executes		Reviews
Pre-Functional Inspection (Installation & start-up)	Performs start-up as required	Performs start-up and executes Pre-Functional Check Sheet	Witness as Required	Witness as Required Review installation & start-up execution and documentation
Functional Performance Testing Plans	Assists with development and execution where required	Assists with development and execution where required	Reviews and comments as required	Develops test procedures
Functional Performance Testing and Verification	Demonstrates operation to CxA	Demonstrates operation to CxA	Witness as required	Witness as required Witness, verify and document results

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA International
.1 CSA-C22.2 No.18.2-06 (2011), Outlet Boxes, Conduit Boxes and Fittings.
.2 CSA-C22.2 No.65-13, Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for wire and box connectors and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for wire and box connectors for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect wire and box connectors from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Pressure type wire connectors to: CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
.1 Connector body and stud clamp for stranded copper conductors.
.2 Clamp for stranded copper conductors.
.3 Stud clamp bolts.
.4 Bolts for copper conductors.
.5 Sized for conductors as indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wire and box connectors installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Remove insulation carefully from ends of conductors and cables and:
.1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.

3.2 INSTALLATION (Cont'd)

.1 (Cont'd)

.2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA-C22.2 No.65.

.3 Install fixture type connectors and tighten to CSA-C22.2 No.65. Replace insulating cap.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20 and Section 01 35 21.

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

END OF SECTION

PART 1 - GENERAL

1.1 PRODUCT DATA

.1 Provide product data in accordance with Section 01 33 00.

1.2 DELIVERY, STORAGE AND HANDLING

.1 Packaging Waste Management: remove for reuse and return of packaging materials in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 BUILDING WIRES

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

2.2 ARMOURED CABLES

.1 Conductors: insulated, copper size as indicated.

.2 Type: AC90.

.3 Armour: interlocking type fabricated from galvanized steel strip.

.4 Connectors: anti short connectors.

2.3 CONTROL CABLES

.1 Type: LVT: soft annealed copper conductors, sized as indicated:
.1 Insulation: thermoplastic.
.2 Sheath : armour of closely wound aluminum wire.

.2 Type: low energy 300 V control cable: stranded annealed copper conductors sized as indicated LVT: soft annealed copper conductors, sized as indicated:
.1 Insulation: TWH.
.2 Shielding: tape coated with paramagnetic material over each conductors.
.3 Overall covering: polyethylene jackets.

.3 Type: 600 V stranded annealed copper conductors, sizes as indicated:

2.3 CONTROL CABLES (Cont'd)

.3 (Cont'd)
- .1 Insulation: RW90.
- .2 Shielding: magnetic tape conductors.
- .3 Overall covering: thermoplastic jacket.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01.

.2 Perform tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

.1 Terminate cables in accordance with Section 26 05 20.

.2 Cable Colour Coding: to Section 26 05 01.

.3 Conductor length for parallel feeders to be identical.

.4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.5 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

.6 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.

.7 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:
.1 In conduit systems in accordance with Section 26 05 34.

3.4 INSTALLATION OF TECK90 CABLE (0 -1000 V)

.1 Group cables wherever possible on channels.

.2 Install cable concealed, securely supported by hangers.

3.5 INSTALLATION OF

.1 Group cables wherever possible on channels.

3.6 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit.

.2 Ground control cable shield.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for connectors and terminations.

1.2 RELATED SECTIONS

.1 Section 26 05 33 - Raceway and Boxes for Electrical Systems.

1.3 REFERENCES

.1 Canadian Standards Association
.1 CSA C22.2 No.41-13, Grounding and Bonding Equipment.

1.4 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

.2 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Departmental Representative.

PART 2 - PRODUCTS

2.1 CONNECTORS AND TERMINATIONS

.1 Copper compression connectors to CSA C22.2 No 41 as required sized for conductors.

.2 Junction boxes with respective pothead for conductor cables in accordance with Section 26 05 33.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Bond and ground as required to CSA C22.2 No.41.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 26 05 01.

1.2 REFERENCES

.1 Institute of Electrical and Electronics Engineers (IEEE).
.1 IEEE 837-2014, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for grounding equipment and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for grounding equipment for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect grounding equipment.
.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.

.2 Copper conductor: minimum 6 m long for each concrete encased electrode, bare, stranded, soft annealed, size as required.

.3 Grounding conductors: bare stranded copper, soft annealed, size as required.

.4 Insulated grounding conductors: green, copper conductors, size as required.

.5 Ground bus: copper, size as required, complete with insulated supports, fastenings, connectors.

.6 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
- .1 Grounding and bonding bushings.
- .2 Protective type clamps.
- .3 Bolted type conductor connectors.
- .4 Thermit welded type conductor connectors.
- .5 Bonding jumpers, straps.
- .6 Pressure wire connectors.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for grounding equipment installation in accordance with manufacturer's written instructions.
- .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

3.1 EXAMINATION (Cont'd)

.1 (Cont'd)

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION GENERAL

.1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Use mechanical connectors for grounding connections to equipment provided with lugs.

.5 Soldered joints not permitted.

.6 Install bonding wire for flexible conduit, connected at both one ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.7 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.8 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.

3.3 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Frames of motors, starters, control panels, panels.

3.4 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00.

3.4 FIELD QUALITY CONTROL (Cont'd)

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 - GENERAL

1.1 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

.2 Remove from site and dispose of all 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.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.

.5 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - PRODUCTS

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted or suspended.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Secure equipment to masonry, tile and plaster surfaces with lead anchors.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.

3.1 INSTALLATION (Cont'd)

.5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.6 Fasten exposed conduit or cables to building construction or support system using straps.
.1 One-hole malleable iron steel straps to secure surface conduits and cables 53 mm and smaller.
.2 Two-hole steel straps for conduits and cables larger than 53 mm.
.3 Beam clamps to secure conduit to exposed steel work.

.7 Suspended support systems.
.1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
.2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.10 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.

.12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)
.1 CSA C22.1-15, Canadian Electrical Code, Part 1.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:
.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 JUNCTION AND PULL BOXES

.1 Construction: welded steel enclosure.

.2 Covers Flush Mounted: 25 mm minimum extension all around.

.3 Covers Surface Mounted: screw-on flat edge covers.

PART 3 - EXECUTION

3.1 SPLITTER INSTALLATION

.1 Mount plumb, true and square to building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.

.3 Install terminal block as indicated in Type T cabinets.

.4 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

3.3 IDENTIFICATION

.1 Equipment Identification: to Section 26 05 00.

.2 Identification Labels: size 2 nameplate.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)
.1 CSA C22.1-15, Canadian Electrical Code, Part 1, 23rd Edition.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 01.

.2 Submit samples for floor box in accordance with Section 01 33 01.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00.

.2 Waste Management and Disposal:
.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 GALVANIZED STEEL OUTLET BOXES

.1 One-piece electro-galvanized construction.

.2 Single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

.4 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.5 Extension and plaster rings for flush mounting devices in finished walls.

2.3 CONDUIT BOXES

.1 Cast FS or FD boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

2.4 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

3.1 INSTALLATION (Cont'd)

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.

.5 Vacuum clean interior of outlet boxes before installation of wiring devices.

.6 Identify systems for outlet boxes as required.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Adhere to the latest Canadian Standards Association (CSA International)
.1 CAN/CSA-C22.2 No. 18.2-06 (R2011), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
.2 CAN/CSA-C22.2 NO. 18.1-13, Metallic Outlet Boxes.
.3 CAN/CSA-C22.2 No. 18.3-12,Conduit, Tubing, and Cable Fittings (Tri-National standard, with ANCE NMX-J-017 and UL 514B).
.4 CSA C22.2 No. 56-13, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
.5 CSA C22.2 No. 83 - M1985 (2013), Electrical Metallic Tubing.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product data: submit manufacturer's printed product literature, specifications and datasheets.
.1 Submit cable manufacturing data.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

PART 2 - PRODUCTS

2.1 CONDUITS

.1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

.2 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

2.2 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 53 mm and smaller.
.1 Two hole steel straps for conduits larger than 53 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 3 m on centre.

.4 Threaded rods, 6 mm diameter, to support suspended channels.

2.3 CONDUIT FITTINGS

.1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.

.2 Ensure factory "ells" where 90 degrees bends for 27 mm and larger conduits.

.3 Watertight connectors and couplings for EMT.
.1 Set-screws are not acceptable.

2.4 FISH CORD

.1 Polypropylene.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.

3.2 INSTALLATION (Cont'd)

.3 Surface mount conduits on existing concrete wall and columns.

.4 Use rigid galvanized steel threaded conduit except where specified otherwise.

.5 Use electrical metallic tubing (EMT) above 2.4 m not subject to mechanical injury.

.6 Use flexible metal conduit for connection to motors in dry areas connection to recessed fixtures without prewired outlet box connection to recessed fluorescent fixtures, work in movable metal partitions.

.7 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.8 Install conduit sealing fittings in hazardous areas.
.1 Fill with compound.

.9 Minimum conduit size for lighting and power circuits: 21 mm.

.10 Bend conduit cold:
.1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.11 Mechanically bend steel conduit over 21 mm diameter.

.12 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.13 Install fish cord in empty conduits.

.14 Run 2-25 mm spare conduits up to ceiling space and 2-25 mm spare conduits down to ceiling space from each flush panel.
.1 Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface type box.

.15 Remove and replace blocked conduit sections.
.1 Do not use liquids to clean out conduits.

.16 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on suspended channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.5 CLEANING

.1 Proceed in accordance with Section 01 74 11.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA International
.1 CSA C22.2 No.42-10 (R2015), General Use Receptacles, Attachment Plugs and Similar Devices.
.2 CAN/CSA-C22.2 No.42.1-13, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
.3 CSA C22.2 No.55-15, Special Use Switches.
.4 CSA C22.2 No.111-10 (R2015), General-Use Snap Switches (Bi-national standard, with UL 20).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for wiring devices and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for wiring devices for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect wiring devices from nicks, scratches, and blemishes.

1.4 DELIVERY, STORAGE AND HANDLING (Cont'd)

.3 (Cont'd)
.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 SWITCHES

.1 15A, 120V, single pole, double pole, three-way, switches to: CSA C22.2 No.55 and CSA C22.2 No.111.

.2 Manually-operated general purpose AC switches with following features:
.1 Terminal holes approved for No. 10 AWG wire.
.2 Silver alloy contacts.
.3 Urea or melamine moulding for parts subject to carbon tracking.
.4 Suitable for back and side wiring.
.5 Ivory on drywall and Brown on existing concrete walls toggle.

.3 Toggle operated fully rated for tungsten filament, LED, and fluorescent lamps, and up to 80% of rated capacity of motor loads.

.4 Switches of one manufacturer throughout project.

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA C22.2 No.42 with following features:
.1 Ivory Brown urea moulded housing.
.2 Suitable for No. 10 AWG for back and side wiring.
.3 Break-off links for use as split receptacles.
.4 Eight back wired entrances, four side wiring screws.
.5 Triple wipe contacts and rivetted grounding contacts.

.2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:
.1 Ivory in drywalls and Brown in concrete walls urea moulded housing.

2.2 RECEPTACLES (Cont'd)

.2 (Cont'd)
.2 Suitable for No. 10 AWG for back and side wiring.
.3 Four back wired entrances, 2 side wiring screws.

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles of one manufacturer throughout project.

2.3 COVER PLATES

.1 Cover plates for wiring devices to: CSA C22.2 No.42.1.

.2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.3 Stainless steel, vertically brushed, 1 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.

.4 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

2.4 SOURCE QUALITY CONTROL

.1 Cover plates from one manufacturer throughout project.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wiring devices installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

3.1 EXAMINATION (Cont'd)

.1 (Cont'd)
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Switches:
.1 Install single throw switches with handle in "UP" position when switch closed.
.2 Install switches in gang type outlet box when more than one switch is required in one location.
.3 Mount toggle switches at height in accordance with Section 26 05 01.

.2 Receptacles:
.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
.2 Mount receptacles at height in accordance with Section 26 05 01.
.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
.4 Install GFI type receptacles as indicated.

.3 Cover plates:
.1 Install suitable common cover plates where wiring devices are grouped.
.2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.3 Repair damage to adjacent materials caused by wiring device installation.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA International (CSA)
.1 CSA C22.2 No. 5-13, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE-2010).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store circuit breakers in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect circuit breakers.
.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers, and ground-fault circuit-interrupters: to CSA C22.2 No. 5.

2.1 BREAKERS GENERAL (Cont'd)

.2 Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

2.2 THERMAL MAGNETIC BREAKERS DESIGN A

.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install circuit breakers as required.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

3.3 CLEANING (Cont'd)

.3 (Cont'd)

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

END OF SECTION

PART 1 - GENERAL

1.1 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00.

1.2 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 DISCONNECT SWITCHES

.1 Non-fusible, disconnect switch in CSA Enclosure 1R, size as indicated.

.2 Provision for padlocking in off switch position by locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Quick-make, quick-break action.

.5 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01.

.2 Indicate name of load controlled on Size 4 nameplate.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses if applicable.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 American National Standards Institute (ANSI)
.1 ANSI C82.1-2004 (R2015), American National Standard for Lamp Ballasts - Line Frequency Fluorescent Lamp Ballasts.

.2 Institute of Electrical and Electronics Engineers
.1 IEEE C62.41.1-2002(R2008), Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.

.3 ASTM International Inc.
.1 ASTM F1137-11e1, Standard Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.4 ICES-005-(09), Radio Frequency Lighting Devices.

.5 Underwriters' Laboratories of Canada (ULC)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Provide complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Departmental Representative.
.3 Photometric data to include: VCP Table where applicable.

.3 Quality assurance submittals: provide following in accordance with Section 01 45 00.
.1 Manufacturer's instructions: provide manufacturer's written installation instructions and special handling criteria, installation sequence and cleaning procedures.

1.3 QUALITY ASSURANCE

.1 Provide mock-ups in accordance with Section 01 45 00 where required.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse and return of pallets and packaging materials in accordance with Section 01 74 20.

.4 Divert unused metal materials from landfill to metal recycling facility.

.5 Disposal and recycling of fluorescent lamps as per local regulations.

.6 Disposal of old PCB filled ballasts.

PART 2 - PRODUCTS

2.1 LAMPS

.1 Incandescent lamps to be - clear, A19, 100W with 1000 hour lamp life, rough-service rated; or as indicated.

.2 Tungsten halogen lamps to be - clear, T-3, 300 Watt, RSC base, 2000 hour lamp life, 5000 lumens; or as indicated.

.3 Fluorescent lamps to be - T8, 32 Watt, medium bi-pin, rapid-start, 4100K, 30,000 hour lamp life, 2950 initial lumens, CRI 85; or as indicated.

2.2 BALLASTS

.1 Fluorescent ballast: CBM and CSA certified, energy efficient type, IC electronic; IC electronic dimmable.
.1 Rating: voltage as indicated, for use with 2-32W, rapid start lamps or as indicated.
.2 Totally encased and designed for 40 degrees Celsius ambient temperature.

2.2 BALLASTS (Cont'd)

.1 (Cont'd)
.3 Power factor: minimum 95% with 95% of rated lamp lumens.
.4 Current crest factor: 1.7 maximum.
.5 Harmonics: 10% maximum THD.
.6 Operating frequency of electronic ballast: 20kHz minimum.
.7 Total circuit power: 62 Watts.
.8 Ballast factor: greater than 0.90.
.9 Sound rated: Class A.
.10 Mounting: integral with luminaire.

2.3 FINISHES

.1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.

2.4 OPTICAL CONTROL DEVICES

.1 As indicated in luminaire schedule.

2.5 LUMINAIRES

.1 As indicated in luminaire schedule.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Locate and install luminaires as indicated.

.2 Provide adequate support to suit ceiling system.

3.2 WIRING

.1 Connect luminaires to lighting circuits:
.1 Install flexible or rigid conduit for luminaires as indicated.

3.3 LUMINAIRE SUPPORTS

.1 For suspended ceiling installations support luminaires independently of ceiling.

3.4 LUMINAIRE ALIGNMENT

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line.

3.4 LUMINAIRE ALIGNMENT (Cont'd)

.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.5 CLEANING

.1 Clean in accordance with Section 01 74 11.
.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA International
.1 CSA C22.2 No.141-15, Emergency Lighting Equipment.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for emergency lighting and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for emergency lighting for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect emergency lighting from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 35 21.

1.4 DELIVERY, STORAGE AND HANDLING (Cont'd)

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 20.

1.5 WARRANTY

.1 For batteries in this Section 26 52 00 - Emergency Lighting, 12 months warranty with a life expectancy of 120 months (10 years).

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 Emergency lighting equipment: to CSA C22.2 No.141.

.2 Supply voltage: 120V, AC.

.3 Output voltage: 12V DC. (to match existing).

.4 Operating time: 30 60120 minutes.

.5 Battery: sealed, maintenance free.

.6 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01 V for plus or minus 10% input variations.

.7 Solid state transfer circuit.

.8 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.

.9 Signal lights: solid state, for 'AC Power ON' and 'High Charge'.

.10 Lamp heads: integral on unit remote, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: quartz halogen LED, 12 W, minimum 200 lumen minimum output.

.11 Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.

2.1 EQUIPMENT (Cont'd)

.12 Finish: to match existing.

.13 Auxiliary equipment:
.1 Test switch.
.2 Time delay relay.
.3 Battery disconnect device.
.4 AC input and DC output terminal blocks inside cabinet.
.5 Shelf Bracket.
.6 Cord and single twist-lock plug connection for AC.
.7 RFI suppressors.

2.2 WIRING OF REMOTE HEADS

.1 Conduit: type EMT, in accordance with Section 26 05 34.

.2 Conductors: RW90 type in accordance with Section 26 05 21, sized as indicated in accordance with manufacturer's recommendations.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for emergency lighting installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install unit equipment and remote mounted fixtures.

.2 Direct heads.

.3 Connect exit lights to unit equipment.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20 and Section 01 35 21.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by emergency lighting installation.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Adhere to the latest Canadian Standards Association (CSA International)
.1 CSA C22.2 No.141-15, Unit Equipment for Emergency Lighting.
.2 CAN/CSA-C860-11 (R2016), Performance of Internally Lighted Exit Signs.

.2 National Fire Protection Association (NFPA)
.1 NFPA 101 - 2015, Life Safety Code.

.3 Underwriters Laboratories of Canada (ULC)
.1 ULC/ORD-924, Standard for Emergency Lighting and Power Equipment.
.2 CAN/ULC-S572-10, First Edition Standard for Photoluminescent and Self-Luminous Exit Signs and Path Marking Systems.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Submit WHMIS MSDS - Material Safety Data Sheets.

.4 Quality Assurance Submittals: submit following in accordance with Section 01 45 00.
.1 Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

.5 Submit manufacturer's written material warranty for lumination of photo-luminescent exit signs. For the Work of this Section 26 53 00 - Exit Lights, the 12 months warranty period prescribed in subsection GC 3.13 of General Conditions is extended to 25 years.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 STANDARD UNITS

.1 Exit lights: to CSA C22.2 No.141 and CSA C860.

.2 Housing: Die-cast aluminum semi-recessed back box for mounting on ceiling and/or wall.

.3 Lamps: one strip LED-2.5W module 120V, 50,000 hours.

.4 Operation: designed for 50,000 hours of continuous operation without relamping.

.5 Downlight: translucent acrylic in bottom of unit.

.6 Face plate to remain captive for relamping.

2.2 DESIGN X1

.1 Ceiling recessed mounting.

.2 Double face with edge-lit face plate to remain captive for relamping.

.3 Arrow: See drawing for detail.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install exit lights to manufacturer's recommendations, listing requirements, NFPA standard and local regulatory requirements.

.2 Connect fixtures to exit light circuits.

3.2 INSTALLATION (Cont'd)

.3 Ensure that exit light circuit breaker is locked in on position.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 11.

.2 Clean photoluminescent sign face with a non-abrasive cloth dampened with water. Do not use any chemical solvents.

.3 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

.1 Supply and install a complete new telecommunications grounding and bonding system linking main telecommunications room, and remote telecom rooms located within 32 Church Street, St. Catharines, Ontario.

.2 Provide grounding & bonding in accordance with good industry practices and in accordance with the following codes and standards.
.1 CSA C22.2 No.41-13 - Grounding & Bonding Equipment
.2 J-STD-607-A - Commercial Building Grounding (Earthing) and Bonding Requirements For Telecommunications
.3 ANSI/TIA/EIA-569-B - Telecommunications Pathways and Spaces

.3 IEEE std 1100-2005 Recommended Practice for Powering and Grounding Electronic Equipment (Emerald Book):
.1 Ontario Electrical Safety Code.
.2 Canadian Electrical Code.
.3 Ontario Building Code.
.4 Local Codes & Bylaws.
.5 BICSI requirements.

1.2 PRODUCT

.1 All components of the grounding & bonding infrastructure shall be by Harger or equivalent.

.2 Typical part numbers are as follows:
.1 Rack Grounding Strips - Part# RGBVKIT145872A.
.2 Rack Jumper Kits - Part# GJ series.
.3 Thread forming screws shall be used. Part # SMS0126SHWZ.

.3 A green jacketed #6 AWG stranded copper conductor shall be used to bond the telecommunications grounding system to all:
.1 Telecommunications Cabinets
.2 Telecommunications Racks
.3 Telecommunications Cable Tray (if required)
.4 Metallic sheath of all backbone cables (use appropriate manufacturer's bond clamp).

1.3 EXECUTION

.1 MTGB AND TGB'S shall be installed at rack height. Refer to accompanying drawings for locations.

.2 The contractor shall ensure that there is complete metal-to-metal contact is made when grounding to painted or powder coated metal surfaces.

.3 A properly sized copper grounding busbar and associated hardware shall be installed in each of the telecommunications spaces by Contractor. The busbar shall be bonded to a separate permanent and continuous ground throughout the telecommunications room.

.4 A Main Telecommunications Grounding Busbar (MTGB) shall be provided in main Data/Telephone Room. The TGB shall be mounted on insulated supports on the walls of the each Telecommunications Space Room. MTGB must be sized ot allow connection of TBB and individual rack/cabinet and tray grounding for room. MTGB must have 25% spare mounting capacity for future cabinets and racks.

.5 A Telecommunications Grounding Busbar (TGB) shall be provided in each Telecommunications Room. The TGB shall be mounted on insulated supports on the walls of the each Telecommunications Space Room. The minimum dimensions are to be 53mm (2 IN.) tall, 300mm (12 IN.) long and 7mm (1/4 IN.) thick.

.6 TGB's and MTGB shall be drilled to allow use of dual lug grounding connectors.

.7 Grounding & bonding infrastructures installed by the contractor shall not interfere with the existing grounding practices within the customer premises.

.8 The contractor shall provide one (1) rack jumper kit for each piece of network equipment as depicted on rack elevation drawings.

.9 The contractor shall utilize thread forming screws, bonding screws & any other hardware necessary to complete the ground system.

1.3 EXECUTION (Cont'd)

.10 All telecommunications equipment shall be bonded and grounded to the provided grounding system as per ANSI/TIA/EIA-J-STD-607.

.11 A minimum 3/0 AWG stranded copper conductor shall be used to bond MTGB and TGB's to each other and to main building ground.

.12 Bonding conductors must not be laid on ceiling tiles. All bonding conductors must be supported for entire run, using separate support than that provided for telecommunications cables.

END OF SECTION

PART 1 GENERAL

1.1 SYSTEM DESCRIPTION

.1 Provide a complete Telecommunications raceway system consisting of outlet boxes, cover plates, conduits, cabletroughs, pull boxes, sleeves and caps, backboards, fish wires, service poles, and service fittings, required to make a complete and operative system.

.2 The system shall be provided to the requirements of the local telephone company, interconnect company, City of St. Catharines and all other authorities having jurisdiction.

.3 Install the empty raceway system, including pullstrings, terminal cabinets, outlet boxes, pull boxes, conduit, sleeves and caps, cabletroughs, miscellaneous and positioning material to constitute a complete system. Co ordinate with other services.

.4 Supply all labour, materials, tools and equipment required to complete the installation in accordance with the full intent of the drawings and specifications.

.5 Provide all work in accordance with codes and manufacturers recommendations

.6 All pathways including conduits, innerduct and cable tray shall be installed parallel or perpendicular to building lines.

1.2 RELATED WORK

.1 Plywood Backboards: Section 26 05 15.

.2 Conduits, Conduit Fastenings and Conduit Fittings: Section 26 05 34.

.3 Splitters, Junction, Pull Boxes and Cabinets: Section 26 05 31.

.4 Outlet Boxes, Conduit Boxes and Fittings: Section 26 05 32.

.5 Wiring Devices: Section 26 27 26.

PART 2 - PRODUCTS

2.1 MATERIAL

.1 Conduits: In accordance with Section 26 05 34 Conduits, Conduit Fastenings and Conduit Fittings.

.2 Cabletroughs: In accordance with Section 27 05 28 Pathways for Communications Systems.

.3 Junction boxes and cabinets: In accordance with Section 26 05 31 Splitters, Junction, Pull Boxes and Cabinets.

.4 Outlet boxes, conduit boxes and fittings: In accordance with Section 26 05 32 Outlet Boxes, Conduit Boxes and Fittings.

.5 Coverplates: In accordance with Section 26 27 26 - Wiring Devices.

.6 Fish wire: polypropylene type, minimum 3/8" (9 mm) dia.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install the raceway system, including wire and cable, terminal cabinets, outlet boxes, pull boxes, cover plates, conduit, sleeves and caps, cabletroughs, miscellaneous and positioning material to constitute a complete system. Co-ordinate with other services.

.2 Conduits shall not have more than 2 90 deg. or equivalent bends (total maximum of 180 degrees) in each run between pull points, with the bending radii not less than ten (10) times the internal conduit dia.

.3 Pull boxes shall be provided in each conduit run of over 108.3' (33 m) at not less than 108.3' (33 m) intervals.

3.1 INSTALLATION (Cont'd)

.4 All material raceways, terminal boards, etc. shall be to the size and number shown and shall also suit the telephone company requirements. Submit all plans to telephone and interconnect company for verification.

.5 No pull elbows or LB's are permitted. Only sweep or 90° elbows shall be utilized.

.6 All conduit and sleeve ends shall be fitted with plastic bushings.

.7 Pull boxes shall be provided with hinged access covers. 24"(610mm)x 24"(610mm) access panels shall be provided where pull boxes are installed in inaccessible ceilings. Pull boxes for vertical conduits shall be installed to provide straight pass through for vertical cables. The size of pull boxes shall be 8 times the size of the inside diameter size of the largest conduit entering the pull box, except pull boxes for 4" conduits shall be 30"(762mm)x 24"(610mm)x 6"(152mm) in size.

.8 Conduits for computer systems shall comply with Enterprise Infrastructure Solutions (EIS) standards.

3.2 HANGARS

.1 Anchors for hangers must not be drilled into post-tensioned beams under any circumstances.

.2 Hangers & supports shall be sized to accommodate the number of cables in each run. Other hardware such as hammer on clamps, screw on clamps and angled hanger brackets to support the backbone and/or horizontal cabling shall be included.

.3 Additional hangars and/or supports shall be provided for any cable bundles running vertically for a distance greater than 2' (e.g. between overhead tray and cabinets/racks).

3.3 CONDUIT

.1 Electrical Metallic Tubing (EMT) of the sizes indicated shall be installed.

.2 Conduit extending from outlet to cable tray/raceway shall be a minimum of 3/4"(in) unless the cables exceed a 40% fill ratio.

3.3 CONDUIT (Cont'd)

.2 Conduit extending from outlet to cable tray/raceway shall be a minimum of 3/4"(in) unless the cables exceed a 40% fill ratio.

.3 No conduit shall be smaller than 3/4"(in) unless specifically detailed in this document.

.4 Standard for workstation outlets shall be double gang box with minimum of 25 mm (1") conduit from outlet to raceway, unless stated otherwise.

.5 No more than two - 90° bends, or a maximum of 180 degree bends in total, in conduit between pull points. Provide a pull box for every 30 m 100'(ft) of conduit. Pull boxes are not to be used as bends.

.6 Conduits of 50mm 2"(in) or less to have a bend radius of six (6) times the conduit diameter. A conduit greater than 50mm 2" (in) to have a bend radius of ten (10) times the conduit diameter.

.7 All conduits shall be labelled at each end indicating the destination.

.8 Run all conduits parallel or perpendicular to building grid lines.

.9 Slots and sleeves to extend a minimum of 50 mm 2"(in) above the finished floor.

.10 Conduits shall protrude a minimum of 76 mm 3"(in) into rooms through walls.

.11 Conduits shall not compromise HVAC ducting or sheet metal work.

.12 Electro metallic tubing (EMT) shall conform to CSA C22.2 No.83.

.13 Conduit and wall boxes to be supplied and installed by Division 16 unless expressly requested in this document.

.14 Pull boxes shall not be used as bends/turns.

.15 Bush, ream and remove any sharp projections on all conduits. Slots and sleeves to extend a minimum of 5 cm (2") above the finished floor. Firestop all floor and wall slots/sleeves to maintain floor/wall fire rating after installation of all cables.

3.3 CONDUIT (Cont'd)

.15 Bush, ream and remove any sharp projections on all conduits. Slots and sleeves to extend a minimum of 5 cm (2") above the finished floor. Firestop all floor and wall slots/sleeves to maintain floor/wall fire rating after installation of all cables.

.16 Conduits shall not compromise any other building systems.

.17 All conduit shall have 3mm polypropylene, minimum, fish cords installed. Cabling Contractor to restore any pull strings used by contractor for any part of installation of telecommunications cabling system included in this document.

3.4 CONDUIT FASTENING

.1 One hole malleable iron, hot dipped galvanized straps to secure surface mounted conduits.

.2 Beam clamps to secure conduits to exposed steel members.

.3 Provide 12 gauge galvanized steel channel type supports for two or more conduits on minimum 1500 mm centres. Use suitable conduit clamps in channel.

.4 Threaded rod with a minimum dia. of 6mm shall be used to support the suspended channels.

3.5 CONDUIT FITTINGS

.1 Fittings manufactured for use with the conduit specified with the same coating as conduit.

.2 Provide insulated steel Rain Tight connectors and couplings for all EMT conduits 50 mm 2" (in) and smaller.

.3 All 4" (in) conduit shall have proper conduit waterfalls installed.

3.6 WIRE MESH CABLE TRAY

.1 Cable trays shall be sized (including 10% growth) as per the drawings and will accommodate all horizontal and/or backbone cabling within the Telecommunications Room as well as entering/existing the Telecommunications Room.

3.6 WIRE MESH CABLE TRAY

.1 Cable trays shall be sized (including 10% growth) as per the drawings and will accommodate all horizontal and/or backbone cabling within the Telecommunications Room as well as entering/existing the Telecommunications Room.

.2 All material to properly install the cable tray shall be provided. The cable tray system shall accommodate the weight of the horizontal and/or backbone cabling. The rung spacing shall be between 6" (in) 152 mm to 8" (in) 203 mm.

.3 Provide horizontal elbows, end plates, vertical risers and drops, tees, wyes, expansion joints and reducers where required.

.4 Ensure wire tray edges do not exert stress on cables where cables change direction in trays.

.5 Provide waterfalls or transitions where cables exit trays in a downward direction (e.g. above cabinets/racks.

.6 Wire mesh cable tray shall be manufactured from round steel wire that is a minimum of .196" (5 mm) in diameter. Wires shall be welded at intersections to form a 2" x 4" (50.8 mm x 101.6mm) grid pattern. The tray shall be U-shaped with equal height sidewalls.

.7 Individual tray sections will be 10' (3048mm) or 5' (1524mm) long and 4" (101.6mm), 6" (152.4mm), 8" (203.2mm), 12" (304.8mm), 16" (406.4mm), 18" (457.2mm), 20" (508mm), or 24" (609.6mm) wide. Sidewalls will be 2" (50.8mm), 4" (101.6mm) or 6" (152.4mm) high.

.8 Tray ends will be formed downward at 90° to allow easy drop-in installation with approved supports.

.9 Wire mesh cable tray will be hot dipped galvanized after fabrication.

.10 Wire mesh cable tray will be UL Classified for grounding purposes.

.11 Provide all components of the tray system (tray, supports, splices, fasteners, waterfalls, and accessories) from a single manufacturer.

3.6 WIRE MESH CABLE TRAY (Cont'd)

.12 Wire mesh cable tray shall be secured to the structural ceiling, building truss system, wall or floor using manufacturer's recommended supports and appropriate hardware as defined by local code or the authority having jurisdiction (AHJ).

.13 When the pathway is overhead, wire mesh cable tray shall be installed with a minimum clearance of 12" (304.8 mm) above and below (between above and below (between tray and top of rack/cabinet) the tray. Leave 12" (304.8 mm) in between the tray and ceiling/building truss structure. Multiple tiers of wire mesh cable tray shall be installed with a minimum clearance of 12" (304.8 mm) in between the trays. When in between the trays. When located above an acoustical drop ceiling, wire mesh cable tray shall be installed a minimum of 3" (75 mm)above the drop ceiling tiles.

.14 When installed under a raised floor, wire mesh cable tray shall be installed with a minimum 1" (25 m)clearance between the top of the tray and the bottom of the floor tiles or floor system stringers, whichever are lower in elevation. Maintain a 3"(75 mm) clearance between trays wherever trays cross over.

.15 Wire mesh cable tray shall be supported every 5' (150 cm) or less in accordance with ANSI/EIA/TIA-569-A. Supports may be located directly under splices or intersections if recommended by the manufacturer's installation instructions. If supports are not located under splices or intersections, wire mesh cable tray shall be supported within 2' (60 cm) on both sides of every splice or intersection. Support wire mesh cable tray on both sides of every change in elevation.

.16 Secure wire mesh cable tray to each support with a minimum of one fastener. Follow the manufacturers' recommended assembly, splice and intersection-forming practices.

.17 Trays shall be supported by hangars on each side of tray at maximum 5' (150 cm) intervals. Trays shall be supported by hangars within 6" (152.4 mm)of end of tray.

3.6 WIRE MESH CABLE TRAY (Cont'd)

.18 Use installation tools recommended by the manufacturer to field fabricate wire mesh cable tray intersections and changes in elevation. Use side-action bolt cutters with an offset head to cut wire mesh cable tray. Use a bending tool to form the ends of cut sections downward at 90° to allow easy drop-in installation with approved supports.

.19 Wire mesh cable tray shall be bonded to the Telecommunications Grounding Busbar (TGB) using an approved ground lug on the wire basket tray and a minimum #6 grounding wire or as recommended by the AHJ. Verify bonds at splices and intersections between individual cable tray sections and supports. Cable pathway shall be electrically continuous through bonding and attached to the TGB.

.20 The quantity of cables within the tray will not exceed a whole number The quantity of cables within the tray will not exceed a whole number value equal to 50% of the interior area of the tray divided by the cross-sectional area of the cable. Cable fill will not exceed the depth of the cable tray's side rail 2" (50 mm), 4" 101.6 mm) or 6" (152.4mm).

.21 The combined weight of cables within the tray will not exceed stated load capacity in manufacturer's specifications.

.22 Separate different media type within the tray. Treat each type of media separately when determining cable fill limits.

.23 Acceptable manufacturers:
.1 Manufacturer not specified.
.2 Tray shall be of wire basket tray type.

3.6 WIRE MESH CABLE TRAY (Cont'd)

.24 Basket Tray sizes:

.1 For the purposes of this specification the Basket tray installed in accessible corridors and ceiling spaces will be 12" x 2" (305 x 50). Basket tray in the IT Rooms will be a minimum size of 12" x 4" (305 x 102). Supports will be as recommended by the tray manufacturer to support the weight of the installed cabling without sagging of the trays over time. Consult manufacturers fill charts for confirmation of tray sizes and submit during shop drawing process.

3.7 WIRE MESH CABLE TRAY SUPPORTS

.1 Supports will be sized at minimum to match the width of the wire mesh cable tray that is supported. The support may be wider than wire mesh cable tray.

.2 Support design will allow the support to be placed under a wire mesh cable tray at any point mid-span or directly under a pathway splice or intersection.

.3 Each support will be punched with an alternating round hole-pattern that accepts wire mesh cable tray ends which are formed downward at 90° and self-threading splice plate attachment hardware.

.4 When placed directly under a splice or intersection, the support will allow drop-in attachment of cable tray. Splice hardware will simultaneously splice cable trays and secure wire mesh cable trays to the support.

.5 Supports will be manufactured from steel extrusion and/or sheet.

.6 Wire Mesh Cable Tray Supports will be hot dipped galvanized after fabrication.

3.8 WIRE MESH CABLE TRAY SPLICES AND FASTENERS

.1 Provide a method of simultaneously splicing, bonding and securing intersecting wire mesh cable tray sections to supports when supports are placed directly under a wire mesh cable tray pathway at a splice point, intersection point, or at the beginning or end of a change in elevation.

3.8 WIRE MESH CABLE TRAY SPLICES AND FASTENERS (Cont'd)

.2 Provide a method of splicing and bonding wire mesh cable tray sections together at a splice point or an intersection point that is not located directly over a support.

.3 Provide a method for bonding and securing wire mesh cable tray to supports when supports are placed mid-span (in between a splice or intersection point) along a wire mesh cable tray pathway.

.4 Provide a method for attaching wire mesh cable tray directly to the top of racks and cabinets.

.5 Provide a method for attaching wire mesh cable tray supports to raised floor pedestals.

.6 Provide a method for attaching a bonding conductor to the wire mesh cable tray.

3.9 WIRE MESH CABLE TRAY ACCESSORIES

.1 Provide a divider to separate cable tray into multiple pathways where required. The divider shall be the same height as the sidewalls of the cable tray.

.2 Provide a bend radius to connect the sidewalls of adjoining wire mesh cable tray wherever a splice or an intersection in the cable tray pathway results in a 4" 101.6 mm), or wider gap between or wider gap between the sidewalls. The bend radius shall be the same height as the sidewalls of the wire mesh cable tray.

.3 Provide a radius drop to form cable over a smooth curve wherever cable exits or enters the side, bottom or end of wire mesh cable tray.

.4 Wire mesh cable tray accessories will be manufactured from steel extrusion and/or sheet.

.5 Wire mesh cable tray accessories will be pre-galvanized before fabrication.

3.10 WIRE MESH CABLE TRAY INSTALLATION TOOLS

.1 Provide specialized cutting and forming tools required for field fabrication of wire mesh cable tray pathways.

3.10 WIRE MESH CABLE TRAY INSTALLATION TOOLS (Cont'd)

.2 Provide specialized tools required for pulling cable around turns, bends or intersections in wire mesh cable tray pathway.

.3 Wire Mesh Cable Tray Support - Installation Hardware:
.1 Provide installation hardware to attach wire mesh cable tray supports to building structure.

3.11 HANGERS

.1 Supply and install Caddy hangers, hanger supports and any other miscellaneous hardware required to support telecommunications cabling where conduit/ladder tray has not been provided.

.2 Panduit J-Pro (or equivalent) hangers are to be used every 4' (ft) 1.2 m.

3.12 INNERDUCT FOR FIBRE OPTIC CABLES

.1 Innerduct is to be appropriately rated to comply with fire codes.

.2 Innerduct shall be sized appropriately to maintain the 40% fill ratio.

.3 All fastening hardware is to be included.

.4 Supply and install innerduct any exposed runs (not in conduit) of fibre optic cable.

.5 The innerduct shall be fastened to the building support when installed in the ceiling space.

.6 The innerduct shall be fastened to the backboard, rack or cabinet by utilizing cradle mounts and plastic permanent cable ties.

3.13 EXECUTION

.1 The Pathways for Communications Cabling shall be installed per instructions in this document and in accordance with prevailing standards and codes.

.2 Identify to site supervisor, and resolve issues with any location where cable pathways fail to meet separation clearances as detailed in this document, prior to start of cable path installation.

3.13 EXECUTION (Cont'd)

.2 Identify to site supervisor, and resolve issues with any location where cable pathways fail to meet separation clearances as detailed in this document, prior to start of cable path installation.

.3 Maintain the following clearances from electrical and heat sources when installing conduits for data/telephone cables.

MINIMUM SEPARATION DISTANCES

ITEM	**(<2kVA)**	**(2-5kVA)**	**(>5kVA)**
Unshielded power lines or electrical equipment in proximity to open or non-metallic pathway.	127 mm 5"(in))	305 mm (12"(in))	610 mm (24"(in))
Unshielded power lines or electrical equipment in proximity to a grounded metal conduit pathway.	64 mm (2.5"(in))	152 mm (6"(in))	305 mm (12"(in)
Power lines enclosed in a grounded metal conduit (or equivalent shielding) in proximity to a grounded metal conduit.	-----	76 mm (3"(in))	152 mm (6"(in))
Motors		1.2 m (4'-0")	
Transformers		1.2 m (4'-0")	
Conduit and cables used for electrical distribution less than 1kV.		0.3 m (1'-0")	
Conduit and cables used for electrical distribution greater than 1kV.		1.0 m (3'-0")	
Fluorescent luminaires		300 mm (12")	
Pipes (gas, oil, water, etc.)		120 mm (5")	
HVAC (equipment, ducts, etc.)		150 mm (6")	
Coax (CATV/CCTV)	Separate conduits or metallic divider in cable tray (do not run Cat6A and coax in same pathways.		

3.13 EXECUTION (Cont'd)

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes:
.1 Materials and installation for "existing" fire alarm systems as required.
.2 Description of existing control panel and any required modifications to facilitate the renovation to carry out fire alarm and protection functions including receiving alarm signals, initiating general two-stage alarm, supervising system continuously, actuating zone annunciators, and initiating trouble signals.
.3 Update existing FACP, annunciator(s) and active graphic on fire alarm PC to reflect all the changes under this renovation.
.1 Trouble signal devices
.2 Power supply facilities.
.3 Manual alarm stations.
.4 Automatic alarm initiating devices.
.5 Audible signal devices.
.6 End-of-line devices.
.7 Annunciators.
.8 Visual alarm signal devices.
.9 Ancillary devices.

.2 Related Sections:
.1 Section 26 05 01.

1.2 REFERENCES

.1 Government of Canada
.1 TB OSH Chapter 3-03, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-03, Standard for Fire protection Electronic Data Processing Equipment.
.2 TB OSH Chapter 3-04, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-04, Standard for Fire Alarm Systems.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
.1 Material Safety Data Sheets (MSDS).

.3 Underwriter's Laboratories of Canada (ULC)
.1 CAN/ULC-S524-14, Standard for the Installation of Fire Alarm Systems.
.2 CAN/ULC-S525-2016, Audible Signal Device for Fire Alarm Systems.

1.2 REFERENCES (Cont'd)

.3 (Cont'd)
.3 CAN/ULC-S526-2016, Visual Signal Devices for Fire Alarm Systems.
.4 CAN/ULC-S528-2014, Manual Pull Stations for Fire Alarm Systems.
.5 CAN/ULC-S529-2016, Smoke Detectors for Fire Alarm Systems.
.6 CAN/ULC-S530-M91, Heat Actuated Fire Detectors for Fire Alarm Systems.
.7 CAN/ULC-S1001-11, Standard for Integrated Systems Testing of Fire Protection and Life Safety Systems.

.4 National Fire Protection Agency
.1 NFPA 72 - 2016, National Fire Alarm Code.
.2 NFPA 90A-2016, Installation of Air Conditioning and Ventilating Systems.
.3 NFPA 20.

1.3 SUBMITTALS

.1 Product Data:
.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00.
.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00.

.2 Shop Drawings:
.1 Submit shop drawings in accordance with Section 01 33 00.
.1 Shop drawings: stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
.2 Include:
.1 Layout of equipment.
.2 Zoning.
.3 Complete wiring diagram, including schematics of modules.

.3 Quality assurance submittals: submit following in accordance with Section 01 33 00.
.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
.2 Instructions: submit manufacturer's installation instructions.

1.3 SUBMITTALS (Cont'd)

.3 (Cont'd)

.3 Manufacturer's Field Reports: manufacturer's field reports specified.

.4 Closeout Submittals:

.1 Submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 in accordance with NFPA 20.

.2 Authority of Jurisdiction will delegate authority for review and approval of submittals required by this Section.

.3 Submit to Authority of Jurisdiction 2 sets of approved submittals and drawings immediately after approval but no later than 15 working days to prior to final inspection.

.4 Submit following:

.1 Manufacturer's Data for:

.1 Manual pull stations.

.2 Heat detectors.

.3 Open-area smoke detectors.

.4 Alarm bells with recessed box and grille to match existing.

.5 Visible appliances.

.6 Mark data which describe more than one type of item to indicate which type will be provided.

.7 Submit 1 original for each item and clear, legible, first-generation photocopies for remainder of specified copies.

.2 System wiring diagrams:

.1 Submit complete wiring diagrams of system showing points of connection and terminals used for electrical connections in the system.

.3 Design data: Power Calculations:

.1 Submit design calculations for new work specified to substantiate that battery capacity exceeds supervisory and alarm power requirements.

.4 Schedules:

.1 Conductor wire marker schedule.

.5 Test Reports:

.1 Open-area 2-wire smoke detectors.

.2 Preliminary testing:

.1 Final acceptance testing.

.2 Submit for inspections and tests specified under Field Quality Control.

1.4 QUALITY ASSURANCE

.1 Qualifications:
.1 Installer: company or person specializing in fire alarm system installations with 5-years documented experience approved by manufacturer.

.2 Provide services of representative or technician from manufacturer of system, experienced in installation and operation of type of system being provided, to supervise installation, adjustment, preliminary testing, and final testing of system and to provide instruction to project personnel.

.3 Extra Materials:
.1 Provide maintenance materials in accordance with Section 01 78 00.

.4 Maintenance Service:
.1 Provide one year's free maintenance with two inspections by manufacturer during warranty period. Inspection tests to conform to CAN/ULC-S536. Submit inspection report to Departmental Representative.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:
.1 Deliver, store and handle in accordance with Section 01 61 00.
.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Waste Management and Disposal:
.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.

.2 Audible signal devices: to CAN/ULC-S525.

.3 Visual signal devices: to CAN/ULC-S526.

2.1 MATERIALS (Cont'd)

.4 Thermal detectors: to CAN/ULC-S530.

.5 Smoke detectors: to CAN/ULC-S529.

2.2 "**EXISTING**" SYSTEM OPERATION

.1 Two stage operation: operation to actuation following:
.1 Manual station.
.2 Heat detector.
.3 Smoke detector.

.2 Actuation of two stage operation device to initiate following:
.1 Audible signal devices throughout building to sound at 20 strokes per minute.
.2 Audible signal devices in zone of alarm and adjacent zones on same floor level zones on floor level immediately above and floor level immediately below to sound continuously while other audible signal devices throughout building sound at 20 strokes per minute.
.3 Zone of alarm to be indicated on control panel and remote annunciator.
.4 Transmit signal to fire department via fire alarm transmitter monitoring station.
.5 Air conditioning and ventilating fans to shut down or to function so as to provide required control of smoke movement.
.6 Fire doors and smoke control doors if normally held open, to close automatically.
.7 Electro-magnetic door holders to de-energize.
.8 Operations to remain in alarm mode (except alarm notification appliances if manually silenced) until system is manually restored to normal.

.3 Operation of alarm initiating device on second stage to:
.1 Cause audible signal devices throughout building to sound continuously.

.4 Capability to program smoke detector status change confirmation on any or zones in accordance with CAN/ULC-S527, Appendix C.

2.3 CONTROL PANEL

.1 Existing control panel to remain. Modify as required to suit the renovation.

2.3 CONTROL PANEL (Cont'd)

.2 Two stage operation.

.3 Zoned Non-zoned.

2.4 AUTOMATIC ALARM INITIATING DEVICES

.1 Heat detectors: provide heat detectors as indicated designed for detection of fire by combination fixed temperature rate-of-rise rate compensating line-type fixed temperature principle.

.2 Open-Area Smoke Detectors: provide detectors designed for detection of abnormal smoke densities by photoelectric principle.
.1 Detectors: 4-wire type.
.2 Provide necessary control and power modules required for operation integral with control panel.
.3 Detectors and associated modules: compatible with control panel and suitable for use in supervised circuit.
.4 Malfunction of electrical circuits to detector or its control or power units to result in operation of system trouble signals.
.5 Equip each detector with visible indicator lamp that will flash when detector is in normal standby mode and glow continuously when detector is activated.
.6 Provide remote indicator lamps for each detector that is locatedabove suspended ceilings, beneath raised floors, concealed from view.
.7 Each detector: plug-in type with tab-lock or twist-lock, quick disconnect head and separate base in which detector base contains screw terminals for making wiring connections.
.8 Detector head: removable from its base without disconnecting wires. Removal of detector head from its base to cause activation of system trouble signals.
.9 Screen each detector to prevent entrance of insects into detection chamber(s).

.3 Photoelectric Detectors: operate on light scattering principle using LED light source.
.1 Detector: respond to both flaming and smoldering fires.

2.4 AUTOMATIC ALARM INITIATING DEVICES (Cont'd)

.4 Locate detectors in accordance with their listing by ULC and the requirements of NFPA 72, except provide at least 2 detectors in rooms of 54 square meters or larger in area.

.5 Mount detectors at underside of ceiling or deck above unless otherwise indicated.
.1 For mounting heights greater than 3 m above floor level, reduce actual detector linear spacing from listed spacing as required by NFPA 72.
.2 For heights greater than 9 m space detectors no farther apart than 34 % of their listed spacing.

.6 Temperature rating of detectors: in accordance with NFPA 72.

.7 Locate detectors minimum 300 mm to lighting fixtures and not closer than 600 mm to air supply or return diffuser.

.8 Ensure detectors, located in areas subject to moisture or exterior atmospheric conditions or hazardous locations as defined by NFPA 70, are approved for such locations.

.9 Provide detectors with terminal screw type connections.

