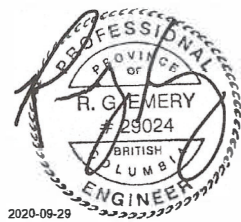


Project No.: R.089617.001  
AAFC Equipment Storage Upgrade  
510 Clearbrook Road  
Abbotsford, B.C.

Section 00 01 07  
**SEALS SHEET**  
Page 1 of 1

Architect  
Kasian Architecture Interior Design and Planning

Structural Consultant  
WSP



Mechanical Consultant  
WSP



Electrical Consultant  
WSP



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**INTRODUCTORY INFORMATION**

00 01 07	Seals Sheet .....	01
00 01 10	Table of Contents .....	03

**DIVISION 01 - GENERAL REQUIREMENTS**

01 11 00	Summary of Work .....	03
01 31 19	Project Meetings .....	02
01 32 16.07	Construction Progress Schedule Bar (Gantt Chart) .....	04
01 33 00	Submittal Procedures .....	05
01 35 33	Health And Safety Requirements .....	08
01 35 43	Environmental Procedures .....	04
01 45 00	Quality Control .....	03
01 51 00	Temporary Utilities .....	03
01 56 00	Temporary Barriers and Enclosures .....	02
01 61 00	Common Product Requirements .....	03
01 71 00	Examination and Preparation .....	02
01 73 00	Execution .....	02
01 74 11	Cleaning .....	02
01 74 19	Waste Management and Disposal .....	07
01 77 00	Closeout Procedures .....	01
01 78 00	Closeout Submittals .....	09
01 79 00	Demonstration and Training .....	02

**DIVISION 02 - SITEWORK**

02 81 01	Hazardous Materials Use and Abatement .....	08
02 82 00	Asbestos Abatement – Minimum Precautions .....	08

**DIVISION 03 - CONCRETE**

03 35 00	Concrete Finishing .....	04
----------	--------------------------	----

**DIVISION 05 - METALS**

05 50 00	Metal Fabrications .....	06
----------	--------------------------	----

**DIVISION 06 - WOOD AND PLASTICS**

06 10 00	Rough Carpentry .....	03
----------	-----------------------	----

**DIVISION 07 - THERMAL AND MOISTURE PROTECTION**

07 21 19	Foamed-In-Place Insulation .....	03
07 27 00	Synthetic Sheathing Water Resistant Membrane .....	03
07 46 13	Preformed Metal Siding .....	04
07 61 00	Sheet Metal Roofing .....	05

**DIVISION 08 - OPENINGS**

08 10 00	Metal Doors and Frames .....	05
08 36 13	Sectional Overhead Doors .....	04
08 51 13	Aluminum Windows .....	04
08 71 00	Finish Hardware .....	03

**DIVISION 09 - FINISHES**

09 29 00	Gypsum Board	03
09 90 00	Painting	05

**DIVISION 10 - SPECIALTIES**

10 44 20	Fire Extinguishers	01
----------	--------------------	----

**DIVISION 13 - SPECIAL EQUIPMENT**

13 34 25	Structural Systems	10
----------	--------------------	----

**DIVISION 22 - PLUMBING**

22 11 18	Domestic Water Piping	02
----------	-----------------------	----

**DIVISION 23 - HVAC**

23 03 00	Common Work Results for Mechanical	06
23 05 48	Seismic Controls for Equipment	03
23 05 54	Mechanical Identification	02
23 05 93	Testing, Adjusting and Balancing for HVAC	02
23 09 33	Electric and Electronic Control System for HVAC	02
23 31 14	Metal Ducts - Low Pressure to 500 Pa	03
23 34 25	Wall Exhaust Fans	02
23 37 20	Louvres	02

**DIVISION 26 - ELECTRICAL**

26 05 00	Common Work Results	21
26 05 03	Operation & Maintenance Manuals	02
26 05 05	Seismic Restraints	03
26 05 10	Basic Electrical Materials and Methods	04
26 05 11	Branch Wiring	01
26 05 20	Wire and Box Connectors 0-1000 V	01
26 05 21	Wiring and Cable 0-1000 V	03
26 05 28	Grounding - Secondary	04
26 05 29	Hangers and Supports for Electrical Systems	02
26 05 31	Splitters, Junction, Pull Boxes and Cabinets	02
26 05 32	Outlet Boxes, Conduit Boxes and Fittings	03
26 05 34	Conduit, Fastenings & Fittings	05
26 05 37	Wireways and Auxiliary Gutters	01
26 05 45	Firestopping	07
26 24 16	Panel Boards - Breaker Type	03
26 27 26	Wiring Devices & Plates	03
26 28 23	Disconnect Switches	02
26 29 10	Motor Starters to 600V	03
26 50 00	Lighting General	03
26 52 00	Unit Equipment for Emergency Lighting	02
26 53 00	Exit Signs	02

**APPENDIX**

Hazardous Building Materials Assessment ..... 45  
Geotechnical Investigation and Report ..... 13

**DRAWING LIST**

**ARCHITECTURAL**

A-001          Cover Page  
A-100          Site Plan  
A-101          Floor Plan and Roof Plan  
A-201          Exterior Elevations  
A-301          Building Sections

**CIVIL**

C-101          Civil Demo and Proposed Servicing Plan

**MECHANICAL**

M-101          Plumbing & Heating Floor Plan

**ELECTRICAL**

E-101          Electrical Single Line Diagram and Site Plan  
E-102          Lighting and Power Floor Plan  
E-103          Elevations

**END OF SECTION 00 01 10**

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## **PART 1 - GENERAL**

### **1.1 WORK COVERED BY CONTRACT DOCUMENTS**

- .1 Work of this contract comprises of the construction of the new AAFC Equipment Storage Facility, and the associated work at 510 Clearbrook Road, Abbotsford, B.C.
- .2 Project to be completed in accordance with the design-build project delivery method. The specifications and drawings included herein provide design intent only. Design-builder shall produce construction documents required to obtain all necessary permits and provide schedules as required by local codes and Authorities Having Jurisdiction. Design-builder shall provide consulting services (architectural and engineering) as necessary to produce construction documents per the outlined design intent. All shop drawings to be reviewed by client's representative prior to fabrication and construction.
- .3 Substantial completion shall be achieved by December 2021.

### **1.2 REGULATORY REQUIREMENTS**

- .1 Perform Work in accordance with National Building Code of Canada (NBCC 2015) including all amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
- .2 Meet or exceed requirements of:
  - .1 Contract documents.
  - .2 Specified standards, codes and referenced documents.

### **1.3 WORK BY OTHERS**

- .1 Co-operate with other Contractors on site in carrying out their respective works and carry out instructions from the Departmental Representative.
- .2 Coordinate work with that of other Contractors. If any part of the work under this Contract depends for its proper execution or result upon work of another Contractor, report promptly to Departmental Representative, in writing, any defects which may interfere with proper execution of work.

### **1.4 CONTRACTOR USE OF PREMISES**

- .1 Contractor has controlled use of site within the construction area for Work, storage, and access as directed by the Departmental Representative.
- .2 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

## 1.5 OWNER AND CONTRACTOR RESPONSIBILITIES

- .1 Owner Responsibilities:
  - .1 Arrange for delivery of up-to-date utility location information, safety requirements, and any site specific work policies that may have changed or were not available at the time of specification and drawing preparation.
- .2 Contractor Responsibilities:
  - .1 Designate Submittals and delivery date for major building components and equipment in progress schedule.
  - .2 Review all submittals and contract requirements. As soon as it becomes apparent, submit to Departmental Representative written and verbal notification of observed discrepancies or problems anticipated due to non-conformance with Contract Documents.
  - .3 Provide any installation inspections required by public safety authorities and authority having jurisdiction.
  - .4 Receive and unload products and equipment at site.
  - .5 Review deliveries jointly with Departmental Representative, record shortages, and damaged or defective items.
  - .6 Handle product at site, including uncrating and storage.
  - .7 Protect product from damage.
  - .8 Repair or replace items damaged by Contractor or subcontractor on site (under their control).

## 1.6 DOCUMENTS REQUIRED ON SITE

- .1 Maintain at job site, one copy each of following:
  - .1 Contract drawings.
  - .2 Specifications.
  - .3 Addenda.
  - .4 Reviewed shop drawings.
  - .5 Change orders.
  - .6 Other modifications to Contract.
  - .7 Field test reports.
  - .8 Copy of approved work schedule.
  - .9 Record Drawings.
  - .10 Manufacturers' installation and application instructions.
  - .11 Health and Safety Plan and Other Safety Related Documents.
  - .12 Other documents as specified.

## 1.7 EXISTING SERVICES

- .1 Notify Departmental Representative of intended interruption of services and obtain required permission. Where work involves breaking into or connecting to existing services, contractor shall submit a request to the Departmental Representative a minimum of 4 weeks prior to the event. The contractor will not proceed until approval has been granted. The Departmental Representative will make all reasonable efforts to accommodate the request; however the Departmental Representative will not accept delay charges should the request not be accepted.
- .2 Provide alternative routes for personnel and vehicular traffic.
- .3 Establish location and extent of service lines in area of work before starting work. Notify Departmental Representative of findings.