.10 Removal of detector head from its base to cause activation of system trouble signals if detectors are provided with separable heads and bases.

2.5 ALARM INITIATING DEVICE SPACING AND LOCATION

.1 Detector spacing and location: in accordance with manufacturer's recommendations and requirements of NFPA 72.

.2 Provide at least 2 detectors in rooms of 54 square meters or larger.

.3 Spacing: not to exceed 9 m by 9 m per detector, and 9 linear m per detector along corridors.

.4 Locate detectors minimum 0.9 from air discharge or return grille, and not closer than 300 mm to lighting fixtures.

2.5 ALARM INITIATING DEVICE SPACING AND LOCATION (Cont'd)

.5 In areas without finished ceilings, mount detectors at underside of deck above unless otherwise indicated.

2.6 NEW AUDIBLE SIGNAL DEVICES TO MATCH EXISTING

.1 Audible device(s):
.1 Bells: recessed mounted, single stroke, polarized, 24 V dc, 150 mm, 95db.

.2 Do not exceed 80 percent of listed rating in amperes of notification appliance circuit. Provide additional circuits above those shown if required to meet this requirement.

.3 Provide appliances specifically listed for outdoor use in locations exposed to weather.

.4 Finish appliances in red enamel.

.5 For surface mounting provide appliance manufacturer's approved back box. Back box finish to match appliance finish.

2.7 END-OF-LINE DEVICES

.1 End-of-line devices to control supervisory current in alarm circuits and signalling circuits, sized to ensure correct supervisory current for each circuit. Open , short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel and remotely as indicated.

.2 Replace end of line devices to facilitate the renovation.

2.8 GRAPHIC ANNUNCIATOR PANEL

.1 Provide revised graphic to reflect the renovation in the existing panel located as shown.

2.9 VISUAL ALARM SIGNAL DEVICES

.1 Surface mounted assembly of stroboscopic type suitable for use in electrically supervised circuit and powered from notification appliance circuits.

2.9 VISUAL ALARM SIGNAL DEVICES (Cont'd)

.2 Appliances: minimum of 110 candela measured as approved by ULC, but not less than effective intensity required by National Building Code of Canada for appliance spacing and location shown.

.3 Protect lamps with thermoplastic lens and labelled "FIRE" in letters at least 12 mm high.

.4 Provide visible appliances within 300 mm of each audible appliance as indicated.

.5 Visible appliances may be part of audio-visual assembly, where more than two appliances are located in same room or corridor.

2.10 CONDUIT

.1 Electrical Metallic Tubing (EMT).

2.11 WIRING

.1 Wire for 120V circuits: No. 12 AWG minimum solid copper conductor.

.2 Wire for low voltage DC circuits: No. 14 AWG minimum solid copper conductor

.3 Insulation 75 degrees C minimum with nylon jacket.

.4 Colour code wiring.

2.12 ANCILLARY DEVICES

.1 Remote relay unit to initiate fan shutdown.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install systems in accordance with CAN/ULC-S524.

.2 Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1 m of air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts.

.3 Connect alarm circuits to main control panel.

.4 Locate and install signal bells chimes horns and visual signal devices and connect to signalling circuits.

.5 Connect signalling circuits to main control panel.

.6 Locate and install remote relay units to control fan shut down.

3.3 FIELD QUALITY CONTROL

.1 Site Tests:

.1 Perform tests in accordance with Section 26 05 00 and CAN/ULC-S537.

.2 Fire alarm system:

.1 Test each device and alarm circuit to ensure manual stations, detectors transmit alarm to control panel and actuate alarm.

.2 Check annunciator panels to ensure zones are shown correctly.

.3 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of system.

.4 Class A circuits.

.1 Test each conductor on circuits for capability of providing alarm signal on each side of single open-circuit fault condition imposed near midmost point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

3.3 FIELD QUALITY CONTROL (Cont'd)

.1 (Cont'd)

.2 (Cont'd)

.2 Test each conductor on circuits for capability of providing alarm signal during ground-fault condition imposed near midmost point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

.5 Class B circuits.

.1 Test each conductor on circuits for capability of providing alarm signal on line side of single open-circuit fault condition imposed at electrically most remote device on circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

.2 Test each conductor on circuits for capability of providing alarm signal during ground-fault condition imposed at electrically most remote device on circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

.3 Verification requirements in accordance with Section 01 61 00, include:

.1 Materials and resources.

.2 Storage and collection of recyclables.

.3 Construction waste management.

.4 Resource reuse.

.5 Recycled content.

.6 Local/regional materials.

.7 Low-emitting materials.

3.4 TRAINING

.1 Arrange and pay for on-site lectures and demonstrations by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

3.5 CLEANING

.1 Proceed in accordance with Section 01 74 11.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

APPENDICES

PART 1 - GENERAL

1.1 REPORTS

.1 A copy of the following report(s) are appended to this Document:

Load Check for High Density Filing System, Ground Floor
32 Church Street, St. Catharines, Ontario
Prepared by: WSP Canada Inc.
Dated: July 27, 2016
3 pages

Asbestos Product Re-Assessment and Designated Substances Survey
Government of Canada Building
32 Church Street, St. Catharines, Ontario
Complex #500350
Prepared by: OH Solutions
Project No.: 16-0786
Dated: August 26, 2016
227 pages

.2 The reports, by their nature, cannot reveal all conditions that exist or can occur on the site. Should subsurface conditions be found to vary substantially from the report, immediately notify Departmental Representative in writing and await instructions.

.3 Contractor shall not be entitled to extra payment or extension of Contract Time for work which is required and which is reasonably inferable in the report(s) as being necessary.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

Load Check for
High Density Filing System

161-08093-00

July 27, 2016

Taylor Hazell Architects Ltd.
333 Adelaide Street W., Fifth Floor
Toronto, Ontario M5V 1R5

Attn: Karen Sekikawa **Email: ksekikawa@taylorhazell.com**

Dear Karen,

Re: 32 Church Street, St. Catharines, Ontario
Load Check for High Density Filing System, Ground Floor

As requested, our office has reviewed the capacity of the existing structure for the proposed installation of a high density filing system on ground floor. Our assessment, including documents reviewed and limitations, is summarized in this letter.

1. DOCUMENTS REVIEWED

- Base building structural drawing S5 prepared by R. A. Hanright Consulting Engineer and dated October 1954
- Architectural floor plan A300 prepared by Taylor Hazell Architects Ltd. and dated May 3, 2016

2. OBSERVATIONS

Based on the available drawings noted above, the ground floor structure consists of a 4" thick reinforced concrete flat slab, supported by a 12"x24" reinforced concrete joists, and 18"x30" concrete beams support by columns. No design loads are noted on the drawings.

Based on the provided information, we understand that the filing system is located on the ground floor between gridlines 10 & 11 and G & H. According to the above specifications, the proposed high density filing system weights a total of 13,189 lbs, including media over a footprint area of 150 ft². The weight is distributed over three rails 33" apart running in east-west direction, with a maximum load per rail of 300 lbs/ft.

3. ASSESSMENT

The capacity of the existing floor structure was reviewed in accordance with the 2015 National Building Code. Based on the above information, it is our opinion that the base building structure has the capacity to support the additional loads imparted by the high density filing system. However we noted that this assessment is sensitive to the location and direction of the rails. In its current configuration, this criteria is met, but our office should be notified if there will be a change to the location or direction of the rails. Refer to the attached SK-1 for the approximate location of the filing system.

WSP Canada Inc.
2300 Yonge Street, Suite 2300
Toronto, Ontario, Canada

Phone: +1 416-487-5256
Fax: +1 416-487-9766
www.wspgroup.com

4. LIMITATIONS

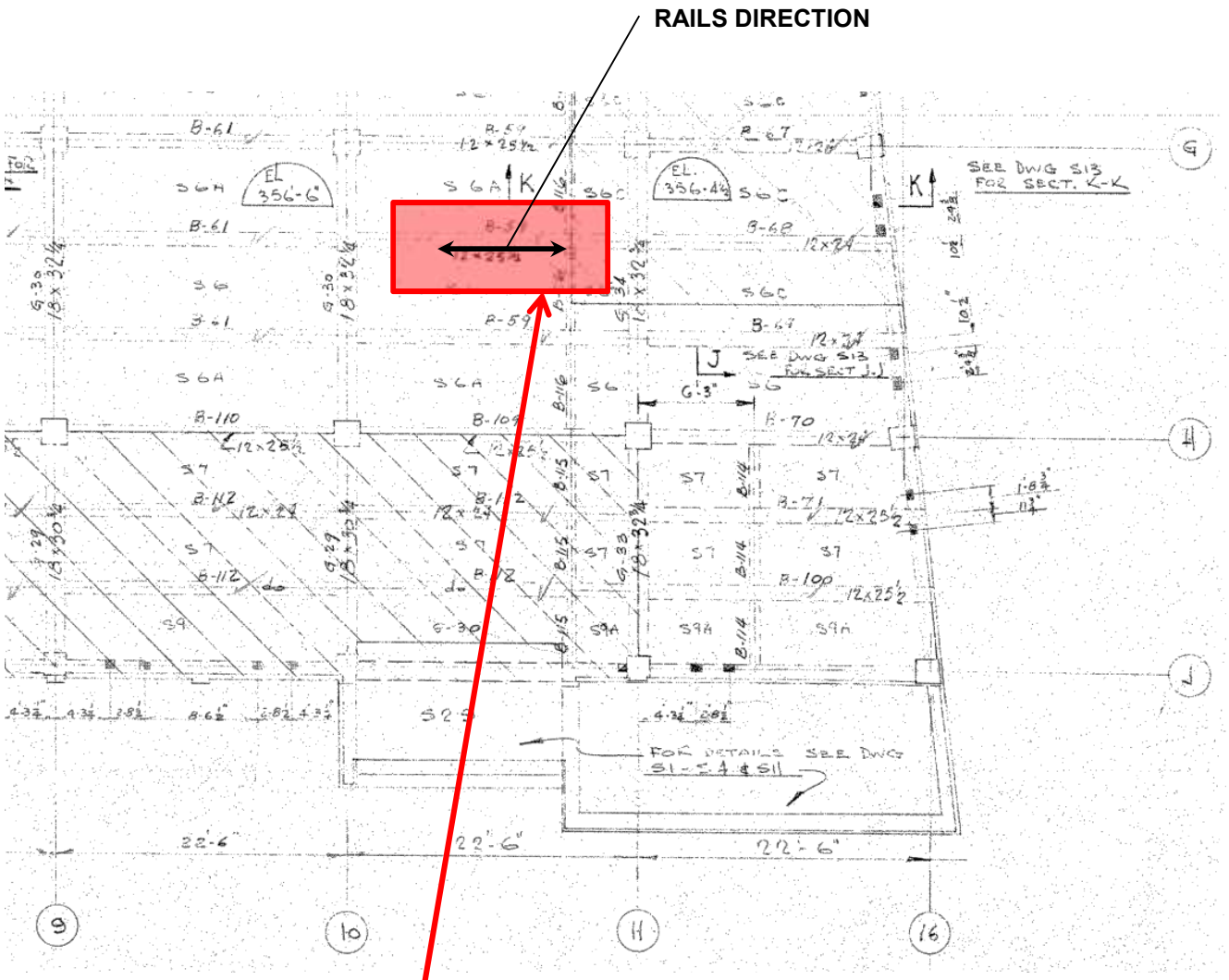
- The existing building is assumed to be in sound condition, with no evidence of structural damage or distress.
- Documents provided for our assessment represent the as built condition.
- Any user accepts that decisions made or actions taken based upon interpretation of our work are the responsibility of only the parties directly involved in the decisions or actions.
- No party other than the Client shall rely on the Consultant's work without the express written consent of the Consultant, and then only to the extent of the specific terms in that consent. Any use which a third party makes of this work, or any reliance on or decisions made based on it, are the responsibility of such third parties.
- The Consultant is not responsible for, or obligated to identify, mistakes or insufficiencies in the information obtained from the various sources, or to verify the accuracy of the information.

We trust that the above information meets your requirements. Feel free to contact me if you have any questions.

Yours very truly,
WSP CANADA INC.

Reza Sharifi, P.Eng.
Project Associate

Transport Canada - HDF Load Check.docx



WSP	**32 CHURCH STREET, ST CATHERINES** **LOAD CHECK FOR HIGH DENSITY FILING SYSTEM**	Date: 27/06/2016	Scale: NTS
		Drawn by: RYS	Checked by: RYS
	PART GROUND FLOOR PLAN	Project No. **161-08093-00**	
	2300-2300 YONGE ST., P.O. BOX 2385, TORONTO, ON CANADA M4P 1E4 PHONE: 416.487.5256 www.wspgroup.ca FAX: 416.487.9766	Drawing No. **SK-1**	

Asbestos Product Re-Assessment and Designated Substances Survey

ASBESTOS PRODUCT RE-ASSESSMENT
AND
DESIGNATED SUBSTANCES SURVEY

GOVERNMENT OF CANADA BUILDING

32 Church Street
St. Catharines, Ontario
Complex # 500350

Prepared for:

Brookfield GIS, c/o PWGSC
4175 14th Avenue
PO BOX 4870
Markham, ON L3R 0J2

August 26th, 2016

OH Solutions Project No.: 16-0786

119 Thames Street, South, Ingersoll ON, Canada, N5C 2T3
T: +1.519.485.2500 F: 866.700.4975 www.ohsolutions.ca

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APPENDICES

EXECUTIVE SUMMARY

OH Solutions Inc (OHS) was retained by Brookfield Global Integrated Solutions (BGIS) to conduct a survey for Designated Substances (including asbestos) within 32 Church Street in St. Catharines, Ontario (the Site).

The assessment of the building was requested in order to comply with Deputy Minister Directive 057 and the Ontario Ministry of Labour Regulation 278/05 made under the *Occupational Health and Safety Act* (Regulation Respecting Asbestos on Construction Projects and in Buildings and Repair Operations). In addition, as outlined under Section 30 of the Occupational Health and Safety Act, this document is intended to fulfil the owner requirements to determine whether any Designated Substances are present at a project site during tendering and/or before beginning construction. This report should be issued by the constructor to each contractor and sub-contractor.

The assessment of the building included a detailed survey of all accessible areas within the building. This included a visual assessment and evaluation of the various building materials present at the Site, bulk sampling and subsequent analysis of an assortment of building materials and the preparation of a final report.

The Site is a two-story building with full basement. The building has a total footprint of approximately 12,500 square metres and appears to have been constructed in 1956. Significant renovations occurred within the building in 2001 whereby most interior finishes were removed and replaced.

Asbestos-containing parging cement and “aircell” straight run insulation remnants are present within the building. This material was sampled by others during previous assessment and has been assumed to contain asbestos. This material was noted to be in good to poor condition at the time of the assessment.

With the exception of newly renovated areas, the majority of floor tile present at the facility contain asbestos. These products were noted to be in good condition and, therefore, no remediation is required at this time.

Asbestos cement or “Transite” products were not observed during the assessment of the building, however, OHS was informed that this material might be present under the roof flashing.

Vermiculate was not observed during the assessment however based on the buildings age, may be present. If vermiculate is discovered the material should be tested for asbestos content prior to its disturbance.

Samples of roofing felts and caulking suspected to contain asbestos were not submitted for analysis. Sampling of this material should be conducted prior to disturbance.

Lead is present within some painted surfaces and suspected to be a component of solder on copper plumbing fixtures, mortar at brick veneer, wool or caulking in bell/spigot fittings on cast iron piping systems.

Mercury is present in florescent light tubes, thermostats and is suspected within building equipment utilizing mercury switches.

Common construction sand contains free crystalline silica and is present in concrete products, mortar, brick, etc. These construction products are typically found throughout building structures.

Evidence suggesting the presence of acrylonitrile, benzene, isocyanates, arsenic, ethylene oxide, vinyl chloride monomer or coke oven emissions was not observed at the Site.

1.0 INTRODUCTION

OH Solutions Inc (OHS) was retained by Brookfield Global Integrated Solutions (BGIS) to conduct a re-assessment for asbestos-containing materials (friable and non-friable) and a Designated Substances Survey within 32 Church Street in St. Catharines, Ontario (the Site).

As outlined under Section 30 of the Occupational Health and Safety Act, the intent of the assessment is to fulfil the owner requirements to determine whether any Designated Substances are present at a project site during tendering and/or before beginning construction. This report should be issued by the constructor to each contractor and sub-contractor.

In addition, this assessment complies with Deputy Minister Directive 057 and the Ontario Ministry of Labour Regulation 278/05 made under the *Occupational Health and Safety Act* (Regulation Respecting Asbestos on Construction Projects and in Buildings and Repair Operations).

2.0 SURVEY METHODOLOGY

2.1 Methodology

A thorough inspection/walkthrough of the building was conducted. Materials suspected of containing designated substances were visually identified, based on the surveyor's knowledge of the historic composition of building products. Mr. Matthew Garner of OHS performed the fieldwork for this report. While on site OHS personnel conducted the following:

- Characterization the existing building data;
- Determined the approximate quantities, location and condition of accessible asbestos-containing materials and;
- Conducted sampling of representative building materials and finishes

OHS utilized the previous sampling results for the facility. Previous sampling was limited to the building materials described within this report. Asbestos may be present within doors, motors, and other equipment that were not disassembled to determine composition.

If additional sampling was required, sampling for suspected asbestos-containing materials was conducted in accordance with Ontario Regulation 278/05. The regulation outlines the minimum requirement to determine if a homogeneous building material does not contain asbestos (i.e. 1, 3, 5 or 7). The surveyor based the sampling strategy on the buildings age of construction, the buildings phases of construction and renovation information (if any) provided by the client.

Note:

- No destructive testing was performed. The inaccessible spaces within the building were not inspected. This includes areas above plaster and drywall ceilings, as well as shafts, chases and bulkheads. Similarly, motors, doors and other equipment were not disassembled to determine composition. Such items should be considered to have asbestos as a component until destructive testing demonstrates otherwise.

- Vinyl sheet flooring and vinyl floor tiles may be present beneath existing floor coverings.

- Roofing materials such as felt and sealers on flat roofs may contain asbestos. These items are typically not sampled as it may damage the integrity of the roof, resulting in leaks. These items should be tested for the presence of asbestos prior to demolition of roofing or other building components.

2.2 Sample Analysis

Sampling for Designated Substances was previously conducted within the building in 2008 and 2011. OHS has included these results within Appendix I.

Any additional samples were submitted to Crisp Analytical, LLC (CRISP) of Carrollton, Texas, USA. This laboratory is accredited under the National Voluntary Laboratory Accreditation Program (NVLAP) to perform asbestos analysis.

Preliminary identification was made using Polarized Light Microscopy (PLM), with confirmation of presence and type of asbestos made by dispersion staining optical microscopy following the U.S. Environmental Protection Agency's Test Method 600. This analytical procedure conforms to the requirements outlined in Ontario Regulation 278/05. The analytical results are attached within Appendix I.

All other designated substances were identified based on visual assessment and historical usage.

2.3 Drawings

Drawings outlining the locations inspected during the assessment have been presented in Appendix III for reference.

2.4 Asbestos Assessment Criteria

2.4.1 Condition

The condition of asbestos-containing materials is critical to the assessment of hazard. In order to help evaluate the hazard, the following terms and criteria were used:

2.4.1.1 Mechanical Insulation

To evaluate the condition of mechanical insulation (on boilers, breeching, ductwork, piping, tanks, equipment, etc.), the following criteria was applied:

GOOD — Insulation is completely covered in jacketing and exhibits no evidence of damage or deterioration. No insulation is exposed. Includes condition where the jacketing has minor damage (i.e. scuffs or stains) but the jacketing is not penetrated.

FAIR — Minor penetrating damage to jacketed insulation (cuts, tears, nicks, deterioration or delamination) or undamaged insulation that has never been jacketed. Insulation was exposed but not showing surface disintegration. The extent of missing insulation ranges from minor to none. Damage can be repaired.

POOR — Original insulation jacket is missing, damaged, deteriorated or delaminated. Insulation is exposed and significant areas have been dislodged. Damage cannot be readily repaired.

2.4.1.2 Sprayed Applied Fireproofing, Insulation and Texture Finishes

To evaluate the condition of surfacing material such as fireproofing, non-mechanical thermal insulation and texture finishes, the following criteria was applied:

GOOD Surface of material shows no significant signs of damage, deterioration or delamination. Up to one (1) percent visible damage to surface was allowed within range of GOOD. GOOD condition includes unencapsulated or unpainted fireproofing or texture finishes, where no delamination or damage is observed and encapsulated fireproofing or texture finishes where the encapsulation has been applied after the damage or fallout occurred.

POOR Sprayed materials show signs of damage, delamination or deterioration. More than one (1) percent damage to surface of ACM spray.

In observations where damage exists in isolated locations, both GOOD and POOR conditions may be applicable. FAIR condition is not utilized in the evaluation of the fireproofing, non-mechanical insulation or texture coat finishes.

2.4.1.3 Non-friable and Potentially Friable Materials

The condition of non-friable or potentially friable ACM, such as plaster finishes, drywall compound, ceiling tiles, asbestos cement products, vinyl asbestos and asbestos paper backed vinyl sheet flooring, which have the potential to become friable when handled were evaluated as follows:

GOOD No significant damage. Material may be cracked or broken but is stable and not likely to become friable upon casual contact. If there is no friable debris present, the condition is rated as GOOD.

POOR Material is severely damaged. Loose debris is present or binder has disintegrated to the point where the material has become friable.

The evaluation of the condition of non-friable or potentially friable materials does not utilize a FAIR condition rating.

2.4.1.4 Asbestos-Containing Debris

The presence of fallen debris was noted separately from the presumed asbestos-containing source material. Debris is considered to be in POOR condition.

2.4.2 Accessibility

For each component four (4) categories of accessibilities were used:

A Accessible to all occupants of the building;
B Accessible to maintenance staff without a ladder;
C Accessible to maintenance staff with a ladder; and,
D Not accessible without demolition or removal of fixed building components or building systems.

2.4.3 Remedial Action

Recommended actions for compliance and for the management of the ACM were classified under the following eight (8) actions:

1. Action dealing with the immediate cleanup of fallen ACM likely to be disturbed.

2. Action dealing with the need to use Type 2 asbestos procedures to enter an area (other than a ceiling space).

3. Action dealing with performing asbestos removal for compliance with the regulations.

4. Action for dealing with Type 2 asbestos procedures for ceiling entry where friable ACM debris is present on top of a ceiling system.

5. Action dealing with the removal of asbestos that goes beyond compliance requirements but simplifies the asbestos management.

6. Action dealing with the repair of asbestos.

7. Action dealing with ACM surveillance requirements of the regulations.

8. Action for dealing with material that may contain asbestos but not conclusively identified in the survey.

3.0 REGULATORY REQUIREMENTS

As stipulated under Directive 057, Public Works and Government Services Canada shall ensure the control of asbestos containing materials (ACM). The responsibilities of the department, as building owner, tenant, landlord and employer, with respect to safety and health issues and environmental control issues, shall be fully addressed and in accordance with the Canada Labour Code. part II, the Canada Occupational Safety and Health Regulations, Part X - Hazardous Substances, and applicable provincial and territorial occupational health and safety and environmental protection legislation.

As outlined under Section 30 of the Occupational Health and Safety Act, the intent of the assessment is to fulfil the owner requirements to determine whether any Designated Substances are present at a project site during tendering and/or before beginning construction. This report should be issued by the constructor to each contractor and sub-contractor.

Designated Substances are regulated under Ontario Regulation 490/09. This regulation outlines the occupational exposure limits (OELs) for each Designated Substance. While construction projects are generally exempt, the OELs establish an Ontario standard for worker protection.

In addition to Ontario Regulation 490/09, Asbestos is regulated under O. Reg. 278/05, Asbestos on Construction Projects and in Buildings and Repair Operation, as amended. Disposal of asbestos waste is subject to waste management regulations under Ontario Regulation 347/90, as amended. As outlined in the regulation, materials containing 0.5% or more asbestos (by dry weight) are considered asbestos-containing material and must follow the appropriate removal procedures as outlined in the regulation. The regulation classifies all disturbance of asbestos as Type 1, Type 2 or Type 3, each of which is associated with defined work practices.

The Ministry of Labour has issued drafted guidelines for control of lead and silica exposures on construction projects. The Guideline for Lead on Construction Projects and the Guideline for Silica on Construction Projects should be adhered to during construction projects in order to protect the health and safety of workers.

Unlike asbestos-containing materials, the MOL does not have a standard to state what percentage of lead or silica a material must have to be considered lead or silica-containing. Procedures that provide an equivalent level of protection should, therefore, be implemented on construction projects where exposure to lead and silica is possible.

It should be noted that The Environmental Abatement Council of Ontario has published a guideline (Lead Guideline for Construction, Renovation, Maintenance or Repair, 2014) that establishes a de minimis (i.e. virtually safe) level of lead in paint or surface coatings where a hazard would not likely be present. This guideline recommends procedures to protect against lead exposure when concentrations of lead in paint exceed 0.1% by weight, but suggests that finishes with concentrations below 0.1% by weight do not require lead specific precautions provided the material is not disturbed in an aggressive manner (e.g. grinding or sandblasting) and that general dust control is adequate.

4.0 RESULTS

4.1 Building Description

The Site is a two-story building with full basement. The building has a total footprint of approximately 12,500 square metres and appears to have been constructed in 1956. Significant renovations to the building occurred in 2001 whereby most interior finishes were removed and replaced.

4.2 Asbestos-containing Materials

The results of the previous and current sampling for asbestos-containing materials are included as Appendix I. The following is a summary of the asbestos-containing materials that were encountered during the survey of the building. A more detailed summary of the asbestos-containing materials and Designated Substances observed are provided in Appendix II – Room-By-Room Asbestos Materials Summary. OHS recommendations pertaining to the building materials described below are provided in Section 5 of this report.

4.2.1 Sprayed Fireproofing (Friable)

Sprayed fireproofing was observed within the Main Floor CCRA space. This material was installed during the 2001 renovation and has been assumed to not contain asbestos.

4.2.2 Textured Finish (Friable)

Textured ceiling finishes were not observed during the assessment.

4.2.3 Mechanical Insulation (Friable)

The following types of insulation were observed:

"Asbestos parging cement", a mixture of cement and asbestos fibre has been applied to elbows, tees, valves (fittings) is present within this facility and was previously sampled by others and contain asbestos.

Remnants of "Aircell", a white corrugated paper has been applied to straight run mechanical piping systems. This material has previously been sampled by others and contains asbestos.

The above materials were noted to be in poor to good condition at the time of the assessment. Locations where asbestos-containing mechanical insulation has been identified during our assessment are listed in Appendix II – Room-By-Room Asbestos Materials Summary.

4.2.4 Acoustic Ceiling Tile (Non-Friable)

Four (4) distinct types of ceiling tiles were identified as suspect ceiling tile. Three (3) samples were collected from each type during the original assessment (Sample Groups 02, 03, 04 and 05). All samples collected were non-asbestos.

4.2.5 Plaster (Friable)

Seven (7) representative samples of plaster finishes were collected and submitted for analysis (Sample Group 07). None of the samples submitted contain asbestos.

Textured plaster was sampled from Room 19A. This material does not contain asbestos (Sample Group OHS-05)

4.2.6 Drywall (Non-Friable)

Drywall compound used on walls within the Old Forms Storage Room (Location 10) were collected for laboratory analysis during our original assessment. Five (5) representative samples were submitted for analysis and do not contain asbestos (Sample Group 08).

4.2.7 Vinyl Sheet Flooring (Non-Friable)

The sheet flooring present within the building was installed during the 2001 renovations and is not suspected to contain asbestos.

4.2.8 Vinyl Floor Tile (Non-Friable)

With the exception of newly renovated area, vinyl floor tiles were sampled throughout the building.

Historically, 9”x9” floor tiles have contained asbestos. Where observed, these floor tiles have been assumed to contain asbestos.

Floor tiles that contain asbestos were sampled from the following locations

- Room 27A (OH-01 3% chrysotile asbestos)
- Room 27 (OH-02 3% chrysotile asbestos)
- Room 22 (OH-03 2% chrysotile asbestos)
- Room 44 (OH-07 2% chrysotile asbestos)

The I.T Storage room (Location 28) was not accessible at the time of the assessment. These floor tiles have been assumed to contain asbestos.

The floor tiles observed at the facility are currently in good condition.

The flooring mastic was sampled from Room 19A (OHS-04). This material contains 3% chrysotile asbestos and is currently in good condition.

The beige floor tiles located in the basement kitchen have been removed but had not been replaced at the time of the assessment (Location 20). Three (3) samples of the original floor tile were submitted for analysis during our original assessment and contained trace (i.e. less than 0.1%) amounts of asbestos in the floor tile and associated mastic used to adhere the tile to the flooring substrate.

The floor tiles located within Room 42 were sampled during the re-assessment and do not contain asbestos (Sample Group OHS-06).

Locations with asbestos-containing vinyl floor tile are identified within the Room-By-Room Asbestos Materials Summary in Appendix II.

4.2.9 Asbestos Cement Products (Non-Friable)

Asbestos cement or “Transite” products were not observed during the assessment of the building; however, OHS was informed that this material may be present under the roof flashing.

4.2.10 Asbestos Paper Products (Non-Friable)

No asbestos paper products were observed during building survey.

4.2.11 Vermiculite Insulation (Friable)

No loose fill vermiculite insulation was observed, however, it should be noted that this material may be present in inaccessible spaces such as cores of concrete blocks.

4.2.12 Window Caulking and Roofing Felts/Tar (Non-Friable)

Samples of roofing felts and window caulking suspected to contain asbestos were not submitted for analysis.

4.2.13 Other ACM

The walls of the existing cafeteria were once covered in carpet. The carpet has since been removed, however, the mastic used to adhere the carpet to the walls remains. This material was sampled during our original assessment (Sample Group 06) and does not contain asbestos.

The presence of asbestos is possible in the following materials: material components or insulation within electrical switchgear, motors, lights, etc.; mechanical packings and pipe gaskets; plastic laboratory benches; moulded chair seats or other plastic products; fire door cores; window putty or caulking. Asbestos textile may have been used as vibration dampers with ductwork. No testing of these products has been performed.

4.3 Lead

Several samples of paint suspected to contain lead were submitted for analysis during the original assessment. Lead was not detected in the majority of samples submitted for analysis. A summary of the sampling conducted in 2008 is provided below. The results of the sampling have been attached within Appendix I.

Summary of 2008 Lead Paint Sampling Results

Sample	Description	Weight (%)
L-01	Beige/Yellow Paint, Location 01	0.0270
L-02	Grey Floor Paint, Location 01	0.0747
L-03	General White Paint, Location 28	<0.0189
L-04	Off Green/Blue, Location 09	<0.0405
L-05	Light Pink, Location 18	<0.0238
L-06	Pale Green, Location 35	0.0626
L-07	White Paint on Drywall, Location 19	<0.0247
L-08	Green Wall Paint, Location Main Floor	<0.0260
L-09	Beige Paint, Location 91	0.1510

OH Solutions submitted additional samples during the 2016 re-assessment. A summary of those results is presented below.

Summary of 2016 Lead Paint Sampling Results

Sample	Description	Weight (%)
L-01	Off White Wall Paint– Location 27a	<0.0179
L-02	Cream Wall Paint – Boiler Room	<0.0244

Lead is also suspected to be a component of the following:

- Solder on copper plumbing fixtures
- Mortar at brick veneer
- Lead wool or caulking in bell/spigot fittings on cast iron piping systems
- Lead-acid batteries

Sampling of the above was not conducted.

4.4 Mercury

The presence of mercury has been identified within fluorescent light tubes and is suspected within building equipment utilizing mercury switches. Mercury-containing thermostats were also identified in Location 01, Boiler Room, and may be present in various other locations

4.5 Silica

Common construction sand contains free crystalline silica and is present in concrete products, mortar, brick, etc. These construction products are typically found throughout building structures.

4.6 Acrylonitrile, Benzene, Isocyanates, Arsenic, Ethylene Oxide, Vinyl Chloride and Coke Oven Emissions

Evidence suggesting the presence of acrylonitrile, benzene, isocyanates, arsenic, ethylene oxide, vinyl chloride monomer or coke oven emissions was not observed at the Site.

5.0 CONCLUSIONS

Asbestos-containing parging cement and “aircell” straight run insulation remnants are present within the building. This material was sampled by others during previous assessment and has been assumed to contain asbestos. This material was noted was noted to be in good to poor condition at the time of the assessment.

Asbestos-containing floor tile and mastic are present within the building and are currently in good condition.

Asbestos cement or “Transite” products were not observed during the assessment of the building, however, OHS was informed that this material might be present under the roof flashing.

Samples of roofing felts and window caulking suspected to contain asbestos were not submitted for analysis.

No other asbestos-containing materials were identified during the assessment.

Lead is present within some painted surfaces and suspected to be a component of solder on copper plumbing fixtures, mortar at brick veneer, wool or caulking in bell/spigot fittings on cast iron piping systems.

Mercury is present in florescent light tubes, thermostats and is suspected within building equipment utilizing mercury switches.

Common construction sand contains free crystalline silica and is present in concrete products, mortar, brick, etc. These construction products are typically found throughout building structures.

6.0 RECOMMENDATIONS

6.1 Asbestos Management Plan

Since asbestos-containing materials have been identified in this facility, it is subject to the requirement for an Asbestos Management Program, as specified under Ontario Regulation 278/05.

Where an owner knows that asbestos-containing materials has been used in the building, the owner shall,

(a) Prepare and maintain on the premises a record of the location of the material,

(b) Give any other person who is an occupier of the building written notice of any information in the record that relates to the area occupied by the person,

(c) Give any employer with whom the owner arranges or contracts for work written notice of the information in the record, if the work,

  (i) may involve material mentioned in the record, or

  (ii) may be carried on in close proximity to such material and may disturb it;

(d) Advise the workers employed by the owner who work in the building of the information in the record, if the workers may do work that,

  (i) involves material mentioned in the record, or

  (ii) is to be carried on in close proximity to such material and may disturb it;

(e) Establish and maintain, for the training and instruction of every worker employed by the owner who works in the building and may do work;

(f) Inspect the material mentioned and update the survey at reasonable intervals (annually) or whenever the owner becomes aware of new information relating to the matters within the survey.

6.2 Specific Recommendations

A summary of recommendations regarding individual building material which may contain asbestos is provided below. All potentially disturbed asbestos-containing materials must be removed and disposed of in accordance with Ontario Regulation 278/05 and Ontario Regulation 558/00 prior to building renovation and demolition.

6.2.1 Mechanical Insulation (Friable)

Some of the piping systems remain within inaccessible spaces such as above plaster and drywall ceilings. Due to the age of building construction, asbestos-containing mechanical insulation may be present within these spaces.

Previous sampling conducted by others confirms the presence of asbestos within remnants of parging cement on elbows and ”aircell” straight run insulation. Some of this material is in good to poor condition and should be repaired or removed. Refer to the “Room-by-Room Asbestos Summary” located in Appendix II and “Recommended Remedial Work” located in Appendix IV for specific locations.

Any activity, which will disturb asbestos-containing mechanical insulation, is governed by the procedures outlined in Ontario Regulation 278/05. The disturbance of less than one (1) square metre of asbestos-containing mechanical insulation may be performed as a Type 2 operation, while any greater disturbance requires Type 3 precautions.

6.2.2 Vinyl Floor Tiles (Non-Friable)

The asbestos-containing vinyl floor tiles and associated flooring mastic are in good condition and do not require remediation.

Vinyl floor tiles may be removed, with manually powered tools, following the Type 1 procedures outlined in Ontario Regulation 278/05. The use of powered equipment on non-friable asbestos materials, an activity which could result in the release of airborne fibres, must be performed under Type 3 precautions.

6.2.3 Asbestos Cement Products (Non-Friable)

Asbestos cement or "Transite" products were not observed during the assessment of the building, however, OHS was informed that this material might be present under the roof flashing.

Any activity, which will disturb asbestos-containing cement products, is governed by the procedures outlined in Ontario Regulation 278/05. Transite may be removed, with manually powered tools, following the Type 1 procedures outlined in Ontario Regulation 278/05. The use of powered equipment on non-friable asbestos materials, an activity which could result in the release of airborne fibres, must be performed under Type 3 precautions.

6.2.4 Roofing Materials and Exterior Caulking (Non-Friable)

Sampling of roofing materials and exterior caulking was not included as part of the assessment. These materials should be tested for asbestos content prior to disturbance.

6.2.5 Vermiculate (Friable)

OHS did not observe vermiculate during the assessment however may be present. If vermiculate is discovered the material should be tested for asbestos content prior to its disturbance.

6.3 Lead

Lead is present within some painted surfaces and suspected to be a component of solder on copper plumbing fixtures, mortar at brick veneer, wool or caulking in bell/spigot fittings on cast iron piping systems.

Only the beige paint sample collected from Location 1 contained lead concentrations above 0.1%. Based on the 2014 EACO Guideline, painted surfaces with leads concentrations above 0.1% by weight require lead specific precautions.

The remaining paint samples contained lead concentrations below 0.1% and therefore do not require lead specific precautions provided the material is not disturbed in an aggressive manner (e.g. grinding or sandblasting) and that general dust control procedures are provided.

Elevated airborne lead levels can result when uncontrolled work procedures such as drilling, cutting, removing, grinding, etc. are used on lead-based materials. The control of dust levels during the demolition of the buildings can be accomplished through proper work practices to reduce overall dust levels and providing workers with proper personal protective equipment.

OHS recommends the work procedures and personal protective equipment outlined within the EACO document 'Lead Guideline for Construction, Renovation, Maintenance or Repair' (2014) be utilized during the disturbance or handling of the material.

In addition, OHS recommends that lead-containing materials scheduled for demolition and subsequent disposal undergo Leachate Toxicity testing as outlined in Ontario Regulation 347/90 (as amended).

6.4 Mercury

Mercury is present in florescent light tubes, thermostats and is suspected within building equipment utilizing mercury switches at this facility.

Exposure to airborne mercury is regulated under the Designated Substances regulation titled, *Ontario Regulation 490/09, Designated Substances*. Mercury waste must be handled and disposed of according to Ontario Regulation 347, as amended, and may be subject to Leachate Criteria (Schedule 4) of this regulation.

6.5 Silica

Disturbance of materials containing silica will occur during demolition activities. Elevated airborne silica levels can result when uncontrolled work procedures such as drilling, cutting, removing, grinding, etc. are used on silica-containing materials.

OHS recommends the work procedures and personal protective equipment outlined within the MOL document 'Guideline – Silica on Construction Projects" (2011) be utilized during the disturbance or handling of the material.

7.0 LIMITATIONS AND WARRANTY

OHS has prepared this report for the exclusive use of the Client in evaluating the Site at the time of OHS's assessment. OHS will not be responsible for the use of this report by any third party, or reliance on or any decision to be made based on it without the prior written consent of OHS. OHS accepts no responsibility for damages, if any, by any third party because of decisions or actions based on this report.

The findings contained in this report are based upon conditions as they were observed at the time of investigation. No assurance is made regarding changes in conditions subsequent to the time of investigation.

If new information is developed in future work, OHS should be contacted to re-evaluate the conclusions of this report and to provide amendments as required.

Respectfully submitted,

OH Solutions Inc.

Jeff Doherty, BSc
Senior Occupational Hygienist

APPENDIX I

LABORATORY RESULTS

Atomic Absorption Lead Report

Analysis Method: Lead in Paint analyzed by Atomic Absorption (AA)/SW-846-7420;
This analysis is not covered by the scope of accreditation by NVLAP or AIHA.

Sample Prep Method: Samples are dissolved in nitric acid, extracted, and analyzed on a properly calibrated AA; Absorbency curve was calculated, bandwidth corrected, and wavelength at the time of the analysis was measured and recorded.

Client Information:
Advanced Environmental Corp
4093 Meadowbrook Drive, Unit 114
London, Ontario N6L1G2

Client Project:
32 Church Street – SNC Lavailn Profac 08-4333

CA Labs Project #:
CAL08107239

Date: 10/21/08 SR

Phone: 519-652-6105

Fax: 519-652-1709

Turnaround Time: 5 Day

Attn:

Samples Received:
10/15/08 11am

Purchase Order #:

Sample#		Sample Concentration: parts per million (ppm)	Weight Percent:
L-01 Beige/Yellow Paint – Location 01		269.60	0.0270
L-02 Gray Floor Paint – Location 01		747.14	0.0747
L-03 General White Paint – Location 28		< 189.39	< 0.0189
L-04 Off Green/Blue – Location 09		405.38	< 0.0405
L-05 Light Pink – Location 18		< 237.81	< 0.0238
L-06 Pale Green – Location 35		626.39	0.0626
L-07 White Paint on Drywall – Location 19		< 247.22	< 0.0247
L-08 Green Wall Paint – Location 1st Floor Offices – Reno.		< 259.74	< 0.0260
L-09 Beige Paint – Location 91		1510.24	0.1510
Lab Blank	< 1.00	----	----

Quality Control:
Duplicate: **2.9 RPD**
Spike: **97.8% Recovery**

NVLAP # 200349-0

TDH # 30-0235

Approved Signatories:

Henry Heiser
Analyst

Leslie Crisp
Laboratory Director

Chad Lytle
Senior Analyst

Notes:
The current guidelines for lead in paint from the Consumer Products Safety Council (CPSC) is 0.06% by weight; the Housing and Urban Development (HUD) guideline is 0.5% by weight.

Analysis performed at Crisp Analytical Labs, LLC 2081 Hutton Dr. Suite 301 Carrollton, TX 75006; phone (972) 488-1414, fax (fax) 488-8006, mobile (214) 564-8366.

IATL International Asbestos Testing Laboratories

16000 Horizon Way Unit 100 Mt. Laurel, NJ 08054
Telephone: 856-231-9449 Fax: 856-231-9818

CERTIFICATE OF ANALYSIS

Client: Advanced Environ. Consultants
4056MeadowBrookDr.;Unit130
London ON N6L 1E3

Report Date: 11/17/2006
Project: FedBldgs-ChurchSt,St.Catherines
Project No.: 06-3580

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 2760089 **Description / Location:** Tan Floor Tile
Client No.: 01-01 Basement Corridor

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
PC Trace	Chrysotile	None Detected	None Detected	100

Lab No.: 2760090 **Description / Location:** Tan Floor Tile
Client No.: 01-02 Basement Corridor

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
PC Trace	Chrysotile	None Detected	None Detected	100

Lab No.: 2760090 **Description / Location:** Black Mastic **Layer No.: 2**
Client No.: 01-02 Basement Corridor

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

NIST-NVLAP No. 101165-0 **NY-DOH No. 11021** **AIHA Lab No. 100188**

Analysis Method: EPA 600/R-93/116

Comments: (PC) Indicates Stratified Point Count Method performed. Method not performed unless stated. Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, negative PLM results cannot be guaranteed. Electron Microscopy can be used as a confirming technique. Regulatory Limit is based upon the sample matrix. Quantification at <0.25% by volume is possible with this method. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed.

Analysis Performed By: L. Solebello

Approved By: Frank E. Ehrenfeld, III
Laboratory Director

Date: 11/17/2006

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Report Date: 11/17/2006
Project: FedBldgs-ChurchSt,St.Catherines
Project No.: 06-3580

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 2760091 **Description / Location:** Tan Floor Tile
Client No.: 01-03 Basement Corridor

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
PC Trace	Chrysotile	None Detected	None Detected	100

Lab No.: 2760091 **Description / Location:** Black Mastic **Layer No.: 2**
Client No.: 01-03 Basement Corridor

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 2760092 **Description / Location:** White/Tan Ceiling Tile; 2x4
Client No.: 02-01 Basement Corridor At BR

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	35	Cellulose	30
		35	Fibrous Glass	

Lab No.: 2760093 **Description / Location:** White/Tan Ceiling Tile; 2x4
Client No.: 02-02 Basement Corridor

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	35	Cellulose	30
		35	Fibrous Glass	

NIST-NVLAP No. 101165-0 **NY-DOH No. 11021** **AIHA Lab No. 100188**

Analysis Method: EPA 600/R-93/116

Comments: (PC) Indicates Stratified Point Count Method performed. Method not performed unless stated. Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, negative PLM results cannot be guaranteed. Electron Microscopy can be used as a confirming technique. Regulatory Limit is based upon the sample matrix. Quantification at <0.25% by volume is possible with this method. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed.

Analysis Performed By: L. Solebello

Date: 11/17/2006

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Project No.: 06-3580

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 2760094
Client No.: 02-03
Description / Location: White/Tan Ceiling Tile; 2x4
1st Floor

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	35	Cellulose	30
		35	Fibrous Glass	

Lab No.: 2760095
Client No.: 03-01
Description / Location: White/Tan Ceiling Tile; 2x4
Old Forms Storage Area

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	35	Cellulose	30
		35	Fibrous Glass	

Lab No.: 2760096
Client No.: 03-02
Description / Location: White/Tan Ceiling Tile; 2x4
Old Forms Storage Area

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	35	Cellulose	30
		35	Fibrous Glass	

Lab No.: 2760097
Client No.: 03-03
Description / Location: White/Tan Ceiling Tile; 2x4
Old Forms Storage Area

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	35	Cellulose	30
		35	Fibrous Glass	

NIST-NVLAP No. 101165-0 **NY-DOH No. 11021** **AIHA Lab No. 100188**

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Analysis Method: EPA 600/R-93/116

Comments: (PC) Indicates Stratified Point Count Method performed. Method not performed unless stated. Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, negative PLM results cannot be guaranteed. Electron Microscopy can be used as a confirming technique. Regulatory Limit is based upon the sample matrix Quantification at <0.25% by volume is possible with this method. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed.

Analysis Performed By: L. Solebello

Date: 11/17/2006

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Report Date: 11/17/2006
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Project No.: 06-3580

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 2760098
Client No.: 04-01
Description / Location: White/Tan Ceiling Tile; 2x4
Old Forms Storage Area

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	35	Cellulose	30
		35	Fibrous Glass	

Lab No.: 2760099
Client No.: 04-02
Description / Location: White/Tan Ceiling Tile; 2x4
Old Forms Storage Area

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	35	Cellulose	30
		35	Fibrous Glass	

Lab No.: 2760100
Client No.: 04-03
Description / Location: White/Tan Ceiling Tile; 2x4
Old Forms Storage Area

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	35	Cellulose	30
		35	Fibrous Glass	

Lab No.: 2760101
Client No.: 05-01
Description / Location: White/Brown Ceiling Tile
Pump Room

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	90	Cellulose	10

NIST-NVLAP No. 101165-0 **NY-DOH No. 11021** **AIHA Lab No. 100188**

Analysis Method: EPA 600/R-93/116

Comments: (PC) Indicates Stratified Point Count Method performed. Method not performed unless stated. Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, negative PLM results cannot be guaranteed. Electron Microscopy can be used as a confirming technique. Regulatory Limit is based upon the sample matrix. Quantification at <0.25% by volume is possible with this method. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed.

Analysis Performed By: L. Solebello

Date: 11/17/2006

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London ON N6L 1E3

Report Date: 11/17/2006
Project: FedBldgs-ChurchSt,St.Catherines
Project No.: 06-3580

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 2760102
Client No.: 05-02
Description / Location: White/Brown Ceiling Tile
Pump Room

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	90	Cellulose	10

Lab No.: 2760103
Client No.: 05-03
Description / Location: White/Brown Ceiling Tile
Pump Room

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	90	Cellulose	10

Lab No.: 2760104
Client No.: 06-01
Description / Location: Yellow Mastic
Kitchen; Carpet

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 2760105
Client No.: 06-02
Description / Location: Yellow Mastic
Kitchen; Carpet

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

NIST-NVLAP No. 101165-0 **NY-DOH No. 11021** **AIHA Lab No. 100188**

Analysis Method: EPA 600/R-93/116

Comments: (PC) Indicates Stratified Point Count Method performed. Method not performed unless stated. Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, negative PLM results cannot be guaranteed. Electron Microscopy can be used as a confirming technique. Regulatory Limit is based upon the sample matrix. Quantification at <0.25% by volume is possible with this method. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed.

Analysis Performed By: L. Solebello

Date: 11/17/2006

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Project No.: 06-3580

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 2760106
Client No.: 06-03
Description / Location: Yellow Mastic
Kitchen; Carpet

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 2760107
Client No.: 07-01
Description / Location: White/Grey Plaster
Boiler Room Corridor; Wall

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 2760108
Client No.: 07-02
Description / Location: White/Grey Plaster
First Aid Room; Wall

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 2760109
Client No.: 07-03
Description / Location: White/Grey Plaster
2nd Floor Stairs 4th Stair

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

NIST-NVLAP No. 101165-0 **NY-DOH No. 11021** **AIHA Lab No. 100188**

Analysis Method: EPA 600/R-93/116

Comments: (PC) Indicates Stratified Point Count Method performed. Method not performed unless stated. Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, negative PLM results cannot be guaranteed. Electron Microscopy can be used as a confirming technique. Regulatory Limit is based upon the sample matrix. Quantification at <0.25% by volume is possible with this method. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed.

Analysis Performed By: L. Solebello

Date: 11/17/2006

IATL International Asbestos Testing Laboratories

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CERTIFICATE OF ANALYSIS

Client: Advanced Environ. Consultants
4056MeadowBrookDr.;Unit130
London ON N6L 1E3

Report Date: 11/17/2006
Project: FedBldgs-ChurchSt,St.Catherines
Project No.: 06-3580

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 2760110
Client No.: 07-04
Description / Location: White/Grey Plaster
Custodial Room; Ceiling

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 2760111
Client No.: 07-05
Description / Location: White/Grey Plaster
2nd Floor Stairwell 3

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 2760112
Client No.: 07-06
Description / Location: White/Grey Plaster
2nd Floor Stairwell 3

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 2760113
Client No.: 07-07
Description / Location: White/Grey Plaster
1st Floor; Wall Stairs 5

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

NIST-NVLAP No. 101165-0 **NY-DOH No. 11021** **AIHA Lab No. 100188**

Analysis Method: EPA 600/R-93/116

Comments: (PC) Indicates Stratified Point Count Method performed. Method not performed unless stated. Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, negative PLM results cannot be guaranteed. Electron Microscopy can be used as a confirming technique. Regulatory Limit is based upon the sample matrix. Quantification at <0.25% by volume is possible with this method. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed.