- .4 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.
- .5 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in a manner approved by authorities having jurisdiction.
- .6 Record locations of maintained, re-routed and abandoned service lines.
- .7 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures. Maintain construction barriers as delineated in the drawings during the full duration of the contract.

**END OF SECTION 01 11 00**

## **PART 1 - GENERAL**

### 1.1 ADMINISTRATIVE

- .1 Schedule and administer site meetings throughout the progress of the work on a regular basis or at the call of Departmental Representative.
- .2 Prepare and distribute agenda at least three (3) days prior to the meetings.
- .3 Distribute written notice of each meeting seven (7) days in advance of meeting date to Departmental Representative.
- .4 Preside at meetings.
- .5 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.
- .6 Reproduce and distribute copies of minutes within five (5) days after meetings and transmit to meeting participants and affected parties not in attendance, Departmental Representative and Consultants.
- .7 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

### 1.2 PRE – CONSTRUCTION MEETING

- .1 Within 15 days after award of Contract: Departmental Representative will request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2 Attendees: Contractor's Representatives, Contractor's General Superintendent, Site Superintendents and Safety Professional, Representatives of Subcontractors or Suppliers, and other parties involved in the work. Trade, Subcontractor's, and Supplier's Representatives shall be qualified and authorized to act on all issues on behalf of the parties each represent.
- .3 Departmental Representative to establish time and location of preconstruction meeting, Contractor to notify parties concerned a minimum of 4 working days before meeting.
- .4 Departmental Representative will chair the meeting, record minutes and issue minutes.
- .5 Agenda to include:
  - .1 Introduction of official representative of participants in the Work.
  - .2 Start date on site.
  - .3 Communication Protocol for submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
  - .4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 51 00 - Temporary Utilities.
  - .5 Security requirements.
  - .6 Site safety in accordance with Section 01 56 00 - Temporary Barriers and Enclosures, Section 01 35 33 – Health and Safety Requirements.
  - .7 Communication Protocol for proposed changes, change orders, procedures, approvals required.
  - .8 Owner's Work.



- .9 Record drawings in accordance with Section 01 78 00 - Closeout Submittals.
- .10 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
- .11 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
- .12 Monthly progress claims, administrative procedures, photographs, holdbacks.
- .13 Appointment of inspection and testing agencies or firms being submitted for Review of Surveyor.

### 1.3 PROGRESS MEETINGS

- .1 During course of Work and two weeks prior to Project Completion, schedule progress meetings bi-weekly.
- .2 Contractor responsible to record minutes of meetings and circulate to attending parties and affected parties not in attendance within five (5) days after meeting.
- .3 Record next meeting dates in the meeting minutes or notify parties minimum of seven (7) days in advance for other ad-hoc meetings.
- .4 Agenda to include, at a minimum, the following:
  - .1 Review, approval of minutes of previous meeting.
  - .2 Review of Health and Safety including any incidents, near misses, and WorkSafe BC visits.
  - .3 Review of Work progress since previous meeting.
  - .4 Construction schedule review.
  - .5 Review of off-site fabrication delivery schedules.
  - .6 Corrective measures and procedures to regain projected schedule.
  - .7 Request for Information (RFI) log review.
  - .8 Engineering Disciplines Reviews.
    - .1 Architectural
    - .2 Structural
    - .3 Mechanical
    - .4 Electrical
    - .5 Civil
  - .9 Change order log review.
  - .10 Review submittal schedule.
  - .11 Review updated as built.
  - .12 Review and resolve site issues.
  - .13 New business.

**END OF SECTION 01 31 19**

## 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.
- .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 15 working days, to allow for progress reporting.
- .4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

- .5 Clearly show sequence and interdependence of construction activities and indicate:
  - .1 Start and completion of all items of Work, their major components and interim milestones completion dates.
  - .2 Activities for procurement, delivery, installation and completion of each major piece of equipment, materials and other supplies, including:
    - .1 Time for submittals, re-submittal and review.
    - .2 Time for fabrication and delivery of manufactured products for Work.
    - .3 Interdependence of procurement and construction activities.
  - .3 Include sufficient detail for project activities to assure adequate planning and execution of work. Activities should generally range in duration from 3 to 15 days each.
  - .4 Provide level of detail for project activities such that sequence and interdependency of Contract tasks are demonstrated to allow coordination and control of project activities. Show continuous flow from left to right.
  - .5 Ensure activities with no float are calculated and clearly indicated on logical CPM construction network system as being whenever possible, continuous series of activities throughout length of project to form critical path.
- 1.3 SUBMITTALS
  - .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Submit to Departmental Representative within 28 working days after Award of Contract Project schedule in form of Bar (GANTT) Chart for planning, monitoring and reporting of project progress.
- 1.4 REVIEW OF THE SCHEDULE
  - .1 Allow 10 working days for Departmental Representative to review proposed schedule. Make necessary changes to proposed schedule within 5 days.
  - .2 Submit letter ensuring the schedule has been prepared in coordination with major subcontractors and suppliers.
  - .3 Promptly provide additional information to validate practicability of schedule as required by Departmental Representative.
  - .4 Submittal of Schedule indicates that it meets Contract Requirements and will be executed generally in sequence.
- 1.5 COMPLIANCE WITH SCHEDULE
  - .1 Comply with reviewed schedule.
  - .2 Proceed with significant changes and deviations from schedule sequence of activities which cause delay only after review by Departmental Representative.
  - .3 Identify activities that are behind schedule and causing delay. Provide recovery plan and schedule to regain slippage.
    - .1 Recovery plan and schedule must include:
      - .1 An increase of personnel on the site for effective activities or work packages.
      - .2 An increase in materials and equipment.
      - .3 Additional work shifts, longer hours.
      - .4 Resource loaded schedule indicating the items noted above.

1.6 PROJECT SCHEDULE

- .1 Develop detailed Project Schedule derived from Master Plan.
- .2 Ensure detailed Project Schedule that shows milestone and activity types and expand from the following items:
  - .1 Award.
  - .2 Shop Drawings, Samples and Approvals.
  - .3 Permits.
  - .4 Mobilization.
  - .5 Mock-ups and Approvals.
  - .6 Procurement.
  - .7 Construction.
  - .8 Installation.
  - .9 Site Works.
  - .10 Training.
  - .11 Commissioning.

1.7 PROJECT SCHEDULE REPORTING

- .1 On an ongoing basis, schedule on job site must show “progress to date”. Arrange participation on and off site of subcontractor and suppliers, as and when necessary, for purpose of network planning, scheduling, updating and progress monitoring. Inspect Work with Departmental Representative at least once monthly to establish progress on each current activity shown on applicable networks.
- .2 Maintain a daily log of progress of the work:
  - .1 Submit daily force report to Departmental Representative daily prior to noon the following day indicating:
    - .1 Total number of personnel on site.
    - .2 Major subcontractors on site listed by trade.
    - .3 Major equipment on site, i.e. excavators, cranes, drills.
    - .4 Concrete volumes.
    - .5 Visitors to site.
    - .6 Weather
    - .7 Documents required from Departmental Representative to Contractor to maintain.
- .3 Perform schedule update monthly dated on last working day of the month. Update to reflect activities completed to date, activities in progress, logic and duration changes.
- .4 Do not automatically update actual start and finish dates by using default mechanisms found in project management software.
- .5 Requirements for monthly progress monitoring and reporting are basis for progress payment request.
- .6 Submit monthly schedule updates with the progress payment request.

- .7 Submit monthly written reports based on schedule, showing Work to Date performed, comparing work progress planned and presenting current forecasts. Report must summarize progress, defining problem areas and anticipated delays with respect to Work Schedule, and critical paths. Explain alternatives for possible schedule recovery to mitigate any potential delay. Include in report:
    - .1 Description of progress made.
    - .2 Pending items and status of: Permits, shop drawings, samples, mockups, deliveries, change orders, possible time extension.
    - .3 Status of Contract Completion Date and Milestones.
    - .4 Current and Anticipated problem areas, potential delays and corrective measures.
  - .8 Submit weekly 3 week look ahead schedule to Departmental Representative on each Friday of the Week indicating the planned tasks of the next three week period.
- 1.8 PROJECT MEETINGS
- .1 Discuss Project Schedule at regular site meetings, 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.

**END OF SECTION 01 32 16.07**

## **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 coordinated 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 coordinated.
- .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.
- .10 Keep one reviewed copy of each submission on site.
- .11 Do not proceed with work until relevant submissions are reviewed 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 When specified in the Contract document, submit drawings stamped and signed by professional engineer registered or licensed in Province of British Columbia 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 coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

- 
- .4 Allow 10 days for Departmental Representative's review of each submission, unless noted otherwise.
  - .5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
  - .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 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 electronic copy of shop drawings for each requirement requested in specification sections and as Departmental Representative may reasonably request.
  - .11 Submit electronic copies 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.

- 
- .12 Submit electronic copies 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.
  - .13 Submit electronic copies 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.
  - .14 Submit electronic copies of manufacturer's 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.
  - .15 Submit copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.
  - .16 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
  - .17 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
  - .18 Delete information not applicable to project.
  - .19 Supplement standard information to provide details applicable to project.
  - .20 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, electronic 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.
  - .21 The review of shop drawings by Departmental Representative is for sole purpose of ascertaining conformance with general concept.
    - .1 This review shall not mean that Departmental Representative 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.



- .22 Shop drawings format larger than 11" x17" (275mm x 430mm) must be submitted with hardcopies together with electronic format. Submit sufficient copies such that Departmental Representative will keep 5 copies plus contractor's distribution and maintenance manual.
- .23 Electronic submissions will only be reviewed and returned electronically. No hardcopies will be returned to contractor.
- .24 All electronic submissions to be uploaded to Document Control System Collaborative site hosted by PWGSC. Contractor will be responsible for becoming familiar with and utilizing the system.

### 1.3 SAMPLES

- .1 Submit for review samples in duplicate as required in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Departmental Representative's business address.
- .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.
- .5 Adjustments made on samples by Departmental Representative are not intended to change Contract Price. 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 be kept onsite and 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 01 45 00 - Quality Control.

### 1.5 PHOTOGRAPHIC DOCUMENTATION

- .1 Submit electronic 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 Viewpoints and their locations as reasonably determined by Departmental Representative.
- .4 Provide photographic documentation of adjacent existing conditions prior to commencement of construction for determining and accidental damage as a result of contractor's work.

- .5 Frequency of photographic documentation: monthly as directed by Departmental Representative.
  - .1 Upon completion of: demolition, framing and services before concealment of Work, and as directed by Departmental Representative.

1.6 CERTIFICATES AND TRANSCRIPTS

- .1 Submit electronic copies of test results and inspection reports required as noted in each section of specifications.

**END OF SECTION 01 33 00**

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## PART 1 - GENERAL

### 1.1 REFERENCES

- .1 Government of Canada.
  - .1 Canada Labour Code - Part II
  - .2 Canada Occupational Health and Safety Regulations.
- .2 National Building Code of Canada (NBC 2010):
  - .1 Part 8, Safety Measures at Construction and Demolition Sites.
- .3 Canadian Standards Association (CSA as amended):
  - .1 CSA Z797-2009 Code of Practice for Access Scaffold
  - .2 CSA S269.1-1975 (R2003) Falsework for Construction Purposes
  - .3 CSA S350-M1980 (R2003) Code of Practice for Safety in Demolition of Structures
- .4 National Fire Code of Canada 2010 (as amended):
  - .1 Part 5 – Hazardous Processes and Operations and Division B as applicable and required.
- .5 American National Standards Institute (ANSI):
  - .1 ANSI A10.3, Operations – Safety Requirements for Powder-Actuated Fastening Systems.
- .6 Province of British Columbia:
  - .1 Workers Compensation Act Part 3-Occupational Health and Safety.
  - .2 Occupational Health and Safety Regulation
- .7 The Canadian Electrical Code (as amended)
- .8 EGD Environmental Best Management Practices in Appendix H.

### 1.2 RELATED SECTIONS

- .1 Construction Progress Schedule Bar (GANTT) Chart      Section 01 32 16.07
- .2 Submittal Procedures      Section 01 33 00
- .3 Temporary Utilities      Section 01 51 00
- .4 Temporary Barriers Enclosures      Section 01 56 00

### 1.3 WORKERS' COMPENSATION BOARD COVERAGE

- .1 Comply fully with the Workers' Compensation Act, regulations and orders made pursuant thereto, and any amendments up to the completion of the work.
- .2 Maintain Workers' Compensation Board coverage during the term of the Contract, until and including the date that the Certificate of Final Completion is issued.

1.4 COMPLIANCE WITH REGULATIONS

- .1 PSPC may terminate the Contract without liability to PSPC where the Contractor, in the opinion of PWGSC, refuses to comply with a requirement of the Workers' Compensation Act or the Occupational Health and Safety Regulations.
- .2 It is the Contractor's responsibility to ensure that all workers are qualified, competent and certified to perform the work as required by the Workers' Compensation Act or the Occupational Health and Safety Regulations.

1.5 SUBMITTALS

- .1 Submit to Departmental Representative submittals listed for review. In accordance with Section 01 33 00 – Submittal Procedures.
- .2 Work effected by submittal shall not proceed until review is complete.
- .3 Submit the following:
  - .1 Site Specific Health and Safety Plan.
  - .2 Copies of reports or directions issued by Federal and Provincial health and safety inspectors.
  - .3 Copies of incident and accident reports.
  - .4 Complete set of Material Safety Data Sheets (MSDS), and all other documentation required by Workplace Hazardous Material Information System (WHMIS) requirements.
  - .5 Emergency Procedures.
- .4 The Departmental Representative will review the Contractor's Site Specific project Health and Safety Plan and emergency procedures, and provide comments to the Contractor within 2 days after Receipt of the plan. Revise the plan as appropriate and resubmit to Departmental Representative.
- .5 Medical surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of work, and submit additional certifications for any new site personnel to Departmental Representative.
- .6 Submission of the Site Specific Health and Safety Plan, and any revised version, to the Departmental Representative is for information and reference purposes only. It shall not:
  - .1 Be construed to imply approval by the Departmental Representative.
  - .2 Be interpreted as a warranty of being complete, accurate and legislatively compliant.
  - .3 Relieve the Contractor of his legal obligations for the provision of health and safety on the project.

1.6 RESPONSIBILITY

- .1 Assume responsibility as the Prime Contractor for work under this contract.
- .2 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.

- .3 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.

#### 1.7 HEALTH AND SAFETY COORDINATOR

- .1 The Health and Safety Coordinator must:
  - .1 Be responsible for completing all health and safety training, and ensuring that personnel that do not successfully complete the required training are not permitted to enter the site to perform work.
  - .2 Be responsible for implementing, daily enforcing, and monitoring the site-specific Health and Safety Plan.
  - .3 Be on site during execution of work.

#### 1.8 GENERAL CONDITIONS

- .1 Provide safety barricades and lights around work site as required to provide a safe working environment for workers and protection for pedestrian and vehicular traffic.
- .2 Ensure that non-authorized persons are not allowed to circulate in designated construction areas of the work site.
  - .1 Provide appropriate means by use of barricades, fences, warning signs, traffic control personnel, and temporary lighting as required.
  - .2 Secure site at night time as deemed necessary to protect site against entry.

#### 1.9 PROJECT/SITE CONDITIONS

- .1 Safety hazards or risks which may be encountered include, but are not limited to:
  - .1 Contact with traveling and mobile cranes, forklifts, manlifts and other motorized vehicles.
  - .2 Overhead hazards such as that created by material transported by cranes.
  - .3 Fall hazards.
  - .4 Drowning hazards.
  - .5 Confined space hazards.
  - .6 Electrical hazards.
  - .7 Contact with operating mechanical, electrical, electronic, pneumatic, thermal, and hydraulic machinery and equipment.
  - .8 Fire hazards.

#### 1.10 REGULATORY REQUIREMENTS

- .1 Comply with specified codes, acts, bylaws, standards and regulations to ensure safe operations at site.
- .2 In event of conflict between any provision of the above authorities, the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, the Departmental Representative will advise on the course of action to be followed.

#### 1.11 WORK PERMITS

- .1 Obtain specialty trade permits related to project before start of work.

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1.12 FILING OF NOTICE

- .1 The General Contractor is to complete and submit a Notice of Project as required by Provincial authorities.
- .2 Provide copies of all notices to the Departmental Representative.

1.13 HEALTH AND SAFETY PLAN

- .1 Conduct a site-specific hazard assessment based on review of Contract documents, required work, and project site. Identify any known and potential health risks and safety hazards.
- .2 Prepare and comply with a site-specific project Health and Safety Plan based on hazard assessment, including, but not limited to, the following:
  - .1 Primary requirements:
    - .1 Contractor's safety policy.
    - .2 Identification of applicable compliance obligations.
    - .3 Definition of responsibilities for project safety/organization chart for project.
    - .4 General safety rules for project.
    - .5 Job-specific safe work, procedures.
    - .6 Inspection policy and procedures.
    - .7 Incident reporting and investigation policy and procedures.
    - .8 Occupational Health and Safety Committee/Representative procedures.
    - .9 Occupational Health and Safety meetings.
    - .10 Occupational Health and Safety communications and record keeping procedures.
  - .2 Summary of health risks and safety hazards resulting from analysis of hazard assessment, with respect to site tasks and operations which must be performed as part of the work.
  - .3 List hazardous materials to be brought on site as required by work.
  - .4 Indicate Engineering and administrative control measures to be implemented at the site for managing identified risks and hazards.
  - .5 Identify personal protective equipment (PPE) to be used by workers.
  - .6 Identify personnel and alternates responsible for site safety and health.
  - .7 Identify personnel training requirements and training plan, including site orientation for new workers.
- .3 Develop the plan in collaboration with all subcontractors. Ensure that work/activities of subcontractors are included in the hazard assessment and are reflected in the plan.
- .4 Revise and update Health and Safety Plan as required, and re-submit to the Departmental Representative.
- .5 Departmental Representative's review: the review of Site Specific Health and Safety Plan by Public Service and Procurement Canada (PSPC) shall not relieve the Contractor of responsibility for errors or omissions in final Site Specific Health and Safety Plan or of responsibility for meeting all requirements of construction and Contract documents.