Analysis Performed By: L. Solebello

Date: 11/17/2006

IATL International Asbestos Testing Laboratories

16000 Horizon Way Unit 100 Mt. Laurel, NJ 08054
Telephone: 856-231-9449 Fax: 856-231-9818

CERTIFICATE OF ANALYSIS

Client: Advanced Environ. Consultants
4056MeadowBrookDr.;Unit130
London ON N6L 1E3

Report Date: 11/17/2006
Project: FedBldgs-ChurchSt,St.Catherines
Project No.: 06-3580

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 2760114 **Description / Location:** White Jt Compound
Client No.: 08-01 Old Forms Storage

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 2760115 **Description / Location:** White Jt Compound
Client No.: 08-02 Old Forms Storage

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 2760116 **Description / Location:** White Jt Compound
Client No.: 08-03 Old Forms Storage

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 2760117 **Description / Location:** Off-White Jt Compound
Client No.: 08-04 Basement Mens WR

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

NIST-NVLAP No. 101165-0 **NY-DOH No. 11021** **AIHA Lab No. 100188**

Analysis Method: EPA 600/R-93/116

Comments: (PC) Indicates Stratified Point Count Method performed. Method not performed unless stated. Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, negative PLM results cannot be guaranteed. Electron Microscopy can be used as a confirming technique. Regulatory Limit is based upon the sample matrix. Quantification at <0.25% by volume is possible with this method. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed.

Analysis Performed By: L. Solebello

Date: 11/17/2006

IATL International Asbestos Testing Laboratories

16000 Horizon Way Unit 100 Mt. Laurel, NJ 08054
Telephone: 856-231-9449 Fax: 856-231-9818

CERTIFICATE OF ANALYSIS

Client: Advanced Environ. Consultants
4056MeadowBrookDr.;Unit130
London ON N6L 1E3

Report Date: 11/17/2006
Project: FedBldgs-ChurchSt,St.Catherines
Project No.: 06-3580

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 2760118
Client No.: 08-05

Description / Location: Off-White Jt Compound
1st Floor Observation Deck

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

NIST-NVLAP No. 101165-0 **NY-DOH No. 11021** **AIHA Lab No. 100188**

Analysis Method: EPA 600/R-93/116

Comments: (PC) Indicates Stratified Point Count Method performed. Method not performed unless stated. Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, negative PLM results cannot be guaranteed. Electron Microscopy can be used as a confirming technique. Regulatory Limit is based upon the sample matrix. Quantification at <0.25% by volume is possible with this method. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed.

Analysis Performed By: L. Solebello

Date: 11/17/2006

CA Labs
Dedicated to Quality

Crisp Analytical, L.L.C.
1929 Old Denton Road
Carrollton, TX 75006
Phone 972-242-2754
Fax 972-242-2798

CA Labs, L.L.C.
12232 Industriplex, Suite 32
Baton Rouge, LA 70809
Phone 225-751-5632
Fax 225-751-5634

Atomic Absorption Lead Report

Analysis Method: Lead in Paint analyzed by Atomic Absorption (AA)/SW-846-7420;
This analysis is not covered by the scope of accreditation by NVLAP or AIHA.

Sample Prep Method: Samples are dissolved in nitric acid, extracted, and analyzed on a properly calibrated AA; Absorbency curve was calculated, bandwidth corrected, and wavelength at the time of the analysis was measured and recorded.

Client Information:
OH Solutions
119 Thames St S
Ingersoll, ON N5C 2T3

Phone: 519-268-2200
Fax: 866-700-4975

Client Project:
16-0786, 32 Church Street – St. Catherines

Turnaround Time: 5 Days
Attn:

CA Labs Project #:
CAL16053642CB

Date of Sampling: None Given
Report Date: 6/1/16
Samples Received: 5/31/16 10:30am
Purchase Order #:

Sample#		Sample Concentration: parts per million (ppm)	Weight Percent:
L1 Off-White Wall – Location 27a		<179.05	<0.0179
L2 Cream Wall – Boiler Rm		<243.90	<0.0244
Lab Blank	< 1.00	----	----

Quality Control:
Duplicate: **1.0** **RPD**
Spike: **98.1** **% Recovery**

All samples received in good condition unless noted

NVLAP # 200349-0

TDH # 30-0235

Approved Signatories:

Robert Olivarez
Analyst

Leslie Crisp
Laboratory Director

Chad Lytle
Senior Analyst

Notes:
The current guidelines for lead in paint from the Consumer Products Safety Council (CPSC) is 0.06% by weight; the Housing and Urban Development (HUD) guideline is 0.5% by weight.

CA Labs is participating in ELPAT rounds sponsored by American Industrial Hygiene Association (AIHA) and National Lead Laboratory Program (NLLAP). This test reports relates only to the items tested. Neither AIHA, NVLAP nor EPA accreditation implies endorsement by any US Government agency. CA Labs is accredited by the American Industrial Hygiene Association (AIHA LAP, LLC.) in the TEM, PLM, and PCM asbestos fields of testing for Industrial Hygiene and in the culturable fungi field of testing for Environmental Microbiology. This report may not be reproduced except in full without written permission from CA Labs. This Method is not covered by the AIHA accreditation for Environmental Hygiene.

These results are submitted pursuant to CA Labs' current terms and condition of sale, including the company's standard warranty and limitation of liability provisions and no responsibility or liability is assumed for the manner in which the results are used or interpreted. Unless notified in writing to return the samples covered by this report, CA Labs will store the samples for a period of ninety (90) days before discarding. A shipping and handling fee may be assessed for the return of any samples.

Analysis performed at Crisp Analytical Labs, LLC 1929 Old Denton Road Carrollton, TX 75006; phone (972) 242-2754, fax (972) 242-2798.

CA Labs
Dedicated to Quality

Crisp Analytical, L.L.C.
1929 Old Denton Road
Carrollton, TX 75006
Phone 972-242-2754
Fax 972-242-2798

CA Labs, L.L.C.
12232 Industriplex, Suite 32
Baton Rouge, LA 70809
Phone 225-751-5632
Fax 225-751-5634

ATOMIC ABSORPTION
LEAD ANALYSIS
LABORATORY ANALYSIS REPORT

OH Solutions
119 Thames St S
Ingersoll, ON N5C 2T3

Reference number: CAL16053642CB

LABORATORY ANALYSIS:

Summary of lead analysis by atomic absorption in all relevant media using the method described in SW-846-7420. All analysts have received the necessary in-house and extramural training to perform analysis of samples for the presence of lead. A duplicate analysis is performed on greater than ten percent of all samples. A spiked concentration sample is analyzed with each sample group for instrument calibration. All analysts are required to participate in quality control analysis rounds. Instrument calibrations are performed on a daily, weekly, and monthly basis.

CA Labs is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) for selected test methods for airborne fiber analysis (TEM) and by the USEPA for analysis of asbestos in drinking water. CA Labs is accredited by the American Industrial Hygiene Association (AIHA LAP, LLC) PLM, TEM and PCM Asbestos fields of testing for industrial hygiene. This analysis is not covered by the scope of accreditation by NVLAP. This method is not covered by the AIHA accreditation for Industrial Hygiene.

This report must not be used to claim product endorsement by AIHA or any agency of the U.S. Government. This test relates only to the items described and tested herein. This report may not be reproduced except in full, without written permission by CA Labs.

METHOD:

The procedure for paint chip analysis follows AOAC5.009(974.02) and SW-846-7420. The analysis of soil, wipes, and wastewater for the presence of lead is also referenced by SW-846-7420. Methodology for the analysis of lead in air samples follows NIOSH Method 7082.

Analysis performed at Crisp Analytical Labs, L.L.C. 1929 Old Denton Road Carrollton, TX 75006: phone (972) 242-2754; fax (972) 242-2798.

CA Labs
Dedicated to Quality

Crisp Analytical, L.L.C.
1929 Old Denton Road
Carrollton, TX 75006
Phone 972-242-2754
Fax 972-242-2798

CA Labs, L.L.C.
12232 Industriplex, Suite 32
Baton Rouge, LA 70809
Phone 225-751-5632
Fax 225-751-5634

Materials Characterization - Bulk Asbestos Analysis

Laboratory Analysis Report - Polarized Light

OH Solutions
119 Thames St S
Ingersoll, ON N5C 2T3

Customer Project: 16-0786, 32 Church Street
Reference #: CAL16053641JE Date: 6/7/2016

Analysis and Method

Summary of polarizing light microscopy (PLM / Stereomicroscopy bulk asbestos analysis) using the methods described in 40CFR Part 763 Appendix E to Subpart E (Interim and EPA 600 / R-93 / 116 (Improved). The sample is first viewed with the aid of stereomicroscopy. Numerous liquid slide preparations are created for analysis under the polarized microscope where identifications and quantifications are preformed. Calibrated liquid refractive oils are used as liquid mouting medium. These oils are used for identification (dispersion staining). A calibrated visual estimation is reported, should any asbestiform mineral be present. Other techniques such as acid washing are used in conjugation with refractive oils for detection of smaller quantities of asbestos. All asbestos percentages are based on calibrated visual estimation traceable to NIST standards for regulated of asbestos. Traceability to measurement and calibration is achieved by using known amounts and types of asbestos from standards where analyst and laboratory accuracy are measured. As little as 0.001% asbestos can be detected in favorable samples, while detection in unfavorable samples may approach the detection limit of 0.50% (well above the laboratory definition of trace).

Discussion

Vermiculite containing samples may have trace amounts of actinolite-tremolite, where not found be PLM should be analyzed using TEM methods and / or water separation techniques. Suspected actinolite/vermiculite presence will be indicated through the sample comment section of this report.

Fibrous talc containing samples may even contain a related asbestos fiber known as anthophyllite. Under certain conditions the same fiber may actually contain both talc and anthophyllite (a phenomenon called intergrowth). Again, TEM detection methods are recommended. CA Labs PLM report comments will denote suspected amounts of asbestiform anthophyllite with talc, where further analysis is recommended.

Some samples (floor tiles, surfacings, etc.) may contain fibers too small to be delectable by PLM analysis and should be analyzed by TEM bulk protocols.

A "trace asbestos" will be reported if the analyst observes far less than 1% asbestos. CA Labs defines "trace asbestos" as a few fibers detected by the analyst in several preparations and will indicate as such under these circumstances.

Qualifications

CA Labs is accredited by the National Voluntary Accreditation Program (NVLAP) for selected test methods for airborne fiber analysis (TEM), and for bulk asbestos fiber analysis (PLM). CA Labs is also accredited by AIHA LAP, LLC. in the PLM asbestos field of testing for Industrial Hygiene. All analysts have a college degree in a natural science (geology, biology, or environmental science) or are recognized by a state professional board in one these disciplines .Extensive in-house training programs are used to augment education background of the analyst. The group leader of polarized light has received supplemental McCrone Research training for asbestos identification. Analysis performed at Crisp Analytical Labs, LLC 1929 Old Denton Road Carrollton, TX 75006

Dallas NVLAP Lab Code 200349-0 TEM/PLM TCEQ# T104704513-15-3 TDH 30-0235
AIHA LAP, LLC Laboratory #102929

CA Labs
Dedicated to Quality

Crisp Analytical, L.L.C.
1929 Old Denton Road
Carrollton, TX 75006
Phone 972-242-2754
Fax 972-242-2798

CA Labs, L.L.C.
12232 Industriplex, Suite 32
Baton Rouge, LA 70809
Phone 225-751-5632
Fax 225-751-5634

Overview of Project Sample Material Containing Asbestos

Customer Project: 16-0786, 32 Church Street **CA Labs Project #:** CAL16053641JE

Sample #	Layer #	Analysts Physical Description of Subsample	Asbestos type / calibrated visual estimate percent	List of Affected Building Material Types
OH01-01	*OH01-01-1*	***Vinyl Floor Tile - 12x12 White With Gray Specks**/ tan floor tile*	***3% Chrysotile***	***tan floor tile*** ***black mastic***
OH02-01	*OH02-01-1*	***Vinyl Floor Tile**/ tan floor tile*	***3% Chrysotile***	
OH03-01	*OH03-01-1*	***Vinyl Floor Tile - Light Green With Gray And White Specs**/ tan floor tile*	***2% Chrysotile***	
OH04-01	*OH04-01-1*	***Floor Mastic**/ black mastic*	***3% Chrysotile***	
OH07-01	*OH07-01-1*	***Vinyl Floor Tile - 12x12 Tan Heavy Rose Streak**/ tan floor tile*	***2% Chrysotile***	

Dallas NVLAP Lab Code 200349-0 TEM/PLM TCEQ# T104704513-15-3 TDH 30-0235
AIHA LAP, LLC Laboratory #102929

Glossary of abbreviations (non-asbestos fibers and non-fibrous minerals):

ca - carbonate
gypsum - gypsum
bi - binder
or - organic
ma - matrix
mi - mica
ve - vermiculite
ot - other
pe - perlite
qu - quartz
fg - fiberglass
mw - mineral wool
wo - wollastinite
ta - talc
sy - synthetic
ce - cellulose
br - brucite
ka - kaolin (clay)
pa - palygorskite (clay)

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Crisp Analytical, L.L.C.
1929 Old Denton Road
Carrollton, TX 75006
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CA Labs, L.L.C.
12232 Industriplex, Suite 32
Baton Rouge, LA 70809
Phone 225-751-5632
Fax 225-751-5634

Polarized Light Asbestiform Materials Characterization

Customer Info: **Attn:**
OH Solutions
119 Thames St S
Ingersoll, ON N5C 2T3

Phone # (519) 268 - 2200
Fax # (866) 700 - 4975

Customer Project:
16-0786, 32 Church Street
Turnaround Time:
5 Days

CA Labs Project #:
CAL16053641JE

Date: 6/7/2016
Samples Received: 5/31/16 10:30am
Date Of Sampling: 5/26/2016
Purchase Order #:

Sample #	Comment	Layer #	Analysts Physical Description of Subsample	Homogeneous (Y/N)	Asbestos type / calibrated visual estimate percent	Non-asbestos fiber type / percent	Non-fibrous type / percent
OH01-01		*OH01-01-1*	***Vinyl Floor Tile - 12x12 White With Gray Specks****/ tan floor tile*	*y*	***3% Chrysotile***		97% qu,ca
		OH01-01-2	*black mastic*	*y*	***None Detected***		100% gy,bi
OH01-02		*OH01-02-1*	***Vinyl Floor Tile - 12x12 White With Gray Specks****/ tan floor tile*		*Positive Stop*		
		OH01-02-2	*black mastic*	*y*	***None Detected***		100% gy,bi
OH01-03		*OH01-03-1*	***Vinyl Floor Tile - 12x12 White With Gray Specks****/ tan floor tile*		*Positive Stop*		
		OH01-03-2	*black mastic*	*y*	***None Detected***		100% gy,bi
OH02-01		*OH02-01-1*	***Vinyl Floor Tile****/ tan floor tile*	*y*	***3% Chrysotile***		97% qu,ca

Dallas NVLAP Lab Code 200349-0 TEM/PLM TCEQ# T104704513-15-3 TDH 30-0235

AIHA LAP, LLC Laboratory #102929

Analysis Method: Interim (40CFR Part 763 Appendix E to Subpart E) / Improved (EPA-600 / R-93/116). *All samples received in good condition unless noted.*
Preparation Method: HCL acid washing for carbonate based samples, chemical reduction for organically bound components, oil immersion for identification of asbestos types by dispersion attaining / becke line method.

ca - carbonate	mi - mica	fg - fiberglass	ce - cellulose
gypsum - gypsum	ve - vermiculite	mw - mineral wool	br - brucite
bi - binder	ot -other	wo - wollastinite	ka - kaolin (clay)
or - organic	pe - perlite	ta - talc	pa - palygorskite (clay)
ma - matrix	qu - quartz	sy - synthetic	

Approved Signatories:

Julio Robles
Analyst

QAC
Leslie Crisp, P.G.

Technical Manager
Chad Lytle

1. Fire Damage significant fiber damage - reported percentages reflect unaltered fibers
2. Fire Damage no significant fiber damages effecting fibrous percentages
3. Actinolite in association with Vermiculite
4. Layer not analyzed - attached to previous positive layer and contamination is suspected
5. Not enough sample to analyze
6. Anthophyllite in association with Fibrous Talc
7. Contamination suspected from other building materials
8. Favorable scenario for water separation on vermiculite for possible analysis by another method
9. < 1% Result point counted positive
10. TEM analysis suggested

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Dedicated to Quality

Crisp Analytical, L.L.C.
1929 Old Denton Road
Carrollton, TX 75006
Phone 972-242-2754
Fax 972-242-2798

CA Labs, L.L.C.
12232 Industriplex, Suite 32
Baton Rouge, LA 70809
Phone 225-751-5632
Fax 225-751-5634

Polarized Light Asbestiform Materials Characterization

Customer Info: **Attn:**
OH Solutions
119 Thames St S
Ingersoll, ON N5C 2T3

Phone # (519) 268 - 2200
Fax # (866) 700 - 4975

Customer Project:
16-0786, 32 Church Street
Turnaround Time:
5 Days

CA Labs Project #:
CAL16053641JE

Date: 6/7/2016
Samples Received: 5/31/16 10:30am
Date Of Sampling: 5/26/2016
Purchase Order #:

Sample #	Comment	Layer #	Analysts Physical Description of Subsample	Homogeneous (Y/N)	Asbestos type / calibrated visual estimate percent	Non-asbestos fiber type / percent	Non-fibrous type / percent
		OH02-01-2	*black mastic*	*y*	***None Detected***		100% gy,bi
OH02-02		*OH02-02-1*	***Vinyl Floor Tile**/ tan floor tile*		*Positive Stop*		
		OH02-02-2	*black mastic*	*y*	***None Detected***		100% gy,bi
OH02-03		*OH02-03-1*	***Vinyl Floor Tile**/ tan floor tile*		*Positive Stop*		
		OH02-03-2	*black mastic*	*y*	***None Detected***		100% gy,bi
OH03-01		*OH03-01-1*	***Vinyl Floor Tile - Light Green With Gray And White Specs**/ tan floor tile*	*y*	***2% Chrysotile***		98% qu,ca
		OH03-01-2	*black mastic*	*y*	***None Detected***		100% gy,bi

Dallas NVLAP Lab Code 200349-0 TEM/PLM TCEQ# T104704513-15-3 TDH 30-0235

AIHA LAP, LLC Laboratory #102929

Analysis Method: Interim (40CFR Part 763 Appendix E to Subpart E) / Improved (EPA-600 / R-93/116). *All samples received in good condition unless noted.*
Preparation Method: HCL acid washing for carbonate based samples, chemical reduction for organically bound components, oil immersion for identification of asbestos types by dispersion attaining / becke line method.

ca - carbonate	mi - mica	fg - fiberglass	ce - cellulose
gypsum - gypsum	ve - vermiculite	mw - mineral wool	br - brucite
bi - binder	ot -other	wo - wollastinite	ka - kaolin (clay)
or - organic	pe - perlite	ta - talc	pa - palygorskite (clay)
ma - matrix	qu - quartz	sy - synthetic	

Approved Signatories:

Julio Robles
Analyst

QAC
Leslie Crisp, P.G.

Technical Manager
Chad Lytle

1. Fire Damage significant fiber damage - reported percentages reflect unaltered fibers
2. Fire Damage no significant fiber damages effecting fibrous percentages
3. Actinolite in association with Vermiculite
4. Layer not analyzed - attached to previous positive layer and contamination is suspected
5. Not enough sample to analyze
6. Anthophyllite in association with Fibrous Talc
7. Contamination suspected from other building materials
8. Favorable scenario for water separation on vermiculite for possible analysis by another method
9. < 1% Result point counted positive
10. TEM analysis suggested

CA Labs
Dedicated to Quality

Crisp Analytical, L.L.C.
1929 Old Denton Road
Carrollton, TX 75006
Phone 972-242-2754
Fax 972-242-2798

CA Labs, L.L.C.
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Baton Rouge, LA 70809
Phone 225-751-5632
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Polarized Light Asbestiform Materials Characterization

Customer Info: **Attn:**
OH Solutions
119 Thames St S
Ingersoll, ON N5C 2T3

Phone # (519) 268 - 2200
Fax # (866) 700 - 4975

Customer Project:
16-0786, 32 Church Street
Turnaround Time:
5 Days

CA Labs Project #:
CAL16053641JE

Date: 6/7/2016
Samples Received: 5/31/16 10:30am
Date Of Sampling: 5/26/2016
Purchase Order #:

Sample #	Comment	Layer #	Analysts Physical Description of Subsample	Homogeneous (Y/N)	Asbestos type / calibrated visual estimate percent	Non-asbestos fiber type / percent	Non-fibrous type / percent
OH03-02		*OH03-02-1*	***Vinyl Floor Tile**/ tan floor tile*		*Positive Stop*		
		OH03-02-2	*black mastic*	*y*	***None Detected***		100% gy,bi
OH03-03		*OH03-03-1*	***Vinyl Floor Tile**/ tan floor tile*		*Positive Stop*		
		OH03-03-2	*black mastic*	*y*	***None Detected***		100% gy,bi
OH04-01		*OH04-01-1*	***Floor Mastic**/ black mastic*	*y*	***3% Chrysotile***		97% gy,bi
OH04-02		*OH04-02-1*	***Floor Mastic**/ black mastic*		*Positive Stop*		
OH04-03		*OH04-03-1*	***Floor Mastic**/ black mastic*		*Positive Stop*		

Dallas NVLAP Lab Code 200349-0 TEM/PLM TCEQ# T104704513-15-3 TDH 30-0235

AIHA LAP, LLC Laboratory #102929

Analysis Method: Interim (40CFR Part 763 Appendix E to Subpart E) / Improved (EPA-600 / R-93/116). *All samples received in good condition unless noted.*
Preparation Method: HCL acid washing for carbonate based samples, chemical reduction for organically bound components, oil immersion for identification of asbestos types by dispersion attaining / becke line method.

ca - carbonate	mi - mica	fg - fiberglass	ce - cellulose
gypsum - gypsum	ve - vermiculite	mw - mineral wool	br - brucite
bi - binder	ot -other	wo - wollastinite	ka - kaolin (clay)
or - organic	pe - perlite	ta - talc	pa - palygorskite (clay)
ma - matrix	qu - quartz	sy - synthetic	

Approved Signatories:

Julio Robles
Analyst

QAC
Leslie Crisp, P.G.

Technical Manager
Chad Lytle

1. Fire Damage significant fiber damage - reported percentages reflect unaltered fibers
2. Fire Damage no significant fiber damages effecting fibrous percentages
3. Actinolite in association with Vermiculite
4. Layer not analyzed - attached to previous positive layer and contamination is suspected
5. Not enough sample to analyze
6. Anthophyllite in association with Fibrous Talc
7. Contamination suspected from other building materials
8. Favorable scenario for water separation on vermiculite for possible analysis by another method
9. < 1% Result point counted positive
10. TEM analysis suggested

CA Labs
Dedicated to Quality

Crisp Analytical, L.L.C.
1929 Old Denton Road
Carrollton, TX 75006
Phone 972-242-2754
Fax 972-242-2798

CA Labs, L.L.C.
12232 Industriplex, Suite 32
Baton Rouge, LA 70809
Phone 225-751-5632
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Polarized Light Asbestiform Materials Characterization

Customer Info: **Attn:**
OH Solutions
119 Thames St S
Ingersoll, ON N5C 2T3

Phone # (519) 268 - 2200
Fax # (866) 700 - 4975

Customer Project:
16-0786, 32 Church Street
Turnaround Time:
5 Days

CA Labs Project #:
CAL16053641JE

Date: 6/7/2016
Samples Received: 5/31/16 10:30am
Date Of Sampling: 5/26/2016
Purchase Order #:

Sample #	Comment	Layer #	Analysts Physical Description of Subsample	Homogeneous (Y/N)	Asbestos type / calibrated visual estimate percent	Non-asbestos fiber type / percent	Non-fibrous type / percent
OH05-01		*OH05-01-1*	***Textured Plaster**/ tan surfaced gray plaster*	*n*	***None Detected***		100% qu,bi,ca
OH05-02		*OH05-02-1*	***Textured Plaster**/ tan surfaced gray plaster*	*n*	***None Detected***		100% qu,bi,ca
OH05-03		*OH05-03-1*	***Textured Plaster**/ tan surfaced gray plaster*	*n*	***None Detected***		100% qu,bi,ca
OH06-01		*OH06-01-1*	***Vinyl Floor Tile - 12x12 Pink**/ tan floor tile*	*y*	***None Detected***		100% qu,ca
		OH06-01-2	*black mastic*	*y*	***None Detected***		100% gy,bi
OH06-02		*OH06-02-1*	***Vinyl Floor Tile - 12x12 Pink**/ tan floor tile*	*y*	***None Detected***		100% qu,ca
		OH06-02-2	*black mastic*	*y*	***None Detected***		100% gy,bi

Dallas NVLAP Lab Code 200349-0 TEM/PLM TCEQ# T104704513-15-3 TDH 30-0235

AIHA LAP, LLC Laboratory #102929

Analysis Method: Interim (40CFR Part 763 Appendix E to Subpart E) / Improved (EPA-600 / R-93/116). *All samples received in good condition unless noted.*
Preparation Method: HCL acid washing for carbonate based samples, chemical reduction for organically bound components, oil immersion for identification of asbestos types by dispersion attaining / becke line method.

ca - carbonate	mi - mica	fg - fiberglass	ce - cellulose
gypsum - gypsum	ve - vermiculite	mw - mineral wool	br - brucite
bi - binder	ot -other	wo - wollastinite	ka - kaolin (clay)
or - organic	pe - perlite	ta - talc	pa - palygorskite (clay)
ma - matrix	qu - quartz	sy - synthetic	

Approved Signatories:

Julio Robles
Analyst

QAC
Leslie Crisp, P.G.

Technical Manager
Chad Lytle

1. Fire Damage significant fiber damage - reported percentages reflect unaltered fibers
2. Fire Damage no significant fiber damages effecting fibrous percentages
3. Actinolite in association with Vermiculite
4. Layer not analyzed - attached to previous positive layer and contamination is suspected
5. Not enough sample to analyze
6. Anthophyllite in association with Fibrous Talc
7. Contamination suspected from other building materials
8. Favorable scenario for water separation on vermiculite for possible analysis by another method
9. < 1% Result point counted positive
10. TEM analysis suggested

CA Labs
Dedicated to Quality

Crisp Analytical, L.L.C.
1929 Old Denton Road
Carrollton, TX 75006
Phone 972-242-2754
Fax 972-242-2798

CA Labs, L.L.C.
12232 Industriplex, Suite 32
Baton Rouge, LA 70809
Phone 225-751-5632
Fax 225-751-5634

Polarized Light Asbestiform Materials Characterization

Customer Info: **Attn:**
OH Solutions
119 Thames St S
Ingersoll, ON N5C 2T3

Phone # (519) 268 - 2200
Fax # (866) 700 - 4975

Customer Project:
16-0786, 32 Church Street
Turnaround Time:
5 Days

CA Labs Project #:
CAL16053641JE

Date: 6/7/2016
Samples Received: 5/31/16 10:30am
Date Of Sampling: 5/26/2016
Purchase Order #:

Sample #	Comment	Layer #	Analysts Physical Description of Subsample	Homogeneous (Y/N)	Asbestos type / calibrated visual estimate percent	Non-asbestos fiber type / percent	Non-fibrous type / percent
OH06-03		*OH06-03-1*	***Vinyl Floor Tile - 12x12 Pink**/ tan floor tile*	*y*	***None Detected***		100% qu,ca
		OH06-03-2	*black mastic*	*y*	***None Detected***		100% gy,bi
OH07-01		*OH07-01-1*	***Vinyl Floor Tile - 12x12 Tan Heavy Rose Streak**/ tan floor tile*	*y*	***2% Chrysotile***		98% qu,ca
		OH07-01-2	*black mastic*	*y*	***None Detected***		100% gy,bi
OH07-02		*OH07-02-1*	***Vinyl Floor Tile - 12x12 Tan Heavy Rose Streak**/ tan floor tile*		*Positive Stop*		
		OH07-02-2	*black mastic*	*y*	***None Detected***		100% gy,bi
OH07-03		*OH07-03-1*	***Vinyl Floor Tile - 12x12 Tan Heavy Rose Streak**/ tan floor tile*		*Positive Stop*		

Dallas NVLAP Lab Code 200349-0 TEM/PLM TCEQ# T104704513-15-3 TDH 30-0235

AIHA LAP, LLC Laboratory #102929

Analysis Method: Interim (40CFR Part 763 Appendix E to Subpart E) / Improved (EPA-600 / R-93/116). *All samples received in good condition unless noted.*
Preparation Method: HCL acid washing for carbonate based samples, chemical reduction for organically bound components, oil immersion for identification of asbestos types by dispersion attaining / becke line method.

ca - carbonate	mi - mica	fg - fiberglass	ce - cellulose
gypsum - gypsum	ve - vermiculite	mw - mineral wool	br - brucite
bi - binder	ot -other	wo - wollastinite	ka - kaolin (clay)
or - organic	pe - perlite	ta - talc	pa - palygorskite (clay)
ma - matrix	qu - quartz	sy - synthetic	

Approved Signatories:

Julio Robles
Analyst

QAC
Leslie Crisp, P.G.

Technical Manager
Chad Lytle

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Sample #	Comment	Layer #	Analysts Physical Description of Subsample	Homogeneous (Y/N)	Asbestos type / calibrated visual estimate percent	Non-asbestos fiber type / percent	Non-fibrous type / percent
		OH07-03-2	*black mastic*	*y*	***None Detected***		100% gy,bi

Dallas NVLAP Lab Code 200349-0 TEM/PLM TCEQ# T104704513-15-3 TDH 30-0235

AIHA LAP, LLC Laboratory #102929

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ca - carbonate	mi - mica	fg - fiberglass	ce - cellulose
gypsum - gypsum	ve - vermiculite	mw - mineral wool	br - brucite
bi - binder	ot -other	wo - wollastinite	ka - kaolin (clay)
or - organic	pe - perlite	ta - talc	pa - palygorskite (clay)
ma - matrix	qu - quartz	sy - synthetic	

Approved Signatories:

Julio Robles
Analyst

QAC
Leslie Crisp, P.G.

Technical Manager
Chad Lytle

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APPENDIX II

ROOM-BY-ROOM ASBESTOS MATERIALS SUMMARY

ASBESTOS ASSESSMENT ACCESSIBILITY AND ACTION CODES

ACCESSIBILITY CODES

A Accessible to all occupants of the building;
B Accessible to maintenance staff without a ladder;
C Accessible to maintenance staff with a ladder; and,
D Not accessible without demolition or removal of fixed building components or building systems.

ACTION CODES

1. Immediate cleanup of debris that is likely to be disturbed.
2. Use Type 2 asbestos procedures to enter an area (other than a ceiling space).
3. Remove asbestos for compliance with the regulations.
4. Require Type 2 asbestos procedures for ceiling entry where friable ACM debris is present on top of a ceiling system.
5. Remove asbestos in order to simplify asbestos management.
6. Repair of asbestos containing material.
7. Monitor condition of ACM.
8. Suspect material that may contain asbestos but sampling was not completed to confirm.

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity		Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Building Number : W500350		**Building Name :** Government Of Canada Building					**Survey Date :** 5/18/2016			
Level :		**Room :** Exterior of Church					**Asbestos Present :** Potentially			
Roof	Suspect Transite	100.0	%	Good		D	7	No	No	
Comments:	There is the potential for ACM transite to be present under roof flashing									
Level : 0 - Basement		**Room :** LOC 01 - Boiler Room					**Asbestos Present :** Yes			
Ceiling	Fibreglass									
Duct	Fibreglass									
Duct	Uninsulated									
Floor	Concrete									
Mechanical	Boiler									
Mechanical	Domestic Hot Water Tank									
Piping	Asbestos Parging Cement	2.0	EA	Good		D	7	No	Yes	PREV
Piping	Fibreglass Fitting									
Piping	Fibreglass Straight Run									
Structure	Concrete									
Wall	Concrete									
Wall	Masonry									
Comments:	Parging cement at penetrations was discovered during alterations being made to heating system piping located behind expansion tank									
Level : 0 - Basement		**Room :** LOC 02 - Pump Room					**Asbestos Present :** No			

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Ceiling	Not Found								
Duct	Not Found								
Floor	Concrete								
Mechanical	Not Found								
Piping	Uninsulated								
Structure	Concrete								
Wall	Concrete								
Wall	Masonry								

Comments:

Level : 0 - Basement **Room :** LOC 03 - Garbage Room **Asbestos Present :** No

Ceiling	Non-Asbestos Drywall Compound								V08
Ceiling	Not Found								
Duct	Not Found								
Floor	Concrete								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Piping	Uninsulated								
Structure	Concrete								
Wall	Concrete								
Wall	Masonry								

Comments:

Hg light tube waste containers.

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity		Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Level : 0 - Basement		**Room :** LOC 04 - Storage Room				**Asbestos Present :** Potentially				
Ceiling	Not Found									
Duct	Not Found									
Floor	Concrete									
Mechanical	Not Found									
Other	Suspect Fire Door	1.0	EA	Good		A	8	Yes	No	
Piping	Fibreglass Fitting									
Piping	Fibreglass Straight Run									
Structure	Concrete									
Wall	Concrete									
Wall	Masonry									
Comments:										
Level : 0 - Basement		**Room :** LOC 05 - Office				**Asbestos Present :** No				
Ceiling	Non-Asbestos 2 x 4 Lay-in Tile									V02
Duct	Not Found									
Floor	Carpet									
Mechanical	Not Found									
Piping	Fibreglass									
Structure	Concrete									
Wall	Masonry									
Comments:										

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample

Level : 0 - Basement **Room :** LOC 06 - I.T. Storage Room **Asbestos Present :** No

Ceiling	Not Found
Duct	Not Found
Floor	Concrete
Mechanical	Not Found
Piping	Fibreglass Fitting
Piping	Fibreglass Straight Run
Structure	Concrete
Wall	Concrete
Wall	Masonry

Comments:

Level : 0 - Basement **Room :** LOC 07 - Corridor **Asbestos Present :** No

Ceiling	Non-Asbestos 2 x 4 Lay-in Tile	V02
Duct	Uninsulated	
Floor	Non-Asbestos Vinyl Tile - New	
Mechanical	Not Found	
Piping	Fibreglass Fitting	
Piping	Fibreglass Straight Run	
Structure	Concrete	
Wall	Concrete	
Wall	Masonry	

Comments:

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Level : 0 - Basement		**Room :** LOC 08 - Corridor			**Asbestos Present :** No				
Ceiling	Non-Asbestos 2 x 4 Lay-in Tile								V02
Duct	Uninsulated								
Floor	Non-Asbestos Vinyl Tile								V01
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Concrete								
Wall	Concrete								
Wall	Masonry								
Comments:									
Level : 0 - Basement		**Room :** LOC 09 - Stairs			**Asbestos Present :** Potentially				
Ceiling	Non-Asbestos Drywall Compound								V08
Duct	Inaccessible								
Floor	Non-Asbestos Vinyl Tile - New								
Mechanical	Inaccessible								
Piping	Inaccessible								
Structure	Inaccessible								
Wall	Non-Asbestos Drywall Compound								V08
Comments: No access above ceiling.									
Level : 0 - Basement		**Room :** LOC 10 - Storage Room			**Asbestos Present :** No				

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Ceiling	Not Found								
Duct	Not Found								
Floor	Concrete								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Piping	Uninsulated								
Structure	Concrete								
Wall	Masonry								

Comments:

Service vertical shaft.

Level : 0 - Basement **Room :** LOC 11 - Electrical Room **Asbestos Present :** No

Ceiling	Not Found								
Duct	Not Found								
Floor	Non-Asbestos Vinyl Tile								V01
Mechanical	Not Found								
Other	Electrical Panel								
Other	Transformer								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Concrete								
Wall	Masonry								

Comments:

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample

Level : 0 - Basement **Room :** LOC 12 - Mechanical Room **Asbestos Present :** No

Ceiling	Not Found
Duct	Fibreglass
Duct	Non-Asbestos Connector
Duct	Uninsulated
Floor	Concrete
Mechanical	Air Handling Unit
Piping	Fibreglass Fitting
Piping	Fibreglass Straight Run
Structure	Concrete
Wall	Concrete
Wall	Masonry

Comments:

Level : 0 - Basement **Room :** LOC 13 - Storage Room **Asbestos Present :** No

Ceiling	Not Found
Duct	Fibreglass
Duct	Uninsulated
Floor	Concrete
Mechanical	Not Found
Piping	Fibreglass Fitting
Piping	Fibreglass Straight Run
Piping	Uninsulated

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity		Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Structure	Concrete									
Wall	Concrete									
Wall	Masonry									

Comments:

Level : 0 - Basement **Room :** LOC 14 - Women's Washroom **Asbestos Present :** Yes

Ceiling	Non-Asbestos Plaster									V07
Duct	Not Found									
Floor	Terrazzo									
Mechanical	Not Found									
Piping	Asbestos Aircell Debris	1.0	SF	Poor		C	2	No	Yes	
Piping	Asbestos Parging Cement Debris	1.0	SF	Poor		C	2	No	Yes	PREV
Piping	Fibreglass Fitting									
Piping	Fibreglass Straight Run									
Piping	Uninsulated									
Structure	Concrete									
Wall	Ceramic Tile									
Wall	Masonry									

Comments:

Anchor bolts into concrete holding pipe in place near hatch - contains remnants of Aircell and parging cement insulation (minor).

Level : 0 - Basement **Room :** LOC 15 - Men's Washroom **Asbestos Present :** No

Ceiling	Non-Asbestos Plaster									V07
Duct	Not Found									

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Floor	Terrazzo								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Piping	Uninsulated								
Structure	Concrete								
Wall	Ceramic Tile								
Wall	Non-Asbestos Drywall Compound								08-04

Comments: Limited access above ceiling.
Access to pipechase.

Level : 0 - Basement **Room :** LOC 16 - Pipechase **Asbestos Present :** No

Ceiling	Non-Asbestos Plaster								V07
Duct	Not Found								
Floor	Concrete								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Piping	Uninsulated								
Structure	Concrete								
Wall	Masonry								
Wall	Non-Asbestos Plaster								V07

Comments:

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample

Level : 0 - Basement **Room :** LOC 17 - Custodial Room **Asbestos Present :** No

Ceiling	Non-Asbestos Plaster								V07
Duct	Not Found								
Floor	Concrete								
Mechanical	Not Found								
Piping	Uninsulated								
Structure	Concrete								
Wall	Non-Asbestos Plaster								V07

Comments:

Level : 0 - Basement **Room :** LOC 18 - Stairs **Asbestos Present :** No

Ceiling	Not Found								
Floor	Non-Asbestos Vinyl Tile								V01
Mechanical	Not Found								
Piping	Uninsulated								
Structure	Concrete								
Wall	Masonry								
Wall	Non-Asbestos Drywall Compound								V08
Wall	Non-Asbestos Plaster								V07

Comments:

Level : 0 - Basement **Room :** LOC 19 - Vacant Area **Asbestos Present :** No

Ceiling	Non-Asbestos 2 x 4 Lay-in Tile								04-01/2/3

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity		Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Ceiling	Non-Asbestos 2 x 4 Lay-in Tile									03-01/2/3
Duct	Fibreglass									
Duct	Uninsulated									
Floor	Carpet									
Floor	Concrete									
Mechanical	Not Found									
Piping	Fibreglass Fitting									
Piping	Fibreglass Straight Run									
Piping	Uninsulated									
Structure	Concrete									
Wall	Non-Asbestos Drywall Compound									08-01/2/3

Comments:

No VAT noted at inspection locations below carpet.
Previous carpet removal following flood resulted in VAT abatement.

Level : 0 - Basement **Room :** LOC 19A - Fire Panel Room **Asbestos Present :** Yes

Ceiling	Not Found									
Duct	Not Found									
Floor	9 x 9 Vinyl Floor Tile	1.0	SF	Good		B	7	Yes	No	
Floor	Asbestos Mastic	4.0	SF	Good	Chrysotile 3.00%	B	7	Yes	No	OH04-01
Mechanical	Not Found									
Piping	Fibreglass Straight Run									
Structure	Concrete Deck									
Wall	Non-Asbestos Stippled Plaster									OH05-01

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample

Comments:

Level : 0 - Basement **Room :** LOC 20 - Office **Asbestos Present :** No

Ceiling	Non-Asbestos 2 x 4 Lay-in Tile								V03
Duct	Uninsulated								
Floor	Concrete								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Piping	Uninsulated								
Structure	Concrete								
Wall	Non-Asbestos Drywall Compound								V08

Comments:

9 x 9 vinyl floor tiles abated.

Level : 0 - Basement **Room :** LOC 21 - Office **Asbestos Present :** No

Ceiling	Non-Asbestos 2 x 4 Lay-in Tile								V03
Duct	Uninsulated								
Floor	Concrete								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Piping	Uninsulated								
Structure	Concrete								

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity		Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Wall	Non-Asbestos Drywall Compound									V08

Comments:

9 x 9 vinyl floor tiles abated.

Level : 0 - Basement **Room :** LOC 21A - Pump Room **Asbestos Present :** No

Ceiling	Not Found									
Duct	Not Found									
Floor	Concrete									
Mechanical	Not Found									
Piping	Fibreglass Fitting									
Piping	Fibreglass Straight Run									
Structure	Concrete									
Wall	Concrete									
Wall	Non-Asbestos Plaster									V07

Comments:

Main springkler room.
9 x 9 vinyl floor tiles have been abated.

Level : 0 - Basement **Room :** LOC 22 - Storage Room **Asbestos Present :** Yes

Ceiling	Not Found									
Duct	Not Found									
Floor	Asbestos Vinyl Floor Tile	800.0	SF	Good	Chrysotile 2.00%	A	7	Yes	No	OH03-01
Mechanical	Not Found									
Structure	Concrete Deck									
Wall	Masonry									

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity		Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Comments:										
Level : 0 - Basement		**Room :** LOC 23 - Storage Room				**Asbestos Present :** Yes				
Ceiling	Non-Asbestos Lay-in Tile - New									
Duct	Uninsulated									
Floor	Asbestos Vinyl Floor Tile	150.0	SF	Good	Chrysotile 2.00%	A	7	Yes	No	VOH03-01
Mechanical	Not Found									
Piping	Fibreglass Straight Run									
Structure	Concrete Deck									
Wall	Masonry									
Comments:										
Level : 0 - Basement		**Room :** LOC 24 - Elevator Mechanical Room				**Asbestos Present :** No				
Ceiling	Not Found									
Duct	Not Found									
Floor	Concrete									
Mechanical	Elevator Lift									
Piping	Fibreglass									
Piping	Uninsulated									
Structure	Concrete									
Wall	Masonry									
Comments:										
Level : 0 - Basement		**Room :** LOC 25 - Quiet Room				**Asbestos Present :** No				

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity		Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Ceiling	Non-Asbestos 2 x 4 Lay-in Tile									V04
Duct	Fibreglass									
Floor	Carpet									
Mechanical	Not Found									
Piping	Fibreglass Fitting									
Piping	Fibreglass Straight Run									
Structure	Concrete									
Wall	Non-Asbestos Drywall Compound									V08

Comments:

Level : 0 - Basement **Room :** LOC 26 - Cafeteria **Asbestos Present :** Yes

Ceiling	Non-Asbestos 2 x 4 Lay-in Tile									V04
Duct	Uninsulated									
Floor	Asbestos Vinyl Floor Tile	1,000.0	SF APPX	Good	Chrysotile 3.00%	A	7	Yes	No	OH02-01
Floor	Concrete									
Floor	Non-Asbestos Vinyl Tile - New									
Mechanical	Exhaust Fan									
Other	Steel Fumehood									
Piping	Fibreglass Fitting									
Piping	Fibreglass Straight Run									
Piping	Uninsulated									
Wall	Concrete									
Wall	Masonry									
Wall	Non-Asbestos Drywall Compound									V08

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity		Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Wall	Non-Asbestos Plaster									V07

Comments:

Level : 0 - Basement **Room :** LOC 27 - Kitchen **Asbestos Present :** Yes

Ceiling	Non-Asbestos 2 x 4 Lay-in Tile									V04
Duct	Uninsulated									
Floor	Asbestos Vinyl Floor Tile	400.0	SF	Good	Chrysotile 3.00%	A	7	Yes	No	VOH02-01
Floor	Concrete									
Floor	Non-Asbestos Vinyl Tile - New									
Mechanical	Not Found									
Piping	Fibreglass									
Piping	Uninsulated									
Structure	Concrete									
Wall	Masonry									
Wall	Non-Asbestos Plaster									V07

Comments:

Level : 0 - Basement **Room :** LOC 27A - I.T. Storage Room **Asbestos Present :** Yes

Ceiling	Non-Asbestos Drywall Compound - New									
Duct	Not Found									
Floor	Asbestos Vinyl Floor Tile	600.0	SF	Good	Chrysotile 3.00%	B	7	Yes	No	OH01-01
Mechanical	Not Found									
Piping	Fibreglass Straight Run									

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity		Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Structure	Concrete Deck									
Wall	Masonry									
Comments:										

Level : 0 - Basement **Room :** LOC 28 - I.T. Storage Room **Asbestos Present :** Potentially

Ceiling	Not Found									
Duct	Not Found									
Floor	Suspect Vinyl Floor Tile	300.0	SF	Good		A	8	Yes	No	
Mechanical	Not Found									
Piping	Fibreglass Fitting									
Piping	Fibreglass Straight Run									
Piping	Uninsulated									
Structure	Concrete									
Wall	Concrete									
Wall	Masonry									
Wall	Non-Asbestos Drywall Compound - New									
Comments:	Possible ACM in Bulkhead No access to bulkhead.									

Level : 0 - Basement **Room :** LOC 29 - SNC-Lavalin **Asbestos Present :** No

Ceiling	Non-Asbestos Lay-in Tile									
Duct	Not Found									
Floor	Carpet									
Mechanical	Not Found									

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Piping	Uninsulated								
Structure	Concrete								
Wall	Non-Asbestos Drywall Compound								V08
Wall	Non-Asbestos Drywall Compound - New								

Comments:

Level : 0 - Basement **Room :** LOC 30 - SNC-Lavalin **Asbestos Present :** No

Ceiling	Non-Asbestos Lay-in Tile								
Duct	Not Found								
Floor	Carpet								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Piping	Uninsulated								
Structure	Concrete								
Wall	Non-Asbestos Drywall Compound								V08
Wall	Non-Asbestos Drywall Compound - New								

Comments:

Level : 0 - Basement **Room :** LOC 31 - Stairs **Asbestos Present :** Potentially

Ceiling	Non-Asbestos Plaster								V07

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Duct	Not Found								
Floor	Terrazzo								
Mechanical	Not Found								
Piping	Uninsulated								
Structure	Inaccessible								
Wall	Non-Asbestos Plaster								V07
Wall	Terrazzo								

Comments: No access above ceiling.

Level : 0 - Basement **Room :** LOC 32 - Corridor **Asbestos Present :** No

Ceiling	Non-Asbestos 2 x 4 Lay-in Tile								02-02
Duct	Fibreglass								
Floor	Non-Asbestos Vinyl Tile								01-01/2/3
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Piping	Uninsulated								
Structure	Concrete								
Wall	Masonry								

Comments:

Level : 0 - Basement **Room :** LOC 33 - Custodial Room **Asbestos Present :** No

Ceiling	Non-Asbestos Plaster								07-04
Duct	Not Found								

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Floor	Terrazzo								
Mechanical	Exhaust Fan								
Piping	Uninsulated								
Structure	Concrete								
Wall	Ceramic Tile								
Wall	Non-Asbestos Plaster								V07

Comments:

Includes washroom.

Level : 0 - Basement **Room :** LOC 34 - First Aid Room **Asbestos Present :** No

Ceiling	Non-Asbestos Plaster								V07
Duct	Not Found								
Floor	Terrazzo								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Piping	Uninsulated								
Structure	Concrete								
Wall	Ceramic Tile								
Wall	Non-Asbestos Plaster								07-02

Comments:

Level : 0 - Basement **Room :** LOC 35 - First Aid Room **Asbestos Present :** No

Ceiling	Non-Asbestos Plaster								V07

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Duct	Not Found								
Floor	Terrazzo								
Mechanical	Exhaust Fan								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Piping	Uninsulated								
Structure	Concrete								
Wall	Ceramic Tile								
Wall	Non-Asbestos Plaster								V07

Comments:

Level : 0 - Basement **Room :** LOC 36 - CCRA **Asbestos Present :** No

Ceiling	Not Found
Duct	Fibreglass
Floor	Concrete
Piping	Fibreglass Straight Run
Piping	Uninsulated
Structure	Concrete Deck
Wall	Concrete
Wall	Masonry

Comments:

Level : 0 - Basement **Room :** LOC 37 - CCRA Storage **Asbestos Present :** No

Ceiling	Not Found

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Duct	Fibreglass								
Duct	Uninsulated								
Floor	Concrete								
Mechanical	Air Handling Unit								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Piping	Uninsulated								
Structure	Concrete								
Wall	Concrete								
Wall	Masonry								

Comments:

Level : 0 - Basement **Room :** LOC 38 - Storage Room **Asbestos Present :** No

Ceiling	Not Found
Duct	Uninsulated
Floor	Carpet
Mechanical	Not Found
Piping	Fibreglass Fitting
Piping	Fibreglass Straight Run
Piping	Uninsulated
Structure	Concrete
Wall	Concrete
Wall	Masonry

Comments:

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample

Level : 0 - Basement **Room :** LOC 39 - Corridor **Asbestos Present :** No

Ceiling	Not Found
Duct	Uninsulated
Floor	Concrete
Mechanical	Not Found
Piping	Armaflex Fitting
Piping	Fibreglass Fitting
Piping	Fibreglass Straight Run
Piping	Uninsulated
Structure	Concrete
Wall	Masonry

Comments:

Stairs B2.

Level : 0 - Basement **Room :** LOC 40 - Stairs **Asbestos Present :** No

Ceiling	Not Found
Duct	Not Found
Floor	Concrete
Mechanical	Not Found
Piping	Fibreglass Fitting
Piping	Fibreglass Straight Run
Piping	Uninsulated
Structure	Concrete

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Wall	Masonry								

Comments:

Includes corridor and closet.

Level : 0 - Basement **Room :** LOC 41 - Storage Room **Asbestos Present :** No

Ceiling	Not Found								
Duct	Not Found								
Floor	Concrete								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Piping	Uninsulated								
Structure	Concrete								
Wall	Concrete								
Wall	Masonry								

Comments:

Level : 0 - Basement **Room :** LOC 42 - Storage Room **Asbestos Present :** No

Ceiling	Not Found								
Duct	Not Found								
Floor	Non-Asbestos Vinyl Tile								OH06-01
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity		Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Piping	Uninsulated									
Structure	Concrete									
Wall	Masonry									

Comments:

Level : 0 - Basement **Room :** LOC 43 - Storage Room **Asbestos Present :** No

Ceiling	Not Found									
Duct	Not Found									
Floor	Non-Asbestos Vinyl Tile									VOHS 06-01
Mechanical	Not Found									
Piping	Fibreglass Fitting									
Piping	Fibreglass Straight Run									
Piping	Uninsulated									
Structure	Concrete									
Wall	Masonry									

Comments:

Level : 0 - Basement **Room :** LOC 44 - Storage Room **Asbestos Present :** Yes

Ceiling	Not Found										
Duct	Not Found										
Floor	Asbestos Vinyl Floor Tile	150.0	SF	Good	Chrysotile 3.00%	A	7	Yes	No		OH07-01
Mechanical	Not Found										
Piping	Fibreglass Fitting										
Piping	Fibreglass Straight Run										

Design	Description	Quantity		Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Piping	Uninsulated									
Structure	Concrete									
Wall	Masonry									
Wall	Steel									

Comments:

Level : 0 - Basement **Room :** LOC 45 - Storage Room **Asbestos Present :** Yes

Ceiling	Not Found									
Duct	Uninsulated									
Floor	Asbestos Vinyl Floor Tile	150.0	SF	Good	Chrysotile 3.00%	A	7	Yes	No	VOH07-01
Mechanical	Not Found									
Piping	Fibreglass Straight Run									
Structure	Concrete Deck									
Wall	Masonry									
Wall	Wood									

Comments:

Level : 0 - Basement **Room :** LOC 46 - Stairs **Asbestos Present :** Potentially

Ceiling	Non-Asbestos Plaster									V07
Duct	Not Found									
Floor	Terrazzo									
Mechanical	Not Found									
Piping	Uninsulated									
Structure	Inaccessible									

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Wall	Non-Asbestos Plaster								V07
Wall	Terrazzo								

Comments: No access above ceiling.
Stairs 4B.

Level : 0 - Basement **Room :** LOC 92 - Elevator Mechanical Room **Asbestos Present :** No

Ceiling	Not Found								
Duct	Not Found								
Floor	Concrete								
Mechanical	Elevator Lift								
Piping	Uninsulated								
Structure	Concrete								
Wall	Non-Asbestos Drywall Compound								V08

Comments:
Penthouse.

Level : 1 - Main Floor **Room :** LOC 69 - Stairs **Asbestos Present :** Potentially

Ceiling	Non-Asbestos Drywall Compound								V08
Duct	Inaccessible								
Floor	Terrazzo								
Mechanical	Inaccessible								
Piping	Inaccessible								
Structure	Inaccessible								
Wall	Terrazzo								

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample

Comments: No access above ceiling.

Level : 1 - Main Floor **Room :** LOC 70 - Stairs **Asbestos Present :** Potentially

Ceiling	Non-Asbestos Drywall Compound								V08
Duct	Inaccessible								
Floor	Terrazzo								
Mechanical	Inaccessible								
Piping	Inaccessible								
Structure	Inaccessible								
Wall	Terrazzo								

Comments: No access above ceiling.

Level : 1 - Main Floor **Room :** LOC 71 - CCRA **Asbestos Present :** No

Ceiling	Non-Asbestos 2 x 4 Lay-in Tile								V02
Duct	Fibreglass								
Floor	Carpet								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Non-Asbestos Fireproofing - New								
Structure	Steel								
Wall	Non-Asbestos Drywall Compound								V08
Wall	Non-Asbestos Plaster								V07

Comments:

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample

Level : 1 - Main Floor **Room :** LOC 72 - Mail Room **Asbestos Present :** No

Ceiling	Non-Asbestos 2 x 4 Lay-in Tile								V02
Duct	Fibreglass								
Duct	Uninsulated								
Floor	Non-Asbestos Vinyl Tile - New								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Non-Asbestos Fireproofing - New								
Structure	Steel								
Wall	Non-Asbestos Drywall Compound								V08

Comments:

Level : 1 - Main Floor **Room :** LOC 72A - Corridor **Asbestos Present :** No

Ceiling	Non-Asbestos Plaster								V07
Duct	Uninsulated								
Floor	Non-Asbestos Vinyl Tile - New								
Mechanical	Not Found								
Piping	Fibreglass Straight Run								
Structure	Non-Asbestos Fireproofing - New								
Structure	Steel								
Wall	Non-Asbestos Drywall Compound								V08
Wall	Non-Asbestos Plaster								V07

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample

Comments:

Level : 1 - Main Floor **Room :** LOC 72B - Vestibule **Asbestos Present :** No

Ceiling	Non-Asbestos Plaster								V07
Duct	Uninsulated								
Floor	Non-Asbestos Vinyl Tile - New								
Mechanical	Not Found								
Piping	Fibreglass Straight Run								
Structure	Non-Asbestos Fireproofing - New								
Structure	Steel								
Wall	Non-Asbestos Drywall Compound								V08
Wall	Non-Asbestos Plaster								V07

Comments:

Level : 1 - Main Floor **Room :** LOC 72C - Receiving **Asbestos Present :** No

Ceiling	Non-Asbestos Lay-in Tile - New								
Duct	Uninsulated								
Floor	Carpet								
Mechanical	Not Found								
Piping	Fibreglass Straight Run								
Structure	Non-Asbestos Fireproofing - New								
Structure	Steel								
Wall	Non-Asbestos Drywall Compound								V08

Comments:

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample

Level : 1 - Main Floor **Room :** LOC 72D - Vestibule **Asbestos Present :** No

Ceiling	Non-Asbestos Lay-in Tile - New								
Duct	Uninsulated								
Floor	Non-Asbestos Vinyl Tile - New								
Mechanical	Not Found								
Piping	Fibreglass Straight Run								
Structure	Non-Asbestos Fireproofing - New								
Structure	Steel								
Wall	Non-Asbestos Drywall Compound								V08
Wall	Non-Asbestos Plaster								V07

Comments:

Level : 1 - Main Floor **Room :** LOC 73 - Public Area **Asbestos Present :** No

Ceiling	Non-Asbestos 2 x 4 Lay-in Tile								V02
Duct	Fibreglass								
Floor	Carpet								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Non-Asbestos Fireproofing - New								
Structure	Steel								
Wall	Non-Asbestos Drywall Compound								V08
Wall	Non-Asbestos Plaster								V07

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample

Comments:

Level : 1 - Main Floor **Room :** LOC 74 - Public Area **Asbestos Present :** No

Ceiling	Non-Asbestos 2 x 4 Lay-in Tile								V02
Duct	Fibreglass								
Floor	Carpet								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Non-Asbestos Fireproofing - New								
Structure	Steel								
Wall	Non-Asbestos Drywall Compound								V08
Wall	Non-Asbestos Plaster								V07

Comments:

Level : 1 - Main Floor **Room :** LOC 75 - Reception **Asbestos Present :** No

Ceiling	Non-Asbestos 2 x 4 Lay-in Tile								V03
Duct	Fibreglass								
Duct	Uninsulated								
Floor	Ceramic Tile								
Floor	Terrazzo								
Mechanical	Not Found								
Piping	Uninsulated								
Structure	Steel								

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Wall	Non-Asbestos Drywall Compound								V08

Comments:

Level : 1 - Main Floor **Room :** LOC 76 - Women's Washroom **Asbestos Present :** No

Ceiling	Non-Asbestos 2 x 4 Lay-in Tile								V02
Duct	Fibreglass								
Duct	Uninsulated								
Floor	Ceramic Tile								
Mechanical	Not Found								
Piping	Fibreglass								
Structure	Non-Asbestos Fireproofing - New								
Structure	Steel								
Wall	Non-Asbestos Drywall Compound								V08

Comments:

Level : 1 - Main Floor **Room :** LOC 77 - Men's Washroom **Asbestos Present :** No

Ceiling	Non-Asbestos 2 x 4 Lay-in Tile								V02
Duct	Fibreglass								
Duct	Uninsulated								
Floor	Ceramic Tile								
Mechanical	Not Found								
Piping	Fibreglass								
Structure	Non-Asbestos Fireproofing - New								
Structure	Steel								

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Wall	Non-Asbestos Drywall Compound								V08

Comments:

Level : 1 - Main Floor **Room :** LOC 78 - Special Collections **Asbestos Present :** No

Ceiling	Non-Asbestos 2 x 4 Lay-in Tile								V02
Duct	Fibreglass								
Duct	Uninsulated								
Floor	Carpet								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Non-Asbestos Fireproofing - New								
Structure	Steel								
Wall	Non-Asbestos Drywall Compound								V08

Comments:

Level : 1 - Main Floor **Room :** LOC 79 - Breakout Room **Asbestos Present :** No

Ceiling	Non-Asbestos 2 x 4 Lay-in Tile								V02
Duct	Fibreglass								
Duct	Uninsulated								
Floor	Carpet								
Mechanical	Not Found								
Piping	Fibreglass								
Structure	Non-Asbestos Fireproofing - New								

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Structure	Steel								
Wall	Non-Asbestos Drywall Compound								V08

Comments:

Level : 1 - Main Floor **Room :** LOC 80 - Barrier-Free Washroom **Asbestos Present :** No

Ceiling	Non-Asbestos 2 x 4 Lay-in Tile								V02
Duct	Uninsulated								
Floor	Ceramic Tile								
Mechanical	Not Found								
Piping	Fibreglass								
Structure	Non-Asbestos Fireproofing - New								
Structure	Steel								
Wall	Ceramic Tile								

Comments:

Level : 1 - Main Floor **Room :** LOC 81 - Elevator Lobby **Asbestos Present :** No

Ceiling	Non-Asbestos Lay-in Tile								
Duct	Fibreglass								
Floor	Ceramic Tile								
Mechanical	Not Found								
Piping	Fibreglass								
Structure	Non-Asbestos Fireproofing - New								
Structure	Steel								
Wall	Non-Asbestos Drywall Compound								V08

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample

Comments:

Level : 1 - Main Floor **Room :** LOC 82 - Training Room **Asbestos Present :** No

Ceiling	Non-Asbestos 2 x 4 Lay-in Tile								V02
Duct	Fibreglass								
Duct	Uninsulated								
Floor	Carpet								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Non-Asbestos Fireproofing - New								
Structure	Steel								
Wall	Non-Asbestos Drywall Compound								V08

Comments:

Level : 1 - Main Floor **Room :** LOC 83 - Training Room **Asbestos Present :** No

Ceiling	Non-Asbestos 2 x 4 Lay-in Tile								V02
Duct	Fibreglass								
Duct	Uninsulated								
Floor	Carpet								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Non-Asbestos Fireproofing - New								

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Structure	Steel								
Wall	Non-Asbestos Drywall Compound								V08

Comments:

Level : 1 - Main Floor **Room :** LOC 84 - Appeals **Asbestos Present :** No

Ceiling	Non-Asbestos 2 x 4 Lay-in Tile								V02
Duct	Fibreglass								
Duct	Uninsulated								
Floor	Carpet								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Non-Asbestos Fireproofing - New								
Structure	Steel								
Wall	Non-Asbestos Drywall Compound								V08

Comments:

Level : 1 - Main Floor **Room :** LOC 85 - Office **Asbestos Present :** No

Ceiling	Non-Asbestos 2 x 4 Lay-in Tile								V02
Duct	Fibreglass								
Duct	Uninsulated								
Floor	Carpet								
Mechanical	Not Found								
Piping	Fibreglass Fitting								

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Piping	Fibreglass Straight Run								
Structure	Non-Asbestos Fireproofing - New								
Structure	Steel								
Wall	Non-Asbestos Drywall Compound								V08

Comments:

Level : 1 - Main Floor **Room :** LOC 86 - Storage Room **Asbestos Present :** No

Ceiling	Non-Asbestos 2 x 4 Lay-in Tile								V02
Duct	Fibreglass								
Duct	Uninsulated								
Floor	Carpet								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Non-Asbestos Fireproofing - New								
Structure	Steel								
Wall	Non-Asbestos Drywall Compound								V08

Comments:

Level : 1 - Main Floor **Room :** LOC 87 - Custodial Room **Asbestos Present :** No

Ceiling	Non-Asbestos Lay-in Tile - New								
Duct	Uninsulated								
Floor	Ceramic Tile								
Mechanical	Not Found								

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Piping	Uninsulated								
Structure	Non-Asbestos Fireproofing - New								
Structure	Steel								
Wall	Ceramic Tile								
Wall	Non-Asbestos Plaster								V07

Comments:

Level : 1 - Main Floor **Room :** LOC 88 - Corridor **Asbestos Present :** No

Ceiling	Non-Asbestos 2 x 4 Lay-in Tile								V02
Duct	Fibreglass								
Duct	Uninsulated								
Floor	Carpet								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Non-Asbestos Fireproofing - New								
Structure	Steel								
Wall	Non-Asbestos Drywall Compound								V08

Comments:

Level : 1 - Main Floor **Room :** LOC 89 - Vestibule **Asbestos Present :** No

Ceiling	Non-Asbestos Lay-in Tile - New								
Duct	Uninsulated								
Floor	Ceramic Tile								

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity		Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Mechanical	Not Found									
Piping	Fibreglass									
Piping	Uninsulated									
Structure	Non-Asbestos Fireproofing - New									
Structure	Steel									
Wall	Non-Asbestos Drywall Compound									V08

Comments:

Level : 1 - Main Floor **Room :** LOC 90 - Stairs **Asbestos Present :** Potentially

Ceiling	Non-Asbestos Drywall Compound									V08
Duct	Inaccessible									
Floor	Terrazzo									
Mechanical	Inaccessible									
Piping	Inaccessible									
Structure	Inaccessible									
Wall	Non-Asbestos Drywall Compound									V08
Wall	Terrazzo									

Comments: No access above ceiling.

Level : 1 - Main Floor **Room :** LOC 91 - Observation Deck **Asbestos Present :** Yes

Ceiling	Non-Asbestos Plaster									V07
Duct	Not Found									
Floor	Asbestos Vinyl Floor Tile	100.0 SF	Good	Chrysotile 3.00%	A	7	Yes	No	VOH07-01	
Floor	Concrete									

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Inaccessible								
Structure	Non-Asbestos Fireproofing - New								
Wall	Non-Asbestos Drywall Compound								V08
Wall	Non-Asbestos Plaster								V07

Comments: No access above ceiling.

Level : 2 - Second Floor **Room :** LOC 47 - CCRA **Asbestos Present :** No

Ceiling	Non-Asbestos Lay-in Tile								
Duct	Fibreglass								
Duct	Uninsulated								
Floor	Carpet								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Piping	Uninsulated								
Structure	Steel								
Wall	Non-Asbestos Drywall Compound								V08
Wall	Non-Asbestos Plaster								V07

Comments:

Level : 2 - Second Floor **Room :** LOC 48 - Stairs **Asbestos Present :** Potentially

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Ceiling	Non-Asbestos Plaster								V07
Duct	Inaccessible								
Floor	Terrazzo								
Mechanical	Inaccessible								
Piping	Inaccessible								
Structure	Inaccessible								
Wall	Non-Asbestos Plaster								V07
Wall	Terrazzo								

Comments: No access above ceiling.

Level : 2 - Second Floor **Room :** LOC 49 - Stairs **Asbestos Present :** Potentially

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Ceiling	Non-Asbestos Plaster								V07
Duct	Inaccessible								
Floor	Terrazzo								
Mechanical	Inaccessible								
Piping	Inaccessible								
Structure	Inaccessible								
Wall	Non-Asbestos Plaster								V07
Wall	Terrazzo								

Comments: No access above ceiling.

Level : 2 - Second Floor **Room :** LOC 50 - Mechanical Room **Asbestos Present :** No

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Ceiling	Not Found								
Duct	Fibreglass								

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Duct	Non-Asbestos Connector								
Duct	Uninsulated								
Floor	Concrete								
Mechanical	Air Handling Unit								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Piping	Uninsulated								
Structure	Non-Asbestos Fireproofing - New								
Structure	Steel								
Wall	Masonry								
Wall	Non-Asbestos Drywall Compound								V08

Comments:

Level : 2 - Second Floor **Room :** LOC 51 - Lunch Room **Asbestos Present :** No

Ceiling	Non-Asbestos Drywall Compound								V08
Ceiling	Non-Asbestos Lay-in Tile								
Duct	Fibreglass								
Duct	Uninsulated								
Floor	Non-Asbestos Vinyl Flooring - New								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Piping	Uninsulated								
Structure	Steel								

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Wall	Non-Asbestos Drywall Compound								V08

Comments:

Level : 2 - Second Floor **Room :** LOC 52 - Women's Washroom **Asbestos Present :** No

Ceiling	Non-Asbestos Plaster								V07
Duct	Uninsulated								
Floor	Ceramic Tile								
Piping	Uninsulated								
Structure	Steel								
Wall	Ceramic Tile								
Wall	Ceramic Tile								

Comments:

Includes B.F. washroom.

Level : 2 - Second Floor **Room :** LOC 53 - Men's Washroom **Asbestos Present :** Potentially

Ceiling	Non-Asbestos Plaster								V07
Duct	Uninsulated								
Floor	Ceramic Tile								
Mechanical	Not Found								
Piping	Inaccessible								
Structure	Steel								
Wall	Ceramic Tile								
Wall	Non-Asbestos Plaster								V07

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample

Comments: No access above ceiling.
Includes storage room.

Level : 2 - Second Floor **Room :** LOC 54 - Office **Asbestos Present :** No

Ceiling	Non-Asbestos Lay-in Tile								
Duct	Fibreglass								
Duct	Uninsulated								
Floor	Carpet								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Steel								
Wall	Non-Asbestos Drywall Compound								V08
Wall	Non-Asbestos Plaster								V07

Comments:

Level : 2 - Second Floor **Room :** LOC 55 - F & A **Asbestos Present :** No

Ceiling	Non-Asbestos 2 x 4 Lay-in Tile								V03
Duct	Fibreglass								
Floor	Carpet								
Mechanical	Not Found								
Piping	Fibreglass								
Piping	Uninsulated								
Structure	Steel								

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Wall	Non-Asbestos Drywall Compound								V08
Wall	Non-Asbestos Plaster								V07

Comments:

Level : 2 - Second Floor **Room :** LOC 56 - I.T. Training **Asbestos Present :** No

Ceiling	Non-Asbestos Lay-in Tile								
Duct	Fibreglass								
Duct	Uninsulated								
Floor	Carpet								
Mechanical	Not Found								
Piping	Not Found								
Structure	Steel								
Wall	Non-Asbestos Drywall Compound								V08

Comments:

Level : 2 - Second Floor **Room :** LOC 57 - Reception **Asbestos Present :** No

Ceiling	Non-Asbestos 2 x 4 Lay-in Tile								V03
Duct	Fibreglass								
Duct	Uninsulated								
Floor	Ceramic Tile								
Floor	Terrazzo								
Mechanical	Not Found								
Piping	Uninsulated								
Structure	Steel								

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Wall	Non-Asbestos Drywall Compound								V08

Comments:

Level : 2 - Second Floor **Room :** LOC 58 - Men's Washroom **Asbestos Present :** Potentially

Ceiling	Non-Asbestos Plaster								V07
Duct	Uninsulated								
Floor	Ceramic Tile								
Mechanical	Not Found								
Piping	Inaccessible								
Structure	Steel								
Wall	Ceramic Tile								
Wall	Non-Asbestos Plaster								V07

Comments: No access above ceiling.
Includes storage room.

Level : 2 - Second Floor **Room :** LOC 59 - Women's Washroom **Asbestos Present :** No

Ceiling	Non-Asbestos Plaster								V07
Duct	Uninsulated								
Floor	Ceramic Tile								
Piping	Uninsulated								
Structure	Steel								
Wall	Ceramic Tile								
Wall	Ceramic Tile								

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample

Comments:

Includes B.F. washroom.

Level : 2 - Second Floor **Room :** LOC 60 - Corridor **Asbestos Present :** No

Ceiling	Non-Asbestos 2 x 4 Lay-in Tile								V04
Duct	Fibreglass								
Duct	Uninsulated								
Floor	Carpet								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Piping	Uninsulated								
Structure	Steel								
Wall	Non-Asbestos Drywall Compound								V08
Wall	Non-Asbestos Plaster								V07

Comments:

Level : 2 - Second Floor **Room :** LOC 61 - Investigations Offices **Asbestos Present :** No

Ceiling	Non-Asbestos 2 x 4 Lay-in Tile								V03
Duct	Fibreglass								
Duct	Uninsulated								
Floor	Carpet								
Mechanical	Not Found								
Piping	Not Found								

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Structure	Steel								
Wall	Non-Asbestos Drywall Compound								V08
Wall	Non-Asbestos Plaster								V07

Comments:

Level : 2 - Second Floor **Room :** LOC 62 - Tech Office **Asbestos Present :** No

Ceiling	Non-Asbestos 2 x 4 Lay-in Tile								V03
Duct	Fibreglass								
Duct	Uninsulated								
Floor	Non-Asbestos Vinyl Tile - New								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Steel								
Wall	Non-Asbestos Drywall Compound								V08

Comments:

Level : 2 - Second Floor **Room :** LOC 63 - Leads **Asbestos Present :** No

Ceiling	Non-Asbestos 2 x 4 Lay-in Tile								V03
Duct	Fibreglass								
Duct	Uninsulated								
Floor	Carpet								
Mechanical	Not Found								
Piping	Fibreglass Fitting								

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Piping	Fibreglass Straight Run								
Structure	Steel								
Wall	Non-Asbestos Drywall Compound								V08

Comments:

Level : 2 - Second Floor **Room :** LOC 64 - Board Room **Asbestos Present :** No

Ceiling	Non-Asbestos Lay-in Tile								
Duct	Fibreglass								
Duct	Uninsulated								
Floor	Carpet								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Structure	Steel								
Wall	Non-Asbestos Drywall Compound								V08
Wall	Non-Asbestos Plaster								V07

Comments:

Level : 2 - Second Floor **Room :** LOC 65 - Stairs **Asbestos Present :** Potentially

Ceiling	Non-Asbestos Plaster								V07
Duct	Inaccessible								
Floor	Terrazzo								
Mechanical	Inaccessible								
Piping	Inaccessible								

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Structure	Inaccessible								
Wall	Non-Asbestos Plaster								V07
Wall	Terrazzo								

Comments: No access above ceiling.

Level : 2 - Second Floor **Room :** LOC 66 - Stairs **Asbestos Present :** No

Ceiling	Non-Asbestos Lay-in Tile								
Duct	Not Found								
Floor	Non-Asbestos Vinyl Tile - New								
Floor	Rubber								
Mechanical	Not Found								
Piping	Not Found								
Structure	Inaccessible								
Wall	Non-Asbestos Drywall Compound								V08

Comments:

Level : 2 - Second Floor **Room :** LOC 67 - Corridor **Asbestos Present :** No

Ceiling	Non-Asbestos Lay-in Tile								
Duct	Fibreglass								
Duct	Uninsulated								
Floor	Carpet								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Structure	Steel								
Wall	Non-Asbestos Drywall Compound								V08

Comments:

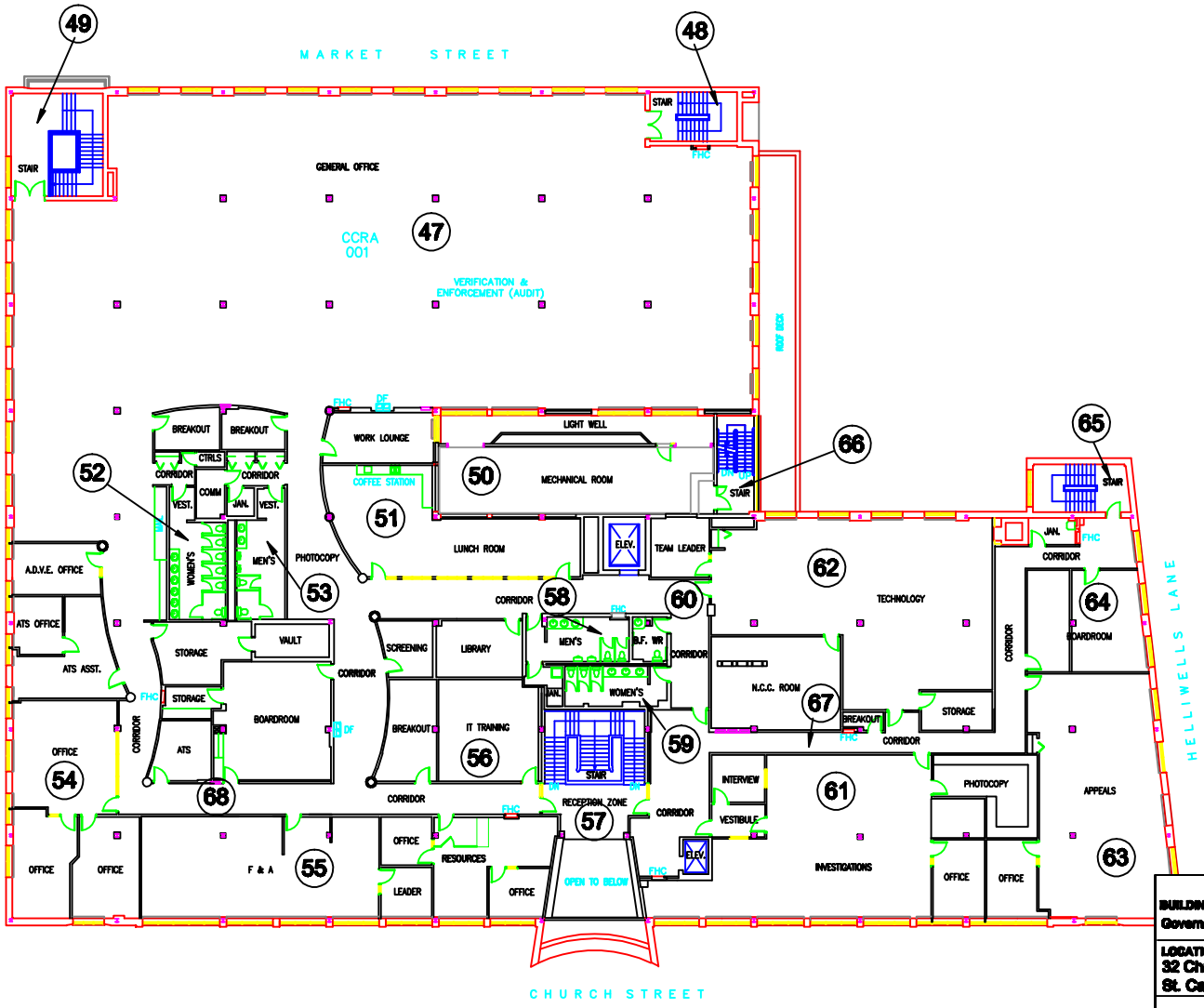
Level : 2 - Second Floor **Room :** LOC 68 - Corridor **Asbestos Present :** No

Ceiling	Non-Asbestos 2 x 4 Lay-in Tile								V04
Duct	Fibreglass								
Duct	Uninsulated								
Floor	Carpet								
Mechanical	Not Found								
Piping	Fibreglass Fitting								
Piping	Fibreglass Straight Run								
Piping	Uninsulated								
Structure	Steel								
Wall	Non-Asbestos Drywall Compound								V08
Wall	Non-Asbestos Plaster								V07

Comments:

APPENDIX III

BUILDING DRAWINGS



BUILDING NAME:
Government of Canada Building

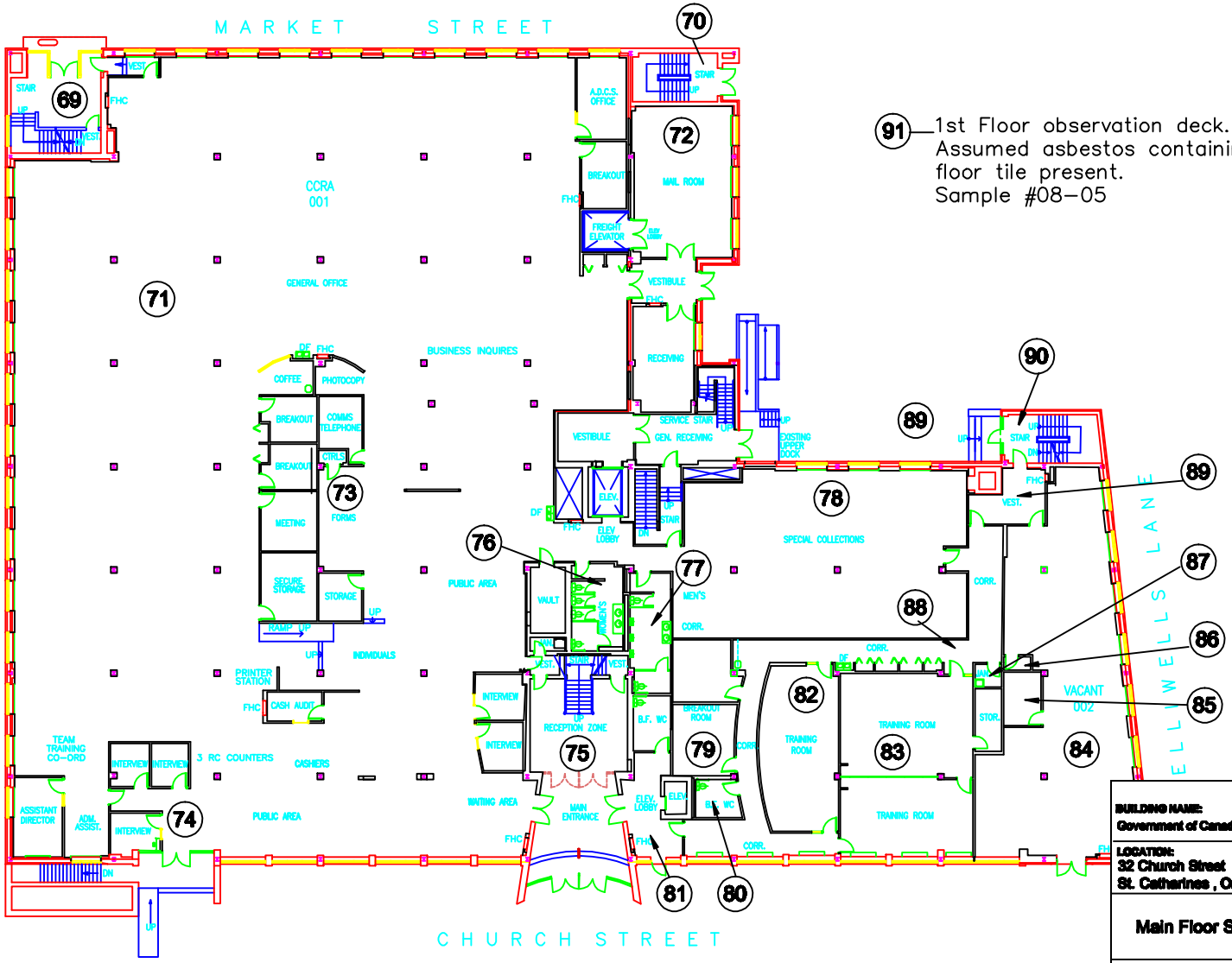
LOCATION:
32 Church Street
St. Catharines , Ontario

Second Floor Survey Locations

Brookfield Global Integrated Solutions.

PROJECT NUMBER:	DATE:	DRAWN BY:
16-0766	Aug 2016	MG
Drawing #: 16-0766-05	SCALE: Not to Scale	CHK BY:

OH Solutions Inc.
119 Thames Street South
Ingersoll, Ontario N5C 2T3



BUILDING NAME:
Government of Canada Building

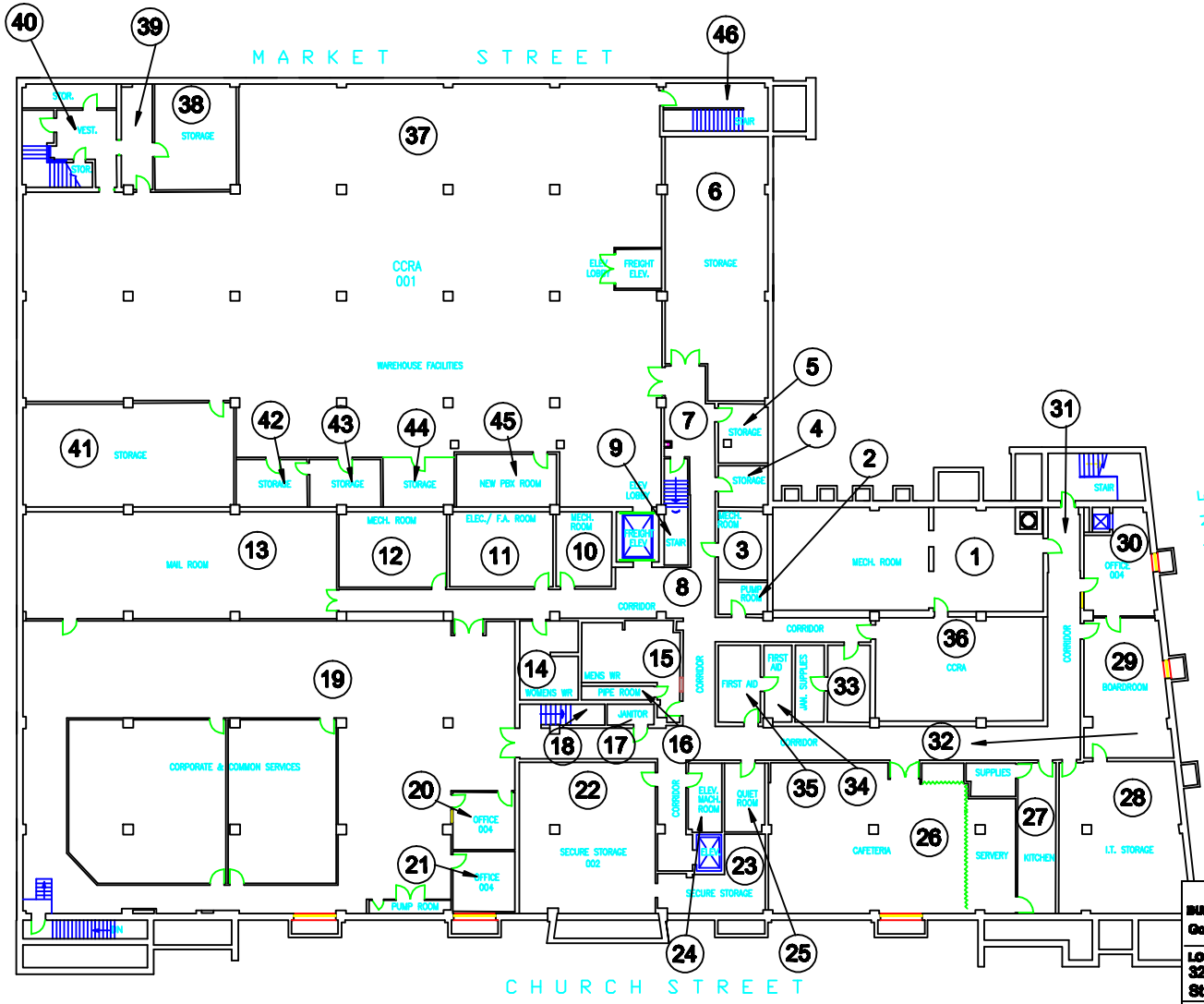
LOCATION:
32 Church Street
St. Catharines , Ontario

Main Floor Survey Locations

Brookfield Global Integrated Solutions.

PROJECT NUMBER:	DATE:	DRAWN BY:
16-0766	Aug 2016	MG
Drawing #: 16-0766-02	SCALE: Not to Scale	CHK'D BY:

OH Solutions Inc.
119 Thames Street South
Ingersoll, Ontario N5C 2T3



BUILDING NAME:
Government of Canada Building

LOCATION:
32 Church Street
St. Catharines , Ontario

Basement Survey Locations

Brookfield Global Integrated Solutions.

PROJECT NUMBER:	DATE:	DRAWN BY:
16-0766	Aug 2016	MG
Drawing #: 16-0766-01	SCALE: Not to Scale	CHK'D BY:

OH Solutions Inc.
119 Thames Street South
Ingersoll, Ontario N5C 2T3

APPENDIX IV

RECOMMENDED REMEDIAL WORK

ASBESTOS ASSESSMENT ACCESSIBILITY AND ACTION CODES

ACCESSIBILITY CODES

A Accessible to all occupants of the building;
B Accessible to maintenance staff without a ladder;
C Accessible to maintenance staff with a ladder; and,
D Not accessible without demolition or removal of fixed building components or building systems.

ACTION CODES

1) Immediate cleanup of debris that is likely to be disturbed.
2) Use Type 2 asbestos procedures to enter an area (other than a ceiling space).
3) Remove asbestos for compliance with the regulations.
4) Require Type 2 asbestos procedures for ceiling entry where friable ACM debris is present on top of a ceiling system.
5) Remove asbestos in order to simplify asbestos management.
6) Repair of asbestos containing material.
7) Monitor condition of ACM.
8) Suspect material that may contain asbestos but sampling was not completed to confirm.

Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = 'W500350' AND (UPPER(Ar2:ActionCode) >= '1' AND UP

Registered User: OH Solutions Inc.

Building Number : W500350 **Building Name :** Government Of Canada Building **Survey Date :** 5/18/2016

Level : 0 - Basement **Room :** LOC 14 - Women's Washroom **Asbestos Present :** Yes

Design	Description	Quantity		Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Piping	Asbestos Aircell Debris	1.0	SF	Poor		C	2	No	Yes	
Piping	Asbestos Parging Cement Debris	1.0	SF	Poor		C	2	No	Yes	PREV

Comments:

Anchor bolts into concrete holding pipe in place near hatch - contains remnants of Aircell and parging cement insulation (minor).

APPENDIX V

DEPUTY MINISTER DIRECTIVE 057, ONTARIO REGULATION 278/05, LEAD ON CONSTRUCTION PROJECTS GUIDELINES AND SILICA ON CONSTRUCTION PROJECTS GUIDELINES

DP 057
1997-12-03
ASBESTOS MANAGEMENT

Table of Contents

1. BACKGROUND

1. Public Works and Government Services Canada shall comply with all federal, provincial, territorial and municipal regulations, statutes and requirements with regard to asbestos containing materials (ACM) in government owned or leased buildings and facilities.
2. This departmental policy and code of practice are established in response to the requirement for a comprehensive approach to departmental asbestos management. This will ensure that the responsibilities of the department, as building owner, tenant, landlord and employer, with respect to safety and health issues and environmental control issues, are fully addressed.
3. This departmental policy and code of practice specify the role and responsibilities of the Regional Asbestos Coordinator and provide standard methods and procedures to address the following:
    1. identification, assessment and inventory of ACM in buildings and facilities;
    2. notification to employees, client departments and contractors regarding the presence of friable asbestos;
    3. reassessment of friable ACM on an annual basis;
    4. maintenance of departmental information regarding ACM;
    5. training modules for PWGSC personnel, based on the responsibilities and duties to be undertaken in relation to asbestos management;
    6. identification, classification, monitoring, inspection and control of asbestos-

related work undertaken by departmental personnel or contractors.

2. POLICY

Public Works and Government Services Canada shall ensure the control of asbestos containing materials (ACM). The responsibilities of the department, as building owner, tenant, landlord and employer, with respect to safety and health issues and environmental control issues, shall be fully addressed and in accordance with the *Canada Labour Code, Part II*, the *Canada Occupational Safety and Health Regulations, Part X - Hazardous Substances*, and applicable provincial and territorial occupational health and safety and environmental protection legislation.

3. SCOPE

This departmental policy and code of practice apply to all managers, supervisors and employees where the duties required to be undertaken involve the removal, repair or maintenance of ACM. This departmental policy and code of practice apply to any building or facility in which friable material, that may contain asbestos, has been used, and all repairs, alterations or maintenance of any building or facility where ACM may exist.

4. DEFINITIONS

See Annex A.

5. ROLES AND RESPONSIBILITIES

See Annex B.

6. GUIDELINES

1. Implementation

The Director, Corporate Environment, Safety and Health shall provide the framework for departmental asbestos management through the provision of approved departmental training modules to meet requirements, and the issue of standard methods and procedures. Training requirements shall be reviewed on an annual basis.

The Regional Asbestos Coordinator shall implement the departmental methods and standards within the region and shall ensure that initial surveys for asbestos are conducted, inventories are developed and properly maintained, and that training requirements for departmental employees are identified and that the training is provided.

2. Monitoring

The Director, Corporate Environment, Safety and Health shall monitor asbestos management to ensure that requirements are met, and that procedures are established and implemented as required throughout the department.

The Regional Asbestos Coordinator and the Regional Manager responsible for Safety and Health shall review the progress of asbestos surveys and training, and

the overall implementation of asbestos management and subsequent safety and health issues, on a quarterly basis.

Training requirements, notifications, records, procedures and other safety and health issues related to asbestos management shall be reviewed on a quarterly basis by the network of Workplace Safety and Health Committees and Representatives.

Issues related to asbestos management that cannot be resolved at the workplace level shall be reported to the Regional Safety and Health Committee. Issues that cannot be resolved at the regional level shall be reported to the National Safety and Health Committee.

7. PROCEDURES

Annex C - Code of Practice

8. COMPLIANCE

Compliance with this departmental policy is mandatory and in accordance with all existing safety and health legislation. The refusal of an employee at any level to comply with this departmental policy or with the provisions of the prescribed codes, standards, regulations, and/or departmental policies will be considered as misconduct.

9. REFERENCES

Acts and Regulations:

- Canada Labour Code, Part II:
  - *Part II of the Canada Occupational Safety and Health Regulations, (COSH), Building Safety*,
  - *Part X of the Canada Occupational Safety and Health Regulations, (COSH), Hazardous Substances*,
  - *Part XIV of the Canada Occupational Safety and Health Regulations, (COSH), Materials Handling*.

Treasury Board Publications:

- *Occupational Health Evaluation Standard*;
- *Procedures for occupational exposure to asbestos*;
- Canadian National Master Specifications, Sections 13280, 13281 and 13282.

PWGSC Publications:

- *DP 007 - Health and Safety Policy*
- *DP 017 - Personal Protective Equipment for Employees*
- *DP 018 - Hazardous Occurrence Investigating, Reporting and Recording*

Other Publications:

- Provincial and Territorial Occupational Health and Safety Legislation;
- Provincial and Territorial Environmental Protection Legislation.

10. INQUIRIES

Departmental:

Director
Corporate Environment, Safety and Health

Regional:

Regional Managers responsible for Safety and Health

Original Signed by
R.A. Quail

R. A. Quail
Deputy Minister and
Deputy Receiver General for Canada

Annex A - Definitions

Asbestos Containing Material (ACM) (Matériau contenant de l'amiante (MCA)) means any material found to contain asbestos that is at or above the limit defined by provincial standards, as determined by the standard Polarized Light Microscopy (PLM) method for the analysis of bulk samples.

Department (ministère) means Public Works and Government Services Canada (PWGSC).

Employee (employé) means a person employed by the department.

Employer (employeur) means a supervisor who is responsible for the work of one or more employees at the workplace.

Friable asbestos product (produit friable à base d'amiante) means ACM, that when dry, can be crumbled, pulverized or powdered by hand pressure. This definition also includes dust or debris arising from non-friable materials that are, or will become, crumbled, pulverized or powdered, i.e., asbestos containing plaster disturbed by demolition. Friable asbestos-suspect products include: Sprayed asbestos products, (fireproofing, thermal insulation, acoustic insulation or decorative products), applied in 1974 or earlier; Acoustic or texture plaster applied in 1983 or earlier; Mechanical insulation installed in 1983 or earlier, (jacketed or not); Compressed mineral fibre ceiling tiles installed in 1983 or earlier.

Hazardous occurrence (situation dangereuse) means an event occurring at a PWGSC managed building or worksite, or through the course of an employee's work that results

in, or has the potential to result in, a fatality, injury, property damage or an escapement of a hazardous material. For the purpose of investigating, recording and reporting of hazardous occurrences, the following are included under this term: Critical Incidents; Disabling Injuries; Non-Disabling Injuries; Minor Injuries; Minor Occurrences and Near-Misses.

Manager in charge of worksite (gestionnaire responsable du lieu de travail) means the person to whom the supervisor reports directly.

Person in charge (personne responsable) means a qualified person, appointed by management, to ensure the safe and proper conduct of an operation, or the work of employees.

Personal protective equipment (équipement de protection individuelle) means any clothing, equipment or device worn or used by a person to protect that person from injury or illness.

Qualified person (personne qualifiée) means, with respect to a specified duty, an individual who, because of knowledge, training and experience, is qualified to safely and properly perform the duty.

Region or Regional, (région ou régional) when utilized in Safety and Health Departmental Policies and Codes of Practice, refers to all Regions and includes the National Capital Area.

Senior employer representative (représentant supérieur de l'employeur) means the individual with the delegated authority to make and carry out decisions of an operational nature, on behalf of the department, for the workplace.

Supervisor (superviseur) means the person at the workplace to whom the employee(s) report(s) directly.

Workplace (lieu de travail) means any place where an employee is engaged in work for the department.

Annex B - Roles and Responsibilities

1. **Branch/Agency Heads** are accountable for the implementation of this departmental policy within their areas of responsibility. This accountability is further referenced in *DP 007, Annex A - Accountability Framework for the Health and Safety Function*.

   In addition, Regional Directors General are responsible for appointing a qualified person as the Regional Asbestos Coordinator.