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#### 1.14 EMERGENCY PROCEDURES

- .1 List standard operating procedures and measures to be taken in emergency situations. Include an evacuation plan and emergency contacts (i.e. names/telephone numbers) of:
  - .1 Designated personnel from own company.
  - .2 Regulatory agencies applicable to work and as per legislated regulations.
  - .3 Local emergency resources.
  - .4 Departmental Representative and site staff.
- .2 Include the following provisions in the emergency procedures:
  - .1 Notify workers and the first-aid attendant, of the nature and location of the emergency.
  - .2 Evacuate all workers safely.
  - .3 Check and confirm the safe evacuation of all workers.
  - .4 Notify the fire department or other emergency responders.
  - .5 Notify adjacent workplaces or residences which may be affected if the risk extends beyond the workplace.
  - .6 Notify Departmental Representative and site staff.
- .3 Provide written rescue/evacuation procedures as required for, but not limited to:
  - .1 Work at high angles.
  - .2 Work in confined spaces or where there is a risk of entrapment.
  - .3 Work with hazardous substances.
  - .4 Underground work.
  - .5 Work on, over, under and adjacent to water.
  - .6 Workplaces where there are persons who require physical assistance to be moved.
- .4 Design and mark emergency exit routes to provide quick and unimpeded exit.
- .5 Revise and update emergency procedures as required, and re-submit to the Departmental Representative.

#### 1.15 HAZARDOUS PRODUCTS

- .1 Comply with requirements of Workplace Hazardous Materials Information system (WHMIS) regarding use, handling, storage and disposal of hazardous materials, and regarding labeling and provision of material Safety Data Sheets (MSDS) acceptable to the Departmental Representative and in accordance with the Canada Labour Code.
- .2 Where use of hazardous and toxic products cannot be avoided:
  - .1 Advise Departmental Representative beforehand of the product(s) intended for use. Submit applicable MSDS and WHMIS documents as per Section 01 33 00.
  - .2 Provide adequate means of ventilation in accordance with Section 01 51 00.

#### 1.16 ELECTRICAL SAFETY REQUIREMENTS

- .1 Comply with authorities and ensure that, when installing new facilities, all electrical personnel are completely familiar with new electrical circuits and equipment and their operation.
  - .1 Before undertaking any work, coordinate required energizing and de-energizing of new circuits with Departmental Representative.
  - .2 Maintain electrical safety procedures and take necessary precautions to ensure safety of all personnel working under this Contract, as well as safety of other personnel on site.

1.17 ELECTRICAL LOCKOUT

- .1 Develop, implement and enforce use of established procedures to provide electrical lockout and to ensure the health and safety of workers for every event where work must be done on any electrical circuit or facility.
- .2 Prepare the lockout procedures in writing, listing step-by-step processes to be followed by workers, including how to prepare and issue the request/authorization form. Have procedures available for review upon request by the Departmental Representative.
- .3 Keep the documents and lockout tags at the site and list in a log book for the full duration of the Contract. Upon request, make such data available for viewing by Departmental Representative or by any authorized safety representative.

1.18 OVERLOADING

- .1 Ensure no part of work is subjected to a load which will endanger its safety or will cause permanent deformation.

1.19 CONFINED SPACES

- .1 Carry out work in confined spaces in compliance with Occupational Health and Safety Regulation, Part 9.

1.20 POWDER-ACTUATED DEVICES

- .1 Use powder-actuated devices in accordance with ANSI A10.3 only after receipt of written permission from the Departmental Representative.

1.21 FIRE SAFETY AND HOT WORK

- .1 Obtain Departmental Representative's authorization before any welding, cutting or any other hot work operations can be carried out on site.
- .2 Hot work includes cutting/melting with use of torch, flame heating roofing kettles, or other open flame devices and grinding with equipment which produces sparks.

1.22 FIRE SAFETY REQUIREMENTS

- .1 Store oily/paint-soaked rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
- .2 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.
- .3 Portable gas and diesel fuel tanks are not permitted on most federal work sites. Approval from the DR is required prior to any gas or diesel tank being brought onto the work site



1.23 FIRE PROTECTION AND ALARM SYSTEM

- .1 Fire protection and alarm systems shall not be:
  - .1 Obstructed.
  - .2 Shut off.
  - .3 Left inactive at the end of a working day or shift.
- .2 Do not use fire hydrants, standpipes and hose systems for purposes other than firefighting.
- .3 Be responsible/liable for costs incurred from the fire department, the building owner and the tenants, resulting from false alarms.

1.24 UNFORESEEN HAZARDS

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

1.25 POSTED DOCUMENTS

- .1 Post legible versions of the following documents on site:
  - .1 Site Specific Health and Safety Plan.
  - .2 Sequence of work.
  - .3 Emergency procedures.
  - .4 Site drawing showing project layout, locations of the first-aid station, evacuation route and marshalling station, and the emergency transportation provisions.
  - .5 Notice of Project.
  - .6 Floor plans or site plans.
  - .7 Notice as to where a copy of the Workers' Compensation Act and Regulations are available on the work site for review by employees and workers.
  - .8 Workplace Hazardous Materials Information System (WHMIS) documents.
  - .9 Material Safety Data Sheets (MSDS).
  - .10 List of names of Joint Health and Safety Committee members, or Health and Safety Representative, as applicable.
- .2 Post all Material Safety Data Sheets (MSDS) on site, in a common area, visible to all workers and in locations accessible to tenants when work of this Contract includes construction activities adjacent to occupied areas.
- .3 Postings should be protected from the weather, and visible from the street or the exterior of the principal construction site shelter provided for workers and equipment, or as approved by the Departmental Representative.

1.26 MEETINGS

- .1 Attend health and safety pre-construction meeting and all subsequent meetings called by the Departmental Representative.

1.27 CORRECTION OF NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by the Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance with health and safety issues identified.
- .3 The Departmental Representative may issue a "stop work order" if non-compliance of health and safety regulations is not corrected immediately or within posted time. The General Contractor/subcontractors will be responsible for any costs arising from such a "stop work order".

**END OF SECTION 01 35 33**

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## PART 1 – GENERAL

### 1.1 DEFINITIONS

- .1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade environment aesthetically, culturally and/or historically.
- .2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction. Control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

### 1.2 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prior to commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review and approval by Departmental Representative. Environmental Protection Plan is to present comprehensive overview of known or potential environmental issues which must be addressed during construction.
- .3 Address topics at level of detail commensurate with environmental issue and required construction tasks.
- .4 Environmental protection plan to include:
  - .1 Names of persons responsible for ensuring adherence to Environmental Protection Plan.
  - .2 Names and qualifications of persons responsible for manifesting contaminated soils and hazardous waste to be removed from site.
  - .3 Names and qualifications of persons responsible for training site personnel.
  - .4 Descriptions of environmental protection personnel training program.
  - .5 Erosion and sediment control plan which identifies type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.
  - .6 Traffic control plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather. Plans include measures to minimize amount of mud transported onto paved public roads by vehicles or runoff.
  - .7 Spill Control Plan: including procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
  - .8 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.
  - .9 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, do not become air borne and travel off project site.
  - .10 Contaminant prevention plan that: identifies potentially hazardous substances to be used on job site; identifies intended actions to prevent introduction of such materials into air, water, or ground; and details provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.

- .11 Waste water management plan that identifies methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.

### 1.3 HAZARDOUS MATERIALS

- .1 Refer to Section 02 81 01 – Hazardous Materials use and Abatement.

### 1.4 FIRES

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

### 1.5 DISPOSAL OF WASTES

- .1 Do not bury rubbish and waste materials on site.
- .2 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways.

### 1.6 DRAINAGE

- .1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.
- .2 Do not pump water containing suspended materials into waterways, sewer or drainage systems.
- .3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

### 1.7 WORK ADJACENT TO WATERWAY

- .1 Do not dump excavated fill, waste material or debris in waterways.

### 1.8 POLLUTION CONTROL

- .1 Maintain temporary erosion and pollution control features installed under this contract.
- .2 Control emissions from equipment and plant to local authorities' emission requirements.
- .3 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

### 1.9 HISTORICAL/ARCHAEOLOGICAL CONTROL

- .1 Give immediate notice to the Departmental Representative if evidence of archaeological finds are encountered during construction and await written instructions before proceeding with work in the vicinity of any such finds.
- .2 Relics, antiquities and items of historical or scientific interest shall remain the property of the Crown. Protect such articles and request directives from the Departmental Representative.

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1.10 NOTIFICATION

- .1 Departmental Representative will notify Contractor in writing of observed non-compliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.
- .2 Contractor: after receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for 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.