2. **Senior Employer Representatives** are responsible for ensuring that all workplaces within their area of responsibility implement the requirements of this departmental policy and code of practice.
3. The **Director, Corporate Environment, Safety and Health** is responsible for:

    1. monitoring the departmental program to ensure that requirements for asbestos management are met, and that procedures are established and implemented as required throughout the department;
    2. approving training modules prior to implementation, and ensuring that an annual review of training requirements is undertaken;
    3. liaising, on behalf of the department, with regulatory bodies, central agencies, and provincial bodies on matters related to asbestos management.
4. The **ADM, Human Resources Branch**, is responsible for ensuring that the appropriate procedures are implemented so that Asbestos-Related Work Records are maintained on employee files for a period of thirty (30) years.
5. The **Regional Asbestos Coordinator** is responsible for:
    1. implementing the requirements for departmental asbestos management within the region;
    2. arranging for initial asbestos surveys and the reassessments of buildings and facilities;
    3. preparing standard notification letters regarding the existence of friable asbestos, for issue by Property, Facility or Project Managers;
    4. maintaining a data base of survey and reassessment information relating to the existence of ACM;
    5. issuing copies of asbestos inventory and assessment reports and updates to Property and Facility Managers;
    6. classifying asbestos-related project work on behalf of Project Managers, and arranging for the preparation of specifications when required;
    7. ensuring that Property and Facility Managers are aware of the requirements of asbestos management, and ensuring that standard procedures are implemented for asbestos work, required training is provided, current information relating to ACM is available and records are properly maintained;
    8. coordinating training requirements for departmental employees and maintaining records of training;
    9. maintaining all records relating to asbestos management within the region and asbestos work undertaken in the region, i.e., asbestos inventory and assessment reports, training records, notification letters and work records;
    10. reviewing all work requirements that have been classified as Type 3, and undertaking the direction of the work when required;
    11. assisting in the identification of circumstances where an employee is, or may be, exposed to airborne asbestos during work not subject to the precautions required by the Asbestos Management Code of Practice and ensuring that any required hazard assessments are undertaken;
    12. ensuring that the Regional Manager responsible for Safety and Health has been notified in situations where an employee has been exposed to a hazardous occurrence where an investigation may be required;
    13. reviewing asbestos-related work requirements, at random, to ensure that work has been properly classified, and that all required specifications have been addressed;
    14. reviewing, on a quarterly basis, the progress of asbestos surveys and training, and implementation of asbestos management, and safety and health issues with the Regional Manager responsible for Safety and Health.
6. **Property Managers, Facility Managers and Project Managers** shall implement this departmental policy and code of practice as required, based on the nature of their function and the duties for which they are responsible, by:

    1. ensuring that the requirements for departmental asbestos management are fully implemented within their area of responsibility;
    2. reviewing all maintenance work requirements against survey information to determine the possibility of friable asbestos being disturbed, and classifying the work based on the approved criteria;
    3. notifying, in writing, Workplace Safety and Health Committees and Representatives, (tenant departments and PWGSC), and employees and contractors of the existence of friable ACM, and providing updates on conditions as modifications or changes are made;
    4. maintaining asbestos inventory, assessment and reassessment reports and ensuring that a copy of this information is maintained in a location that is accessible to maintenance staff and contractors;
    5. obtaining the approval of the Regional Asbestos Coordinator prior to arranging for the removal or repair of damaged or deteriorated friable ACM;
    6. submitting all Type 3 work requirements to the Regional Asbestos Coordinator for review prior to arranging for the work to be undertaken;
    7. consulting the Regional Asbestos Coordinator, when necessary, to determine the impact of a specific project with regards to ACM;
    8. maintaining a stock of required equipment for work classified as Type 1 and Type 2;
    9. identifying and providing a suitable storage area for waste resulting from asbestos work, and arranging for periodic waste removal.
7. **Managers in Charge of Worksites and Supervisors** shall implement this departmental policy and code of practice as required by the nature of the tasks for which they are responsible, by:
    1. ensuring that employees have been provided with the required training to undertake the work;
    2. ensuring that the appropriate personal protective equipment, tools and clothing required for the work are provided;
    3. ensuring that testing, maintenance and storage routines are established and implemented for all personal protective equipment and tools;
    4. identifying a qualified person to undertake the duties of the "Person in Charge";
    5. ensuring that an Asbestos-Related Work Record Form (PWGSC-TPSGC 55) is completed for each period of work, and that a copy of this record is submitted to Human Resources Branch to be placed on employee files, and a copy is submitted to the Regional Asbestos Coordinator;
    6. ensuring that all employees required to perform work classified as Type 2 or Type 3 undertake health evaluations as per the requirements of *DP 059 - Health Evaluations - Safety and Health, PWGSC*;
    7. notifying the Asbestos Coordinator of any hazardous occurrence that has taken place or when their has been a requirement to undertake emergency asbestos-related work for a particular situation.
8. The **Person in Charge** is responsible for:
    1. ensuring that workers on site have been provided with the required training for the work to be undertaken;
    2. ensuring that all required equipment is on site before commencement of the work;
    3. ensuring that the appropriate personal protective equipment, tools and clothing required for the work are worn and/or utilized;
    4. ensuring that the appropriate procedures for the work are implemented and that all workers are aware of, and comply with, established procedures;

    5. ensuring that all procedures for inspection and air monitoring are implemented based on the classification of the work and the specified requirements;
    6. immediately informing the Manager in Charge of the Worksite or the Supervisor of a hazardous occurrence involving asbestos-related work.
9. **Regional Managers responsible for Safety and Health** are responsible for:
    1. monitoring worksites periodically to ensure that standard procedures are implemented for asbestos work, required training is provided, current information relating to ACM is available and records are properly maintained;
    2. investigating specific workplace complaints concerning asbestos and asbestos-related work and taking appropriate action;
    3. providing assistance and advising the Asbestos Coordinator of specific safety and health issues and requirements related to asbestos management;
    4. reviewing, on a quarterly basis, with the Regional Asbestos Coordinator the implementation of asbestos management and safety and health issues.
10. **Workplace Safety and Health Committees and Representatives** are responsible for:
    1. participating in hazard investigations to determine the risks and hazards associated with asbestos-related work requirements;
    2. monitoring workplaces to ensure that the requirements for asbestos-related work have been addressed, i.e., training has been provided; personal protective equipment is provided and properly utilized; records are maintained and procedures are implemented;
    3. reporting immediately, specific workplace complaints related to asbestos management, to the Regional Manager responsible for Safety and Health;
    4. undertaking a review of training requirements for asbestos-related work on an annual basis.
11. **Employees** are responsible for:
    1. applying the appropriate practices, procedures and equipment for the type of asbestos-related work;
    2. wearing and/or utilizing and maintaining the required personal protective equipment, clothing and tools;
    3. reporting immediately, to the Person in Charge, the Manager in Charge of the Worksite, or the Supervisor, all known or suspected conditions or activities that are in violation of approved practices and procedures and that may cause a hazardous occurrence.

Annex C - Code of Practice

1. Asbestos Surveys, Assessments and Inventories

To ensure that a complete inventory of ACM that includes friable ACM and the principal types of non-friable ACM is developed, it is necessary to undertake a thorough survey of all government-owned or leased facilities. Once ACMs are identified through surveys and assessments of the materials are made,

inventories shall then be established and maintained.

Leasing Space and Friable Asbestos

When space is considered for lease in a building that was constructed before 1983, PWGSC shall request and obtain from the lessor, an asbestos survey that identifies all friable asbestos materials located within the structure.

This survey shall be signed by and conducted under the direction of a qualified person, competent in asbestos control, i.e., a Professional Engineer, a Certified Industrial Hygienist, or a Registered Occupational Hygienist.

If friable asbestos is present the following rules shall be applied in considering the space:

1. the department shall not lease space when there is friable asbestos material located directly within the space to be occupied;
2. the department may lease space when friable asbestos is present elsewhere in the building, provided that there is an asbestos management program in place that meets the basic requirements of the department, as described herein by the departmental policy and code of practice for asbestos management.

Asbestos Surveys

The Regional Asbestos Coordinator shall undertake the planning and coordination of all asbestos surveys. A detailed survey of each location within the region shall be undertaken initially, in order to determine the presence of ACM, including all friable asbestos materials, applications of floor finishes and asbestos reinforced cement products, i.e., asbestos cement sheeting and piping. This survey shall be conducted on a floor-by-floor and room-by-room basis.

The Regional Asbestos Coordinator shall ensure that all surveys are conducted under the direction of a qualified person competent in asbestos control, i.e., Professional Engineer, Certified Industrial Hygienist, or Registered Occupational Hygienist.

The Regional Asbestos Coordinator shall ensure that each survey is signed off by the qualified person who directed the survey.

Assessment of Asbestos Materials

ACM that is identified during the survey shall be assessed, and recommendations regarding the action to be taken shall be determined as per the specifications provided in *Appendix 1 - Evaluation of Asbestos Containing Materials (ACM) and Recommendations for Control*.

Appendix 1 provides specific criteria for the assessment of materials based on condition and accessibility, and provides an Action Matrix, which is utilized in determining the recommended action to control ACM based on the particular circumstances. Detailed information regarding the requirements to properly

undertake each action are also provided.

NOTE: Analysis of materials to determine asbestos content shall be performed by Health Canada, or by private laboratories accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) of the U.S. National Institute of Science and Technology (NIST), in the use of the Polarized Light Microscopy method. The analysis of bulk samples shall be performed to the detection limits as indicated in Appendix 1 - Detection Limit of Bulk Analysis.

Asbestos Inventories

Once surveys have been completed and assessment of materials has been made, the Asbestos Coordinator shall ensure that this inventory information is entered into the PWGSC Asbestos Management Database. The Asbestos Coordinator shall update this information as changes are made at the various locations, or where new information identifies the existence of ACM not previously identified.

The Asbestos Coordinator shall ensure that Completed Asbestos Inventory, Assessment Reports and Reassessment Reports are forwarded to the respective Property or Facility Manager, and that current copies of these documents are made available at a location in each building or facility that is accessible to maintenance staff, contractors and workplace safety and health committee members and representatives.

NOTE: Property and Facility Managers shall notify the Regional Asbestos Coordinator prior to arranging for, or undertaking, removal or repair of damaged or deteriorated friable asbestos materials identified by the Asbestos Inventory and Assessment.

2. Notification of Friable Asbestos

The Regional Asbestos Coordinator shall provide written notice to Property and Facility Managers concerning the presence of friable ACM, as per the findings of surveys and assessments.

For those locations where a survey and assessment are pending, and the presence of friable ACM is known, the Regional Asbestos Coordinator shall provide interim written notice to the Property or Facility Manager.

Upon receipt of Asbestos Inventory and Assessment reports, the Regional Asbestos Coordinator shall provide updated written notification to Property and Facility Managers.

Property and Facility Managers shall ensure that written notice is provided to the following groups:

- Workplace Safety and Health Committees and Representatives;
- Maintenance Employees;
- Contractors, Inspectors. (Those who may enter parts of the building or facility where friable ACM may be present, i.e., telecommunications firms, boiler maintenance contractors, inspectors, etc.) See Appendix 2 -

Contractor Notification and Acknowledgement.

Copies of all notices issued to Property and Facility Managers shall be maintained by the Regional Asbestos Coordinator.

3. Reassessment of Friable Asbestos

The Regional Asbestos Coordinator shall arrange for an annual reassessment of all friable ACM present in exposed locations.

Copies of reassessment reports shall be distributed to Property and Facility Managers. Property and Facility Managers shall provide updated information to the following groups:

- Workplace Safety and Health Committees and Representatives;
- Maintenance Employees;
- Contractors, Inspectors. (Those who may enter parts of the building or facility where friable ACM may be present, i.e., telecommunications firms, boiler maintenance contractors, etc.) See Appendix 2 - Contractor Notification and Acknowledgement.

Property and Facility Managers shall notify the Regional Asbestos Coordinator prior to arranging for, or undertaking, removal or repair of damaged or deteriorated friable ACM.

4. Training

Training shall be provided to PWGSC personnel, as required, based on their roles and responsibilities related to asbestos management. Training shall be delivered in modules in order to target specific requirements and related duties, and to avoid duplication.

The duration of training and mode of delivery shall be determined by the Director, Corporate Environment, Safety and Health, in consultation with the National Safety and Health Committee.

The Regional Asbestos Coordinator and the Human Resources Branch, shall maintain records of training.

Training requirements shall be reviewed annually by the network of Workplace Safety and Health Committees and Representatives.

Asbestos Management Training

Asbestos management training shall be provided to the Regional Asbestos Coordinators, Property and Facility Managers, and Project Managers. This training will include an introduction to the asbestos inventory and assessment reports, health hazards of asbestos exposure, regulations, the Asbestos Management Code of Practice, classification of asbestos work, asbestos project control, and emergency procedures.

Asbestos Procedures Training

Training shall be provided to maintenance workers who will perform Type 1 or Type 2 work. The training will include an introduction to the asbestos inventory and assessment reports, health hazards of asbestos exposure, regulations, the Asbestos Management Code of Practice, Type 1 and Type 2 work practices, and disposal procedures. Upon completion of the training, workers shall sign a form acknowledging the training received. See Appendix 3 - *Certificate of Training for Asbestos-Related Work*.

Respirator Training

Respirator training shall be provided to all those who will perform Type 2 work, and to employees who will perform Type 1 work and request a respirator. The training will cover limitations of use, fitting, and maintenance of respirators. Persons provided with a respirator will be fit-tested with the assigned respirator, using the CSA irritant smoke method. See Appendix 6 - *Respirator Fitting, Inspection, Cleaning and Disinfecting* for procedures and related information regarding respirators.

NOTE: Employees who will utilize a respirator shall be required to undertake a medical evaluation as per the requirements of *DP 059 - Health Evaluations - Safety and Health, PWGSC*

Asbestos Awareness Training

Training shall be provided to all maintenance and operations personnel who may work near asbestos materials.

This training shall also be required for those who supervise workers or contractors who may work near asbestos materials.

The module will introduce the asbestos inventory and assessment reports, health hazards of asbestos exposure, the Asbestos Management Code of Practice, and emergency procedures.

This training shall also be made available to Workplace Safety and Health Committee Members and Representatives.

5. Identification, Classification and Control of Asbestos-Related Work

Maintenance Work

Property and Facility Managers, or their designates, are responsible to review all maintenance work for the possibility of the disturbance of ACM when required work is undertaken.

When there are friable or non-friable ACMs in the area, and this material will be disturbed by the work, then the work shall be determined as asbestos-related

work and classified as Type 1, Type 2, or Type 3. Appropriate procedures shall be implemented based on the classification of the work. See Appendix 5 - *Classification of Asbestos-Related Work*, and Appendix 6 - *Work Procedures*.

If there are friable or non-friable ACMs in the area of maintenance, that will be disturbed by the intended work, the Property or Facility Manager or designate shall classify the work as Type 1, Type 2, or Type 3. Work determined to be a Type 3 classification shall be forwarded to the Asbestos Coordinator for review.

The Regional Asbestos Coordinator shall review all work that is classified as Type 3 asbestos work. The Regional Asbestos Coordinator shall determine, based on the requirements and specific circumstances of the work, the degree of his/her personal involvement in the direction of the work.

NOTE: If there are friable ACMs in the area of maintenance, and it has been determined that these materials will not likely be disturbed by the maintenance work, the Property or Facility Manager shall inform maintenance staff and/or the contractor of the presence of friable ACMs prior to the commencement of work.

On completion of any maintenance work which involves asbestos removal or repair, a report will be provided to the Regional Asbestos Coordinator which indicates the asbestos-related work that has been completed. See Appendix 4 - Asbestos-Related Work Record. The Regional Asbestos Coordinator will then update the information in the inventory as required, and ensure that this information is distributed as required.

NOTE:

- Property and Facility Managers shall maintain a stock of the approved equipment required for Type 1 and Type 2 asbestos work, where PWGSC staff perform asbestos work.
- When asbestos work is performed by PWGSC staff, asbestos debris shall be packaged in double-bagged containers or other suitable containers, by those completing the project. These containers shall be held at a pre-determined, secure location in the building.
- The Property or Facility Manager shall arrange for periodic collection of asbestos waste containers from this location.

Renovation and Construction Work

Project Managers shall consult the Regional Asbestos Coordinator prior to undertaking renovation or construction work. The Regional Asbestos Coordinator shall review the asbestos survey reports for the possible impact on asbestos materials, prior to all renovation and construction work.

Prior to commencement of projects that include the demolition of plaster installed prior to December 1983, testing of the plaster for asbestos shall be undertaken, unless previous comprehensive testing in the building has shown this plaster to be free of asbestos. Records of plaster test results shall be maintained by the Asbestos Coordinator and the Property or Facility Manager along with the asbestos surveys of the building.

The Regional Asbestos Coordinator, on behalf of the Project Manager, shall classify the work as Type 1, Type 2, or Type 3.

In Ontario, the Project Manager, through the Regional Asbestos Coordinator, shall obtain a Designated Substance Report (a prescribed listing of asbestos, lead, silica, and other hazardous materials) prior to tendering the work.

The Regional Asbestos Coordinator, on behalf of the Project Manager, shall arrange for specifications to be prepared for asbestos work, following the National Master Specification. Alterations to specifications, in order to accommodate specific provincial requirements, shall be determined when required.

Services related to the design and preparation of specifications shall be performed by Consultants or Engineers with the appropriate training, experience and insurance for asbestos-related work. Insurance shall specifically include professional liability with pollution coverage.

When there are friable asbestos materials in the renovation area, and the Regional Asbestos Coordinator has determined that these materials are not likely to be disturbed by the work, the maintenance staff or the contractor must be notified of the presence of friable asbestos materials. The contractor shall be required to sign the Contractor Notification and Acknowledgement Form prior to commencement of the work. See Appendix 2 - *Contractor Notification and Acknowledgement*.

At the completion of any project work which alters the amount or condition of friable ACM, a report will be provided to the Regional Asbestos Coordinator which indicates the work that has been completed. See Appendix 4 - *Asbestos-Related Work Record*. The Regional Asbestos Coordinator will then update information in the inventory, and ensure that this information is distributed as required.

6. Asbestos Work Records and Medical Surveillance

Managers in Charge of Worksites and Supervisors shall ensure that an Asbestos-Related Work Record is completed for employees performing Type 2 or Type 3 work, or entering a Type 2 or Type 3 work area. A work record shall be completed for each period of work.

Managers in Charge of Worksites and Supervisors shall ensure that a copy of each work record is forwarded to Human Resources Branch and to the Regional Asbestos Coordinator. See Appendix 4, for a sample of the Asbestos-Related Work Record.

Human Resources Branch shall maintain Asbestos-Related Work Reports on employee files for a period of thirty (30) years. Asbestos-Related Work Reports shall be maintained by the Office of the Regional Asbestos Coordinator for a period of thirty (30) years.

All PWGSC employees who will perform Type 2 or Type 3 work shall undertake a medical evaluation as per the requirements of *DP 059 - Health Evaluations -*

Safety and Health, PWGSC.

7. Asbestos Work Procedures

Type 1, Type 2, and Glove Bag Procedures

Standard procedures for performing Type 1, Type 2, and Glove Bag asbestos work are provided in Appendix 6 - *Work Procedures*.

Type 3 Procedures

Type 3 procedures are not included in the standard procedures provided in Appendix 6 - *Work Procedures*.

Procedures for Type 3 work are developed for the particular work to be undertaken, and the specific circumstances and worksite. These procedures shall be developed in compliance with the National Master Specification, Section 13282, Asbestos Abatement (maximum precautions).

Emergency Procedures

Procedures for asbestos work, required on an emergency basis, as an immediate response to floods, pipe breaks, ceiling collapses, or other emergencies that affect asbestos materials, are provided in Appendix 6 - *Work Procedures*. These procedures shall be implemented to protect those undertaking the work, and to protect all others from, or limit exposure to, airborne asbestos.

Emergency procedures, indicated in Appendix 6 - *Work Procedures*, shall be followed as closely as possible, in the event of an emergency situation.

Emergency Plans

An Emergency Plan that corresponds with the emergency procedures for the specific site shall be developed and implemented, to ensure that safety and health requirements are addressed in the event of emergency situations that require work shut-down and evacuation.

8. Asbestos Work Inspection and Air Monitoring

Type 1 and Type 2 Work

Type 1 and Type 2 work shall be subject to the standard maintenance or project inspection requirements for non-asbestos work. Asbestos-specific air monitoring or inspection is not mandatory.

Type 3 Work

The Regional Asbestos Coordinator, on behalf of the Project Manager, may arrange for the inspection and air monitoring during Type 3 asbestos projects. These services shall be provided by consultants or engineers with the appropriate training, experience and insurance for asbestos-related work.

When Type 3 work is to be undertaken in an occupied building, or in a building in use, daily inspection and air monitoring shall be required. If the building is not occupied, inspection shall be at critical stages of the work, unless provincial standards require daily inspection, as necessary in Quebec and British Columbia.

All Type 3 removal projects shall be subject to final clearance air testing. The clearance criteria shall be a maximum fibre concentration of 0.01 fibre/ml of air, as determined by the standard Phase Contrast Microscope (PCM) method.

9. Air Monitoring and Bulk Analysis

Air Monitoring for Hazard Assessment

When the Regional Asbestos Coordinator is requested to, and has determined the requirement for, air monitoring under normal conditions of building use (i.e., away from asbestos work), the measurements shall be made by the Transmission Electron Microscopy (TEM) analytical method.

NOTE: Air monitoring shall not be used as the primary method for the assessment of hazard from asbestos materials.

Air Monitoring During Asbestos Work

The Regional Asbestos Coordinator shall arrange for air monitoring during Type 3 work, as required, to confirm the safety of work practices and the effectiveness of work area isolation. These measurements shall be made by the Phase Contrast Microscope (PCM) method recognized by Human Resources Development Canada (HRDC) - Labour Programs and provincial occupational health and safety authorities.

PCM measurements shall be made by National Institute of Occupational Safety and Health (NIOSH) method 7400, except work in British Columbia and Quebec, where provincial analytical methods are in place.

Analysis of PCM samples shall be performed by Health Canada or individuals or organizations successfully participating in a recognized external quality control program.

Bulk Sample Collection and Analysis

Procedures for collection and labeling of bulk samples for asbestos analysis are detailed in Appendix 6 - *Work Procedures*.

Analysis of materials to determine asbestos content shall be performed by Health

Canada or by private laboratories accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) of the U.S. National Institute of Science and Technology (NIST). The laboratories shall report to the limits of detection as indicated in Appendix 1 - *Detection Limit of Bulk Analysis*.

Maintenance of Records

The Regional Asbestos Coordinator shall maintain copies of all reports and records relating to testing, sampling and analysis undertaken for buildings and facilities within the region.

10. Hazard Investigation

When an employee is or may be exposed to airborne asbestos as a result of direct disturbance of asbestos materials during maintenance, renovation or construction work not subject to the appropriate precautions required by the Asbestos Code of Practice, or by similar inadvertent direct contact not subject to the appropriate precautions, the Regional Asbestos Coordinator shall appoint a qualified person to conduct a hazard assessment. This assessment must consider the potential hazard, and must conclude as to whether the hazardous material could be present.

The Regional Asbestos Coordinator shall notify, in writing, the Workplace Safety and Health Committee or Representatives of this assessment.

The assessment shall determine the potential hazard, and must conclude as to whether the hazardous material could be present as an airborne hazard, at a level of at least 50% of the exposure limit. When it has been determined that the hazardous material could be present at a level of at least 50% of the exposure limit, a control plan must be instituted.

Control Plans for Asbestos

When an assessment has determined that asbestos could be present as an airborne hazard, at a level of at least 50% of the exposure limit, a control plan must be established and implemented to address the following requirements:

- a record of where asbestos materials are located;
- written procedures for control;
- medical surveillance, when applicable;
- training of employees.

The control plan must be reviewed at least once per year, or as new information is received that changes the requirements of the plan.

Annex C - Appendix 1 - Evaluation of Asbestos Containing Materials (ACM) and Recommendations for Control

1. Assessment of Condition

Spray Applied Fireproofing, Insulation and Texture Finishes

In evaluating the condition of ACM spray applied as fireproofing, thermal insulation or texture, decorative or acoustic finishes, the following criteria apply:

GOOD	Surface of material shows no significant signs of damage, deterioration or delamination. Up to one percent visible damage to surface is allowed within range of GOOD. Evaluation of sprayed fireproofing requires the surveyor to be familiar with the irregular surface texture typical of sprayed asbestos products. GOOD condition includes unencapsulated or unpainted fireproofing or texture finishes, where no delamination or damage is observed, and encapsulated fireproofing or texture finishes where the encapsulation has been applied after the damage or fallout occurred.
POOR	Sprayed materials show signs of damage, delamination or deterioration. More than one percent damage to surface of ACM spray.

In observation areas, where damage exists in isolated locations, both GOOD and POOR condition may be reported. The extent or percentage of each condition will be recorded on the survey or reassessment form.

NOTE: FAIR condition is not utilized or considered as a valid criterion in the evaluation of sprayed fireproofing, sprayed insulation, or texture coat finishes.

The evaluation of ACM spray applied as fireproofing, non-mechanical thermal insulation, or texture, decorative or acoustic finishes which are present above ceilings, may be limited by the number of observations made, and by building components such as ducts or full height walls that obstruct the above ceiling observations. Persons entering the ceiling area are advised to be watchful for ACM DEBRIS prior to accessing or working above ceilings in areas of buildings with ACM, regardless of the reported condition.

Mechanical Insulation

In evaluating the condition of mechanical insulation (on boilers, breeching, ductwork, piping, tanks, equipment etc.) the following criteria are used:

GOOD	Insulation is completely covered in jacketing and exhibits no evidence of damage or deterioration. No insulation is exposed. Includes conditions where the jacketing has minor surface damage (i.e., scuffs or stains), but the jacketing is not penetrated.
FAIR	Minor penetration damage to jacketed insulation (cuts, tears, nicks, deterioration or delamination) or undamaged insulation that has never been jacketed. Insulation is exposed but not showing surface disintegration. The extent of missing insulation ranges should be minor to none.
POOR	Original insulation jacket is missing, damaged, deteriorated or

	delaminated. Insulation is exposed and significant areas have been dislodged. Damage cannot be readily repaired.

The evaluation of mechanical insulation may be limited by the number of observations made and building components such as ducts or full height walls that obstruct observations. In these circumstances, it is not possible to observe each foot of mechanical insulation from all angles.

Non-Friable and Potentially Friable Materials

Non-friable materials generally have little potential to release airborne fibres, even when damaged by mechanical breakage. However, some non-friable materials, i.e., exterior asbestos cement products, may have deteriorated so that the binder no longer effectively contains the asbestos fibres. In such cases of significantly deteriorated non-friable material, the material will be treated as a friable product.

2. Evaluation of Accessibility

The accessibility of building materials known or suspected of being ACM is rated according to the following criteria:

ACCESS (A)	Areas of the building within reach (from floor level) of all building users. Includes areas such as gymnasiums, workshops, and storage areas where activities of the building users may result in disturbance of ACM not normally within reach from floor level.
ACCESS (B)	Frequently entered maintenance areas within reach of maintenance staff, without the need for a ladder. Includes: frequently entered pipe chases, tunnels and service areas or areas within reach from a fixed ladder or catwalk, i.e., tops of equipment, mezzanines.
ACCESS (C) EXPOSED	Areas of the building above 8'0" where use of a ladder is required to reach the ACM. Only refers to ACM materials that are exposed to view, from the floor or ladder, without removing or opening other building components such as ceiling tiles, or service access doors or hatches. Does not include infrequently accessed service areas of the building.
ACCESS (C) CONCEALED	Areas of the building which require the removal of a building component, including lay-in ceilings and access panels into solid ceiling systems. Includes rarely entered crawl spaces, attic spaces, etc. Observations are limited to the extent visible from the access points.
ACCESS (D)	Areas of the building behind inaccessible solid ceiling systems, walls, or mechanical equipment, etc., where demolition of the

ceiling, wall or equipment, etc., is required to reach the ACM. Evaluation of condition and extent of ACM is limited or impossible, depending on the surveyor's ability to visually examine the materials in Access D.

3. ACM Debris

Debris from Friable ACM

The presence of fallen ACM is noted separately from the presumed friable ACM source (sprayed fireproofing, thermal insulation, texture, decorative or acoustic finishes or mechanical insulation) and is referred to as DEBRIS.

Debris from Damaged Non-Friable ACM

The presence of fallen ACM, from damaged non-friable ACM, is reported separately from the non-friable ACM source. Only fallen non-friable ACM, that has become friable, is reported as DEBRIS.

The identification of the exact location or presence of DEBRIS on the top of ceiling tiles is limited by the number of observations made and the presence of building components such as ducts or full height walls that obstruct observations. Workers are advised to be watchful for the presence of DEBRIS prior to accessing, or working in proximity to, mechanical insulation or above ceiling areas of buildings with ACM, regardless of the reported presence or absence of DEBRIS.

4. Action Matrix and Action Descriptions

The Asbestos Management Program requires the following responses:

- Immediate clean-up of DEBRIS that is likely to be disturbed;
- The removal, repair or enclosure of friable ACM in POOR or FAIR condition where continued deterioration will result in DEBRIS that is likely to be disturbed.

The following factors shall be considered in making site-specific recommendations for compliance with the regulation, and for the practical implementation of asbestos management:

3. ACM in POOR condition is not routinely repairable.

   If an abatement action is necessary, removal is the recommended action (enclosure is a viable option in unusual circumstances).

4. Mechanical insulation in FAIR condition will be repaired or removed based on the following general recommendations, applied on a case by case basis.

Repair ACM mechanical insulation found in FAIR condition in ACCESS (B) or ACCESS (C) EXPOSED areas.

Remove ACM mechanical insulation found in FAIR condition in ACCESS (B) and ACCESS (C) EXPOSED areas, where future damage to the ACM is likely to occur.

5. ACM in GOOD condition present in ACCESS (A) can be managed by surveillance, as long as it is not disturbed by future renovation, maintenance or demolition. Proactive removal of the ACM in ACCESS (A) will be considered where damage is possible by ongoing occupant activity (accidental or intentional).
6. Non-friable or manufactured products are considered in the action matrix as follows:
    - Non-friable and manufactured products reported in POOR condition, or friable DEBRIS resulting from the deterioration of non-friable ACM, are treated as friable materials and the appropriate Action, depending on accessibility, is determined from the Action Matrix for friable ACM.
    - For non-friable or manufactured products reported in GOOD condition, Action 7 (surveillance) is recommended regardless of Accessibility.

7. Remove all ACM from a particular area where small quantities of asbestos are present and removal will negate the need for the use of the Asbestos Management Program in that area.

The Action Matrix provided below establishes the recommended asbestos control action. The ACTIONS are described in full following the matrix.

ACTION MATRIX TABLE				
FRIABLE ACM				
ACCESS	CONDITION			DEBRIS
	GOOD	FAIR	POOR	
(A)	ACTION 5/7[1]	ACTION 5/6[2]	ACTION 3	ACTION 1
(B)	ACTION 7	ACTION 6/5[3]	ACTION 3	ACTION 1
(C) exposed	ACTION 7	ACTION 6	ACTION 4	ACTION 2

(C) concealed	ACTION 7	ACTION 7	ACTION 4	ACTION 2
(D)	ACTION 7	ACTION 7	ACTION 7	ACTION 7

[1]If material in **ACCESS (A)/GOOD** condition is not removed **ACTION 7** is required.
[2]If material in **ACCESS (A)/FAIR** condition is not removed **ACTION 6** is required.
[3]Remove **ACM** in **ACCESS (B)/FAIR** condition if **ACM** is likely to be disturbed.

ACTION 1	**Immediate Clean-up of Debris That is Likely to be Disturbed** Restrict access that is likely to cause a disturbance of the ACM DEBRIS and clean up ACM DEBRIS immediately. Utilize correct asbestos procedures. This action is required for compliance with regulatory requirements. The surveyor should immediately notify the Regional Asbestos Coordinator of this condition.
ACTION 2	**Entry Into Areas With ACM Debris - Type 2 Precautions** At locations where ACM DEBRIS can be isolated in lieu of removal or cleaned up, use appropriate means to limit entry to the area. Restrict access to the area to persons utilizing Type 2 asbestos-work precautions. The precautions will be required until the ACM DEBRIS has been cleaned up, and the source of the DEBRIS has been stabilized or removed.
ACTION 3	**ACM Removal Required for Compliance** Remove ACM for compliance with regulatory requirements. Utilize asbestos procedures appropriate to the scope of the removal work.
ACTION 4	**Access into Areas Where ACM is Present and Likely to be Disturbed by Access - Type 2 Precautions** Use Type 2 asbestos precautions when entry or access into an area is likely to disturb the ACM. ACTION 4 must be used until the ACM is removed (Use ACTION 1 or 2 if DEBRIS is present).
ACTION 5	**Proactive ACM Removal** Remove ACM in lieu of repair, or at locations where the presence of asbestos in GOOD condition is not desirable.
ACTION 6	**ACM Repair** Repair ACM found in FAIR condition, and not likely to be damaged again or disturbed by normal use of the area or room. Upon completion of the repair work, treat ACM as material in GOOD condition and implement ACTION 7. If ACM is likely to be damaged or disturbed, during normal use of the area or room, implement ACTION 5.

ACTION 7	**Routine Surveillance** Institute routine surveillance of the ACM. Trained workers or contractors must use appropriate asbestos precautions (Type 1, Type 2 or Type 3) during disturbance of the remaining ACM.

5. Detection Limit of Bulk Analysis

Asbestos containing material, (ACM), is defined as any material found to contain asbestos at or above the limit for an asbestos containing material, (ACM), set provincially, as determined by the standard Polarized Light Microscopy method for the analysis of bulk samples. The provincially regulated limits, or generally accepted guidelines, to consider a material as an asbestos containing material, (ACM), subject to asbestos in buildings regulation, is provided as follows:

MINIMUM CONCENTRATION TO CONSIDER AS AN ASBESTOS CONTAINING MATERIAL (BY PROVINCE)	
PROVINCE/REGION	
NEWFOUNDLAND NOVA SCOTIA PRINCE EDWARD ISLAND NEW BRUNSWICK ALBERTA BRITISH COLUMBIA	1.0%
ONTARIO (includes part of National Capital Region) SASKATCHEWAN (no published concentration)	0.5%
QUEBEC (includes part of National Capital Region) MANITOBA	0.1%

Annex C - Appendix 2 - Contractor Notification and Acknowledgement

Form PWGSC-TPSGC 16

Annex C - Appendix 3 - Certificate of Training for Asbestos-Related Work

Form PWGSC-TPSGC 15

Annex C - Appendix 4 - Asbestos-Related Work Record

Form PWGSC-TPSGC 55

Annex C - Appendix 5 - Classification of Asbestos-Related Work

The following criteria shall be utilized in determining the classification of asbestos work.

TYPE 1 WORK

- Installation or removal of a non-friable ACM with a hand tool.
- Disturbance of a non-friable ACM with a powered tool equipped with a HEPA dust collection device.
- Removal of drywall materials where joint filling materials contain asbestos.
- Removal or replacement of ten or less asbestos-containing compressed mineral fibre type ceiling tiles.
- Collecting samples of asbestos-suspect friable materials.
- Working close to friable sprayed asbestos, where the material may be affected by the work activities.

TYPE 2 WORK

- Removal or replacement of more than ten asbestos-containing compressed mineral fibre type ceiling tiles.
- Entry into ceiling spaces, crawlspaces, pipe tunnels, etc., where friable asbestos debris is present.
- In British Columbia, removal of drywall installed before 1980.
- Minor removal of friable ACM. Type 2 removal is limited to a maximum per work period of:
    - In British Columbia - 0.1 m^2 surface area, or 3 lineal metres of pipe insulation;
    - In Quebec - 0.03 m^2 of Debris;
    - All Others - 1 m^2 of surface area.
- Repair of asbestos mechanical insulation. (No limit is imposed as to the amount of repair permitted under Type 2 conditions.)

TYPE 3 WORK

- More than minor removal or disturbance of friable ACM.
- Use of a power tool on non-friable ACM without HEPA exhausted dust collection.

- The spray application of an encapsulant or sealer to friable asbestos surfacing materials.
- Disturbance of the ductwork and air handling equipment serving or passing through areas of buildings with sprayed asbestos fireproofing or insulation.
- Repair, alteration or demolition of a boiler, furnace, kiln, or similar equipment with asbestos-containing refractory.

Annex C - Appendix 6 - Work Procedures

TYPE 1 - Work Procedures

For locations of non-friable ACM, refer to the current version of the Asbestos Inventory and Assessment Report.

NOTE: These Type 1 procedures assume the non-friable material can be removed with relatively little loose dry dust released. Generation of debris is permissible as long as the debris can be well wetted before being removed. If the work will release more than a trivial amount of dry loose dust, do not proceed. The Regional Asbestos Coordinator will determine which of Type 1, 2 or 3 procedures are appropriate.

1. **Equipment**

   All equipment must be on site before proceeding.

   1. *Vacuum*

      Use of a vacuum is optional. Wet cleaning methods may be used in place of a vacuum. If a vacuum is used it must be equipped with a high efficiency particulate (HEPA) filter and all brushes, fittings, etc. The vacuum must only be opened in an enclosure, following Type 2 procedures, or in a laboratory exhaust hood. The vacuum exterior should be carefully wet cleaned after emptying. A HEPA filter is at least 99.97% efficient in collecting a 0.3 micrometre particle.

   2. *Respirators*

      Use of a respirator is optional for Type 1 work. However, a respirator is strongly advised for work on sheet flooring, any type of ceiling tile, any other work performed overhead. Respirators shall be supplied by the employer upon request. The type of respirator supplied shall be a half-face respirator with HEPA filter. Training in the proper use of the respirator and qualitative fit testing shall also be provided. Respirators must be NIOSH approved and acceptable to the Provincial Authorities having jurisdiction. Respirators shall be used according to the written procedures for use, provided to the worker during training sessions. Filters must be changed after 24 hours of wear, or sooner if breathing resistance increases.

      NOTE: Employees are required to undertake a medical evaluation as specified by *DP 059 - Health Evaluations - Safety and Health, PWGSC* prior to being trained in

the proper use of respirators.

3. *Protective Clothing*

   Reusable or disposable clothing may be used. Non-disposable clothing with visible asbestos contamination shall be cleaned with a HEPA vacuum and laundered as asbestos contaminated. Disposable clothing and respirator filters will be disposed of as asbestos waste.

4. *Other Equipment*
   - plastic sheet (0.15 mm (6 mil) polyethylene) - to serve as a drop sheet;
   - pump sprayer with mister nozzle, or alternate method to wet material;
   - labelled, yellow asbestos waste bags, 0.15 mm (6 mil) - for all asbestos waste, disposable equipment, plastic, etc.;
   - small tools and cleaning supplies - e.g., scouring pads, sponges, brushes, buckets, etc.

2. Other Protective Measures

1. Do not eat, drink or smoke in the work area.
2. On leaving work area, proceed to washroom and wash all exposed skin on hands and face.

3. Preparation

1. Before disturbing non-friable asbestos materials, (wherever practical) cover floor and surfaces below work with polyethylene sheeting to catch debris.
2. Wherever dust on a surface is likely to be disturbed, remove with HEPA vacuum or damp cloth.

4. Execution

1. Removal of Vinyl Asbestos Floor Tile
   1. Do not use electric powered scrapers.
   2. Start removal by wedging a heavy duty scraper in seam of two adjoining tiles and gradually force edge of one tile up and away from floor. Do not break off pieces of tile, but continue to force balance of tile up.
   3. Continue removal of tiles using hand tools, removing tiles intact wherever possible. When adhesive is spread heavily or is quite hard, it may prove easier to force scraper through tightly adhered areas by striking scraper handle with a hammer using blows of moderate force while maintaining scraper at 25° to 30° angle to floor. When this technique does not loosen tile, removal can be simplified by heating tile thoroughly with a hot air gun until heat penetrates through tile and softens the adhesive.
   4. As each tile is removed, place into asbestos waste receptor. Do not break into smaller pieces.
   5. After removal of a small area, scrape up adhesive remaining on floor with a hand scraper until only a thin smooth film remains. Where deposits are

heavy or difficult to scrape, a hot air gun may be used. Deposit scrapings in the asbestos waste disposal bag. Do not dry scrape surface pieces of tile that remain adhered. Do not use powered electric scrapers.

6. On completion of the area, vacuum clean floor with HEPA vacuum or wet mop. Dispose of the mop head as contaminated waste.

2. Removal of Asbestos-Containing Sheet Flooring
    1. Remove binding strips or other restrictive mouldings. Workers shall wear air purifying respirator fitted with high efficiency filter, and coveralls, at all times.
    2. Make series of cuts 100 mm to 200 mm (4" to 8") apart through top layers and about halfway through felt backing, parallel to wall.
    3. Start at end of room furthest from door and pry up corner of strip, separating top sheet from backing layer. Pull top layer back upon itself slowly and evenly, and half backing and top layers should pull free. After it is removed, roll up strip face out into tight roll, tape or tie securely, and place into asbestos waste receptor. Wet the asbestos felt underlay remaining on floor as soon as exposed.
    4. Continue with successive strips. Avoid walking on exposed asbestos felt. Seal asbestos waste receptors when filled. Remove maximum of three strips before wet scraping exposed felt underlay.
    5. Remove remaining adhered underlay by wet scraping. Soak area with water applied by sprayer. Allow water to penetrate felt. Scrape off remaining material. Maintain material wet by applying more water. Place scrapings in asbestos waste receptor.
    6. Continue this procedure alternately removing top sheets and then wet scraping felt, three strips at a time. Be careful not to walk on stripped floor.
    7. When whole floor has been cleaned of asbestos felt, allow it to dry and vacuum up any dirt with a HEPA vacuum or wet mop. Do *not* dry sweep. Dispose of the mop head as contaminated waste.
    8. Thoroughly clean tools and equipment with a damp cloth before returning to regular service. Dispose of cloth as contaminated waste.

3. Installing, Cutting or Drilling Non-Friable Asbestos Materials
    1. Work using power tools not fitted with HEPA filter dust collectors, must not be performed as Type 1 work.
    2. Where possible wet all materials to be disturbed.
    3. Immediately place waste in asbestos waste receptor. Clean area frequently during work with HEPA vacuum or by wet methods.
    4. At completion of work, drop sheets that will be reused must be cleaned with HEPA vacuum or by wet methods.
    5. Drop sheets that will not be reused must be disposed of as asbestos waste.

4. Removal of Other Non-Friable Asbestos Materials
    1. Type 1 procedures apply only to materials which can be removed intact, or in sections, without producing a pulverized or powdered waste. This method is most applicable to asbestos-cement board products, acoustic

ceiling tiles, gaskets, etc.
2. Where possible wet all material to be disturbed.
3. Undo fasteners necessary to remove material. Whenever possible remove asbestos cement panels intact. Break only if unavoidable. If broken, wet freshly exposed edges.
4. Where sections are adhered to the substrate, wet material and use hand scraping to remove adhering material.
5. Place removed material into asbestos waste receptor. Clean surrounding surfaces and asbestos work area frequently with HEPA vacuum or with wet methods (i.e., damp cloth that is disposed of as asbestos waste after cleaning).
6. Drop sheets shall be disposed of as asbestos waste.

5. **Waste Transport and Disposal**

1. Place waste into asbestos labelled disposal bag, seal with tape, clean the exterior of the bag with a clean cloth, and place into a second clean bag, also to be sealed with tape. Use a barrel, fibre drum, or cardboard or wooden box in place of the second bag when the asbestos waste material is likely to tear the inner bag. Seal the outer container.
2. Place waste containers in storage area for holding asbestos waste. Containers shall be labelled and assigned exclusively for asbestos waste.
3. Prepare waste for disposal in compliance with provincial regulations. The Property Manager will arrange for disposal.

TYPE 2 - Work Procedures

For locations of asbestos materials, refer to the current version of the Asbestos Inventory and Assessment Report.

1. **Equipment**

Equipment required for the work must be on-site before proceeding.

1. *Vacuum*

An asbestos-approved vacuum (HEPA filtered), equipped with brushes, fittings, etc. Vacuum must not be opened except by a fully protected worker within a Type 2 enclosure. The vacuum exterior shall be carefully wet cleaned after emptying. A HEPA filter is at least 99.97% efficient in collecting a 0.3 micrometre particle.

2. *Respirators*

Workers within the work area shall wear approved respirator. Respirators and filters will be provided by the employer, and individually assigned to workers. Respirator shall be a half-facepiece respirator with high efficiency filters. Respirators must be NIOSH approved and acceptable to the Provincial Authorities having jurisdiction. Respirators shall be kept in position throughout the entire time the worker is in the area of the work, from first disturbance of a ceiling tile or asbestos material, until the

final cleaning of the area and bagging of waste is complete. Change filters after 24 hours of wear or sooner if breathing resistance increases.

3. *Protective Clothing*

   All workers shall wear disposable coveralls with attached elasticized hood. Coveralls should be worn with the hood in place at all times. Coveralls may be vacuumed or wet wiped clean for reuse, for a maximum of 8 hours cumulative wear. Suit and head cover shall remain in place until worker leaves work area or the enclosure is dismantled. Boot covers or dedicated boots are recommended.

4. *Other Equipment*
   - plastic sheet (0.15 mm (6 mil) polyethylene) - to erect a total enclosure or to serve as drop sheet;
   - wood framing or clips to support polyethylene sheeting, as appropriate to work area;
   - tape - to fasten plastic enclosure to ceiling or to tape drop sheet to floor; ¾" double-sided tape recommended for attaching polyethylene to T-bar ceiling;
   - labelled asbestos waste bag 0.15 mm (6 mil) - for all asbestos waste, disposable suit, plastic for disposal, etc.;
   - pump sprayer containing water with wetting agent to wet asbestos as necessary (dilute wetting agent as per manufacturer's recommendations);
   - asbestos warning signs;
   - cleaning supplies - e.g., scouring pads, sponges, brushes, buckets, etc.;
   - insulation repair supplies (lagging compound, cloth, PVC covers);
   - encapsulating sealer, for brush or airless spray application.

2. Other Protective Measures

1. Do not eat, drink or smoke in the work area.
2. On leaving work area, proceed to washroom and wash all exposed skin on hands and face.

3. Scheduling of Work

1. Schedule work when occupants are absent. If persons are present, do not start work.
2. If work above ceiling is required on an emergency basis, and the area is occupied, ensure that client department(s) advise occupants to vacate area until work is complete and clearance is given to return.

4. Preparation

1. Shut down ventilation systems to and from the work area. Seal over all ventilation openings, diffusers, grilles, etc., with plastic and tape.
2. Where practical, clear areas of movable furnishings or equipment. This should include anything that occupants may wish to use during work period. Any furnishings or equipment not removed shall be adequately covered and sealed

using 0.15 mm (6 mil) polyethylene and tape. The intent of the protection is to provide an airtight envelope to protect the articles from airborne dust or splashed debris.

3. Post signs or barrier tape, appropriate to the work area, to indicate asbestos hazard and requirement for protective clothing for anyone entering the space.
4. For small rooms, cover walls with plastic such that the complete room becomes the work area. For larger rooms, erect enclosure of 0.15 mm (6 mil) polyethylene, of suitable dimensions to enclose the work area, and scaffolds and ladders required to gain access. If a suspended ceiling is present, the enclosure shall extend to the ceiling line. The enclosure shall be as airtight as conditions permit, and will include the provision of a double overlapping flap at the entrance. The floor of the work area shall be a layer of 0.15 mm (6 mil) polyethylene sealed to the plastic walls of the enclosure.
5. Don protective clothing and respirator prior to removing ceiling tile or disturbing pipe jacketing or sprayed fireproofing.

5. Execution

1. To remove fireproofing or texture plaster, saturate with amended water solution, using a pump sprayer. Do not remove the asbestos material until the material is thoroughly wetted to the substrate. Do not use water where electrical hazard exists.
2. To remove pipe insulation, first wet any area of damage, then carefully cut jacket. Keep insulation surface wetted by mist of water with wetting agent. Remove insulation in large sections and place immediately in disposal bag. After large pieces have been removed, saturate debris on mechanical equipment and clean all exposed surfaces with abrasive pads, sponges, cloths, etc.
3. To repair pipe insulation, use drop sheet under area of work to aid clean-up of any dislodged material. Plastic enclosure is not required. Mist any exposed insulation to wet surface and apply lagging paint and canvas or PVC jacketing as required.
4. For removal of suspended ceiling tiles (where asbestos debris is present on top of tiles or equipment to be accessed), remove the first tile carefully and vacuum all surfaces. Vacuum the upper surface of each subsequent tile prior to removal. Store tiles in the work area.
5. Remove dust and loose friable material likely to be disturbed in the process of doing the work, with a HEPA vacuum or by damp wiping.
6. When asbestos material is removed, all pieces should be placed directly into 0.15 mm (6 mil) polyethylene bags as they are removed. Avoid dropping material to floor wherever possible. After bulk removal is complete, wet wash the exposed surface.
7. Frequently, and at regular intervals during the work, clean up dust and waste in the work area by wet mopping, placing in disposal bags, or by HEPA vacuuming.
8. After completion of removal, seal exposed ends of fireproofing, texture plaster, or mechanical insulation with heavy layer of encapsulating sealer. Apply sealer coat to surfaces from which asbestos material was removed.
9. At completion of work, decontaminate equipment, tools and materials used in the work area by wet cleaning or HEPA vacuum.
10. Dispose of drop sheets and enclosures by wetting the polyethylene, then folding into disposal bags. Do not reuse drop sheets or enclosures.
11. Before leaving work area, decontaminate shoes and protective clothing by using HEPA vacuum or damp wiping. When protective clothing is to be disposed of, it shall be decontaminated as above and placed in labelled disposal bags. Workers shall vacuum all exposed skin, suit and respirator, and proceed to nearest

washroom to wash hands and face.

6. **Waste Transport and Disposal**

    1. Place waste into asbestos labelled disposal bag, seal with tape, clean the bag, and place into a second clean bag, also to be sealed with tape. Use a barrel, fibre drum, or cardboard or wooden box in place of the second bag when the asbestos waste material is likely to tear the inner bag. Seal the rigid outer container.
    2. Place waste containers in storage area for holding asbestos waste. Containers shall be labelled and assigned exclusively for asbestos waste.
    3. Prepare for waste disposal in compliance with provincial regulations. The Property Manager will arrange for disposal.

TYPE 3 - Work Procedures

Type 3 procedures are not included in the standard work procedures due to the requirement for the development of specific procedures for the site and for the particular circumstances.

Glove Bag Work Procedures

1. **Equipment**

    All equipment must be on site before proceeding with the work. Note that these procedures are primarily based on the use of Safe-T-Strip polyvinyl chloride movable glove bags. (Only the Safe-T-Strip glove bag is permitted for use in Ontario.) If the single use polyethylene glove bags permitted in some other jurisdictions are used, it should be understood that they are for use at one location only, and cannot be moved or used elsewhere.

    NOTE: If single use polyethelene glove bag is used Section 5 - Execution, shall be replaced by manufacturer's recommended procedures.

    1. *Glove Bag*

        Prefabricated, 0.25 mm (10 mil) minimum thickness polyvinyl-chloride bag with integral 0.25 mm (10 mil) thick polyvinyl-chloride gloves and elasticized port. Bag shall be equipped with reversible double-pull double throw zipper on top. Bag must incorporate internal closure strip if it is to be removed from pipe for reuse elsewhere. Provide size and configuration appropriate for insulation to be removed. The bag must be disposed of once filled. Bag shall not be emptied and reused.

    2. *Securing Straps*

        Reusable nylon straps at least 25 mm (1") wide with metal buckle for sealing ends of bags around pipe and/or insulation.

    3. *Water Sprayer*

        Garden reservoir type, low velocity, capable of producing mist or fine spray with

water-containing wetting agent. Wetting agent shall be diluted as per manufacturer's recommendations.

4. *Respirators*

   Workers using glove bag must wear approved respiratory protection. Respirators and filters must be provided by the employer, and individually assigned to workers. Respiratory protection must be equal to, or exceed, protection of half-face respirator with high efficiency filters. Respirators must be NIOSH approved and acceptable to the Provincial Authorities having jurisdiction. Respirators shall be kept in position from the time the worker is attaching bag to pipe until final cleaning of the pipe and bagging of waste is completed. Filters shall be changed after 24 hours of wear or sooner if breathing resistance increases.

5. *Protective Clothing*

   Workers shall wear disposable coveralls with attached elasticized hood. Coveralls and hood shall remain in place until worker completes cleaning of pipe. Suit may be cleaned for reuse or disposed of as asbestos waste.