1.11 SPILLS OR RELEASE OF DELETERIOUS SUBSTANCES

- .1 Measures to be implemented to prevent, control or mitigate spills or release of deleterious substances:
  - .1 Contractor shall take due care to ensure no deleterious materials enter any surface drainage pathways located in the project area.
  - .2 Emergency response procedure for spills of deleterious substances must be in place. In the event of a spill, the contractor will immediately implement their Spill Response Protocol.
  - .3 The Contractor is responsible for all costs associated with a spill or release as a result of their actions. This will include but not limited costs of spill response equipment and materials, associated sampling, analysis and any required restoration of the impacted area.
  - .4 Response equipment to be on site at all times (i.e. spill kits) and workers trained in their location and use. The resources on hand must be sufficient to respond effectively and expediently to any spill that could occur on site.
  - .5 All construction equipment brought onto the site will be clean and properly maintained.
  - .6 Any equipment maintenance must occur in a designated area and must be conducted away from any surface water drains or collection points.
  - .7 Any equipment remaining on site overnight shall have appropriately placed drip pans.
  - .8 Waste generated will be prevented from entering the environment.
  - .9 Prevent discharges containing asphalt, grout, concrete or other waste materials from reaching storm drains or the marine environment. This includes, but is not limited to:
    - .1 Cleaning equipment off site; and
    - .2 Protection of any other drainage structures not identified here with filter fences and/or silt socks, if required.
  - .10 Protection of the roadways from tracking of mud, soil and debris needs to be maintained throughout the work.
  - .11 Limit of work activities to normal business hours to minimize noise outside of those hours. Ensure that equipment and machinery is properly maintained to minimize unnecessary noise pollution. Consider local municipal noise bylaws when mobilizing equipment.
  - .12 All utilities must be located prior to excavation.

1.12 IMPORT OF FILL MATERIAL

- .1 Prior to import of any material used for surfacing, backfilling or any other use requiring fill material the Contractor will provide sufficient documentation, as agreed on by Departmental Representative, to ensure that the imported material meets the Canadian Council of Ministers of the Environment (CCME) Residential/Parkland (RL/PL) Land Usage Soil Quality Guidelines.
- .2 Environmental characterization of fill material must be conducted in accordance with the following: British Columbia, Ministry of Environment, Technical Guidance Document #1 – Site Characterization and Confirmation Testing.
- .3 Prior to import of any material the Contractor must inform the Departmental representative of the proposed fill source(s) and identify the nature of current and historic activities conducted at the source.
- .4 The Departmental Representative reserves the right to request additional testing of imported material at the source and at the deposit site to satisfy their requirements. All testing will be done at the Contractor's cost.
- .5 All material brought to the site that does not meet the CCME RL/PL Guidelines will be removed from the property immediately at the Contractors cost.

**END OF SECTION 01 35 43**

## **PART 1 - GENERAL**

### **1.1 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 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, 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.

### **1.2 INDEPENDENT INSPECTION AGENCIES**

- .1 Independent Inspection/Testing Agencies will be engaged by Contractor for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Contractor.
- .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 re-inspection.

### **1.3 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.

### **1.4 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 orderly sequence to not cause delays 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.

#### 1.5 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, Owner will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Departmental Representative.

#### 1.6 REPORTS

- .1 Submit electronic copy of inspection and test reports to Departmental Representative. Testing and Inspection companies engaged by the Contractor will furnish paper copies of reports on site to allow for work to proceed in a timely manner.
- .2 Provide copies to subcontractor of work being, inspected or tested or manufacturer or fabricator of material being inspected or tested.

#### 1.7 TESTS AND MIX DESIGNS

- .1 Furnish test results and mix designs as requested.
- .2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Departmental Representative and may be authorized as recoverable.

#### 1.8 MOCK-UPS

- .1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of Sections required to provide mock-ups.
- .2 Construct in locations acceptable to Departmental Representative as specified in specific Section.
- .3 Prepare mock-ups for Departmental Representative review with reasonable promptness and in orderly sequence, to not cause delays in Work.
- .4 Failure to prepare mock-ups 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.
- .5 If requested, Departmental Representative will assist in preparing 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.

1.9 MILL TESTS

.1 Submit mill test certificates as requested.

1.10 EQUIPMENT AND SYSTEMS

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

**END OF SECTION 01 45 00**

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**PART 1 - GENERAL**

1.1 ACCESS AND DELIVERY

- .1 Contractor is required to use only the designated entrance to access the work site, for deliveries to site, and as the exit for offsite disposal.
  - .1 Maintain for duration of contract.
  - .2 Make good damage resulting from Contractor's use.
  - .3 Maintain road cleanliness utilizing mechanical means from project site to main entrance on a daily basis.
- .2 Provide and maintain access roads, sidewalk crossing ramps and construction runways as may be required for access to the work. All roadways and walkways outside of the Contractor's work site must be kept clear of materials and equipment at all times.

1.2 STORAGE FACILITIES

- .1 Confine work and operations of employees to areas indicated on Contract Documents. Do not unreasonably encumber premises with products. Storage space to be limited to the area of construction.
- .2 Do not load or permit to load any part of Work with weight or force that will endanger Work or existing structure or elements.
- .3 Provide and pay for all off-site storage as required. Refer to site plan for location of Contractor's site storage and lay-down area.

1.3 POWER AND LIGHT

- .1 Arrange, pay for and maintain temporary electric power supply in accordance with local power authority governing regulations and ordinances.
- .2 Electrical power and lighting installed under this contract may be used for construction purposes at no extra cost, provided that guarantees are not affected thereby and electrical components used for temporary power are replaced when damaged.
- .3 Replace lighting bulbs/tubes used for more than three months or provide replacement bulbs/tubes and hand over to Departmental Representative.

1.4 AIR

- .1 Contractor to supply his own compressed air for the duration of the contract.

1.5 WATER SUPPLY

- .1 Provide temporary water supply system for construction purposes.

1.6 SANITARY FACILITIES

- .1 Contractor will provide their own portable sanitary facilities. Maintain in a safe and sanitary condition.

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1.7 TEMPORARY HEATING AND VENTILIATION

- .1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.
- .2 Construction heaters used inside building must be vented to outside or be non flameless type. Solid fuel salamanders are not permitted.
- .3 Provide temporary heat and ventilation in enclosed areas as required to:
  - .1 Facilitate progress of Work.
  - .2 Protect Work and products against dampness and cold.
  - .3 Prevent moisture condensation on surfaces.
  - .4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
  - .5 Provide adequate ventilation to meet health regulations for safe working environment.
- .4 Maintain temperatures of minimum 10 degrees C in areas where construction is in progress.
- .5 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.
  - .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.

1.8 SCAFFOLDING

- .1 Construct and maintain scaffolding in rigid, secure and safemanner.
- .2 Erect scaffolding independent of walls. Remove promptly when no longer required.

1.9 HOISTING

- .1 Provide, operate and maintain hoists required for moving of workers, materials and equipment. Make financial arrangements with Sub-contractors for their use of hoists.
- .2 Hoists shall be operated by qualified operator.

1.10 SITE OFFICE

- .1 Contractor to provide their own trailer as temporary site office.
- .2 Contractor should clear and demolish site office at end of project according to contract requirement.

1.11 REMOVAL OF TEMPORARY FACILITIES

- .1 Remove temporary facilities from site when directed by the Departmental Representative.

1.12 SIGNS AND NOTICES

- .1 Signs and notices for safety and instruction shall be in both official languages or graphic symbols conforming to CAN/CSA-Z321.
- .2 Maintain approved signs and notices in good condition for duration of Project, and dispose of offsite on completion of Project when directed by Departmental Representative.

1.13 CLEAN-UP

- .1 Remove construction debris, waste materials, packaging material from work site daily.
- .2 Clean dirt of mud tracked onto paved or surfaced roadways.
- .3 Store materials resulting from demolition activities that are salvageable.
- .4 Stack stored new or salvaged material not in construction facilities.
- .5 At completion of Project: Remove and dispose of all debris, thoroughly clean and restore site to condition found at commencement of Work. Repair and make good to all damage caused by construction activities.

**END OF SECTION 01 51 00**

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**PART – 1 GENERAL**

1.1 REFERENCES

- .1 Canadian General Standards Board (CGSB)
  - .1 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
  - .2 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.
- .2 Canadian Standards Association (CSA International)
  - .1 CSA-O121-M1978(R2003, Douglas Fir Plywood.
- .3 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions 'C'.

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 GUARD RAILS AND BARRICADES

- .1 Provide secure, rigid guard rails and barricades around deep excavations, openshafts, open stair wells, and open edges of floors and roofs,
- .2 Provide as required by governing authorities.

1.4 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.
- .3 Design enclosures to withstand wind pressure and snow loading.

1.5 ACCESS TO SITE

- .1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.

1.6 PUBLIC TRAFFIC FLOW

- .1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect public.

1.7 FIRE ROUTES

- .1 Maintain access to property including overhead clearances for use by emergency response vehicles.
- .2 Maintain clearance for all egress routes.

1.8 PROTECTION OFF-SITE AND PUBLIC PROPERTY

- .1 Protect surrounding private and public property from damage during performance of Work.
- .2 Be responsible for damage incurred.