6. *Other Equipment*
   - labelled asbestos waste bags 0.15 mm (6 mil) - for all asbestos waste in glove bag, disposable suit, cleaning materials, etc.;
   - asbestos warning signs;
   - wire saw - saw with flexible serrated wire blade and handles to allow use inside glove bag;
   - knife with fully retractable blade for use inside glove bag;
   - plastic sheet (4 mil polyethylene) to cover exposed or damaged section of pipe prior to attaching glove bag;
   - tape-to fasten plastic to pipe if required;
   - cleaning supplies e.g., scouring pads, sponges, brushes, buckets, etc.;
   - HEPA vacuum, for evacuating air from bag prior to removing bag from pipe. A HEPA filter is at least 99.97% efficient in collecting a 0.3 micrometre particle.

2. Other Protective Measures

1. Do not eat, drink or smoke in the work area.
2. On completing clean-up of work area, use HEPA vacuum or wet cloth to clean hands, face, respirator and boots. Remove protective equipment and proceed to nearest washroom to wash all exposed skin on hands and face.

3. Scheduling of Work

1. Schedule work when occupants are absent. If persons are present, do not start work.

4. **Preparation**

1. Where practical, clear area below pipe of moveable furnishings or equipment. Provide scaffold as required to reach pipe.
2. Post an asbestos warning sign at all entrances to room in which the procedure is being used. If necessary use rope or tape barriers to separate work area.
3. Segregate the area of asbestos work, from other parts of the building required to remain in use by using polyethylene walls or barrier tape.
4. Shut off and seal all diffusers, vents and other openings to ventilation and exhaust systems in the room with polyethylene secured with tape.
5. Cover all items or equipment located in the designated work area with polyethylene when items or equipment cannot be cleaned in the case of a spill. Tape the polyethylene in place. The polyethylene should cover a width equal to the height of the pipe from the floor, with a minimum width of 3.6 m (12 feet), where required.
6. Seal all openings and voids in the vicinity of the glove bag operation with one layer of polyethylene secured with tape.
7. Check condition of pipe insulation where work will be performed. If the pipe insulation has minor isolated damage, mist surface and patch with tape. If damage is more extensive, wrap pipe with plastic and "candy stripe" it with duct tape first. If pipe insulation is severely damaged and cannot be simply repaired, glove bag is not appropriate. (Use Type 2 Procedures.)
8. Pre-clean with HEPA vacuum or wet methods any loose material on surface of pipe or any material on the floor. If significant amount of material is on floor, Type 2 procedures may be required for clean-up. (See Type 2 Procedures.)
9. Place necessary tools in bottom of glove bag.

5. **Execution**

1. Zip the bag onto the pipe and seal each end to the pipe with the securing straps. Do not pull the bag tightly to the ends - a small amount of slack allows better room to work within the bag. If a vertical bag is in use, ensure lower strap passes through plastic grommet and cloth tab on zipper.
2. Place hands into gloves and use necessary tools (wire saw, utility knife, wire cutters) to remove insulation from pipe. Arrange insulation in bottom of bag to obtain full capacity of bag. Roll metal jacketing carefully to minimize ripping or puncturing of the bag.
3. Insert nozzle of spray pump into bag through valve and wash pipe and interior of upper section of bag thoroughly. Use one hand to aid washing process. Wet surface of insulation in lower section of bag and any exposed ends of asbestos insulation remaining on pipe.
4. Prior to removing bag from the pipe, wash the top section of the bag and tools thoroughly. Insert nozzle of HEPA filtered vacuum into bag through the elasticized valve and evacuate air from bag. Seal the closure strip, remove the vacuum nozzle and straps, and remove the bag. Re-install and seal in new location before reopening closure.
5. If bag is to be moved along the same pipe, loosen securing straps, move bag, re-seal to pipe using double-pull zipper to pass hangers. Repeat insulation removal operation.
6. If during use the glove bag is ripped, cut or opened in any way, cease work and repair opening before continuing work. All spilled material must be cleaned up and removed with a HEPA vacuum or wet cleaning.
7. To remove bag after completion of insulation removal, thoroughly wash top section

of bag and tools and seal internal zip-lock closure. Place tools in one glove, pull hand out inverted, twist to create a separate pouch, tape inside-out glove at two separate locations 1" apart to seal pouch. Remove inside-out glove and tools by cutting between the tape seals.

8. Place glove pouch and tools into the next clean glove bag to be used. Alternately, place the tool pouch into water bucket, open pouch underwater and clean tools, then allow to dry.
9. Prior to disposal of bag, evacuate the bag with a HEPA vacuum. Pull a 0.15 mm (6 mil) polyethylene bag over glove bag before removing from pipe. Remove securing straps. Unfasten zipper. Seal glove bag and seal 0.15 mm (6 mil) polyethylene bag.
10. After removal of bag ensure pipe is clean of all residue. If necessary, after removal of each section of asbestos, vacuum all surfaces of pipe, using HEPA filtered vacuum equipment, or wipe with wet cloth.
11. Seal all surfaces of freshly-exposed pipe with encapsulating sealer to tack-down any residual dust. Cover exposed ends of any remaining asbestos insulation with lagging cloth or tape.
12. Before leaving work area, a worker shall decontaminate shoes and protective clothing by using HEPA vacuum or damp wiping. When protective clothing is to be disposed of, it shall be decontaminated as above and placed in labelled disposal bags. Workers shall vacuum all exposed skin, suit, respirator and hair (after removing hood) and proceed to nearest washroom to wash hands and face.

6. **Waste Transport and Disposal**

1. Place waste containers in storage area for holding asbestos waste. Containers shall be labelled and assigned exclusively for asbestos waste.
2. Prepare waste for disposal in compliance with provincial regulations. The Property Manager will arrange for disposal.

Asbestos Work Procedures

Emergency Asbestos Work Procedures

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, pipe breaks, ceiling collapses, or other emergencies that affect asbestos materials, are as follows:

1. Clear area of all occupants.
2. Construct enclosure around area if time permits.
3. Shut down ventilation system serving area.
4. Worker performing repair shall wear protective respirator and disposable suit. If normal work clothes are worn they must be disposed of if visibly contaminated.
5. Use drop sheet under work, if possible, to minimize clean-up.
6. Perform emergency repair with minimum disturbance of asbestos.
7. Obtain asbestos equipment and perform clean-up of visible material. Use HEPA filtered vacuum or wet cleaning. Dispose of all cleaning supplies as contaminated waste.

8. The worker should wipe off or vacuum disposable clothing and footwear. Proceed to washroom to wash face and hands.
9. Notify the Property Manager regarding the asbestos disturbance, before allowing unprotected persons to enter the area. The Property Manager will contact the Regional Asbestos Coordinator to determine if additional precautionary measures are to be implemented. The Regional Asbestos Coordinator will arrange for removal, clean-up or repair of the asbestos material.
10. The Regional Asbestos Coordinator shall investigate the extent of asbestos disturbance, will determine additional actions to be undertaken and will determine if a hazard investigation under the *Canada Occupational Safety and Health Regulation* is appropriate.

Bulk Sample Collection Procedures

1. Sample the material when the area is not in use. Only those persons needed for sampling should be present in the immediate area.
2. Spray the material with a light mist of water to prevent fibre release during sampling. Do not disturb the material any more than necessary.
3. Materials of different appearance should be sampled separately. Mechanical insulation must be sampled separately on all systems, tanks, vessels, etc. Sample both the straight sections of pre-formed insulation and the insulating cement typically present at elbows, fittings, etc. (unless visually identified as fibreglass).
4. Collect the sample by penetrating the entire depth of the material, as the insulation may have been applied in more than one layer or covered with paint or other protective coating.
5. The use of a respirator is recommended for all sampling. Depending on the condition of the material, significant amounts of airborne fibres can be generated during sampling.
6. If pieces of material break off during sampling, the contaminated area must be cleaned up with a HEPA vacuum cleaner or by wet cleaning. Any debris generated must be placed in plastic bags, labelled, sealed and disposed of as asbestos waste.
7. Place samples in labelled plastic bags with a zip-lock closure or in sealed plastic vials. Samples shall be identified with the following information:
    - Sample Number;
    - Building;
    - Room Number;
    - Date of Sampling;
    - Name of Sampler;
    - Source of sample, e.g., Cold Water Pipe, Cold Water Fitting, etc.
8. Temporarily seal any openings created to collect the sample, (for example, with tape, paint or metal foil tape wrapped completely around the pipe). Advise the Property Manager or Regional Asbestos Coordinator.
9. Analysis must be performed by the Health Canada Laboratory or by a laboratory accredited by the National Voluntary Laboratory Accreditation Program (NVLAP). Contact the Regional Asbestos Coordinator for a list of acceptable laboratories.

Respirator Fitting, Inspection, Cleaning and Disinfecting

Notes for Air Purifying Half-Facepiece Respirators

WARNING: This respirator does not supply oxygen. It must not be used in or for: oxygen deficient

atmospheres (less than 19.5%); poorly ventilated areas or enclosed spaces such as tanks or small rooms; abrasive blasting or firefighting; or for protection against contaminants excluded or not covered by the applicable Approval Label.

Respirators must be approved for protection against asbestos. Check for NIOSH certification.

1. **Respirator Fitting**

   Persons required to wear respirators must first pass a qualitative fit-test administered according to the current version of CSA standard Z-94.4. The fit-test should be repeated yearly.

2. **Inspection Items Prior to Each Use**

   1. Examine facepiece for:
      - dirt;
      - cracks, tears or holes;
      - distortion and inflexibility;
      - cracks or breaks in filter holders, worn threads and missing gaskets.
   2. Examine head straps for:
      - breaks or tears;
      - loss of elasticity;
      - broken or malfunctioning buckles and attachments.
   3. Examine valves for:
      - detergent residue, dust or other material on valves or valve seats;
      - cracks, tears or distortion in the valve material;
      - missing or defective valves or valve covers.
   4. Examine filter for:
      - proper filter for protection against asbestos (High Efficiency Particulate);
      - incorrect installation, loose connections, missing or worn gaskets or cross threading;
      - cracks or dents in filter housing.
   5. Leak-checks:

      Perform the following tests on each donning:

      - *negative pressure test:* cover inlets to filters, breathe in and hold breath; respirator should be drawn to face for minimum of ten seconds (if not, check exhalation valve and fit);
      - *positive pressure test:* cover exhalation valve cover and puff out slightly and hold breath; respirator should slightly pressurize and still hold seal (if not, check inhalation valves and fit).

3. **Respirator Cleaning and Disinfecting**

   1. Remove filters and disassemble facepiece. Discard or repair defective parts.
   2. Wash components in warm water (50°C - 60°C) with mild detergent, using a brush. Cleaning and disinfectant solutions are available from respirator manufacturers.
   3. Thoroughly rinse components in clean, warm water.
   4. Air dry or hand dry components with a clean, lint-free cloth.

5. Reassemble respirator and test to ensure that all components are working properly (see above). Be careful to check that valves are not lost in the cleaning.

4. **Filter Cartridge Handling and Replacement**

1. Filters can be reused until an increase in breathing resistance is noted. Under typical Type 2 conditions, filter cartridges should last a minimum of 24 hours. Inlet side of filter cartridge to be reused shall be sealed on the inlet side with tape for storage.
2. When no longer usable, filter cartridges will be sealed on the inlet side with tape, and disposed of as contaminated waste.

Ontario

GUIDELINE

SILICA ON CONSTRUCTION PROJECTS

Health and Safety Guidelines

For more copies, please contact

Publications Section
Ministry of Labour
655 Bay St., 14th Floor
Toronto ON M7A 1T7

(416) 326-7731
Toll-free: 1-800-268-8013
Fax: (416) 326-7745
E-mail: mol.publications@mol.gov.on.ca
Web: www.gov.on.ca/lab

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GUIDELINE

SILICA ON CONSTRUCTION PROJECTS

Occupational Health and Safety Branch
Ministry of Labour

September 2004

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Foreword

This Guideline has been prepared to assist persons, such as employers, construction project owners, constructors, contractors and subcontractors, who have duties under the Occupational Health and Safety Act (OHSA) and its regulations to protect workers from exposure to silica. It should not be taken to be a statement of the law or what is necessary to comply with the law. A person with legal duties may or may not agree with the Guideline and there is no legal requirement to follow the Guideline. It is for each such person to decide what is necessary to comply with the OHSA and its regulations.

A person who needs assistance in determining what constitutes compliance should consult with his or her legal advisor. Ministry inspectors will assess workplace situations against the relevant provisions of the OHSA and its regulations but they do not enforce the Guideline, although they may refer to it in determining whether the relevant laws have been complied with.

1.0 INTRODUCTION

Scope

Employers have a duty to protect their workers from silica exposure on construction projects. This Guideline has been prepared to raise the awareness of employers and workers in the construction industry of the hazards posed by silica in construction and the measures and procedures that should be taken to control those hazards

For the purposes of this guideline, silica refers to crystalline silica in a respirable[1] form.

Silica in Construction

Silica (SiO_2) is a compound resulting from the combination of one atom of silicon with two atoms of oxygen. It is the second most common mineral in the earth's crust and is a major component of sand, rock and mineral ores. Silica exists in several forms, of which crystalline silica is of most concern. The best-known and most abundant type of crystalline silica is quartz. Other forms of crystalline silica include cristobalite, tridymite, and tripoli.

In construction, worker exposure to silica is of particular concern because silica is the primary component of many construction materials. Some commonly used construction materials containing silica include:

- abrasives used for blasting
- brick, refractory brick
- concrete, concrete block, cement, mortar
- granite, sandstone, quartzite, slate
- gunite
- mineral deposits
- rock and stone
- sand, fill dirt, top soil
- asphalt containing rock or stone.

Many construction activities can generate airborne silica-containing dust. In construction, abrasive blasting generates the most dust. Exposure to silica from abrasive blasting can result if the abrasive contains silica and/or if the material being blasted contains silica. Other activities that generate airborne dust include:

[1] "Respirable" means that size fraction of the airborne particulate deposited in the gas-exchange region of the respiratory tract and collected during air sampling with a particle size-selective device that,

(a) meets the American Conference of Governmental Industrial Hygienists (ACGIH) particle size-selective criteria, and

(b) has the cut point of 4 microns at 50 per cent collective efficiency.

- chipping, hammering, and drilling of rock
- crushing, loading, hauling, and dumping of rock
- sawing, hammering, drilling, grinding, and chipping of concrete or masonry structures
- demolition of concrete and masonry structures
- dry sweeping or pressurized air blowing of concrete, rock, or sand dust
- road construction
- sweeping, cleaning, and dismantling equipment
- tunnelling, excavation, and earth moving of soils with high silica content.

2.0 LEGAL REQUIREMENTS

Occupational Health and Safety Act (OHSA)

The OHSA sets out, in very general terms, the duties of employers and others to protect workers from health and safety hazards on the job. These duties include, but are not limited to:

- taking all reasonable precautions to protect the health and safety of workers [clause 25(2)(h)],
- ensuring that equipment, materials and protective equipment are maintained in good condition [clause 25(1)(b)],
- providing information, instruction and supervision to protect worker health and safety [clause 25(2)(a)], and
- acquainting a worker or a person in authority over a worker with any hazard in the work and in the handling, storage, use, disposal and transport of any article, device, equipment or a biological, chemical or physical agent [clause 25(2)(d)].

In addition, section 30 of the OHSA deals with the presence of designated substances on construction projects. Since silica is a designated substance (R.R.O. 1990, Reg. 845), compliance with the OHSA and regulations will require some action to be taken where there is a silica hazard on a construction project.

Section 30 of the OHSA requires the owner of a project to determine if silica is present on a project and, if it is, to so inform all potential contractors as part of the bidding process. In a similar way, contractors who receive this information are to pass it onto other contractors and subcontractors who are bidding for work on the project. If the owner or any contractor fails to comply with this requirement, they will be liable for any loss or damages that result from a contractor subsequently discovering that silica is present.

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

The WHMIS Regulation applies to all workplaces covered by the OHSA. Any employer or constructor who uses WHMIS controlled products is required to comply with the WHMIS Regulation regarding the requirements for labels, material safety data sheets, and worker education and training.

The Ministry of Labour is responsible for the administration and enforcement of both federal and provincial WHMIS legislation.

Regulation for Construction Projects, O. Reg. 213/91

The Regulation for Construction Projects, O. Reg. 213/91, applies to all construction projects. Although silica is not mentioned specifically, the following sections of the regulation would apply to situations where there is the potential for workers to be exposed to silica:

Section 14 (5) A competent person shall perform tests and observations necessary for the detection of hazardous conditions on a project.

Section 21 (1) A worker shall wear such protective clothing and use such personal protective equipment or devices as are necessary to protect the worker against the hazards to which the worker may be exposed.

(2) A worker's employer shall require the worker to comply with subsection (1).

(3) A worker required to wear personal protective clothing or use personal protective equipment or devices shall be adequately instructed and trained in the care and use of the clothing, equipment or device before wearing or using it.

Section 30 Workers who handle or use…substances likely to endanger their health shall be provided with washing facilities with clean water, soap and individual towels.

Section 46 (1) A project shall be adequately ventilated by natural or mechanical means,

(a) if a worker may be injured by inhaling a noxious…dust or fume;

(2) If it is not practicable to provide natural or mechanical ventilation in the circumstances described in clause (1)(a), respiratory protective equipment suitable for the hazard shall be provided and be used by the workers.

Section 59 If the dissemination of dust is a hazard to a worker, the dust shall be adequately controlled or each worker who may be exposed to the hazard shall be provided with adequate personal protective equipment.

Regulation Respecting Silica, R.R.O. 1990, Reg. 845

The Ministry's designated substance regulation (DSR) for silica, Regulation 845, specifies occupational exposure limits (OELs) for silica and requires assessment and a control program to ensure compliance with these OELs. The OEL for respirable crystalline silica is 0.05 milligrams per cubic metre (mg/m3) of air by volume as an 8-hour daily or 40-hour weekly time-weighted average for cristobalite and tridymite. In the case of quartz and tripoli, the OEL is 0.10 milligrams per cubic meter of air by volume.

Despite the fact that Regulation 845 and the OEL for silica do not generally apply to a constructor or to an employer on a construction project in respect of those workers who work at or on the project, construction employers still have a responsibility to protect the health of their workers. However, if the construction project is located at a workplace where silica is present and likely to be inhaled by a worker then the employer of the workplace must protect the workers on the project by obeying the instructions set out in sections 4 and 5 of Regulation 845, even if the work is performed under a contract with another person. (Section 4 and 5 state how much airborne silica the worker may be exposed to with safety and describes when, and what circumstances, respirators must be used in order to meet these requirements.).

Measures and procedures that ensure construction workers receive the same standard of protection as workers covered by Regulation 845 should therefore be implemented on construction projects where exposure to silica is a hazard. Such measures and procedures are deemed to be in compliance with section 25(2)(h) of the OHSA, as taking “every precaution reasonable in the circumstances for the protection of a worker”.

3.0 HEALTH EFFECTS

The prolonged inhalation of respirable dust containing crystalline silica may result in silicosis, a disease characterized by progressive fibrosis of the lungs. A pneumoconiosis (lung disease caused by the inhalation of dust), silicosis is marked by shortness of breath and impaired lung function which may give rise to complications that can result in death. The development and the severity of silicosis depends on the airborne concentration of silica dust to which a worker is exposed and the duration of exposure.

The International Agency for Research on Cancer (IARC) has concluded that crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans and has classified these forms of silica as Group 1 carcinogens. In addition, the American Conference of Governmental Industrial Hygienists (ACGIH) has classified quartz as a suspected human carcinogen with an A2 classification

Crystalline silica may be harmful following high exposure levels received over a period, ranging from a few weeks to years or after long-term exposures to lower levels. There are three major types of silicosis: chronic, accelerated, and acute.

Chronic Silicosis

Chronic silicosis is most common. Symptoms may not appear for a long time, usually more than 10 years, and may progress and worsen over a period of many years. Chronic silicosis may be either a simple or a complicated type.

The effects of silicosis can continue to develop even after the exposure ceases and they are irreversible. In addition, the progression of lung fibrosis can also lead to the development of lung cancer

Simple Chronic Silicosis
Simple silicosis is almost entirely without symptoms. In the early stages of the disease the lung nodules are small (usually 1 to 3 mm) and discrete in the upper lung fields. As the disease progresses the nodules increase in number and size and also occupy the lower field. Although simple silicosis may never grow more serious, long-term exposure to silica dust may lead to complicated silicosis.

Complicated Chronic Silicosis
Complicated chronic silicosis is also called progressive massive fibrosis (PMF). The first symptoms may be shortness of breath with exercise, wheezing or sputum that causes coughing. However, some people with the disease have no symptoms. Complicated silicosis can become worse when in combination with other lung diseases. Severe complicated silicosis can result in heart disease in addition to lung disease.

Accelerated Silicosis

Accelerated silicosis is almost the same as chronic silicosis. However, it develops more quickly and the lung scars show up sooner. Accelerated silicosis can develop when exposure to large amounts of silica dust occurs over a short time period. Nodules may appear on a chest x-ray five years after the first exposure to silica dust and the disease can quickly worsen.

Acute Silicosis

Acute silicosis is a lung disease that develops rapidly. As few as 8 to 18 months may elapse from the time of first exposure to the onset of symptoms, which include progressive shortness of breath, fever, cough and weight loss. There is a rapid progression of respiratory failure usually resulting in death within one or two years.

How does silica enter the body?

Occupational exposure to silica occurs through inhalation of small airborne particles of silica dust, mainly in the range of 5.0 μm to 0.5 μm, which are not expelled from the lung when inhaled. Instead, they remain in the lung and are deposited in lymph nodes, where over time, calcium can deposit in those nodes and settle along the rim of the lymph node. This condition is known as “egg-shell” calcification. In some cases, silica particles are carried into the lungs where a scar may form around the particles. Over time, the hardened scars gradually start to show up on the chest x-ray as fibrosis of the lung.

4.0 CONTROLLING THE SILICA HAZARD

In order for silica to be a hazard, silica-containing dust particles that are small enough to be inhaled (i.e., respirable) must get into the air. The strategy for controlling the silica hazard can therefore be broken down into three basic approaches:

- prevent silica dust from getting into the workplace air
- remove silica dust present in the air
- if present, prevent workers from inhaling the dust.

To avoid the inhalation of silica, it is essential to have the following control methods in place:

- engineering controls
- work practices and hygiene practices
- respirators and personal protective equipment
- training.

However, even with appropriate measures to control silica, some workers may still be affected. For this reason, periodic medical examinations are important for determining if the control measures in place are effective and if workers are suffering from any of the effects of silica exposure. This is known as medical surveillance (see Appendix 1), and can be considered to be a method of early detection and prevention of silicosis.

4.1 Engineering Controls

Engineering controls are methods of designing or modifying equipment, ventilation systems, and processes to minimize the amount of a substance that gets into the workplace air. They include:

- substitution
- process control
- enclosure and/or isolation of the emission source
- ventilation.

Substitution can eliminate silica from certain processes by replacing it with a less toxic material. Some examples are:

- silica sand used in abrasive blasting may be replaced by metal shot and grit, alumina, garnet, cereal husks, sawdust, high pressure water, steel sand, silicon carbide or corundum (Note: When choosing non-silica containing abrasives, avoid choosing abrasives that may introduce new health hazards to the workplace. For example, abrasives containing walnut shells may cause allergic reactions in some workers.);
- the replacement of sandstone grinding wheels with ones using an abrasive like aluminum oxide; and
- the use of magnesite or aluminum oxide bricks in place of silica bricks in furnaces.

When it is not possible to use a silica substitute, changing how a process is performed can lower silica exposures. For instance, wet methods reduce dust and should be used whenever practical, particularly in cutting, grinding, and drilling operations. Another example is the modification of an abrasive operation to produce a coarser dust that is less hazardous because it settles more readily and is less likely to be trapped in the lungs if inhaled.

If a process cannot be modified to reduce exposure, it may have to be isolated or enclosed. Dusty operations can be isolated by carrying them out in areas that are physically separated from non-dusty areas and keeping workers not involved in the operation out of the area. Where isolation is not effective, the process can be completely sealed off from the rest of the workplace with an enclosure.

Ventilation refers to engineering controls that rely on the removal of contaminated air from the workplace and the replacement of exhausted air with filtered air. The most effective use of ventilation to control a silica hazard is the removal of dust at its source (local exhaust ventilation). Often dust-generating tools are equipped with dust collection systems to prevent dust from spreading or becoming airborne. An essential component of these systems are the cleaning devices, such as filters, which will effectively remove the dust.

4.2 Work Practices and Hygiene Practices

Work practices and hygiene practices are on-the-job activities that reduce the exposure potential from contaminated surfaces and work areas. Silica can also accumulate on the hands, clothing and hair. From there it can be disturbed, re-suspended in air and inhaled. Workers should therefore be able to wash and shower at the end of each shift. There should be no smoking, eating, drinking or chewing in contaminated areas and lunches should be stored in an uncontaminated area. It is therefore important to follow good work and hygiene practices whenever silica is present.

Good housekeeping is important wherever silica dust is generated. Containers of silica-containing waste should be kept tightly covered to prevent dust from becoming airborne. Surfaces should be kept clean by washing down with water or vacuuming with a vacuum equipped with a high-efficiency particulate air (HEPA) filter. Cleaning with compressed air or dry sweeping should be avoided.

4.3 Personal Protective Equipment

Personal protective equipment includes protective clothing and respirators. The purpose of protective clothing is to prevent the contamination of regular clothing and the transportation of silica-containing materials from the workplace. Clothing that is contaminated with silica dust should not therefore be worn home without cleaning.

Sometimes engineering controls and work practices cannot lower the concentration of silica to non-hazardous levels and workers must wear respirators for protection. If respirators must be used, a respirator program should be implemented. It should include written procedures for the selection, use, care and maintenance of personal respiratory protection equipment. Workers should be instructed and trained on the care and use of personal protective equipment before using it. Some workers may have a medical condition that causes them to have difficulty breathing when wearing a respirator. Such workers should not be assigned to do work that requires a respirator if they have written medical proof of their condition.

Respirator Selection

Where respirators are provided, they should be appropriate in the circumstances for the type and the concentration of airborne silica. Respirators should be selected in accordance with the U.S. National Institute for Occupational Safety and Health (NIOSH) assigned protection factors (APF).

Use, Care, and Maintenance of Respirators

The following general use, care, and maintenance procedures should be followed whenever respirators are required:

- respirators should be used and maintained in accordance with the manufacturer's specifications
- proper seal of respirators should be checked prior to each use
- storage of respirators should be in a convenient, clean and sanitary location and stored in a manner that does not subject them to damage or distortion
- respirators assigned for the exclusive use of one worker, should be cleaned, disinfected and inspected after each shift
- respirators used by more than one worker, should be cleaned, disinfected and inspected after each use
- any respirator parts that are damaged or that have deteriorated should be replaced before the respirator is used.

For additional information on the use, care, and maintenance of respirators, please refer to CSA standard Z94.4-02.

Ideally respirators should be assigned for the exclusive use of one worker. But before a decision is made for a respirator to be shared by more than one worker, the following factors should be considered:

- the fit of the equipment
- the health and safety risk to the worker that would be caused by non-exclusive use of the equipment
- any undue economic hardship to the employer that would be caused by exclusive use of the equipment.

Respirators with a tight-fitting facepiece must be fitted to the worker in such a way that there is an effective seal between the equipment and the worker's face. Each worker must be fit-tested for each type of respirator to be worn.

4.4 Training

Training is an important component in preventing worker exposure to silica. Control methods, measures and procedures can only be as effective as the workers carrying them out. It is therefore essential for training to cover the following:

- WHMIS training
- the hazards of silica, including health effects and symptom recognition;
- the recognition of typical operations containing silica;
- personal hygiene, respirator requirements, and work measures and procedures;
- the use, care, maintenance, cleaning and disposal of personal respiratory protective equipment.

Instruction and training should be provided by a competent person. This could be the employer or someone hired by the employer. A competent person is defined under the OHSA as a person who:

- is qualified because of his/her knowledge, training and experience to organize the work and its performance;
- is familiar with the provisions of this Act and the regulations that apply to the work; and
- has knowledge of any potential health and safety hazards in the workplace.

The health and safety representative or the representative of a joint health and safety committee should be advised about when and where the training and instruction is to be carried out.

4.5 Medical Surveillance

Medical surveillance can be used as a preventive and remedial measure. By providing regular medical examinations and clinical tests on workers exposed to silica, subsequent adverse health effects can be detected. The examining physician can then alert the worker, the employer and the joint health and safety committee to exposure problems in the workplace that might otherwise go unrecognized. This should ensure that remedial steps will be taken.

Workers working with silica on a regular basis should have pre-placement medical examinations that include chest X-rays and pulmonary function tests, followed by periodic medical examinations. The frequency of the periodic examination will depend on the intensity and length of exposure to silica and shall be decided by the examining physician. It need not be the same for all workers but shall be done at least once every two years. Additional information on the medical surveillance program for silica exposed workers can be found in Appendix 1.

5.0 CLASSIFICATION OF WORK

A key feature of this guideline is the classification of work. It is the classification of the work that determines the appropriate respirators, measures and procedures that should be followed to protect the worker from silica exposure. In this guideline, silica-containing construction operations are classified into three groups, Type 1, Type 2, and Type 3 operations, and can be thought of as being of low, medium and high risk. From Type 1 to Type 3 operations, the corresponding respirator, and measures and procedures become increasingly stringent.

The classification of typical silica-containing construction tasks is based on available and published exposure data. Type 1, Type 2, and Type 3 operations, are based on the following airborne concentrations of respirable crystalline silica in the form of cristobalite, tridymite, quartz, and tripoli:

	TYPE 1 OPERATIONS	TYPE 2 OPERATIONS	TYPE 3 OPERATIONS
Cristobalite and Tridymite	> 0.05 to 0.50 mg/m^3	> 0.50 to 2.50 mg/m^3	> 2.5 mg/m^3
Quartz and Tripoli	> 0.10 to 1.0 mg/m^3	> 1.0 to 5.0 mg/m^3	> 5.0 mg/m^3

The following section lists the typical construction operations that generate silica-containing dust:

TYPE 1 OPERATIONS

- The drilling of holes in concrete or rock that is not part of a tunnelling operation or road construction.
- Milling of asphalt from concrete highway pavement.
- Charging mixers and hoppers with silica sand (sand consisting of at least 95 per cent silica) or silica flour (finely ground sand consisting of at least 95 per cent silica).
- Any other operation at a project that requires the handling of silica-containing material in a way that may result in a worker being exposed to airborne silica.
- Entry into a dry mortar removal or abrasive blasting area while airborne dust is visible for less than 15 minutes for inspection and/or sampling.
- Working within 25 metres of an area where compressed air is being used to remove silica-containing dust outdoors.

TYPE 2 OPERATIONS

- Removal of silica containing refractory materials with a jackhammer.
- The drilling of holes in concrete or rock that is part of a tunnelling or road construction.
- The use of a power tool to cut, grind, or polish concrete, masonry, terrazzo or refractory materials.
- The use of a power tool to remove silica containing materials.
- Tunnelling (operation of the tunnel boring machine, tunnel drilling, tunnel mesh installation)
- Tuckpoint and surface grinding.
- Dry mortar removal with an electric or pneumatic cutting device.
- Dry method dust cleanup from abrasive blasting operations.
- The use of compress air outdoors for removing silica dust.
- Entry into area where abrasive blasting is being carried out for more than 15 minutes.

TYPE 3 OPERATIONS

- Abrasive blasting with an abrasive that contains ≥ 1 per cent silica.
- Abrasive blasting of a material that contains ≥ 1 per cent silica.

Employers, supervisors, and workers should be able to recognize and correctly classify the types of operations carried out in the workplace, in order to select appropriate respirators, and implement appropriate measures and procedures. Respirator requirements are listed in Table 1 (below) for Type 1, Type 2, and Type 3 operations.

Table 1: Respirator Requirements

Operations	Required Respirator
Type 1 **(> 0.05 to 0.50 mg/m^3 of silica in the form of cristobalite and tridymite)** **(> 0.10 to 1.0 mg/m^3 of silica in the form of quartz and tripoli)**	**NIOSH APF = 10**
• The drilling of holes in concrete or rock that is not part of a tunnelling operation or road construction. • Milling of asphalt from concrete highway pavement. • Charging mixers and hoppers with silica sand (sand consisting of at least 95 per cent silica) or silica flour (finely ground sand consisting of at least 95 per cent silica). • Any other operation at a project that requires the handling of silica-containing material in a way that may result in a worker being exposed to airborne silica. • Entry into a dry mortar removal or abrasive blasting area while airborne dust is visible for less than 15 minutes for inspection and/or sampling. • Working within 25 metres of an area where compressed air is being used to remove silica-containing dust outdoors.	Half-mask particulate respirator with N-, R-, or P-series filter and 95, 99 or 100 per cent efficiency.
Type 2 **(> 0.50 to 2.5 mg/m^3 of silica in the form of cristobalite and tridymite)** **(> 1.0 to 5.0 mg/m^3 of silica in the form of quartz and tripoli)**	**NIOSH APF = 50**
• Removal of silica containing refractory materials with a jackhammer. • The drilling of holes in concrete or rock that is part of a tunnelling operation or road construction. • The use of a power tool to cut, grind, or polish concrete, masonry, terrazzo or refractory materials. • The use of a power tool to remove silica-containing materials. • The use of a power tool indoors to chip or break and remove concrete, masonry, stone, terrazzo or refractory materials. • Tunnelling (operation of the tunnel boring machine, tunnel drilling, tunnel mesh installation). • Tuckpointing and surface grinding. • Dry method dust clean-up from abrasive blasting operations. • Dry mortar removal with an electric or pneumatic cutting device. • The use of compressed air outdoors for removing silica dust. • Entry into area where abrasive blasting is being carried out for more than 15 minutes.	Full-facepiece air-purifying respirator with any 100-series particulate filter. Tight-fitting powered air-purifying respirator with any 100-series particulate filter. Full-facepiece supplied-air respirator operated in demand mode. Half-mask or full-facepiece supplied air respirator operated in continuous-flow mode.
Type 3 **(> 2.5 mg/m^3 of silica in the form of cristobalite and tridymite)** **(> 5.0 mg/m^3 of silica in the form of quartz and tripoli)**	**NIOSH APF ≥ 1000**
• Abrasive blasting with an abrasive that contains ≥ 1 per cent silica • Abrasive blasting of a material that contains ≥ 1 per cent silica	Type CE abrasive-blast supplied air respirator operated in a positive-pressure mode with a tight-fitting half-mask facepiece. Type CE abrasive-blast supplied air respirator operated in a pressure-demand or positive pressure mode with a tight-fitting full-facepiece.

* NIOSH APF = National Institute of Occupational Safety and Health Assigned Protection Factor
Note: It is recommended that compressed air that is used to supply supplied air respirators meet the breathing air purity requirements of CSA Standard Z180.1-00. Where an oil-lubricated compressor is used to supply breathing air, a continuous carbon monoxide monitor/alarm should be provided.

6.0 MEASURES AND PROCEDURES FOR WORKING WITH SILICA

Protective measures and procedures should be implemented when working with silica. Specific measures and procedures will depend on how the work is classified. This section of the guideline outlines the general measures and procedures for all work with lead, followed by specific recommendations for Type 1, Type 2 and Type 3 operations.

6.1 General Measures and Procedures for Type 1, Type 2, and Type 3 Operations

The following is a list of general measures and procedures that should be followed for all work with silica:

- Clean-up after each operation is encouraged to prevent dust containing silica from spreading;
- Compressed air or dry sweeping should be avoided when cleaning a work area;
- Compressed air should not be used for removing dust from clothing;
- Workers exposed to silica should be provided with or have access to washing facilities equipped with clean water, soap, and individual towels.
- Silica dust on personal protective clothing and equipment should be removed by damp wiping or HEPA vacuuming;
- Contaminated personal protective clothing and equipment should be handled with care to prevent disturbing the silica dust and the generation of airborne silica dust
- Washing facilities and laundering procedures must be suitable for handling silica contaminated laundry.

<u>Preparation of the Work Area</u>

Warning signs should be posted in sufficient number to warn of the hazard. If it is an indoor operation, signs should be posted at each entrance to the work area. The signs should display the following information in large, clearly visible letters:

1. There is a silica dust hazard.
2. Access to the work area is restricted to authorized persons.
3. Respirators must be worn in the work area.

<u>Dust Control Measures</u>

The generation of airborne silica-containing dust should be controlled with a mechanical ventilation system, wetting, or the use of a dust collection system. If silica-containing airborne dust is generated, mechanical ventilation with an air flow sufficient to remove airborne contaminants from workers' breathing zone should be provided. The air flow of the mechanical ventilation system should be at least 50 cubic feet per minute per square foot of face area (0.25 m^3/s per square meter of face area). However, if it is determined that none of these methods are practical, workers may be provided with respirators (see Table 1: Respirator

Requirements) to protect them from exposure. The following should be considered before assigning respirators:

- Risk to workers using wetting or a dust collection system.
- Likelihood of damage to equipment if wetting or a dust collection system is used.
- Frequency and duration of the operation.

If compressed air is being used to remove silica-containing dust outdoors, the operator and workers within 25 metres of the work area who may be exposed to the dust must either be removed from the path of the dust cloud or provided with respirators (see Table 1: Respirator Requirements).

Where effective dust control measures are in place and where an employer can demonstrate on a continual basis that the silica exposure levels are below the OEL, respirators may not be required.

6.2 Measures and Procedures for Type 1 Operations

A half-mask particulate respirator with N-, R-, or P-series filter and 95, 99 or 100 per cent efficiency should be provided for workers performing Type 1 operations. Respirators should also be provided when:

- entering a dry mortar removal area with visible airborne dust for less than 15 minutes for the purposes of inspection and/or sampling purposes.
- work is being performed within 25 metres of an outdoor area where silica-containing dust is being removed with compressed air.

6.3 Measures and Procedures for Type 2 Operations

Respirators with a NIOSH APF of 50 (see Table 1: Respirator Requirements) should be provided for workers performing Type 2 operations. In addition, the generation of silica-containing airborne dust should be controlled by thoroughly wetting the area prior to and/or during drilling or cutting operations and during the loading, scraping or moving of rock.

Other workers entering a work area where Type 2 operations are being performed should remain at least 10 metres away. Ropes or barriers should be set up to prevent unauthorized personnel from entering the work area. If this is not possible and there are workers within the 10-metre limit, the Type 2 operation should be enclosed to prevent the escape of airborne silica-containing dust (see Section 6.4.1: Barriers, Partial Enclosures and Full Enclosures).

6.4 Measures and Procedures for Type 3 Operations

The operator of the abrasive blasting nozzle should wear a Type CE abrasive blast supplied air respirator operated in a pressure demand or positive pressure mode with a tight-fitting half-mask or full facepiece.

It is recommended that compressed air that is used to supply supplied air respirators meet the breathing air purity requirements of CSA Standard Z180.1-00. Where an oil-lubricated compressor is used to supply breathing air, a continuous carbon monoxide monitor/alarm should be provided

While abrasive blasting is in progress or the airborne dust from abrasive blasting is visible,

- any worker entering the work area where abrasive blasting is being carried out for less than 15 minutes for inspection and/or sampling purposes should wear a half-mask particulate respirator with N-, R-, or P-series filter and 95, 99 or 100 per cent efficiency.
- any worker entering a work area where abrasive blasting is being carried out for more than 15 minutes should wear a respirator with a NIOSH APF of 50 (see Table 1: Respirator Requirements).
- workers engaged in cleaning dust from abrasive blasting operations, should wear a respirator with a NIOSH APF of 50 (see Table 1: Respirator Requirements).

Where abrasive blasting is conducted, barriers, partial enclosures and full enclosures should be in place to prevent other workers from being exposed to silica-containing dust and to prevent the spread of dust to other work areas.

6.4.1 Barriers, Partial Enclosures and Full Enclosures

Barriers, partial enclosures, and full enclosures are used to separate the work area from the rest of the project, and in some cases, to prevent silica exposure to other workers not directly involved in the operation. Partial and full enclosures can also prevent or reduce the dispersion of silica into the surrounding work area and environment. Barriers should only be used where full and partial enclosures are not practicable.

Barriers

Ropes or barriers do not prevent the release of contaminated dust or other contaminants into the environment. However, they can be used to restrict access of workers who are not adequately protected with proper PPE, and also prevent the entry of workers not directly involved in the operation. Ropes or barriers should be placed at a distance far enough from the operation that allows the silica-containing dust to settle. If this is not achievable, warning signs should be posted at the distance where the silica-containing dust settles to warn that access is restricted to persons wearing PPE. For example, the removal of mortar and cutting operations, ropes or barriers should be located at least 10 metres away. All workers within the barrier or warning sign zone must be adequately protected.

Partial Enclosures

Partial enclosures allow some level of emission to the atmosphere outside of the enclosure. Partial enclosures may consist of vertical tarps and floor tarps so long as the tarps are overlapped and securely fixed together at the seams. A partial enclosure is not a recommended containment system if significant dust is being generated.

Full Enclosures

Full enclosures are tight enclosures (with tarps that are generally impermeable and fully sealed joints and entryways). Full enclosures allow minimal or no fugitive emissions to reach the outside environment.

For full enclosures, the following requirements should be met:

If, as outlined above, a Type 3 operation should be enclosed, the enclosure should meet the following requirements:

- entry ways in the enclosure should be equipped with air locks, overlapping door tarps or doors
- the enclosure should be supported by a secure structure
- all joints in the enclosure should be fully sealed
- the escape of abrasive and debris from the enclosure should be controlled, at air supply points, by the use of baffles, louvers, flap seals and filters
- general mechanical ventilation should be provided to remove contaminated air from the enclosure and replacement air should be provided to replace the exhausted air
- the air pressure within the enclosure should be negative relative to the outside
- equipment venting such air shall be equipped with filters adequate to control vented air to provincial environmental standards
- the air velocity within the enclosure should provide an average minimum cross-draft or down-draft past each worker during abrasive blasting operations as follows:
    - cross-draft velocity of 0.5 m/sec (100 ft/min)
    - down-draft velocity of 0.25 m/sec (50 ft/min)

If the enclosure is located outdoors these additional requirements should be met:

- the enclosure should be made of windproof materials that are impermeable to dust
- the enclosure should be supported by a structure that prevents more than minor movement of the enclosure.

Indoor Operations

If abrasive blasting is being conducted indoors and persons other than those doing the abrasive blasting may be exposed to silica-containing dust, the abrasive blasting area should be separated from the rest of the project by an enclosure that will confine the dust within the abrasive blasting area. When an indoor abrasive blasting operation is completed, dust and waste should be cleaned up and removed by vacuuming with a HEPA-filter-equipped vacuum, wet sweeping or wet shovelling.

Outdoor Operations

If abrasive blasting is being conducted outdoors and persons other than those doing the abrasive blasting may be exposed to silica-containing dust, the work area should be identified by ropes or barriers located at least 25 metres from the abrasive blasting area, to prevent entry by workers not directly involved in the operation.

If it is not possible to locate the ropes or barriers at least 25 metres from the abrasive blasting operation, the employer should ensure that the abrasive blasting area is separated from the rest of the project by an enclosure that will confine the dust within the abrasive blasting area.

APPENDIX 1 – MEDICAL SURVEILLANCE OF SILICA-EXPOSED WORKERS

Where construction workers are exposed to airborne silica, measures and procedures to control their exposure should be implemented. This Guideline has outlined (in Section 4) the types of controls that should be in place for various work activities. However, even with the appropriate measures to control the silica hazard, some workers may be affected. Workers should therefore be periodically examined to determine if they are experiencing any adverse effects.

The essential features of a silica medical surveillance program are presented below.

Medical Surveillance Program

Purpose

The objective of a medical surveillance program is to protect the health of workers by:

- ensuring their fitness for exposure to silica
- evaluating their absorption of silica
- enabling remedial action to be taken when necessary
- providing health education.

Program

The medical surveillance program should include the following:

- pre-employment and pre-placement medical examinations
- periodic medical examinations
- clinical tests
- health education
- record keeping.

Medical Examinations

The medical examination should include the following:

History

The initial medical and occupational history should include enquiries about the worker's previous exposure to silica, personal habits (smoking) and history of present or past respiratory disorders (particularly tuberculosis). At the periodic examination, the history shall be updated to include:

(a) information on the frequency and duration of exposure to silica since the previous examination; and

(b) the occurrence of signs and symptoms of respiratory disease, e.g., dyspnea, cough, sputum, haemoptysis, wheezing and chest pain.

Physical Examination

Medical surveillance should include a general physical examination, with attention particularly directed to the respiratory system. The frequency of periodic examinations will depend on the intensity and length of exposure to silica and should be decided by the examining physician. It need not be the same for all workers but should not be less than once every two years.

Clinical Tests

X-rays and pulmonary function tests should be taken to assess a worker's fitness for continued exposure to silica. Refer to the Code for Medical Surveillance of Silica Exposed Workers in R.R.O. 1990, Reg. 845 for specific requirements.

To avoid unnecessary x-rays at a pre-placement medical examination, the examining physician should, where practicable, obtain the medical status from another facility if the worker has been previously examined in the past year. Radiographs should be closely examined for early signs of silicosis or other chest disease.

When exposure is discontinued, the frequency of X-rays and the period of surveillance will depend on the intensity and duration of exposure and the findings in previous X-rays. The examining physician shall determine the duration and frequency of follow-up

Pulmonary Function Tests

Pulmonary function tests should be taken in conjunction with the chest X-rays. Calibration of the instruments should meet current standards. Tests should include FEV_1, FVC, FEV_1/FVC per cent and a mid-flow rate such as FEF 25-75 per cent. All relevant data should be corrected to body temperature and pressure (BTPS).

Action Levels

An assessment of a worker's fitness for work should be based on both the clinical examination and clinical test results. For this reason, no specific action levels are stated for the latter. If silicosis is confirmed, the physician should then determine whether the worker is fit, fit with limitations or unfit for further exposure. A worker should not be removed from silica exposure before consultation with the Workplace Safety Insurance Board (WSIB). To qualify for compensation or rehabilitation further assessment by the WSIB will be necessary.

APPENDIX 2: RESPIRATOR REQUIREMENTS & OTHER MEASURES AND PROCEDURES FOR TYPE 1, 2, AND 3 SILICA-CONTAINING OPERATIONS

OPERATIONS	REQUIRED RESPIRATOR	OTHER MEASURES & PROCEDURES
TYPE 1		
• The drilling of holes in concrete or rock that is not part of a tunnelling operation or road construction. • Milling of asphalt from concrete highway pavement. • Charging mixers and hoppers with silica sand (sand consisting of at least 95 per cent silica) or silica flour (finely ground sand consisting of at least 95 per cent silica). • Any other operation at a project that requires the handling of silica-containing material in a way that may result in a worker being exposed to airborne silica. • Entry into a dry mortar removal or abrasive blasting area while airborne dust is visible for less than 15 minutes for inspection and/or sampling. • Working within 25 metres of an area where compressed air is being used to remove silica-containing dust outdoors.	Half-mask particulate respirator with N-, R-, or P-series filter and 95, 99 or 100% efficiency.	• Clean-up after each operation should be done to prevent dust containing silica from spreading • Compressed air or dry sweeping should be avoided when cleaning a work area • Compressed air should not be used for removing dust from clothing • Workers exposed to silica should be provided with or have access to washing facilities equipped with clean water, soap, and individual towels • Silica dust on personal protective clothing and equipment should be removed by damp wiping or HEPA vacuuming • Contaminated personal protective clothing and equipment should be handled with care to prevent disturbing the silica dust and the generation of airborne silica dust • Washing facilities and laundering procedures must be suitable for handling lead contaminated laundry • Warning signs should be posted in sufficient numbers to warn of the silica hazard. There should be a sign, at least, at each entrance to the work area. The signs should display the following information in large, clearly visible letters: – There is a silica dust hazard. – Access to the work area is restricted to authorized persons. – Respirators must be worn in the work area.

OPERATIONS	REQUIRED RESPIRATOR	OTHER MEASURES & PROCEDURES
TYPE 2		
• Removal of silica containing refractory materials with a jackhammer. • The drilling of holes in concrete or rock that is part of a tunnelling operation or road construction. • The use of a power tool to cut, grind, or polish concrete, masonry, terrazzo or refractory materials. • The use of a power tool to remove silica-containing materials. • The use of a power tool indoors to chip or break and remove concrete, masonry, stone, terrazzo or refractory materials. • Tunnelling (operation of the tunnel boring machine, tunnel drilling, tunnel mesh installation). • Tuckpointing and surface grinding. • Dry mortar removal with an electric or pneumatic cutting device. • Dry method dust clean-up from abrasive blasting operations. • The use of compressed air outdoors for removing silica dust. • Entry into area where abrasive blasting is being carried out for more than 15 minutes.	Full-facepiece air-purifying respirator with N-, R-, or P-series filter and 100% efficiency. Tight-fitting powered air-purifying respirator with a high-efficiency filter. Full-facepiece supplied-air respirator operated in demand mode. Half-mask or full-facepiece supplied air respirator operated in continuous-flow mode.	**(In addition to Type 1 measures and procedures.)** • Other workers entering a work area where Type 2 operations are being performed should remain at least 10 metres away. Ropes or barriers should be set up to prevent unauthorized personnel from entering the work area. If this is not possible and there are workers within the 10-metre limit, the Type 2 operation should be enclosed to prevent the escape of airborne silica-containing dust (partial or full enclosures).
TYPE 3		
• Abrasive blasting with an abrasive that contains ≥ 1 per cent silica • Abrasive blasting of a material that contains ≥ 1 per cent silica	Type CE abrasive-blast supplied air respirator operated in a positive-pressure mode with a tight-fitting half-mask facepiece. Type CE abrasive-blast supplied air respirator operated in a pressure-demand or positive pressure mode with a tight-fitting full-facepiece.	**(In addition to Type 1 and Type 2 measures and procedures.)** • While abrasive blasting is in progress or the airborne dust from abrasive blasting is visible, – any worker entering the work area where abrasive blasting is being carried out for less than 15 minutes for inspection and/or sampling purposes should wear a half-mask particulate respirator with N-, R-, or P-series filter and 95, 99 or 100% efficiency. – any worker entering a work area where abrasive blasting is being carried out for more than 15 minutes should wear a respirator with a NIOSH APF of 50 – workers engaged in cleaning dust from abrasive blasting operations, should wear a respirator with a NIOSH APF of 50 • Where abrasive blasting is conducted, barriers, partial enclosures and full enclosures should be in place to prevent other workers from being exposed to silica-containing dust and to prevent the spread of dust to other work areas.

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GUIDELINE

LEAD ON CONSTRUCTION PROJECTS

Health and Safety Guidelines

For more copies, please contact

Publications Section
Ministry of Labour
655 Bay St., 14th Floor
Toronto ON M7A 1T7

(416) 326-7731
Toll-free: 1-800-268-8013
Fax: (416) 326-7745
E-mail: mol.publications@mol.gov.on.ca
Web: www.gov.on.ca/lab

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GUIDELINE

LEAD ON CONSTRUCTION PROJECTS

Occupational Health and Safety Branch
Ministry of Labour

September 2004

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Foreword

This Guideline has been prepared to assist persons, such as employers, construction project owners, constructors, contractors and subcontractors, who have duties under the Occupational Health and Safety (OHSA) and its regulations to protect workers from exposure to lead. It should not be taken to be a statement of the law or what is necessary to comply with the law. A person with legal duties may or may not agree with the Guideline and there is no legal requirement to follow the Guideline. It is for each such person to decide what is necessary to comply with the OHSA and its regulations.

A person who needs assistance in determining what constitutes compliance should consult with his or her legal advisor. Ministry inspectors will assess workplace situations against the relevant provisions of the OHSA and its regulations but they do not enforce the Guideline, although they may refer to it in determining whether the relevant laws have been complied with.

1.0 INTRODUCTION

Scope

Employers have a duty to protect their workers from lead exposure on construction projects. This guideline has been prepared to raise the awareness of employers and workers in the construction industry of the hazards posed by lead in construction and the measures and procedures that should be taken to control those hazards.

For the purpose of this guideline, lead refers to inorganic lead.

Lead in Construction

Lead is a heavy metal that has been in industrial use for thousands of years. It is pale silvery grey when freshly cut but it darkens on exposure to air. It is heavy, malleable, and a poor conductor of electricity. Lead may be used in its pure elemental form or combined chemically with other elements to form lead compounds. Inorganic lead compounds are used in pigments, paints, glasses, plastics and rubber compounds.

Lead can be present on construction projects in two distinct ways:

- It can be found in construction materials, such as paints, coatings, mortar, concrete, solder, and sheet metal.
- It can be present at a construction site in existing structures, building components, and where lead was previously used in a manufacturing process.

Construction activities of particular concern include:

- abrasive blasting of structures coated with lead-based paints
- application or removal of lead-containing paints
- welding, burning, or high temperature cutting of lead-containing coatings or materials
- removal of lead-containing dust using an air mist extraction system
- removal of lead-containing mortars using an electric or pneumatic cutting device.

2.0 LEGAL REQUIREMENTS

Occupational Health and Safety Act (the OHSA)

The OHSA sets out, in very general terms, the duties of employers and others to protect workers from health and safety hazards on the job. These duties include:

- taking all reasonable precautions to protect the health and safety of workers [clause 25(2)(h)]
- ensuring that equipment, materials and protective equipment are maintained in good condition [clause 25(1)(b)]
- providing information, instruction and supervision to protect worker health and safety [clause 25(2)(a)]
- acquainting a worker or a person in authority over a worker with any hazard in the work and in the handling, storage, use, disposal and transport of any article, device, equipment or a biological, chemical or physical agent [clause 25(2)(d)].

In addition, section 30 of the OHSA deals with the presence of designated substances on construction projects. Since lead is a designated substance (R.R.O. 1990, Reg. 843), compliance with the OHSA and Regulations will require some action to be taken where there is a lead hazard on a construction project.

Section 30 requires the owner of a project to determine if lead is present on a project and, if it is, to so inform all potential contractors as part of the bidding process. In a similar way, contractors who receive this information are to pass it onto other contractors and subcontractors who are bidding for work on the project. If the owner or any contractor fails to comply with this requirement, they will be liable for any loss or damages that result from a contractor subsequently discovering that lead is present.

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

The WHMIS Regulation applies to all workplaces covered by the OHSA. Any employer or constructor who uses WHMIS controlled products is required to comply with the WHMIS Regulation (Reg. 860) regarding the requirements for labels, material safety data sheets, and worker education and training.

The Ministry of Labour is responsible for the administration and enforcement of both federal and provincial WHMIS legislation.

Regulation for Construction Projects. O. Reg. 213/91

The Regulation for Construction Projects, O. Reg. 213/91, applies to all construction projects. Although lead is not mentioned specifically, the following sections of the O. Reg. 213/91 would apply to situations where there is the potential for workers to be exposed to lead:

Clause 14 (5) A competent person shall perform tests and observations necessary for the detection of hazardous conditions on a project.

Section 21 (1) A worker shall wear such protective clothing and use such personal protective equipment or devices as are necessary to protect the worker against the hazards to which the worker may be exposed.

(2) A worker's employer shall require the worker to comply with subsection (1).

(3) A worker required to wear personal protective clothing or use personal protective equipment or devices shall be adequately instructed and trained in the care and use of the clothing, equipment or device before wearing or using it.

Section 30 Workers who handle or use…substances likely to endanger their health shall be provided with washing facilities with clean water, soap and individual towels.

Section 46 (1) A project shall be adequately ventilated by natural or mechanical means,

(a) if a worker may be injured by inhaling a noxious…dust or fume;

(2) If it is not practicable to provide natural or mechanical ventilation in the circumstances described in clause (1)(a), respiratory protective equipment suitable for the hazard shall be provided and be used by the workers.

Section 59 If the dissemination of dust is a hazard to a worker, the dust shall be adequately controlled or each worker who may be exposed to the hazard shall be provided with adequate personal protective equipment.

Regulation respecting Lead, R.R.O. 1990, Regulation 843

The Ministry's designated substance regulation (DSR) for lead, Regulation 843, specifies occupational exposure limits (OELs) for lead, and requires assessment and a control program to ensure compliance with these OELs. The OEL for inorganic lead is 0.05 milligrams per cubic metre (mg/m^3) of air as an 8-hour daily or 40-hour weekly time-weighted average.

Despite the fact that Regulation 843 and the OEL for lead do not generally apply to a constructor or to a construction employer on a construction project in respect of those workers who work at or on the project, construction employers still have a responsibility to protect the health of their workers. However, if the construction project is located at a workplace where lead is present and likely to be inhaled, ingested or absorbed by a worker then the employer of the workplace must protect the workers on the project by obeying the instructions set out in sections 4 and 5 of Regulation 843, even if the work is performed under a contract with another person. (Section 4 and 5 state how much airborne lead the worker may be exposed to with safety and describes when, and what circumstances, respirators must be used in order to meet these requirements.)

Measures and procedures that ensure construction workers receive the same standard of protection as workers covered by Regulation 843 should therefore be implemented on construction projects where exposure to lead is a hazard. Such measures and procedures are deemed to be in compliance with section 25(2)(h) of the OHSA, as taking "every precaution reasonable in the circumstances for the protection of a worker".

3.0 HEALTH EFFECTS

How lead enters the body – what are the routes of entry?

Two routes of entry are of major concern: inhalation and ingestion. Airborne lead particles in the form of fumes, dusts and mists can be inhaled deeply into the lungs if they are small enough, less than five micrometres (μm), i.e., five one-millionths of a meter. Larger particles are trapped in the upper respiratory tract, cleared from the lungs, and subsequently swallowed. You can also swallow lead dust if it gets in your food or drinks, or if you eat or smoke without washing your hands first.

What happens when lead enters the body – what are the health effects?

Shortly after lead is inhaled or ingested, it can enter the bloodstream and travel to soft tissues (such as the liver, kidneys, lungs, brain, spleen, muscles, and heart). After several weeks, most of the lead moves into your bones and teeth and can be stored there for a long time. Therefore, exposure to small amounts of lead can build up over time, and the more lead you have in your body, the more likely it is that you will experience health problems.

Early signs of lead poisoning include:

- tiredness
- irritability
- muscle and joint pain
- headaches
- stomach aches and cramps.

Harmful effects can follow a high exposure over a short period of time **(acute poisoning)**, or long-term exposure to lower doses **(chronic poisoning)**. Symptoms of acute lead poisoning include a metallic taste in the mouth and gastrointestinal symptoms such as vomiting, abdominal cramps, constipation, and diarrhea. Symptoms of chronic lead poisoning are more difficult to recognize because they are similar to many common complaints. However, severe chronic poisoning can lead to more characteristic symptoms, such as a blue line on the gums, wrist drop (the inability to hold the hand extended), severe abdominal pain and pallor.

Lead can also cause serious damage to a number of systems in the body. Overexposure to lead can affect:

> **Blood:** Lead can interfere with the body's ability to manufacture hemoglobin, the molecule in red blood cells responsible for carrying oxygen to the tissues. This may lead to anemia.

Kidneys: Kidneys purify blood before it is distributed for use by the rest of the body. However, kidneys are not effective in filtering lead from the bloodstream. In addition, lead can damage the kidneys and reduce its ability to filter waste from the bloodstream.

Gastrointestinal System: Lead poisoning may result in abdominal pain, loss of appetite, vomiting, nausea, constipation or diarrhea.

Nervous System: Lead poisoning can cause peripheral nerve damage that results in muscle weakness. It may also lead to behavioural changes and to impairment of vision and hearing. At very high levels, lead can affect the brain, causing convulsions, coma, and even death.

Reproductive System: Lead may harm the developing fetus because of the shared blood supply between a mother and her fetus. Exposure of pregnant women to excessive lead may result in miscarriages and stillbirths. Overexposure to lead in men can impair sperm production.

Bones and Teeth: Absorbed lead can be deposited and stored in mineralizing tissues (bones and teeth) for a long period of time. Under certain circumstances, the release of stored lead increases and can re-enter the blood and target other systems in the body. The release of stored lead increases during periods of pregnancy, lactation, menopause, physiologic stress, chronic disease, hyperthyroidism, kidney disease, broken bones, and advanced age, and is exacerbated by calcium deficiency.

Although there are many possible symptoms, they should not be relied upon to warn of a lead-exposure problem because some changes take a long time to develop and workers may not notice a change in their health. If workers carry lead-containing dust home on their clothes, footwear, skin or hair, their family can be exposed to lead too. Children in particular are more susceptible to the harmful effects of lead. Even low-level exposures may harm the intellectual development, behaviour, size and hearing of infants. The best approach in preventing lead poisoning is to ensure that proper lead-exposure controls are in place before any health problems are noted.

4.0 CONTROLLING THE LEAD HAZARD

Lead may affect the health of workers if it is in a form that may be inhaled (i.e. airborne particles) or ingested. In order for lead to be a hazard by inhalation, lead particles that are small enough to be inhaled must get into the air. There are three types of particles: dust, fume and mist. Lead dust consists of solid particles created through processes such as blasting, sanding, grinding, and electric or pneumatic cutting. Lead fumes are produced when lead or lead-contaminated materials are heated to temperatures above 500 °C, such as welding, high temperature cutting, and burning operations. The heating causes a vapour to be given off and the vapour condenses into solid fume particles. Mists are made up of liquid droplets suspended in air. The spray application of lead-based paint can generate a high concentration of lead-containing mist.

The strategy for controlling airborne lead hazard can therefore be broken down into three basic approaches:

- prevent lead from getting into the air
- remove lead present in the air
- if present in the air, prevent workers from inhaling it.

To prevent the ingestion of lead, workers should exercise good work and hygiene practices.

To avoid the ingestion, inhalation and unintentional transfer of lead from contaminated areas, it is essential to have the following control methods in place:

- engineering controls
- work practices and hygiene practices
- protective clothing and equipment
- training.

Even with appropriate measures to control lead, some workers may still be affected. For this reason, periodic medical examinations are important for determining if the control measures in place are effective and if workers are suffering from the effects of lead exposure. This is known as medical surveillance (see Appendix 1) and can be considered to be a method for early detection and prevention of lead poisoning.

4.1 Engineering Controls

Workplace parties, which include owners, constructors, contractors, supervisors and workers, involved in construction projects that may expose workers to lead should:

- Substitute lead-containing coatings and materials with lead-free coatings and materials (e.g. substitute lead-containing paints with non-lead based paints). This may also apply to those who develop specifications.
- Select methods and equipment for the removal or installation of lead-containing coatings and materials that will reduce dust generation (e.g. wet methods, such as wet sweeping and shovelling, reduce dust generation and should be used whenever practicable). This may also apply to those who develop the specifications.
- General mechanical ventilation should be provided to remove contaminated air from the workplace, and filtered air should be provided to replace the exhausted air.
- Local mechanical ventilation should be provided to remove contaminants at the source. This is the most effective method. Power tools that can generate lead-containing dust should be equipped with effective dust collection systems.

4.2 Work Practices and Hygiene Practices

Work practices and hygiene practices are on-the-job activities that reduce the exposure potential. Lead-containing material can accumulate on the hands, clothing and hair. From there it can be disturbed, re-suspended in air and inhaled or ingested. Workers should therefore be able to wash and shower at the end of each shift. The specific washing and decontamination facilities that should be provided for the most hazardous work are described in Section 6 of this guideline. For all work involving lead exposure, there should be no smoking, eating, drinking or chewing in contaminated areas. Food and beverages should be stored in an uncontaminated area.

An effective housekeeping program requires the regular cleanup removal of lead-containing dust and debris. Surfaces should be kept clean by washing down with water or vacuuming with a vacuum equipped with a high efficiency particulate air (HEPA) filter. Containers of lead-containing waste should be kept tightly covered to prevent dust from becoming airborne. Cleaning with compressed air or dry sweeping should be avoided.

4.3 Protective Clothing and Equipment

Personal protective clothing and equipment should be provided where workers may be exposed to lead. Appropriate personal protective clothing and equipment to prevent skin contamination, include but are not limited to coveralls or full-body work clothing; gloves, hats, and footwear or disposable coverlets; and safety glasses, face shields or goggles. Respirators should be provided to prevent the inhalation of lead where engineering controls and work practices do not control the concentration of lead to below the OEL.

Protective Clothing

The purpose of protective clothing is to prevent skin exposure and the contamination of regular clothing. All clothing and equipment that has been worn in a lead-contaminated area must be

removed at the end of each shift and be decontaminated. Under no circumstances should these be taken home. When handling lead-contaminated clothing avoid shaking, as this can be a significant source of exposure to lead dust. Lead-contaminated clothing and equipment should be placed in sealed impermeable plastic bags with proper labels indicating lead contamination. Washing facilities and procedures must be suitable for handling lead contaminated laundry.

Respirators

Where engineering controls and work practices do not control the concentration of lead to below the OEL, workers should wear respirators. If respirators are used, a respirator program should be implemented. The program should be developed in consultation with the joint health and safety committee or health and safety representative, if there is one, and should include written procedures for the selection, use, care and maintenance of personal respiratory protective equipment. Workers should be instructed and trained on the care and use of personal protective equipment before using it. Some workers may have a medical condition that causes them to have difficulty breathing when wearing a respirator. If such workers have written medical proof of their condition, they should not be required to do work that requires a respirator.

Respirator selection

Where respirators are provided, they should be appropriate in the circumstances for the anticipated concentrations of airborne lead. Respirators should be selected in accordance with the U.S. National Institute for Occupational Safety and Health (NIOSH) assigned protection factors (APF).

Use, Care, and Maintenance of Respirators

The following general use, care, and maintenance procedures should be followed whenever respirators are required:

- respirators should be used and maintained in accordance with the manufacturer's specifications
- storage of respirators should be in a convenient, clean and sanitary location and in a manner that does not subject them to damage or distortion
- respirators assigned for the exclusive use of one worker, should be cleaned, disinfected and inspected after each shift on which they are used
- respirators used by more than one worker, should be cleaned, disinfected and inspected after each use
- any respirator parts that are damaged or that have deteriorated should be replaced before the respirator is used
- please refer to CSA standard Z94.4-02 for additional information of the use and care of respirators.

Ideally respirators should be assigned for the exclusive use of one worker. But before a decision is made for a respirator to be shared by more than one worker, the following factors should be considered:

- the fit of the equipment
- the health and safety risk to the worker that supplying non-exclusive use equipment would cause
- any undue economic hardship to the employer that supplying exclusive use equipment would cause.

Respirators with a tight-fitting face-piece, must be fitted to the worker in such a way that there is an effective seal between the equipment and the worker's face. Each worker must be fitted for each type of respirator to be worn.

4.4 Training

Training is an important component in preventing worker exposure to lead. Control methods, measures and procedures can only be as effective as the workers carrying them out. It is therefore essential for training to cover the following:

- WHMIS training,
- the hazards of lead, including health effects and symptom recognition,
- personal hygiene, respirator requirements, and work measures and procedures, and
- the use, cleaning and disposal of respirators and protective equipment;

Instruction and training should be provided by a competent person. This could be the employer or someone hired by the employer. A competent person is defined under the OHSA as a person who:

- is qualified because of his/her knowledge, training and experience to organize and carry out the work safely;
- is familiar with the provisions of the act and the regulations that apply to the work; and
- has knowledge of any potential health and safety hazards in the workplace.

The health and safety representative or the representative of a joint health and safety committee should be advised about when and where the training and instruction is to be carried out.

4.5 Medical Surveillance

Medical surveillance can be used as a preventive measure. By providing regular medical examinations and biological monitoring (i.e. blood-lead tests) on workers exposed to lead, subsequent adverse health effects can be detected. The examining physician can then alert the

worker, the employer and the joint health and safety committee to exposure problems in the workplace that might otherwise go unrecognized

Workers working with lead on a regular basis should have pre-placement medical examinations that include blood-lead tests, followed by periodic medical examinations. Blood-lead tests should be taken every six months, or more frequently at the discretion of a physician. Additional information of the medical surveillance program for lead exposed workers can be found in Appendix 1.

5.0 CLASSIFICATION OF WORK

A key feature of this guideline is the classification of work. It is the classification of the work that determines the appropriate respirators, measures and procedures that should be followed to protect the worker from lead exposure. In this guideline, lead-containing construction operations are classified into three groups, Type 1, Type 2, and Type 3 operations, and can be thought of as being of low, medium and high risk. Some groups, Type 2 and Type 3, are further subdivided. From Type 1 to Type 3 operations, the corresponding respirator requirements, and measures and procedures become increasingly stringent.

The classification of typical lead-containing construction tasks is based on presumed airborne concentrations obtained from the U.S. Occupational Safety and Health Administration (OSHA), the Ontario Ministry of Labour, and published research studies. The classification of Type 1, Type 2, or Type 3 operations are grouped based on the following concentrations of airborne lead:

TYPE 1 OPERATIONS	TYPE 2 OPERATIONS		TYPE 3 OPERATIONS	
	Type 2a	Type 2b	Type 3a	Type 3b
< 0.05 mg/m^3	> 0.05 to 0.50 mg/m^3	> 0.50 to 1.25 mg/m^3	> 1.25 to 2.50 mg/m^3	> 2.50 mg/m^3

TYPE 1 OPERATIONS

- Application of lead-containing coatings with a brush or roller.
- Removal of lead-containing coatings with a chemical gel or paste and fibrous laminated cloth wrap.
- Removal of lead-containing coatings or materials using a power tool that has an effective* dust collection system equipped with a HEPA filter.
- Installation or removal of lead-containing sheet metal.
- Installation or removal of lead-containing packing, babbit or similar material.
- Removal of lead-containing coatings or materials using non-powered hand tools, other than manual scraping or sanding.
- Soldering.

* Effective implies that the dust collection system should be capable of controlling airborne lead concentration levels to below 0.05 mg/m^3. Employers should follow manufacturer's recommendations and maintenance specifications for optimal function.

TYPE 2 OPERATIONS

TYPE 2a OPERATIONS

- Welding or high temperature cutting of lead-containing coatings or materials outdoors. This operation is considered a Type 2a operation only if it is short-term, not repeated, and if the material has been stripped prior to welding or high temperature cutting. Otherwise, it will be considered a Type 3a operation.
- Removal of lead-containing coatings or materials by scraping or sanding using non-powered hand tools.
- Manual demolition of lead-painted plaster walls or building components by striking a wall with a sledgehammer or similar tool.

TYPE 2b OPERATIONS

- Spray application of lead-containing coatings.

TYPE 3 OPERATIONS

TYPE 3a OPERATIONS

- Welding or high temperature cutting of lead-containing coatings or materials indoors or in a confined space.
- Burning of a surface containing lead.
- Dry removal of lead-containing mortar using an electric or pneumatic cutting device.
- Removal of lead-containing coatings or materials using power tools without an effective dust collection system equipped with a HEPA filter.
- Removal or repair of a ventilation system used for controlling lead exposure.
- Demolition or cleanup of a facility where lead-containing products were manufactured.
- An operation that may expose a worker to lead dust, fume or mist that is not a Type 1, Type 2, or Type 3b operation.

TYPE 3b OPERATIONS

- Abrasive blasting of lead-containing coatings or materials.
- Removal of lead-containing dust using an air mist extraction system.

Employers, supervisors, and workers should be able to recognize and classify lead-containing operations in order to provide appropriate respirators, measures and procedures. Respirator requirements are listed in Table 1 for Type 1, Type 2, and Type 3 operations.

TABLE 1: RESPIRATOR REQUIREMENTS

Operations	Required Respirator
Type 1 (< 0.05 mg/m^3)	
• Application of lead-containing coatings with a brush or roller. • Removal of lead-containing coatings with a chemical gel or paste and fibrous laminated cloth wrap. • Removal of lead-containing coatings or materials using a power tool that has an effective dust collection system equipped with a HEPA filter. • Installation or removal of lead-containing sheet metal. • Installation or removal of lead-containing packing, babbit or similar material. • Removal of lead-containing coatings or materials with a non-powered hand tool, other than manual scraping and sanding. • Soldering.	Respirators should not be necessary if the general procedures listed in Section 6.1 are followed and if the level of lead in the air is less than 0.05 mg/m^3. However, if the 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 (> 0.05 to 0.50 mg/m^3)	**NIOSH APF = 10**
• Welding or high temperature cutting of lead-containing coatings or materials outdoors. This operation is considered a Type 2a operation only if it is short-term, not repeated, and if the material has been stripped prior to welding or high temperature cutting. Otherwise, it will be considered a Type 3a operation. • Removal of lead-containing coatings or materials by scraping or sanding using non-powered hand tools. • Manual demolition of lead-painted plaster walls or building components by striking a wall with a sledge hammer or similar tool.	Half-mask particulate respirator with N-, R-or P-series filter, and 95, 99 or 100% efficiency.
Type 2b (> 0.50 mg/m^3 to 1.25 mg/m^3)	**NIOSH APF = 25**
• Spray application of lead-containing coatings.	Powered air purifying respirator equipped with a hood or helmet, and any type of high efficiency filter. Supplied air respirator equipped with a hood or helmet and operated in a continuous flow mode.

Operations	Required Respirator
Type 3a (> 1.25 to 2.50 mg/m^3)	**NIOSH APF = 50**
• Welding or high temperature cutting of lead-containing coatings or materials indoors or in a confined space. • Burning of a surface containing lead. • Dry removal of lead-containing mortar using an electric or pneumatic cutting device • Removal of lead-containing coatings or materials using power tools without an effective dust collection system equipped with a HEPA filter. • Removal or repair of a ventilation system used for controlling lead exposure. • Demolition or cleanup of a facility where lead-containing products were manufactured. • An operation that may expose a worker to lead dust, fume or mist that is not a Type 1,Type 2 or Type 3b operation.	Full-facepiece air-purifying respirator with N-, R-or P-series filter, and 100% efficiency. Tight-fitting powered air-purifying respirator with a high efficiency filter. Full-facepiece supplied-air respirator operated in demand mode. Half-mask or full-facepiece supplied air respirator operated in continuous-flow mode.
Type 3b (> 2.50 mg/m^4)	**NIOSH APF ≥ 1000**
• Abrasive blasting of lead-containing coatings or materials.	Type CE abrasive-blast supplied respirator operated in a positive pressure mode with a tight-fitting half-mask facepiece.
• Removal of lead-containing dust using an air mist extraction system.	Full-facepiece supplied-air respirator operated in pressure-demand or other positive-pressure mode.

* NIOSH APF = National Institute of Occupational Safety and Health Assigned Protection Factor
Note: It is recommended that compressed air used to supply air respirators should meet the breathing air purity requirement of CSA Standard Z180.1-00. Where an oil-lubricated compressor is used to supply breathing air, a continuous carbon monoxide monitor/alarm must be provided.

6.0 MEASURES AND PROCEDURES FOR WORKING WITH LEAD

Protective measures and procedures should be implemented when working with lead. Specific measures and procedures will depend on how the work is classified. This section of the guideline outlines general measures and procedures for all work with lead, followed by specific recommendations for Type 1, Type 2, and Type 3 operations.

6.1 General Measures and Procedures for Type 1, Type 2, and Type 3 Operations

The following is a list of general measures and procedures that should be followed for **all** work with lead:

- washing facilities consisting of a wash basin, water, soap and towels should be provided and workers should use these washing facilities before eating, drinking, smoking or leaving the project;
- workers should not eat, drink, chew gum or smoke in the work area;
- drop sheets should be used below all lead operations which produce or may produce dust, chips, or debris containing lead;
- dust and waste should be cleaned up and removed by vacuuming with a HEPA filter equipped vacuum;
- clean-up after each operation should be done to prevent lead contamination and exposure to lead;
- dust and waste should be cleaned up at regular intervals and placed in a container that is:
    - dust tight
    - identified as containing lead waste
    - cleaned with a damp cloth or a vacuum equipped with a HEPA filter immediately before being removed from the work area
    - removed from the workplace frequently and at regular intervals;
- the work area should be inspected daily at least once to ensure that the work area is clean; and
- compressed air or dry sweeping should not be used to clean up any lead-containing dust or waste from a work area or from clothing.

6.2 Measures and Procedures for Type 1 Operations

Respirators should not be necessary if the general procedures (above) are followed. However, any worker who requests a respirator should be provided with a half-mask particulate respirator with N-, R- or P-series filter, and 95, 99 or 100% efficiency.

6.3 Measures and Procedures for Type 2 Operations

Preparation of the Work Area

For all Type 2 operations, signs should be posted in sufficient numbers to warn of the lead hazard. There should be a sign, at least, at each entrance to the work area. The signs should display the following information in large, clearly visible letters:

1. There is a lead dust, fume or mist hazard.
2. Access to the work area is restricted to authorized persons.
3. Respirators must be worn in the work area.

Personal Protective Clothing and Equipment

Suitable protective clothing and equipment, as recommended in Section 4.3, should be worn by every worker who enters the work area.

Where lead-containing paints or coatings are being applied by spraying, all workers in the work area should wear a powered air purifying respirator equipped with a hood or helmet and a high efficiency filter, or a supplied air respirator equipped with a hood or helmet and operated in a continuous flow mode should be adequate.

For all other Type 2 operations, a half-mask particulate respirator with N-, R- or P-series filter, and 95, 99 or 100% efficiency should be adequate.

6.4 Measures and Procedures for Type 3 Operations

6.4.1 Preparation of the Work Area

Warning signs should be provided for all Type 3 operations. Signs should be posted in sufficient numbers to warn of the lead hazard, and at least at each entrance of the work area. The signs should display the following information in large, clearly visible letters:

1. There is lead dust, fume or mist hazard.
2. Access to the work area is restricted to authorized persons.
3. Respirators must be worn in the work area.

6.4.2 Barriers, Partial Enclosures and Full Enclosures

Barriers, partial enclosures, and full enclosures are used to separate the work area from the rest of the project, and in some cases, to prevent lead exposure to other workers not directly involved in the operation. Partial and full enclosures can also prevent or reduce the dispersion of lead into the surrounding work area and environment. Barriers should only be used where full and partial enclosures are not practicable.

Barriers

Ropes or barriers do not prevent the release of contaminated dust or other contaminants into the environment. However, they can be used to restrict access of workers who are not adequately protected with proper PPE, and also prevent the entry of workers not directly involved in the operation. Ropes or barriers should be placed at a distance far enough from the operation that allows the lead-containing dust to settle. If this is not achievable, warning signs should be posted at the distance where the lead-containing dust settles to warn that access is restricted to persons wearing PPE. For example, the removal of mortar and cutting operations, ropes or barriers should be located at least 10 metres away. All workers within the barrier or warning sign zone must be adequately protected.

Partial Enclosures

Partial enclosures allow some emissions to the atmosphere outside of the enclosure. Partial enclosures may consist of vertical tarps and floor tarps so long as the tarps are overlapped and securely fixed together at the seams. A partial enclosure is not a recommended containment system if significant dust is being generated.

Full Enclosures

Full enclosures are tight enclosures (with tarps that are generally impermeable and fully sealed joints and entryways). Full enclosures allow minimal or no fugitive emissions to reach the outside environment. For full enclosures, the following requirements should be met:

- the enclosure should be made of windproof materials that are impermeable to dust
- the enclosure should be supported by a secure structure
- all joints in the enclosure should be fully sealed
- entrances to the enclosure should be equipped with overlapping tarps or air locks
- the escape of abrasive and debris from the enclosure should be controlled, at air supply points, by the use of baffles, louvers, flap seals and filters
- general mechanical ventilation should be provided to remove contaminated air from the enclosure and filtered air should be provided to replace the exhausted air
- equipment venting such air should be equipped with filters adequate to control vented air to provincial environmental standards
- the air velocity within the enclosure should provide an average minimum cross-draft or down-draft past each worker during abrasive blasting operations as follows:
    - cross-draft velocity of 0.5 m/sec (100 ft/min)
    - down-draft velocity of 0.25 m/sec (50 ft/min)

Indoor Operations

- For Type 3a operations conducted indoors, barriers, partial enclosures, or full enclosures should be provided.
- For Type 3b operations (abrasive blasting, removal of lead-containing dust using an air mist extraction system) conducted indoors, full enclosures should be provided.

Outdoor Operations

- For Type 3a and 3b operations conducted outdoors, barriers, partial enclosures, or full enclosures should be provided.
- For dry abrasive blasting conducted outdoors, full enclosures should be provided.

6.4.3 Decontamination Facility

A decontamination facility should be made available for workers carrying out for the following Type 3 operations:

Type 3a Operations

- removal of lead-containing coatings and materials using power tools without an effective dust collection system equipped with a HEPA filter
- demolition or clean-up of a facility where lead-containing products were manufactured

Type 3b Operations

- abrasive blasting of lead-containing coatings or materials
- removal of lead-containing dust using an air mist extraction system

The decontamination facility should be located as close as practicable to the work area and should consist of:

- a room suitable for changing into protective clothing and for storing contaminated protective clothing and equipment
- a shower room as described below
- a room suitable for changing into street clothes and for storing clean clothing and equipment

The rooms in the decontamination facility should be arranged in sequence and constructed so as to prevent the spread of lead dust.

The shower room in the decontamination facility should be provided with the following:

- hot and cold water or water of a constant temperature that is not less than 40° Celsius or more than 50° Celsius

- individual controls inside the room to regulate water flow and, if there is hot and cold water, temperature
- clean towels.

Prior to each shift in which a decontamination facility is being used, a competent person should inspect the facility to ensure that there are no defects that would allow lead-containing dust to escape. Defects should be repaired before the facility is used. The decontamination facility should be maintained in a clean and sanitary condition.

Workers using the decontamination facility should do the following in the order shown:

- decontaminate protective clothing that will be reused on site by vacuuming with a HEPA-filter-vacuum or by damp wiping
- remove the decontaminated protective clothing
- place protective clothing that will not be reused on site in a container suitable for lead-containing dust and waste
- shower without removing the respirator
- remove and clean the respirator

6.4.4 Dust Control Measures

General and Local Mechanical Ventilation

Where the work area is enclosed, general mechanical ventilation should be provided. The air exhausted from an enclosed work area should pass through a dust collector effective for capturing the size of particulate matter being generated and for the volume and velocity of air moving through the enclosure.

Where a dust generating operation is carried out, local mechanical ventilation should be provided to remove dust at the source. Local mechanical ventilation is highly recommended for welding, burning, and high temperature cutting of lead-containing coatings and materials, and for the removal of lead-containing coatings and materials using power tools. Where local mechanical ventilation is used, the following should be met:

- Air velocity at any point in front of or at the opening of the ventilation hood should be sufficient to overcome opposing air currents and capture the contaminated air by causing it to flow into the hood.
- Air velocity at the source should be at least 0.5 m/sec (100 ft/min)
- Air discharged from the local mechanical ventilation system should pass through a HEPA filter and be routed out of the workplace in a way that will prevent the return of contaminants to the workplace.

If local ventilation is not practicable, an appropriate respirator (as listed in Table 1) should be provided. However, the decision that local ventilation is not practicable should not be made without first consulting the joint health and safety committee or health and safety representative, if any, and without considering the following:

- any undue economic hardship to the employer that providing a local ventilation system would cause
- the frequency and duration of the operation
- any potential risks to the workers by not providing a local ventilation system.

Wet Methods

Wet methods should be incorporated in the operation to reduce dust generation. Examples of wet methods include wetting surfaces, wet scraping, and wet shovelling.

Wetting should not be used if it would create a hazard or could cause damage to equipment or to the project. Power tools should be equipped with a shroud, and the shroud should be kept flush with the surface.

6.4.5 Personal Protective Equipment

Protective Clothing

Every worker who enters a Type 3 operation work area should wear protective clothing (see Protective Clothing in Section 4.3).

Respirators

For most Type 3 operations, workers should wear a respirator with a NIOSH approved assigned protection factor of 50 (see Respirator Requirements in Table 1). Where the operation is abrasive blasting, the operator should wear a Type CE abrasive blast supplied air respirator operated in a pressure demand or positive pressure mode with a tight-fitting half-mask or tight-fitting full-facepiece.

It is recommended that compressed air used to supply supplied air respirators meet the breathing air purity requirements of CSA Standard Z180.1-00. Where an oil-lubricated compressor is used to supply breathing air, a continuous carbon monoxide monitor/alarm should be provided.

6.4.6 Clean-Up

Dust and waste should be cleaned up and removed by vacuuming with a HEPA filter equipped vacuum, wet sweeping and/or wet shovelling. Clean-up after each operation should be encouraged to prevent lead contamination and exposure to lead.

When abrasive blasting is finished, cleanup and removal of lead-containing dust and waste should take place.

APPENDIX 1 – Medical Surveillance Of Lead-Exposed Workers

Where construction workers are exposed to airborne lead, measures and procedures to control their exposure should be implemented. This guide has outlined (in Section 4) the types of controls that should be in place for various work activities. But to ensure that these controls are effective they should be periodically evaluated. One way of doing this is by establishing a medical surveillance program. A medical surveillance program refers to the systematic collection, analysis, and evaluation of health data in the workplace to identify cases, patterns, or trends suggesting an adverse effect on workers' health. It is highly recommended that employers establish and maintain a medical surveillance program in their workplace.

The essential features of a lead medical surveillance program are outlined below.

Medical Surveillance Program

Purpose

The objective of a medical surveillance program is to protect the health of workers by:

- ensuring their fitness for exposure to lead
- evaluating their absorption of lead
- enabling remedial action to be taken when necessary
- providing health education.

Program

The medical surveillance program should include the following:

- pre-employment and pre-placement medical examinations
- periodic medical examinations
- clinical tests
- health education
- record keeping.

Medical Examinations

The medical examination should include the following:

History

The initial medical and occupational history should include enquiries about the worker's previous exposure to lead (both occupational and non-occupational), personal habits

(smoking and hygiene), and history of present or past gastrointestinal, hemopoietic, renal, reproductive, endocrine, or nervous disorders.

At subsequent examinations, the history should be updated to include:

- information on the frequency and duration of exposure to lead since the previous examination;
- the occurrence of signs and symptoms that may be an early indication of lead intoxication, e.g., abdominal pain, constipation, vomiting, asthenia, paraesthesia and psychological change.

Physical Examination

Medical surveillance should include a general physical examination. Particular attention should be directed to those systems that may be affected by lead. Personal hygiene should also be noted.

Biological Monitoring

Biological monitoring refers to the collection and assessment of bodily fluids or tissue, to evaluate occupational exposure to chemical hazards. The concentration of lead in a worker's blood is a good indicator of lead absorption by that individual. It does not indicate the total body burden of lead, but it is useful in the assessment of a worker's fitness for continued exposure to lead. As such, determining the blood lead levels in lead-exposed workers is highly recommended.

The concentration of lead in the blood can be used to determine:

- When a worker should be removed from lead exposure;
- When an enquiry regarding work practices and personal hygiene should be made;
- When further test(s) should be made; and,
- When a worker may be permitted to return to work.

The determination of whether a worker is fit, fit with limitations or unfit for exposure to lead should only be made by a physician. In addition, a physician should determine the required frequency for biological monitoring on an individual basis.

If symptoms or signs of lead intoxication are present the worker should be removed from lead exposure regardless of blood lead level.

In addition, it is recommended that a pre-placement blood-lead test be taken to establish a baseline for each worker that is exposed to lead.

APPENDIX 2: Respirator Requirements & Other Measures and Procedures for Type 1, 2, and 3 Lead-Containing Operations

OPERATIONS	REQUIRED RESPIRATOR	OTHER MEASURES & PROCEDURES
TYPE 1		
• Application of lead-containing coatings with a brush or roller. • Removal of lead-containing coatings with a chemical gel or paste and fibrous laminated cloth wrap. • Removal of lead-containing coatings or materials using a power tool that has an effective dust collection system equipped with a HEPA filter. • Installation or removal of lead-containing sheet metal. • Installation or removal of lead-containing packing, babbit or similar material • Removal of lead-containing coatings or materials using non-powered hand-held tools, other than manual scraping or sanding. • Soldering.	Respirators should not be necessary if general procedures listed in Section 6.1 of the Guideline are followed and if the levels of lead in air are less than 0.05 mg/m^3. However, if the 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.	• Washing facilities consisting of wash basin, water, soap and towels should be provided and workers should use these washing facilities before eating, drinking, smoking or leaving the project; • Workers should not eat, drink, chew gum or smoke in the work area; • Dust and waste should be cleaned up at regular intervals and placed in a container that is: - dust tight - identified as containing lead waste - cleaned with a damp cloth or a vacuum equipped with a HEPA filter immediately before being removed from the work area - removed from the workplace frequently and at regular intervals; • Drop sheets should be used below all lead operations which produce or may produce dust, chips, or debris containing lead; • Cleanup after each operation is encouraged to prevent lead contamination and exposure to lead; • Work area should be inspected at least daily to ensure that the work area is clean; • Compressed air or dry sweeping should not be used to clean up any lead-containing dust or waste from a work area or from clothing.

OPERATIONS	REQUIRED RESPIRATOR	OTHER MEASURES & PROCEDURES
TYPE 2		
TYPE 2a		
• Welding or high temperature cutting of lead-containing coatings or materials outdoors. This operation is considered a Type 2a operation only if it is short-term, not repeated, and if the material has been stripped prior to welding or high temperature cutting. • Removal of lead-containing coatings or materials by scraping or sanding using non-powered hand tools • Manual demolition of lead-painted plaster walls or building components by striking a wall with a sledge hammer or similar tool	Half-mask particulate respirator with N-, R-, or P-series filter and 95, 99 or 100 percent efficiency.	**(In addition to Type 1 measures and procedures.)** • Signs should be posted in sufficient numbers to warn of the lead hazard. There should be a sign, at least, at each entrance to the work area. The signs should display the following information in large, clearly visible letters: - There is a lead dust, fume or mist hazard. - Access to the work area is restricted to authorized persons. - Respirators must be worn in the work area. • Suitable protective clothing and equipment should be worn by every worker who enters the work area (refer to Section 4.3 of the guideline).
TYPE 2b		
• Spray application of lead-containing coatings.	Powered air purifying respirator equipped with a hood or helmet, and a high efficiency filter. OR Supplied air respirator equipped with a hood or helmet and operated in a continuous flow mode.	

OPERATIONS	REQUIRED RESPIRATOR	OTHER MEASURES & PROCEDURES
TYPE 3		
TYPE 3a		**(In addition to Type 1 and Type 2 measures and procedures.)** • For Type 3a operations conducted indoors or outdoors, enclosures should be provided in the form of barriers, partial enclosures, or full enclosures. • For Type 3b operations conducted indoors, full enclosures should be provided. • With the exception of dry abrasive blasting conducted outdoors, enclosures provided for all other Type 3b operations conducted outdoors should be in the form of barriers, partial enclosures, or full enclosures. For dry abrasive blasting outdoors, full enclosures should be provided. • Where there is an enclosure, general mechanical ventilation should be provided. • A decontamination facility (refer to 6.4.3 of the guideline) should be made available for workers carrying out the following operations: - abrasive blasting of lead-containing coatings or materials - the removal of lead-containing coatings or materials using power tools without an effective dust collection system equipped with a HEPA filter - removal of lead-containing dust using an air mist extraction system - demolition or cleanup of a facility where lead-containing products were manufactured. • When abrasive blasting is finished, dust and waste should be cleaned up and removed by vacuuming with a HEPA filter equipped vacuum, wet sweeping and/or wet shovelling. • Where a dust generating operation is carried out, local exhaust ventilation should be provided to remove dust at the source. Wet methods should also be incorporated in the operation to reduce dust generation.
• Welding or high temperature cutting of lead-containing coatings or materials indoors or in a confined space. • Burning of a surface containing lead. • Dry removal of lead-containing mortar using an electric or pneumatic cutting device. • Removal of lead-containing coatings or materials using power tools without an effective dust collection system equipped with a HEPA filter. • Removal or repair of a ventilation system used for controlling lead exposure. • Demolition or cleanup of a facility where lead-containing products were manufactured. • An operation that may expose a worker to lead dust, fume or mist that is not a Type 1, Type 2, or Type 3b operation.	Full-facepiece air-purifying respirator equipped with N-, R-, or P-series filter and 100% efficiency. OR Tight-fitting PAPR with a high efficiency particulate filter. OR Half-mask or full-facepiece supplied air respirator operated in a continuous flow mode. OR Half-mask supplied air respirator operated in pressure-demand or other positive-pressure mode.	
TYPE 3b		
• Abrasive blasting of lead-containing coatings or materials.	Type CE abrasive-blast supplied air respirator operated in a positive-pressure mode with a tight-fitting half-mask facepiece. Type CE abrasive-blast supplied air respirator operated in a pressure-demand or positive pressure mode with a tight-fitting full-facepiece	
• Removal of lead-containing dust using an air mist extraction system	Supplied air respirator equipped with a tight-fitting half-mask or full-facepiece and operated in pressure demand or positive pressure mode.	

Occupational Health and Safety Act
Loi sur la santé et la sécurité au travail

ONTARIO REGULATION 278/05

No Amendments

DESIGNATED SUBSTANCE — ASBESTOS ON CONSTRUCTION PROJECTS AND IN BUILDINGS AND REPAIR OPERATIONS

Notice of Currency:* This document is up to date.

*This notice is usually current to within two business days of accessing this document. For more current amendment information, see the Table of Regulations – Legislative History Overview.

This Regulation is made in English only.

Note: This Regulation comes into force on November 1, 2005. See: O. Reg. 278/05, s. 26 (1).

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Definitions

1. (1) In this Regulation,

"asbestos" means any of the fibrous silicates listed in subsection (2);

"asbestos-containing material" means material that contains 0.5 per cent 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;

"competent worker", in relation to specific work, means a worker who,

(a) is qualified because of knowledge, training and experience to perform the work,

(b) is familiar with the Act and with the provisions of the regulations that apply to the work, and

(c) has knowledge of all potential or actual danger to health or safety in the work;

"demolition" includes dismantling and breaking up;

"examine", when used with reference to material, means to carry out procedures in accordance with section 3 to establish its asbestos content and to establish the type of asbestos, and "examination" has a corresponding meaning;

"friable material" means material that,

(a) when dry, can be crumbled, pulverized or powdered by hand pressure, or

(b) is crumbled, pulverized or powdered;

"HEPA filter" means a high efficiency particulate aerosol filter that is at least 99.97 per cent efficient in collecting a 0.3 micrometre aerosol;

"homogeneous material" means material that is uniform in colour and texture;

"joint health and safety committee" means,

(a) a joint health and safety committee established under section 9 of the Act,

(b) a similar committee described in subsection 9 (4) of the Act, or

(c) the workers or their representatives who participate in an arrangement, program or system described in subsection 9 (4) of the Act;

"occupier" has the same meaning as in the *Occupiers' Liability Act*;

"Type 1 operation" means an operation described in subsection 12 (2);

"Type 2 operation" means an operation described in subsection 12 (3);

"Type 3 operation" means an operation described in subsection 12 (4). O. Reg. 278/05, s. 1 (1).

(2) The fibrous silicates referred to in the definition of "asbestos" in subsection (1) are:

1. Actinolite.
2. Amosite.
3. Anthophyllite.
4. Chrysotile.
5. Crocidolite.
6. Tremolite. O. Reg. 278/05, s. 1 (2).

Application

2. (1) This Regulation applies to,

(a) every project, its owner, and every constructor, employer and worker engaged in or on the project;

(b) the repair, alteration or maintenance of a building, the owner of the building, and every employer and worker engaged in the repair, alteration or maintenance;

(c) every building in which material that may be asbestos-containing material has been used, and the owner of the building;

(d) the demolition of machinery, equipment, aircraft, ships, locomotives, railway cars and vehicles, and every employer and worker engaged in the demolition; and

(e) subject to subsection (3),

(i) work described in subsection (2) in which asbestos-containing material is likely to be handled, dealt with, disturbed or removed, and

(ii) every employer and worker engaged in the work. O. Reg. 278/05, s. 2 (1).

(2) Clause (1) (e) applies to,

(a) the repair, alteration or maintenance of machinery, equipment, aircraft, ships, locomotives, railway cars and vehicles; and

(b) work on a building that is necessarily incidental to the repair, alteration or maintenance of machinery or equipment. O. Reg. 278/05, s. 2 (2).

(3) This Regulation does not apply to an employer to whom Regulation 837 of the Revised Regulations of Ontario, 1990 (Designated Substance — Asbestos) applies in respect of those workers employed by the employer and engaged in the activities described in clause (1) (e) if the employer has on or before December 16, 1985 put into effect and maintained measures and procedures to control the exposure of workers to asbestos and has incorporated the same in an asbestos control program in accordance with Regulation 837 of the Revised Regulations of Ontario, 1990. O. Reg. 278/05, s. 2 (3).

(4) This Regulation does not apply to an owner of a private residence occupied by the owner or the owner's family or to an owner of a residential building that contains not more than four dwelling units, one of which is occupied by the registered owner or family of the registered owner. O. Reg. 278/05, s. 2 (4).

Adoption of standard

3. (1) For the purposes of this Regulation, the method and procedures for establishing whether material is asbestos-containing material and for establishing its asbestos content and the type of asbestos shall be in accordance with the following standard:

1. U.S. Environmental Protection Agency. Test Method EPA/600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials. June 1993. O. Reg. 278/05, s. 3 (1).

(2) The procedures required by subsection (1) shall be carried out on bulk material samples that are randomly collected by a competent worker and are representative of each area of homogeneous material. O. Reg. 278/05, s. 3 (2).

(3) The minimum number of bulk material samples to be collected from an area of homogeneous material is set out in Table 1. O. Reg. 278/05, s. 3 (3).

(4) If analysis establishes that a bulk material sample contains 0.5 per cent or more asbestos by dry weight,

(a) it is not necessary to analyze other bulk material samples taken from the same area of homogeneous material; and

(b) the entire area of homogeneous material from which the bulk material sample was taken is deemed to be asbestos-containing material. O. Reg. 278/05, s. 3 (4).

Restrictions re sprayed material, insulation, sealants

4. (1) No person shall apply or install or cause to be applied or installed, by spraying, material containing 0.1 per cent or more asbestos by dry weight that can become friable. O. Reg. 278/05, s. 4 (1).

(2) No person shall apply or install or cause to be applied or installed, as thermal insulation, material containing 0.1 per cent or more asbestos by dry weight that can become friable. O. Reg. 278/05, s. 4 (2).

(3) A liquid sealant shall not be applied to friable asbestos-containing material if,

(a) the material has visibly deteriorated; or

(b) the material's strength and its adhesion to the underlying materials and surfaces are insufficient to support its weight and the weight of the sealant. O. Reg. 278/05, s. 4 (3).

Information for workers

5. (1) This section applies whenever a worker is to do work that,

(a) involves material that,

(i) is asbestos-containing material,

(ii) is being treated as if it were asbestos-containing material,

(iii) is the subject of advice under section 9 or a notice under subsection 10 (8); or

(b) is to be carried on in close proximity to material described in clause (a) and may disturb it. O. Reg. 278/05, s. 5 (1).

(2) The constructor or employer shall advise the worker and provide him or her with the following information:

1. The location of all material described in clause (1) (a).
2. For each location, whether the material is friable or non-friable.
3. In the case of sprayed-on friable material, for each location,
   i. if the material is known to be asbestos-containing material, the type of asbestos, if known, or
   ii. in any other case, a statement that the material will be treated as though it contained a type of asbestos other than chrysotile. O. Reg. 278/05, s. 5 (2).