1.9 PROTECTION OF EXISTING PROPERTY

- .1 Provide protection for finished and partially finished property 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.

1.10 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

**END OF SECTION 01 56 00**

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## **PART 1 - GENERAL**

### 1.1 PRODUCTS/MATERIAL AND EQUIPMENT

- .1 Use NEW products/material and equipment unless otherwise specified. The term "products" is referred to throughout the specifications.
- .2 Use products of one manufacturer for material and equipment of the same type or classification unless otherwise specified.
- .3 Unless otherwise specified, comply with manufacturer's latest printed instructions for materials and installation methods.
- .4 Notify Departmental Representative in writing of any conflict between these specifications and manufacturer's instructions. Departmental Representative will designate which document is to be followed.
- .5 Provide metal fastenings and accessories in the same texture, colour and finish as base metal in which they occur.
  - .1 Prevent electrolytic action between dissimilar metals.
  - .2 Use non-corrosive fasteners, anchors and spacers for securing exterior work.
  - .3 Fastenings which cause spalling or cracking are not acceptable.
  - .4 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
  - .5 Use heavy hexagon heads, semi-finished unless otherwise specified.
  - .6 Bolts may not project more than 1 diameter beyond nuts.
  - .7 Types of washers as follows:
    - .1 Plain type washers: use on equipment and sheet metal.
    - .2 Soft gasket lock type washers: use where vibrations occur.
    - .3 Resilient washers: use with stainless steel.
  - .8 Deliver, store and maintain packaged material and equipment with manufacturer's seals and labels intact.
  - .9 Prevent damage, adulteration and soiling of products during delivery, handling and storage. Immediately remove rejected products from site.
  - .10 Store products in accordance with suppliers' instructions.
  - .11 Touch up damaged factory finished surfaces to Departmental Representative's satisfaction.
    - .1 Use primer or enamel to match original.
    - .2 Do not paint over nameplates.

### 1.2 QUALITY OF PRODUCTS

- .1 Products, materials and equipment (referred to as products) incorporated into work shall be new, not damaged or defective, and of the best quality (compatible with the specifications) for the purpose intended. If requested, furnish evidence as to type, source and quality of the products provided.
- .2 Defective products will be rejected regardless of previous inspections.
  - .1 Inspection does not relieve responsibility, but is precaution against oversight or error.
  - .2 Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

- .3 Retain purchase orders, invoices and other documents to prove that all products utilized in this Contract meet the requirements of the specifications. Produce documents when requested by the Departmental Representative.
- .4 Should any dispute arise as to quality or fitness of products, the decision rests strictly with the Departmental Representative based upon the requirements of the Contract documents.
- .5 Unless otherwise indicated in the specifications, maintain uniformity of manufacture for any particular or like item throughout the building.
- .6 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.

### 1.3 AVAILABILITY OF PRODUCTS

- .1 Immediately upon signing the Contract, review product delivery requirements and anticipate foreseeable supply delays for any items.
- .2 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 the work.
- .3 In event of failure to notify Departmental Representative at the start of work and should it subsequently appear that the work may be delayed for such reason, the Departmental Representative reserves the right to substitute more readily available products of similar character, at no increase in either the Contract price or the Contract time.

### 1.4 MANUFACTURER'S INSTRUCTIONS

- .1 Unless otherwise indicated in the specifications, install or erect products in accordance with the manufacturer's instructions.
  - .1 Do not rely on labels or enclosures provided with products.
  - .2 Obtain written instructions directly from the manufacturer.
- .2 Notify Departmental Representative in writing of conflicts between the specifications and the manufacturer's instructions so that the Departmental Representative may establish the course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes the Departmental Representative to require removal and reinstallation at no increase in either the Contract price or the Contract time.

### 1.5 CONTRACTOR'S OPTIONS FOR SELECTION OF PRODUCTS FOR TENDERING

- .1 Products are specified by "Prescriptive" specifications: select any product meeting or exceeding specifications.
- .2 Products specified under "Acceptable Products": select any one of the indicated manufacturers, or any other manufacturer meeting or exceeding the Prescriptive specifications and indicated Products.
- .3 Products specified by performance and referenced standard: select any product meeting or exceeding the referenced standard.



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- .4 Products specified to meet particular design requirements or to match existing materials: use only material specified Acceptable Product. Alternative products may be considered provided full technical data is received in writing by Departmental Representative in accordance with "Special Instructions to Tenderers".
  - .5 When products are specified by a referenced standard or by or Performance specifications, upon request of Departmental Representative obtain from manufacturer an independent laboratory report showing that the product meets or exceeds the specified requirements.
- 1.6 SUBSTITUTION AFTER CONTRACT AWARD
- .1 No substitutions are permitted without prior written approval of the Departmental Representative.
  - .2 Proposals for substitution may only be submitted after Contract award. Such request must include statements of respective costs of items originally specified and the proposed substitution.
  - .3 Proposals will be considered by the Departmental Representative if:
    - .1 Products selected by tenderer from those specified are not available;
    - .2 Delivery date of products selected from those specified would unduly delay completion of Contract, or;
    - .3 Alternative product to that specified, which is brought to the attention of and considered by Departmental Representative as equivalent to the product specified, and will result in a credit to the Contract amount.
    - .4 Should the proposed substitution be accepted either in part or in whole, assume full responsibility and costs when substitution affects other work on the project. Pay for design or drawing changes required as result of substitution.
    - .5 Amounts of all credits arising from approval of the substitutions will be determined by the Departmental Representative and the Contract price will be reduced accordingly.

**END OF SECTION 01 61 00**

## **PART 1 - GENERAL**

### 1.1 REFERENCES

- .1 Owner's identification of existing survey control points and property limits.

### 1.2 QUALIFICATIONS OF SURVEYOR

- .1 Qualified registered land surveyor, licensed to practice in the province of British Columbia, acceptable to Departmental Representative.

### 1.3 SURVEY REFERENCE POINTS

- .1 Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.
- .2 Make no changes or relocations without prior written notice to Departmental Representative.
- .3 Report to Departmental Representative when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
- .4 Require surveyor to replace control points in accordance with original survey control.

### 1.4 SURVEY REQUIREMENTS

- .1 Establish two permanent bench marks on site, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.
- .2 Establish lines and levels, locate and lay out, by instrumentation.
- .3 Stake for grading, fill and topsoil placement and landscaping features.
- .4 Stake slopes.
- .5 Establish pipe invert elevations.
- .6 Stake batter boards for foundations.
- .7 Establish foundation and floor elevations.
- .8 Establish lines and levels for mechanical and electrical work.

### 1.5 EXISTING SERVICES

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

### 1.6 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.

#### 1.7 RECORDS

- .1 Maintain a complete, accurate log of control and survey work as it progresses.
- .2 On completion of foundations and major site improvements, prepare a certified survey showing dimensions, locations, angles and elevations of Work.
- .3 Record locations of maintained, re-routed and abandoned service lines.

#### 1.8 SUBMITTALS

- .1 Submit name and address of Surveyor to Departmental Representative.
- .2 On request of Departmental Representative, submit documentation to verify accuracy of field engineering work.
- .3 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform and do not conform with Contract Documents.

#### 1.9 SUBSURFACE CONDITIONS

- .1 Promptly notify Consultant in writing if subsurface conditions at Place of Work differ materially from those indicated in Contract Documents, or a reasonable assumption of probable conditions based thereon.
- .2 After prompt investigation, should Consultant determine that conditions do differ materially, instructions will be issued for changes in Work as provided in Changes and Change Orders.

**END OF SECTION 01 71 00**

## **PART 1 - GENERAL**

### 1.1 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit written request in advance of cutting or alteration which affects:
  - .1 Structural integrity of elements of project.
  - .2 Integrity of weather-exposed or 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 - Submittal Procedures.

### 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.
- .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.
- .5 Provide protection from elements for areas which are to be exposed by uncovering work; maintain excavations free of water.

### 1.4 EXECUTION

- .1 Execute cutting, fitting, and patching including excavation and fill, 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 weather-exposed and 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 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
  - .11 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material, full thickness of the construction element.
  - .12 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.
  - .13 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 recycling in accordance with Section 01 74 19- Waste Management and Disposal.

**END OF SECTION 01 73 00**

## **PART 1 - GENERAL**

### 1.1 PROJECT CLEANLINESS

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, including that caused by Owner or other Contractors.
- .2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.
- .3 Clear snow and ice from access to building, bank/pile snow in designated areas only.
- .4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5 Provide on-site containers for collection of waste materials and debris.
- .6 Provide and use marked separate bins for recycling. Refer to Section 01 74 19 - Waste Management and Disposal.
- .7 Dispose of waste materials and debris off site.
- .8 Clean interior areas prior to start of finishing 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.
- .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 buildings systems.

### 1.2 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 including 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, unless approved by Departmental Representative.

- .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, millwork floors and ceilings.
- .9 Clean lighting reflectors, lenses, and other lighting surfaces.
- .10 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 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
- .14 Remove dirt and other disfiguration from exterior surfaces.
- .15 Clean and sweep gutters.
- .16 Sweep and wash clean paved areas.
- .17 Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.
- .18 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.
- .19 Remove snow and ice from access to buildings.