Demolition

6. (1) The demolition of all or part of machinery, equipment, a building, aircraft, locomotive, railway car, vehicle or ship shall be carried out or continued only when any asbestos-containing material that may be disturbed during the work has been removed to the extent practicable. O. Reg. 278/05, s. 6 (1).

(2) Subsection (1) does not apply so as to prevent work necessary to gain access to the asbestos-containing material that is to be removed, if the workers doing the work are protected from the hazard. O. Reg. 278/05, s. 6 (2).

Ongoing asbestos management in buildings, two-year transitional period

7. (1) This section does not apply on or after November 1, 2007. O. Reg. 278/05, s. 7 (1).

(2) Subsection (3) applies if,

(a) the owner of a building treats friable material that has been used in the building for any purpose related to it, including insulation and fireproofing, as if it were asbestos-containing material;

(b) the owner of a building has been advised under section 9 of the discovery of friable material that may be asbestos-containing material;

(c) the owner of a building knows or ought reasonably to know that friable asbestos-containing material has been used in a building for any purpose related to the building, including insulation, and fireproofing;

(d) an examination under subsection (8) or section 10 establishes, or would have established if carried out as required, that friable asbestos-containing material has been used in a building for any purpose related to the building, including insulation and fireproofing; or

(e) a constructor or employer notifies the owner of a building, in accordance with subsection 10 (8), of the discovery of friable material that may be asbestos-containing material and that was not referred to in a report prepared under subsection 10 (4). O. Reg. 278/05, s. 7 (2).

(3) If this subsection applies, the owner shall,

(a) prepare and keep on the premises a record containing the information set out in subsection (4);

(b) give any other person who is an occupier of the building written notice of any information in the record that relates to the area occupied by the person;

(c) give any employer with whom the owner arranges or contracts for work that is not described in clause 10 (1) (a) written notice of the information in the record, if the work,

(i) may involve material mentioned in the record, or

(ii) may be carried on in close proximity to such material and may disturb it;

(d) advise the workers employed by the owner who work in the building of the information in the record, if the workers may do work that,

(i) involves material mentioned in the record, or

(ii) is to be carried on in close proximity to such material and may disturb it;

(e) establish and maintain, for the training and instruction of every worker employed by the owner who works in the building and may do work described in clause (d), a program dealing with,

(i) the hazards of asbestos exposure,

(ii) the use, care and disposal of protective equipment and clothing to be used and worn when doing the work,

(iii) personal hygiene to be observed when doing the work, and

(iv) the measures and procedures prescribed by this Regulation; and

(f) inspect the material mentioned in the record at reasonable intervals in order to determine its condition. O. Reg. 278/05, s. 7 (3).

(4) The record shall contain the following information:

1. The location of all material described in clauses (2) (a), (b), (c), (d) and (e).
2. In the case of sprayed-on material, for each location,

   i. if the material is known to be asbestos-containing material, the type of asbestos, if known, or

   ii. in any other case, a statement that the material will be treated as though it contained a type of asbestos other than chrysotile. O. Reg. 278/05, s. 7 (4).

(5) The owner shall update the record described in clause (3) (a),

(a) at least once in each 12-month period; and

(b) whenever the owner becomes aware of new information relating to the matters the record deals with. O. Reg. 278/05, s. 7 (5).

(6) If updating under subsection (5) results in any change to the record, clauses (3) (b), (c) and (d) apply with necessary modifications. O. Reg. 278/05, s. 7 (6).

(7) An occupier who receives a notice under clause (3) (b) is responsible for performing the duties set out in clauses (3) (d) and (e) with respect to the occupier's own workers. O. Reg. 278/05, s. 7 (7).

(8) If it is readily apparent that friable material used in a building as fireproofing or acoustical or thermal insulation has fallen and is being disturbed so that exposure to the material is likely to occur,

(a) the owner shall cause the material to be examined to establish whether it is asbestos-containing material; and

(b) until it has been established whether the material is asbestos-containing material, no further work involving the material shall be done. O. Reg. 278/05, s. 7 (8).

(9) Subsection (8) does not apply if the work is carried out in accordance with this Regulation as though the material were asbestos-containing material and, in the case of sprayed-on material, as though it contained a type of asbestos other than chrysotile. O. Reg. 278/05, s. 7 (9).

(10) If the examination mentioned in subsection (8) establishes that the material is asbestos-containing material, or if the material is treated as though it were asbestos-containing material as described in subsection (9),

(a) the owner shall cause the fallen material to be cleaned up and removed; and

(b) if it is readily apparent that material will continue to fall because of the deterioration of the fireproofing or insulation, the owner shall repair, seal, remove or permanently enclose the fireproofing or insulation. O. Reg. 278/05, s. 7 (10).

(11) Subsection (10) does not apply if the fallen material is confined to an area that is,

(a) above a closed false ceiling; and

(b) not part of a return air plenum. O. Reg. 278/05, s. 7 (11).

Ongoing asbestos management in buildings after transitional period

8. (1) This section applies on and after November 1, 2007. O. Reg. 278/05, s. 8 (1).

(2) Subsection (3) applies if,

(a) the owner of a building treats material that has been used in the building for any purpose related to it, including insulation, fireproofing and ceiling tiles, as if it were asbestos-containing material;

(b) the owner of a building has been advised under section 9 of the discovery of material that may be asbestos-containing material;

(c) the owner of a building knows or ought reasonably to know that asbestos-containing material has been used in a building for any purpose related to the building, including insulation, fireproofing and ceiling tiles;

(d) an examination under subsection (8) or section 10 establishes, or would have established if carried out as required, that asbestos-containing material has been used in a building for any purpose related to the building, including insulation, fireproofing and ceiling tiles; or

(e) a constructor or employer advises the owner of a building, in accordance with subsection 10 (8), of the discovery of material that may be asbestos-containing material and that was not referred to in a report prepared under subsection 10 (4). O. Reg. 278/05, s. 8 (2).

(3) If this subsection applies, the owner shall,

(a) prepare and keep on the premises a record containing the information set out in subsection (4);

(b) give any other person who is an occupier of the building written notice of any information in the record that relates to the area occupied by the person;

(c) give any employer with whom the owner arranges or contracts for work that is not described in clause 10 (1) (a) written notice of the information in the record, if the work,

(i) may involve material mentioned in the record, or

(ii) may be carried on in close proximity to such material and may disturb it;

(d) advise the workers employed by the owner who work in the building of the information in the record, if the workers may do work that,

(i) involves material mentioned in the record, or

(ii) is to be carried on in close proximity to such material and may disturb it;

(e) establish and maintain, for the training and instruction of every worker employed by the owner who works in the building and may do work described in clause (d), a program dealing with,

(i) the hazards of asbestos exposure,

(ii) the use, care and disposal of protective equipment and clothing to be used and worn when doing the work,

(iii) personal hygiene to be observed when doing the work, and

(iv) the measures and procedures prescribed by this Regulation; and

(f) inspect the material mentioned in the record at reasonable intervals in order to determine its condition. O. Reg. 278/05, s. 8 (3).

(4) The record shall contain the following information:

1. The location of all material described in clauses (2) (a), (b), (c), (d) and (e).

2. For each location, whether the material is friable or non-friable.

3. In the case of friable sprayed-on material, for each location,

i. if the material is known to be asbestos-containing material, the type of asbestos, if known, or

ii. in any other case, a statement that the material will be treated as though it contained a type of asbestos other than chrysotile. O. Reg. 278/05, s. 8 (4).

(5) The owner shall update the record described in clause (3) (a),

(a) at least once in each 12-month period; and

(b) whenever the owner becomes aware of new information relating to the matters the record deals with. O. Reg. 278/05, s. 8 (5).

(6) If updating under subsection (5) results in any change to the record, clauses (3) (b), (c) and (d) apply with necessary modifications. O. Reg. 278/05, s. 8 (6).

(7) An occupier who receives a notice under clause (3) (b) is responsible for performing the duties set out in clauses (3) (d) and (e) with respect to the occupier's own workers. O. Reg. 278/05, s. 8 (7).

(8) If it is readily apparent that friable material used in a building as fireproofing or acoustical or thermal insulation has fallen and is being disturbed so that exposure to the material is likely to occur,

(a) the owner shall cause the material to be examined to establish whether it is asbestos-containing material; and

(b) until it has been established whether the material is asbestos-containing material, no further work involving the material shall be done. O. Reg. 278/05, s. 8 (8).

(9) Subsection (8) does not apply if the work is carried out in accordance with this Regulation as though the material were asbestos-containing material and, in the case of friable sprayed-on material, as though it contained a type of asbestos other than chrysotile. O. Reg. 278/05, s. 8 (9).

(10) If the examination mentioned in subsection (8) establishes that the material is asbestos-containing material, or if the material is treated as though it were asbestos-containing material as described in subsection (9),

(a) the owner shall cause the fallen material to be cleaned up and removed; and

(b) if it is readily apparent that material will continue to fall because of the deterioration of the fireproofing or insulation, the owner shall repair, seal, remove or permanently enclose the fireproofing or insulation. O. Reg. 278/05, s. 8 (10).

(11) Subsection (10) does not apply if the fallen material is confined to an area that is,

(a) above a closed false ceiling; and

(b) not part of a return air plenum. O. Reg. 278/05, s. 8 (11).

Responsibility of employer other than owner

9. An employer whose workers work in a building of which the employer is not the owner shall advise the owner if the workers discover material that may be asbestos-containing material in the building. O. Reg. 278/05, s. 9.

Owner's responsibilities before requesting tender or arranging work

10. (1) An owner shall comply with subsections (2), (3), (4), (5) and (6) before,

(a) requesting tenders for the demolition, alteration or repair of all or part of machinery, equipment, or a building, aircraft, locomotive, railway car, vehicle or ship; or

(b) arranging or contracting for any work described in clause (a), if no tenders are requested. O. Reg. 278/05, s. 10 (1).

(2) Unless clause (3) (a) or (b) applies, the owner shall have an examination carried out in accordance with section 3 to establish whether any material that is likely to be handled, dealt with, disturbed or removed, whether friable or non-friable, is asbestos-containing material. O. Reg. 278/05, s. 10 (2).

(3) An examination under subsection (2) is not required if,

(a) the owner,

(i) already knows that the material is not asbestos-containing material, or

(ii) already knows that the material is asbestos-containing material and, in the case of sprayed-on friable material, knows the type of asbestos; or

(b) the work is being arranged or contracted for in accordance with this Regulation as though the material were asbestos-containing material and, in the case of sprayed-on friable material, as though it contained a type of asbestos other than chrysotile. O. Reg. 278/05, s. 10 (3).

(4) Whether an examination is required under subsection (2) or not, the owner shall have a report prepared,

(a) stating whether,

(i) the material is or is not asbestos-containing material, or

(ii) the work is to be performed in accordance with this Regulation as though the material were asbestos-containing material and, in the case of sprayed-on friable material, as though it contained a type of asbestos other than chrysotile;

(b) describing the condition of the material and stating whether it is friable or non-friable; and

(c) containing drawings, plans and specifications, as appropriate, to show the location of the material identified under clause (a). O. Reg. 278/05, s. 10 (4).

(5) An owner shall give any prospective constructor a copy of the complete report prepared under subsection (4). O. Reg. 278/05, s. 10 (5).

(6) Subsection (5) applies, with necessary modifications, with respect to,

(a) a constructor and a prospective contractor; and

(b) a contractor and a prospective subcontractor. O. Reg. 278/05, s. 10 (6).

(7) Subsections (8), (9) and (10) apply if, during work described in clause (1) (a), material is discovered that,

(a) was not referred to in the report prepared under subsection (4); and

(b) may be asbestos-containing material. O. Reg. 278/05, s. 10 (7).

(8) The constructor or employer shall immediately notify, orally and in writing,

(a) an inspector at the office of the Ministry of Labour nearest the workplace;

(b) the owner;

(c) the contractor; and

(d) the joint health and safety committee or the health and safety representative, if any, for the workplace. O. Reg. 278/05, s. 10 (8).

(9) The written notice referred to in subsection (8) shall include the information referred to in clauses 11 (3) (a) to (f). O. Reg. 278/05, s. 10 (9).

(10) No work that is likely to involve handling, dealing with, disturbing or removing the material referred to in subsection (7) shall be done unless,

(a) it has been determined under section 3 whether the material is asbestos-containing material; or

(b) the work is performed in accordance with this Regulation as though the material were asbestos-containing material and, in the case of sprayed-on friable material, as though it contained a type of asbestos other than chrysotile. O. Reg. 278/05, s. 10 (10).

(11) Subsection (10) does not prohibit handling, dealing with, disturbing or removing material for the sole purpose of determining whether it is asbestos-containing material. O. Reg. 278/05, s. 10 (11).

Advance notice re Type 3 operations and certain Type 2 operations

11. (1) Before commencing a Type 3 operation, the constructor, in the case of a project, and the employer, in any other case, shall notify, orally and in writing, an inspector at the office of the Ministry of Labour nearest the workplace of the operation. O. Reg. 278/05, s. 11 (1).

(2) Subsection (1) also applies with respect to a Type 2 operation described in paragraph 9 of subsection 12 (3) in which one square metre or more of insulation is to be removed. O. Reg. 278/05, s. 11 (2).

(3) The written notice required by subsection (1) shall set out,

(a) the name and address of the person giving the notice;

(b) the name and address of the owner of the place where the work will be carried out;

(c) the municipal address or other description of the place where the work will be carried out sufficient to permit the inspector to locate the place, including the location with respect to the nearest public highway;

(d) a description of the work that will be carried out;

(e) the starting date and expected duration of the work; and

(f) the name and address of the supervisor in charge of the work. O. Reg. 278/05, s. 11 (3).

Type 1, Type 2 and Type 3 operations

12. (1) For the purposes of this Regulation, operations that may expose a worker to asbestos are classified as Type 1, Type 2 and Type 3 operations. O. Reg. 278/05, s. 12 (1).

(2) The following are Type 1 operations:

1. 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.
2. 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.
3. 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.
4. Removing less than one square metre of drywall in which joint-filling compounds that are asbestos-containing material have been used. O. Reg. 278/05, s. 12 (2).

(3) The following are Type 2 operations:

1. Removing all or part of a false ceiling to obtain access to a work area, if asbestos-containing material is likely to be lying on the surface of the false ceiling.
2. The removal or disturbance of one square metre or less of friable asbestos-containing material during the repair, alteration, maintenance or demolition of all or part of machinery or equipment or a building, aircraft, locomotive, railway car, vehicle or ship.
3. Enclosing friable asbestos-containing material.
4. Applying tape or a sealant or other covering to pipe or boiler insulation that is asbestos-containing material.
5. Installing or removing ceiling tiles that are asbestos-containing material, if the tiles cover an area of 7.5 square metres or more and are installed or removed without being broken, cut, drilled, abraded, ground, sanded or vibrated.
6. Breaking, cutting, drilling, abrading, grinding, sanding or vibrating non-friable asbestos-containing material if,
   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.
7. Removing one square metre or more of drywall in which joint filling compounds that are asbestos-containing material have been used.
8. Breaking, cutting, drilling, abrading, grinding, sanding or vibrating non-friable asbestos-containing material if the work is done by means of power tools that are attached to dust-collecting devices equipped with HEPA filters.
9. Removing insulation that is asbestos-containing material from a pipe, duct or similar structure using a glove bag.
10. Cleaning or removing filters used in air handling equipment in a building that has sprayed fireproofing that is asbestos-containing material.

11. An operation that,

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. O. Reg. 278/05, s. 12 (3).

(4) The following are Type 3 operations:

1. The removal or disturbance of more than one square metre of friable asbestos-containing material during the repair, alteration, maintenance or demolition of all or part of a building, aircraft, ship, locomotive, railway car or vehicle or any machinery or equipment.

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

3. Cleaning or removing air handling equipment, including rigid ducting but not including filters, in a building that has sprayed fireproofing that is asbestos-containing material.

4. Repairing, altering or demolishing all or part of a kiln, metallurgical furnace or similar structure that is made in part of refractory materials that are asbestos-containing materials.

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

6. Repairing, altering or demolishing all or part of any building in which asbestos is or was used in the manufacture of products, unless the asbestos was cleaned up and removed before March 16, 1986. O. Reg. 278/05, s. 12 (4).

(5) 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. O. Reg. 278/05, s. 12 (5).

(6) 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. O. Reg. 278/05, s. 12 (6).

(7) Nothing in subsection (6) affects an inspector's power to issue an order for a contravention of this Regulation. O. Reg. 278/05, s. 12 (7).

Respirators

13. (1) A respirator provided by an employer and used by a worker in a Type 1, Type 2 or Type 3 operation,

(a) shall be fitted so that there is an effective seal between the respirator and the worker's face, unless the respirator is equipped with a hood or helmet;

(b) shall be assigned to a worker for his or her exclusive use, if practicable;

(c) shall be used and maintained in accordance with written procedures that are established by the employer and are consistent with the manufacturer's specifications;

(d) shall be cleaned, disinfected and inspected after use on each shift, or more often if necessary, when issued for the exclusive use of one worker, or after each use when used by more than one worker;

(e) shall have damaged or deteriorated parts replaced prior to being used by a worker; and

(f) when not in use, shall be stored in a convenient, clean and sanitary location. O. Reg. 278/05, s. 13 (1).

(2) The following additional requirements apply to a respirator of the supplied air type:

1. The compressed air used for breathing shall meet the standards set out in Table 1 of CSA Standard Z180.1-00, Compressed Breathing Air and Systems (March, 2000).

2. If an oil-lubricated compressor is used to supply breathing air, a continuous carbon monoxide monitor equipped with an alarm shall be provided.

3. If an ambient breathing air system is used, the air intake shall be located in accordance with Appendix B of the standard referred to in paragraph 1. O. Reg. 278/05, s. 13 (2).

(3) If respirators are used in the workplace,

(a) the employer shall establish written procedures regarding the selection, use and care of respirators; and

(b) a copy of the procedures shall be provided to and reviewed with each worker who is required to wear a respirator. O. Reg. 278/05, s. 13 (3).

(4) A worker shall not be assigned to an operation requiring the use of a respirator unless he or she is physically able to perform the operation while using the respirator. O. Reg. 278/05, s. 13 (4).

Measures and procedures, Type 1 operations

14. The following measures and procedures apply to Type 1 operations:

1. Before beginning work, visible dust shall be removed with a damp cloth or a vacuum equipped with a HEPA filter from any surface in the work area, including the thing to be worked on, if the dust on that surface is likely to be disturbed.
2. The spread of dust from the work area shall be controlled by measures appropriate to the work to be done including the use of drop sheets of polyethylene or other suitable material that is impervious to asbestos.
3. In the case of an operation mentioned in paragraph 4 of subsection 12 (2), the material shall be wetted before and kept wet during the work to control the spread of dust or fibres, unless wetting would create a hazard or cause damage.
4. A wetting agent shall be added to water that is to be used to control the spread of dust and fibres.
5. Frequently and at regular intervals during the doing of the work and immediately on completion of the work,
   i. dust and waste shall be cleaned up and removed using a vacuum equipped with a HEPA filter, or by damp mopping or wet sweeping, and placed in a container as described in paragraph 5 of section 15, and
   ii. drop sheets shall be wetted and placed in a container as described in paragraph 5 of section 15, as soon as practicable after subparagraph i has been complied with.
6. Drop sheets shall not be reused.
7. After the work is completed, polyethylene sheeting and similar materials used for barriers and enclosures shall not be reused, but shall be wetted and placed in a container as described in paragraph 5 of section 15 as soon as practicable after paragraph 5 of this section has been complied with.
8. After the work is completed, barriers and portable enclosures that will be reused shall be cleaned, by using a vacuum equipped with a HEPA filter or by damp wiping, as soon as practicable after paragraphs 5 and 7 have been complied with.
9. Barriers and portable enclosures shall not be reused unless they are rigid and can be cleaned thoroughly.
10. Compressed air shall not be used to clean up and remove dust from any surface.
11. Eating, drinking, chewing or smoking shall not be permitted in the work area.
12. If a worker requests that the employer provide a respirator to be used by the worker, the employer shall provide the worker with a NIOSH approved respirator in accordance with Table 2, and the worker shall wear and use the respirator.
13. If a worker requests that the employer provide protective clothing to be used by the worker, the employer shall provide the worker with protective clothing as described in paragraph 12 of section 15, and the worker shall wear the protective clothing.
14. A worker who is provided with protective clothing shall, before leaving the work area,
    i. decontaminate his or her protective clothing by using a vacuum equipped with a HEPA filter, or by damp wiping, before removing the protective clothing,
    ii. if the protective clothing will not be reused, place it in a container as described in paragraph 5 of section 15.
15. Facilities for the washing of hands and face shall be made available to workers and shall be used by every worker when leaving the work area. O. Reg. 278/05, s. 14.

Measures and procedures, Type 2 and Type 3 operations

15. The following measures and procedures apply to Type 2 operations and to Type 3 operations:

1. The work area shall be identified by clearly visible signs warning of an asbestos dust hazard.
2. Signs required by paragraph 1 shall be posted in sufficient numbers to warn of the hazard and shall state in large clearly visible letters that,
   i. there is an asbestos dust hazard, and

ii. access to the work area is restricted to persons wearing protective clothing and equipment.

3. A wetting agent shall be added to water that is to be used to control the spread of dust and fibres.
4. Eating, drinking, chewing or smoking shall not be permitted in the work area.
5. Containers for dust and waste shall be,
   i. dust tight,
   ii. suitable for the type of waste,
   iii. impervious to asbestos,
   iv. identified as asbestos waste,
   v. cleaned with a damp cloth or a vacuum equipped with a HEPA filter immediately before being removed from the work area, and
   vi. removed from the workplace frequently and at regular intervals.
6. Frequently and at regular intervals during the doing of the work and immediately on completion of the work,
   i. dust and waste shall be cleaned up and removed using a vacuum equipped with a HEPA filter, or by damp mopping or wet sweeping, and placed in a container as described in paragraph 5, and
   ii. drop sheets shall be wetted and placed in a container as described in paragraph 5, as soon as practicable after subparagraph i has been complied with.
7. Drop sheets shall not be reused.
8. After the work is completed, polyethylene sheeting and similar materials used for barriers and enclosures shall not be reused, but shall be wetted and placed in a container as described in paragraph 5 as soon as practicable after paragraph 6 has been complied with.
9. After the work is completed, barriers and portable enclosures that will be reused shall be cleaned, by using a vacuum equipped with a HEPA filter or by damp wiping, as soon as practicable after paragraphs 6 and 8 have been complied with.
10. Barriers and portable enclosures shall not be reused unless they are rigid and can be cleaned thoroughly.
11. The employer shall provide every worker who will enter the work area with a NIOSH approved respirator in accordance with Table 2 and the worker shall wear and use the respirator.
12. Protective clothing shall be provided by the employer and worn by every worker who enters the work area, and the protective clothing,
    i. shall be made of a material that does not readily retain nor permit penetration of asbestos fibres,
    ii. shall consist of 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,
    iii. shall include suitable footwear, and
    iv. shall be repaired or replaced if torn.
13. Compressed air shall not be used to clean up and remove dust from any surface.
14. Only persons wearing protective clothing and equipment shall enter a work area where there is an asbestos dust hazard. O. Reg. 278/05, s. 15.

Additional measures and procedures, Type 2 operations

16. In addition to the measures and procedures prescribed by section 15, the following measures and procedures apply to Type 2 operations:

1. If the operation is one mentioned in paragraph 1 of subsection 12 (3), the friable material that is likely to be disturbed shall be cleaned up and removed by using a vacuum equipped with a HEPA filter when access to the work area is obtained.
2. Before commencing work that is likely to disturb friable asbestos-containing material that is crumbled, pulverized or powdered and that is lying on any surface, the friable material shall be cleaned up and removed by damp wiping or by using a vacuum equipped with a HEPA filter.
3. Friable asbestos-containing material that is not crumbled, pulverized or powdered and that may be disturbed or removed during the work shall be thoroughly wetted before the work and kept wet during the work, unless wetting would create a hazard or cause damage.

4. Subject to paragraph 5, the spread of dust from a work area shall be controlled by measures appropriate to the work to be done, including the use of drop sheets of polyethylene or other suitable material that is impervious to asbestos.
5. If the operation is one mentioned in paragraph 1 or 2 of subsection 12 (3) and is carried on indoors, the spread of dust from the work area shall be prevented, if practicable, by,
   i. using an enclosure of polyethylene or other suitable material that is impervious to asbestos (including, if the enclosure is opaque, one or more transparent window areas to allow observation of the entire work area from outside the enclosure), if the work area is not enclosed by walls,
   ii. disabling the mechanical ventilation system serving the work area, and
   iii. sealing the ventilation ducts to and from the work area.
6. Before leaving the work area, a worker shall,
   i. decontaminate his or her protective clothing by using a vacuum equipped with a HEPA filter, or by damp wiping, before removing the protective clothing, and
   ii. if the protective clothing will not be reused, place it in a container as described in paragraph 5 of section 15.
7. Facilities for the washing of hands and face shall be made available to workers and shall be used by every worker when leaving the work area. O. Reg. 278/05, s. 16.

Additional measures and procedures, glove bag operations

17. In addition to the measures and procedures prescribed by sections 15 and 16, the following measures and procedures apply to Type 2 operations referred to in paragraph 9 of subsection 12 (3):

1. The work area shall be separated from the rest of the workplace by walls, barricades, fencing or other suitable means.
2. The spread of asbestos-containing material from the work area shall be prevented by disabling the mechanical ventilation system serving the work area and sealing all openings or voids, including ventilation ducts to and from the working area.
3. Surfaces below the work area shall be covered with drop sheets of polyethylene or other suitable material that is impervious to asbestos.
4. 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.
5. The glove bag shall be equipped with,
   i. 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,
   ii. 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,
   iii. a tool pouch with a drain,
   iv. a seamless bottom and a means of sealing off the lower portion of the bag, and
   v. a high strength double throw zipper and removable straps, if the bag is to be moved during the removal operation.
6. A glove bag shall not be used to remove insulation from a pipe, duct or similar structure if,
   i. it may not be possible to maintain a proper seal for any reason including, without limitation,
      A. the condition of the insulation, or
      B. the temperature of the pipe, duct or similar structure, or
   ii. the bag could become damaged for any reason including, without limitation,
      A. the type of jacketing, or
      B. the temperature of the pipe, duct or similar structure.
7. 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.
8. The glove bag shall be inspected for damage or defects,
   i. immediately before it is attached to the pipe, duct or other similar structure, and
   ii. at regular intervals during its use.

9. If damage or defects are observed when the glove bag is inspected under subparagraph 8 i, the glove bag shall not be used and shall be disposed of.

10. If damage or defects are observed when the glove bag is inspected under subparagraph 8 ii or at any other time,

    i. the use of the glove bag shall be discontinued,

    ii. the inner surface of the glove bag and the contents, if any, shall be thoroughly wetted,

    iii. the glove bag and the contents, if any, shall be removed and placed in a container as described in paragraph 5 of section 15, and

    iv. the work area shall be cleaned by vacuuming with a vacuum equipped with a HEPA filter before removal work is resumed.

11. When the removal work is completed,

    i. the inner surface of the glove bag and the waste inside shall be thoroughly wetted and the air inside the bag shall be removed through an elasticized valve, by means of a vacuum equipped with a HEPA filter,

    ii. the pipe, duct or similar structure shall be wiped down and sealed with a suitable encapsulant,

    iii. the glove bag, with the waste inside, shall be placed in a container as described in paragraph 5 of section 15, and

    iv. the work area shall be cleaned by damp wiping or by cleaning with a vacuum equipped with a HEPA filter. O. Reg. 278/05, s. 17.

Additional measures and procedures, Type 3 operations

18. (1) In addition to the measures and procedures prescribed by section 15, the following measures and procedures apply to Type 3 operations:

1. The work area shall be separated from the rest of the workplace by walls, the placing of barricades or fencing or other suitable means.

2. Subsection (2) applies to an operation mentioned in paragraph 5 of subsection 12 (4).

3. Subsection (3) applies to an operation mentioned in paragraph 1, 2, 3 or 4 of subsection 12 (4) that is carried on outdoors.

4. Subsection (4) applies to an operation mentioned in paragraph 1, 2, 3, 4 or 6 of subsection 12 (4) that is carried on indoors. O. Reg. 278/05, s. 18 (1).

(2) In the case of an operation mentioned in paragraph 5 of subsection 12 (4), the following measures and procedures also apply:

1. The spread of dust from the work area shall be prevented by,

    i. using enclosures of polyethylene or other suitable material that is impervious to asbestos (including, if the enclosure material is opaque, one or more transparent window areas to allow observation of the entire work area from outside the enclosure), if the work area is not enclosed by walls, and

    ii. using curtains of polyethylene sheeting or other suitable material that is impervious to asbestos, fitted on each side of each entrance or exit from the work area.

2. Unless the operation is carried on outdoors, or inside a building that is to be demolished and will not be entered by any person except the workers involved in the operation and the workers involved in the demolition, the spread of dust from the work area shall also be prevented by,

    i. creating and maintaining within the enclosed area, by installing a ventilation system equipped with a HEPA filtered exhaust unit, a negative air pressure of 0.02 inches of water, relative to the area outside the enclosed area,

    ii. ensuring that replacement air is taken from outside the enclosed area and is free from contamination with any hazardous dust, vapour, smoke, fume, mist or gas, and

    iii. using a device, at regular intervals, to measure the difference in air pressure between the enclosed area and the area outside it.

3. The ventilation system referred to in subparagraph 2 i shall be inspected and maintained by a competent worker before each use to ensure that there is no air leakage, and if the filter is found to be damaged or defective, it shall be replaced before the ventilation system is used.

4. Before leaving the work area, a worker shall,

    i. decontaminate his or her protective clothing by using a vacuum equipped with a HEPA filter, or by damp wiping, before removing the protective clothing, and

ii. if the protective clothing will not be reused, place it in a container as described in paragraph 5 of section 15.

5. Facilities for the washing of hands and face shall be made available to workers and shall be used by every worker when leaving the work area. O. Reg. 278/05, s. 18 (2).

(3) In the case of an operation mentioned in paragraph 1, 2, 3 or 4 of subsection 12 (4) that is carried on outdoors, the following measures and procedures also apply:

1. If practicable, any asbestos-containing material to be removed shall be thoroughly wetted before and during removal, unless wetting would create a hazard or cause damage.
2. Dust and waste shall not be permitted to fall freely from one work level to another.
3. If practicable, the work area shall be washed down with water after completion of the clean-up and removal described in paragraph 6 of section 15.
4. Temporary electrical power distribution systems for tools and equipment involved in wet removal operations shall be equipped with ground fault circuit interrupters.
5. A decontamination facility shall be located as close as practicable to the work area and shall consist of,
   i. a room suitable for changing into protective clothing and for storing contaminated protective clothing and equipment,
   ii. a shower room as described in paragraph 7 of subsection (4), and
   iii. a room suitable for changing into street clothes and for storing clean clothing and equipment.
6. The rooms described in subparagraphs 5 i, ii and iii shall be arranged in sequence and constructed so that any person entering or leaving the work area must pass through each room.
7. When leaving the work area, a worker shall enter the decontamination facility and shall, in the following order,
   i. decontaminate his or her protective clothing by using a vacuum equipped with a HEPA filter, or by damp wiping, before removing the protective clothing,
   ii. if the protective clothing will not be reused, place it in a container as described in paragraph 5 of section 15,
   iii. shower, and
   iv. remove and clean the respirator. O. Reg. 278/05, s. 18 (3).

(4) In the case of an operation mentioned in paragraph 1, 2, 3, 4 or 6 of subsection 12 (4) that is carried on indoors, the following measures and procedures also apply:

1. Friable asbestos-containing material that is crumbled, pulverized or powdered and that is lying on any surface in the work area shall be cleaned up and removed using a vacuum equipped with a HEPA filter or by damp wiping and everything shall be removed from the work area or covered with polyethylene sheeting or other suitable material that is impervious to asbestos.
2. The spread of dust from the work area shall be prevented by an enclosure of polyethylene or other suitable material that is impervious to asbestos, if the work area is not enclosed by walls, and by a decontamination facility consisting of a series of interconnecting rooms including,
   i. a room suitable for changing into protective clothing and for storing contaminated protective clothing and equipment,
   ii. a shower room as described in paragraph 7,
   iii. a room suitable for changing into street clothes and for storing clean clothing and equipment, and
   iv. curtains of polyethylene sheeting or other suitable material that is impervious to asbestos, fitted to each side of the entrance or exit to each room.
3. The rooms described in subparagraphs 2 i, ii and iii shall be arranged in sequence and constructed so that any person entering or leaving the work area must pass through each room.
4. The mechanical ventilation system serving the work area shall be disabled and all openings or voids, including ventilation ducts to or from the work area, shall be sealed by tape or other appropriate means.
5. Unless the operation is carried on inside a building that is to be demolished and will not be entered by any person except the workers involved in the operation and the workers involved in the demolition, the spread of dust from the work area shall also be prevented by,
   i. creating and maintaining within the enclosed area, by installing a ventilation system equipped with a HEPA filtered exhaust unit, a negative air pressure of 0.02 inches of water, relative to the area outside the enclosed area,

ii. ensuring that replacement air is taken from outside the enclosed area and is free from contamination with any hazardous dust, vapour, smoke, fume, mist or gas, and

iii. using a device, at regular intervals, to measure the difference in air pressure between the enclosed area and the area outside it.

6. The ventilation system referred to in subparagraph 5 i shall be inspected and maintained by a competent worker before each use to ensure that there is no air leakage, and if the filter is found to be damaged or defective, it shall be replaced before the ventilation system is used.

7. The shower room in the decontamination facility shall,

   i. be provided with hot and cold water or water of a constant temperature that is not less than 40° Celsius or more than 50° Celsius,

   ii. have individual controls inside the room to regulate water flow and, if there is hot and cold water, individual controls inside the room to regulate temperature,

   iii. be capable of providing adequate supplies of hot water to maintain a water temperature of at least 40° Celsius, and

   iv. be provided with clean towels.

8. When leaving the work area, a worker shall enter the decontamination facility and shall, in the following order,

   i. decontaminate his or her protective clothing by using a vacuum equipped with a HEPA filter, or by damp wiping, before removing the protective clothing,

   ii. if the protective clothing will not be reused, place it in a container as described in paragraph 5 of section 15,

   iii. shower, and

   iv. remove and clean the respirator.

9. If practicable, existing electrical power distribution systems that are not water-tight shall be de-energized and locked out where wet removal operations are to be carried out.

10. Temporary electrical power distribution systems for tools and equipment involved in wet removal operations shall be equipped with ground fault circuit interrupters.

11. Friable asbestos-containing material shall be thoroughly wetted before and during removal, unless wetting would create a hazard or cause damage.

12. The work area shall be inspected by a competent worker for defects in the enclosure, barriers and decontamination facility,

   i. at the beginning of each shift,

   ii. at the end of a shift if there is no shift that begins immediately after the first-named shift, and

   iii. at least once each day on days when there are no shifts.

13. Defects observed during an inspection under paragraph 12 shall be repaired immediately and no other work shall be carried out in the work area until the repair work is completed.

14. If practicable, dust and waste shall be kept wet.

15. On completion of the work,

   i. negative air pressure shall be maintained if required by subparagraph 5 i,

   ii. the inner surface of the enclosure and the work area inside the enclosure shall be cleaned by a thorough washing or by vacuuming with a vacuum equipped with a HEPA filter,

   iii. equipment, tools and other items used in the work shall be cleaned with a damp cloth or by vacuuming with a vacuum equipped with a HEPA filter or they shall be placed in a container as described in paragraph 5 of section 15 before being removed from the enclosure, and

   iv. a visual inspection shall be conducted by a competent worker to ensure that the enclosure and the work area inside the enclosure are free from visible dust, debris or residue that may contain asbestos.

16. Once the work area inside the enclosure is dry after the steps set out in subparagraphs 15 ii, iii and iv have been completed, clearance air testing shall be conducted by a competent worker in accordance with subsection (5), unless the operation is carried on inside a building that is to be demolished and will not be entered by any person except the workers involved in the operation and the workers involved in the demolition.

17. The barriers, enclosure and decontamination facility shall not be removed or dismantled until,

    i. cleaning has been done as described in paragraph 15, and

    ii. if clearance air testing is required, it has been completed and the work area inside the enclosure has passed the clearance air test. O. Reg. 278/05, s. 18 (4).

(5) The following rules apply to clearance air testing:

1. Sample collection and analysis shall be done,

    i. using the phase contrast microscopy method, in accordance with subsection (6), or

    ii. using the transmission electron microscopy method, in accordance with subsection (7).

2. If the work area inside the enclosure fails the clearance air test, the steps set out in subparagraphs 15 ii, iii and iv of subsection (4) shall be repeated and the work area shall be allowed to dry before a further test is carried out, unless paragraph 6 of subsection (6) applies. O. Reg. 278/05, s. 18 (5).

(6) Clearance air testing using the phase contrast microscopy method shall be carried out in accordance with U.S. National Institute of Occupational Safety and Health Manual of Analytical Methods, Method 7400, Issue 2: Asbestos and other Fibres by PCM (August 15, 1994), using the asbestos fibre counting rules, and shall comply with the following requirements:

1. Testing shall be based on samples taken inside the enclosure.
2. Forced air shall be used, both before and during the sampling process, to ensure that fibres are dislodged from all surfaces inside the enclosure before sampling begins and are kept airborne throughout the sampling process.
3. At least 2,400 litres of air shall be drawn through each sample filter, even though the standard mentioned above provides for a different amount.
4. The number of air samples to be collected shall be in accordance with Table 3.
5. The work area inside the enclosure passes the clearance air test only if every air sample collected has a concentration of fibres that does not exceed 0.01 fibres per cubic centimetres of air.
6. If the work area inside the enclosure fails a first test that is done using the phase contrast microscopy method, the samples may be subjected to a second analysis using transmission electron microscopy in accordance with the standard mentioned in subsection (7).
7. When a second analysis is done as described in paragraph 6, the work area inside the enclosure passes the clearance air test only if every air sample collected has a concentration of asbestos fibres that does not exceed 0.01 fibres per cubic centimetre of air. O. Reg. 278/05, s. 18 (6).

(7) Clearance air testing using the transmission electron microscopy method shall be carried out in accordance with U.S. National Institute of Occupational Safety and Health Manual of Analytical Methods, Method 7402, Issue 2: Asbestos by TEM (August 15, 1994), and shall comply with the following requirements:

1. Testing shall be based on samples taken inside the enclosure and samples taken outside the enclosure but inside the building.
2. Forced air shall be used inside the enclosure, both before and during the sampling process, to ensure that fibres are dislodged from all surfaces before sampling begins and are kept airborne throughout the sampling process.
3. At least 2,400 litres of air shall be drawn through each sample filter, even though the standard mentioned above provides for a different amount.
4. At least five air samples shall be taken inside each enclosure and at least five air samples shall be taken outside the enclosure but inside the building.
5. Sampling inside and outside the enclosure shall be conducted concurrently.
6. The work area inside the enclosure passes the clearance air test if the average concentration of asbestos fibres in the samples collected inside the enclosure is statistically less than the average concentration of asbestos fibres in the samples collected outside the enclosure, or if there is no statistical difference between the two average concentrations. O. Reg. 278/05, s. 18 (7).

(8) Within 24 hours after the clearance air testing results are received,

(a) the owner and the employer shall post a copy of the results in a conspicuous place or places,

    (i) at the workplace, and

    (ii) if the building contains other workplaces, in a common area of the building; and

(b) a copy shall be provided to the joint health and safety committee or the health and safety representative, if any, for the workplace and for the building. O. Reg. 278/05, s. 18 (8).

(9) The owner of the building shall keep a copy of the clearance air testing results for at least one year after receiving them. O. Reg. 278/05, s. 18 (9).

Instruction and training

19. (1) The employer shall ensure that instruction and training in the following subjects are provided by a competent person to every worker working in a Type 1, Type 2 or Type 3 operation:

1. The hazards of asbestos exposure.
2. Personal hygiene and work practices.
3. The use, cleaning and disposal of respirators and protective clothing. O. Reg. 278/05, s. 19 (1).

(2) The joint health and safety committee or the health and safety representative, if any, for the workplace shall be advised of the time and place where the instruction and training prescribed by subsection (1) are to be carried out. O. Reg. 278/05, s. 19 (2).

(3) Without restricting the generality of paragraph 3 of subsection (1), the instruction and training related to respirators shall include instruction and training related to,

(a) the limitations of the equipment;

(b) inspection and maintenance of the equipment;

(c) proper fitting of a respirator; and

(d) respirator cleaning and disinfection. O. Reg. 278/05, s. 19 (3).

Note: Section 20 comes into force on November 1, 2007. See: O. Reg. 278/05, s. 26 (2).

Asbestos abatement training programs

20. (1) The employer shall ensure that,

(a) every worker involved in a Type 3 operation has successfully completed the Asbestos Abatement Worker Training Program approved by the Ministry of Training, Colleges and Universities; and

(b) every supervisor of a worker involved in a Type 3 operation has successfully completed the Asbestos Abatement Supervisor Training Program approved by the Ministry of Training, Colleges and Universities. O. Reg. 278/05, s. 20 (1).

(2) The employer shall ensure that every worker and supervisor successfully completes the appropriate program required under subsection (1) before performing or supervising the work to which the program relates. O. Reg. 278/05, s. 20 (2).

(3) A document issued by the Ministry of Training, Colleges and Universities, showing that a worker has successfully completed a program mentioned in subsection (1), is conclusive proof, for the purposes of this section, of his or her successful completion of the program. O. Reg. 278/05, s. 20 (3).

(4) In accordance with the *Agreement on Internal Trade, 1995* and the *Protocols of Amendment*, a worker shall be deemed to hold a document showing successful completion referred to in subsection (3) if he or she has successfully completed equivalent training in another province or territory of Canada, as determined by the Director. O. Reg. 278/05, s. 20 (4).

Asbestos work report

21. (1) The employer of a worker working in a Type 2 operation or a Type 3 operation shall complete an asbestos work report in a form obtained from the Ministry for each such worker,

(a) at least once in each 12-month period; and

(b) immediately on the termination of the employment of the worker. O. Reg. 278/05, s. 21 (1).

(2) As soon as the asbestos work report is completed, the employer shall,

(a) forward it to the Provincial Physician, Ministry of Labour, and

(b) give a copy to the worker. O. Reg. 278/05, s. 21 (2).

(3) For the purposes of clause (2) (a), the employer may deliver the report to the Provincial Physician in person or send it by ordinary mail, by courier or by fax. O. Reg. 278/05, s. 21 (3).

Asbestos Workers Register

22. (1) The Provincial Physician, Ministry of Labour, shall establish and maintain an Asbestos Workers Register listing the name of each worker for whom an employer submits an asbestos work report under section 21. O. Reg. 278/05, s. 22 (1).

(2) On the recommendation of the Provincial Physician, a worker who is listed in the Register may volunteer to undergo the prescribed medical examination described in paragraph 1 of subsection (4). O. Reg. 278/05, s. 22 (2).

(3) A worker who has undergone the prescribed medical examination described in paragraph 1 of subsection (4) may volunteer to undergo subsequent examinations of the same type if they are recommended by his or her physician. O. Reg. 278/05, s. 22 (3).

(4) The following medical examinations are prescribed for the purposes of subsection 26 (3) of the Act:

1. An examination consisting of a medical questionnaire, chest x-rays and pulmonary function tests.
2. A subsequent examination that consists of the components described in paragraph 1, is recommended by the worker's physician and takes place at least two years after the most recent examination. O. Reg. 278/05, s. 22 (4).

(5) A worker who is removed from exposure to asbestos because an examination discloses that he or she may have or has a condition resulting from exposure to asbestos and suffers a loss of earnings as a result of the removal from exposure to asbestos is entitled to compensation for the loss in the manner and to the extent provided by the *Workplace Safety and Insurance Act, 1997*. O. Reg. 278/05, s. 22 (5).

Use of equivalent measure or procedure

23. A constructor, in the case of a project, or the employer, in any other case, may vary a measure or procedure required by this Regulation if the following conditions are satisfied:

1. The measure or procedure, as varied, affords protection for the health and safety of workers that is at least equal to the protection that would be provided by complying with this Regulation.
2. The constructor or employer gives written notice of the varied measure or procedure, in advance, to the joint health and safety committee or the health and safety representative, if any, for the workplace. O. Reg. 278/05, s. 23.

Notice to inspector

24. (1) When this Regulation requires written notice to an inspector at an office of the Ministry of Labour, the notice shall be given,

(a) by delivering it to the office in person;

(b) by sending it by ordinary mail, by courier or by fax, or

(c) by sending the notice to the inspector by electronic means that are acceptable to the Ministry. O. Reg. 278/05, s. 24 (1).

(2) When this Regulation requires oral notice to an inspector at an office of the Ministry of Labour, the notice shall be given,

(a) in person;

(b) by telephoning the inspector; or

(c) by sending the notice to the inspector by electronic means that are acceptable to the Ministry. O. Reg. 278/05, s. 24 (2).

25. OMITTED (REVOKES OTHER REGULATIONS). O. Reg. 278/05, s. 25.

26. OMITTED (PROVIDES FOR COMING INTO FORCE OF PROVISIONS OF THIS REGULATION). O. Reg. 278/05, s. 26.

TABLE 1

BULK MATERIAL SAMPLES

Subsection 3 (3)

Item	Type of material	Size of area of homogeneous material	Minimum number of bulk material samples to be collected
1.	Surfacing material, including without limitation material that is applied to surfaces by spraying, by troweling or otherwise, such as acoustical plaster on ceilings and fireproofing materials on structural members	Less than 90 square metres	3

		90 or more square metres, but less than 450 square metres	5
		450 or more square metres	7
2.	Thermal insulation, except as described in item 3	any size	3
3.	Thermal insulation patch	Less than 2 linear metres or 0.5 square metres	1
4.	Other material	Any size	3

O. Reg. 278/05, Table 1.

TABLE 2

RESPIRATORS

Paragraph 12 of section 14 and paragraph 11 of section 15

Column 1		**Column 2**
Work Category		**Required respirator**
Type 1 Operations		
Worker requests that the employer provide a respirator to be used by the worker, as described in paragraph 12 of section 14		Air purifying half-mask respirator with N-100, R-100 or P-100 particulate filter
Type 2 Operations		
Work described in paragraph 1 of subsection 12 (3)		One of the following: - Air purifying full-facepiece respirator with N-100, R-100 or P-100 particulate filter - Powered air purifying respirator equipped with a tight-fitting facepiece (half or full-facepiece) 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-facepiece - Continuous flow supplied air respirator equipped with a tight fitting facepiece (half or full-facepiece)
Work described in paragraphs 2 to 7 and 9 to 11 of subsection 12 (3)		Air purifying half-mask respirator with N-100, R-100 or P-100 particulate filter
Breaking, cutting, drilling, abrading, grinding, sanding or vibrating non-friable material containing asbestos by means of power tools, if the tool is attached to a dust collecting device equipped with a HEPA filter as described in paragraph 8 of subsection 12 (3)	Material is not wetted	One of the following: - Air purifying full-facepiece respirator with N-100, R-100 or P-100 particulate filter - Powered air purifying respirator equipped with a tight-fitting facepiece (half or full-facepiece) 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-facepiece - Continuous flow supplied air respirator equipped with a tight fitting facepiece (half or full-facepiece)
	Material is wetted to control spread of fibre	Air purifying half-mask respirator with N-100, R-100 or P-100 particulate filter
Type 3 Operations		
Breaking, cutting, drilling, abrading, grinding, sanding or vibrating non-friable material containing asbestos by means of power tools, if the tool is not attached to a dust collecting device equipped with a HEPA filter as described in paragraph 5 of subsection 12 (4)	Material is not wetted	Pressure demand supplied air respirator equipped with a half mask
	Material is wetted to control spread of fibre	One of the following: - Air purifying full-facepiece respirator with N-100, R-100 or P-100 particulate filter - Powered air purifying respirator equipped with a tight-fitting facepiece (half or full-facepiece) 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-facepiece - Continuous flow supplied air respirator equipped with a tight fitting facepiece (half or full-facepiece)

Work with friable material containing asbestos, as described in paragraphs 1 to 4 and 6 of subsection 12 (4)	Material is not wetted	Pressure demand supplied air respirator equipped with a full facepiece
Work with friable material, as described in paragraphs 1 to 4 and 6 of subsection 12 (4), that contains a type of asbestos other than chrysotile	Material was applied or installed by spraying, and is wetted to control spread of fibre	Pressure demand supplied air respirator equipped with a half mask
Work with friable material, as described in paragraphs 1 to 4 and 6 of subsection 12 (4), that contains only chrysotile asbestos		One of the following: - Air purifying full-facepiece respirator with N-100, R-100 or P-100 particulate filter - Powered air purifying respirator equipped with a tight-fitting facepiece (half or full-facepiece) 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-facepiece - Continuous flow supplied air respirator equipped with a tight fitting facepiece (half or full-facepiece)
Work with friable material containing asbestos, as described in paragraphs 1 to 4 and 6 of subsection 12 (4)	Material was not applied or installed by spraying, and is wetted to control spread of fibre	One of the following: - Air purifying full-facepiece respirator with N-100, R-100 or P-100 particulate filter - Powered air purifying respirator equipped with a tight-fitting facepiece (half or full-facepiece) 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-facepiece - Continuous flow supplied air respirator equipped with a tight fitting facepiece (half or full-facepiece)

O. Reg. 278/05, Table 2.

TABLE 3

AIR SAMPLES

Paragraph 4 of subsection 18 (6)

Minimum number of air samples to be taken from each enclosure	**Area of enclosure**
2	10 square metres or less
3	More than 10 but less than 500 square metres
5	500 square metres or more

O. Reg. 278/05, Table 3.