1.3 **WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for recycling in accordance with Section 01 74 19- Waste Management and Disposal.

**END OF SECTION 01 74 11**

## **PART 1 - GENERAL**

### 1.1 WASTE MANAGEMENT GOALS

- .1 Prior to start of Work conduct meeting with Departmental Representative to review and discuss PWGSC's Waste Management Plan and Goals.
- .2 Accomplish maximum control of solid construction waste.
- .3 Preserve environment and prevent pollution and environment damage.

### 1.2 DEFINITIONS

- .1 Class III: non-hazardous waste - construction renovation and waste.
- .2 Cost/Revenue Analysis Workplan (CRAW): based on information from WRW, and intended as financial tracking tool for determining economic status of waste management practices.
- .3 Inert Fill: inert waste - exclusively asphalt and concrete.
- .4 Materials Source Separation Program (MSSP): consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.
- .5 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.
- .6 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .7 Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- .8 Reuse: repeated use of product in same form but not necessarily for same purpose.  
Reuse includes:
  - .1 Returning reusable items including pallets or unused products to vendors.
- .9 Separate Condition: refers to waste sorted into individual types.
- .10 Source Separation: acts of keeping different types of waste materials separate beginning from first time they became waste.
- .11 Waste Audit (WA): detailed inventory of materials in building. Involves quantifying by volume/weight amounts of materials and wastes generated during construction. Indicates quantities of reuse, recycling and landfill. Refer to Schedule A.
- .12 Waste Management Co-ordinator (WMC): contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.
- .13 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. Refer to Schedule B. WRW is based on information acquired from WA (Schedule A).



1.3 DOCUMENTS

- .1 Maintain at job site, one copy of following documents:
  - .1 Waste Audit.
  - .2 Waste Reduction Workplan.
  - .3 Material Source Separation Plan.
  - .4 Schedules completed for project.

1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare and submit following prior to project start-up:
  - .1 Submit 2 copies of completed Waste Reduction Workplan (WRW): Schedule B.
  - .2 Submit 2 copies of Materials Source Separation Program (MSSP) description.

1.5 WASTE AUDIT (WA)

- .1 Conduct WA prior to project start-up.
- .2 Prepare WA: Schedule A.
- .3 Record, on WA - Schedule A, extent to which materials or products used consist of recycled or reused materials or products.

1.6 WASTE REDUCTION WORKPLAN (WRW)

- .1 Prepare WRW prior to project start-up.
- .2 WRW should include but not limited to:
  - .1 Destination of materials listed.
  - .2 Location.
  - .3 Security.
  - .4 Protection.
  - .5 Clear labelling of storage areas.
  - .6 Details on materials handling and removal procedures.
  - .7 Quantities for materials to be salvaged for reuse or recycled and materials sent to landfill.
- .3 Structure WRW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.
- .4 Describe management of waste.
- .5 Identify opportunities for reduction, reuse, and recycling of materials. Based on information acquired from WA.
- .6 Post WRW or summary where workers at site are able to review content.
- .7 Set realistic goals for waste reduction, recognize existing barriers and develop strategies to overcome these barriers.
- .8 Monitor and report on waste reduction by documenting total volume and cost of actual waste removed from project.

- 1.7 MATERIALS SOURCE SEPARATION PROGRAM (MSSP)
  - .1 Prepare MSSP and have ready for use prior to project start-up.
  - .2 Implement MSSP for waste generated on project in compliance with approved methods and as reviewed by Departmental Representative.
  - .3 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.
  - .4 Provide containers to deposit reusable and recyclable materials.
  - .5 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.
  - .6 Locate separated materials in areas which minimize material damage.
  - .7 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition.
    - .1 Transport to approved and authorized recycling facility.
  
- 1.8 STORAGE, HANDLING AND PROTECTION
  - .1 Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representative.
  - .2 Unless specified otherwise, materials for removal become Contractor's property.
  - .3 Protect surface drainage, mechanical and electrical from damage and blockage.
  - .4 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.
    - .1 On-site source separation is recommended.
    - .2 Remove co-mingled materials to off-site processing facility for separation.
    - .3 Provide waybills for separated materials.
  
- 1.9 DISPOSAL OF WASTES
  - .1 Do not bury rubbish or waste materials.
  - .2 Do not dispose of waste, volatile materials, mineral spirits, oil, paint thinner, into waterways, storm, or sanitary sewers.
  - .3 Keep records of construction waste including:
    - .1 Number and size of bins.
    - .2 Waste type of each bin.
    - .3 Total tonnage generated.
    - .4 Tonnage reused or recycled.
    - .5 Reused or recycled waste destination.

1.10 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises.
- .2 Provide temporary security measures approved by Departmental Representative.

1.11 SCHEDULING

- .1 Co-ordinate Work with other activities at site to ensure timely and orderly progress of Work.

2.1 PRODUCTS

2.2 NOT USED

- .1 Not Used.

3.1 **EXECUTION**

3.2 APPLICATION

- .1 Do Work in compliance with WRW.
- .2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

3.3 CLEANING

- .1 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.
- .2 Clean-up work area as work progresses.
- .3 Source separate materials to be reused/recycled into specified sort areas.

3.4 DIVERSION OF MATERIALS

- .1 From following list, separate materials from general waste stream and stockpile in separate piles or containers, as reviewed by Departmental Representative, and consistent with applicable fire regulations.
  - .1 Mark containers or stockpile areas.
  - .2 Provide instruction on disposal practices.
- .2 On-site sale of salvaged recovered reusable and/or recyclable materials is not permitted.

.3 Demolition Waste:

Material Type	Recommended Diversion %	Actual Diversion %
Acoustical Insulation	100	
Doors and Frames	100	
Electrical Equipment	80	
Mechanical Equipment	100	
Metals	100	
Rubble	100	
Wood (uncontaminated)	100	
Other		

.4 Construction Waste:

Material Type	Recommended Diversion %	Actual Diversion %
Cardboard	100	
Plastic Packaging	100	
Rubble	100	
Steel	100	
Wood (uncontaminated)	100	
Other		

3.5 WASTE AUDIT (WA)

The following pertains to Schedule A - Waste Audit (WA). Column-1 refers to the category of waste, and a physical description of the material (e.g. off-cuts, clean drywall, etc.). Column-2 refers to the total quantity of materials received by the Contractor. Measurement units must be specified. Column-3 refers to the estimated percentage of material that is waste. Column-4 refers to the total quantity of waste (column-2 x column-3). Column-5 refers to the areas(s) in which the waste was generated. Column-6 refers to the total percentage of recycled material from the specified total quantity of waste (column-4). Column-7 refers to the total percentage of reused material from the specified total quantity of waste (column-4).

.1 Schedule A - Waste Audit (WA):

(1) Material Category	(2) Material Quantity Unit %	(3) Estimated Waste	(4) Total Quantity of Waste (unit)	(5) Generation Point	(6) % Recycled	(7) % Reused
Wood & Plastics						
Material Description						
Off-Cuts						
Warped						
Plastic						
Cardboard						
Other						
Doors & Windows						
Material Description						
Frames						
Glass						
Wood						
Metal						

3.6 WASTE REDUCTION WORKPLAN (WRW)

The following pertains to Schedule B - Waste Reduction Workplan (WRW). Column-1 refers to the category and type of waste materials. Column-2 refers to the persons responsible for completing the WRW. Column-3 refers to Column-4 of Schedule A. Column-4 refers to the amount of reused waste predicted and realized. Column-5 refers to the amount of recycled waste predicted and realized. Column-6 refers to the approved recycling facility.

.1 Schedule B:

(1) Material Quantity Category	(2) Person Amount Responsible Waste	(3) Total of Project (unit)	(4) Reused Actual (units)	(5) Recycle Actual (s) Amount	(6) Material Destination (s)
Wood & Plastics					
Material Description					
Chutes					
Warped Plastic					
Cardboard Packaging					
Other					
Doors & Windows					
Material Description					
Painted					
Frames					
Glass					
Wood					
Metal					
Other					

3.7 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT

.1 Schedule E - Government Chief Responsibility for the Environment:

- .1 Ministry of Environment Lands and Parks  
810 Blanshard Street, 4<sup>th</sup> Floor  
Victoria, BC V8V 1X4  
604-387-1161 / 604-356-6464
- .2 Waste Reduction Commission Soils and Hazardous Waste  
770 South Pacific Blvd, Suite 303  
Vancouver BC, V6B 5E7  
604-660-9550 / 604-660-9596

**PART 1 - GENERAL**

1.1 SECTION INCLUDES

- .1 Administrative procedures preceding preliminary and final inspections of Work.

1.2 RELATED SECTIONS

- .1 Section 01 78 00 - Closeout Submittals.

1.3 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 3 weeks prior to the satisfactory completion site visit of the Contractor's Inspection to allow Departmental Representative to schedule relevant authorities.
  - .2 Attend Departmental Representative's Inspection.
  - .3 Departmental Representative's Review: Departmental Representative and Contractor will perform review of Work to identify obvious defects or deficiencies. Contractor and Departmental Representative will agree to the values set forth in the deficiencies identified in the Certificate of Final Completion and set a schedule of completion for all deficiencies.
  - .4 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 authorities having jurisdiction.
    - .5 Commissioning of all systems: Final commissioning reports have been submitted to the Departmental Representative.
    - .6 Operation of systems have been demonstrated to Owner's personnel.
    - .7 Work is complete and ready for Final Inspection.
- .2 Submit required forms as described in General Conditions and Standard Acquisition Contract Clause (SACC) manual.

**END OF SECTION 01 77 00**

**PART 1 - GENERAL**

1.1 RELATED SECTIONS

.1	General Instructions:	Section 01 11 55
.2	Quality Control	Section 01 45 00
.3	Examination & Preparation	Section 01 71 00
.4	Closeout Procedures	Section 01 77 00
.5	Demonstration and Training	Section 01 79 00
.6	General Commissioning CX Requirements	Section 01 91 31
.7	Building Management Manual	Section 01 91 51

1.2 SUBMISSION

- .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .2 Copy of operating and maintenance manual will be returned after Substantial Completion Inspection, with Departmental Representative's comments.
- .3 Revise content of documents as required prior to formal submittal.
- .4 Two weeks prior to Substantial Completion of the Work, submit to the Departmental Representative, four draft copies of operating and maintenance manuals in English.
- .5 An electronic copy Interactive Operating and Maintenance Manual System is required as specified under clause 1.3. Provide 4 sets of the Electronic Interactive Operating and Maintenance Manual System to the Departmental Representative.
- .6 Hard copies of the Operating and Maintenance Manual System is required as specified under clause 1.4. Provide 4 sets of the Hard Copy Interactive Operating and Maintenance Manual System to the Departmental Representative.
- .7 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.
- .8 If requested, furnish evidence as to type, source and quality of products provided.
- .9 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .10 Pay costs of transportation.
- .11 Certificate of Completion.



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1.3 INTERACTIVE OPERATING AND MAINTENANCE MANUAL SYSTEM

- .1 In addition to the printed copies, submit provide an Interactive Operating and Maintenance Manual System as specified herein.
- .2 System Description and Requirements
  - .1 All as constructed drawings and operation and maintenance (O&M) manuals listed under the Scope of Work shall be converted, where necessary, into Portable Data File (PDF) format for viewing using the Adobe Acrobat Reader.
  - .2 Documentation storage and retrieval system shall be structured based on a database framework with direct links to the appropriate PDF files. Documents retrieval and viewing shall be executed through a menu driven approach.
- .3 Program shall be capable of storing separately and independently data of multiple buildings and shall be expandable for addition of new buildings and systems.
- .4 Data of each building shall be accessible by the input of either the building name or building number as defined by the Departmental Representative.
- .5 O&M data and as constructed drawings shall be classified by their corresponding disciplines, including:
  - .1 Architectural
  - .2 Mechanical
  - .3 Electrical
  - .4 Data & Communication
  - .5 BSCS
  - .6 Under each discipline, data shall be grouped into the following four major categories:
    - .1 Basic Documents
      - .1 'Basic Documents' shall, according to the type of services or disciplines, include the full contents of each hard copy of the O&M manuals with the addition of Miscellaneous Maintenance Reports and Records, or as defined by the user. In general the following shall be included unless specifically excluded by the Departmental Representative:
        - .1 Introduction
        - .2 Consultant/Contractor/Suppliers List
        - .3 System Description
        - .4 Maintenance and Lubrication Schedules
        - .5 Testing and Commissioning (T&C) Reports
        - .6 Misc. Reports
        - .7 Specifications
        - .8 Equipment and/or point schedules as identified in the hard copy documents
        - .9 Others as stipulated by the Departmental Representative
      - .2 All Basic Documents PDF files shall be enhanced with appropriate bookmarks to facilitate searching of information within the document or linking to other relevant documents for references.
    - .2 'As-Constructed' Drawings
      - .1 'As-Constructed' drawings shall be converted from the original electronic files, such as CAD, into PDF format. If only the hard copies of the 'as constructed' drawings are available, they shall

be scanned and saved in PDF format. PDF files of the 'As-Constructed' drawings shall be enhanced with the following bookmarks to zoom into legible views on the computer screen as a minimum:

- .1 Drawing Number and Title
  - .2 Drawing Notes
  - .3 Major Equipment Locations
  - .4 Cross-links to other related drawings
  - .5 Revisions
- .3 System Data
- .1 Building systems shall be identified by their services, disciplines, function, nature and specific scope. System data shall be classified into the following categories:
    - .1 System Description
    - .2 Schematic (where applicable)
    - .3 Equipment List
  - .2 Provide hot key buttons, where applicable, for direct access to drawings/data referenced on the schematics. The same shall be applied to listed equipment for direct links to the corresponding equipment data.
- .4 Equipment Data
- .1 Equipment data shall be classified into the following categories:
    - .1 Equipment submittals
    - .2 T&C Report
    - .3 Maintenance Data
    - .4 Maintenance Records
    - .5 Photo
  - .2 Provide a summary screen to list all equipment classified under a specific system. On the summary screen, provide direct links to the corresponding equipment data under each category with addition links to the relevant 'As Constructed' drawings.
- .6 The system shall be executed by Professional Engineers with a minimum of 10 years post qualification experience in the field of Building Services Engineering.
- .7 The Contractor shall provide a minimum of 3 past job references as proven record of similar undertakings.
- .8 The Contractor shall provide a demonstration of the system to the Departmental Representative to provide verification that the requirements of the specification are fulfilled.

#### 1.4 FORMAT HARD COPY MANUALS

- .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 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 on CD.

#### 1.5 CONTENTS - EACH VOLUME

- .1 Table of Contents: provide title of project;
  - .1 date of submission;
  - .2 names, addresses, and telephone and fax numbers of Contractor, Subcontractors, Suppliers with name of responsible parties;
  - .3 schedule of products and systems, indexed to content of volume.
  - .4 copy of hardware schedule and paint schedules, complete with the actual manufacturer, supplier and identification names and numbers.
  - .5 all extended guarantees, warranties, maintenance bonds, certificates, letters of guarantees, registration cards, as called for in the various sections of the specification.
  - .6 complete set of all final reviewed shop drawings.
  - .7 certificates of inspection by authorities having jurisdiction.
  - .8 test reports and certificates as applicable.
  - .9 complete set of as constructed drawings.
- .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.
- .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 - Quality Control.
- .6 Training: Refer to Section 01 79 00 - Demonstration and Training.

1.6 'AS CONSTRUCTED' DRAWINGS AND SAMPLES

- .1 In addition to requirements in General Instructions, maintain at the site one record copy of:
  - .1 Contract Drawings.
  - .2 Specifications.
  - .3 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.
- .6 Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring. Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed. Use different colour waterproof ink for each service.
- .7 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings. 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).
- .8 Provide an electronic copy of as constructed drawings.

1.7 RECORDING ACTUAL SITE CONDITIONS

- .1 Record information on set of black line opaque drawings, 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 depths of elements of foundation in relation to finish first floor datum.
  - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

- .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
  - .4 Field changes of dimension and detail.
  - .5 Changes made by change orders.
  - .6 Details not on original Contract Drawings.
  - .7 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 Addenda and change orders.
- .6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

## 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.
- .1 Operation data to include:
    - .1 Control schematics for systems including environmental controls.
    - .2 Description of systems and their controls.
    - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
    - .4 Operation instruction for systems and component.
    - .5 Description of actions to be taken in event of equipment failure.
    - .6 Valves schedule and flow diagram.
    - .7 Colour coding chart.
  - .2 Maintenance data to include:
    - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
    - .2 Data to include schedules of tasks, frequency, tools required and task time.
    - .3 Description of plumbing specialties and accessories, giving manufacturer's name, type, model, year, capacity. List of recommended spare parts.
  - .3 Performance data to include:
    - .1 Equipment performance verification test results.
    - .2 Special performance data as specified.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
  - .6 Provide servicing and lubrication schedule, and list of lubricants required.
  - .7 Include manufacturer's printed operation and maintenance instructions.
  - .8 Include sequence of operation by controls manufacturer.
  - .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
  - .10 Provide installed control diagrams by controls manufacturer.
  - .11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.
  - .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
  - .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
  - .14 Include test and balancing reports as specified in Section 01 45 00 - Quality Control and 01 91 13 – General Commissioning (Cx) Requirements.
  - .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 and Weather-exposed 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.
  - .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 finalpayment.

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 the Operating and Maintenance Manuals.
- .5 Obtain receipt for delivered products and submit prior to finalpayment.

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 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.

**END OF SECTION 01 78 00**



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## PART 1 - GENERAL

### 1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Demonstrate scheduled operation and maintenance of equipment and systems to Owner's personnel two weeks prior to date of substantial performance.
- .2 Owner: provide list of personnel to receive instructions, and co-ordinate their attendance at agreed-upon times.
- .3 Preparation:
  - .1 Verify conditions for demonstration and instructions comply with requirements.
  - .2 Verify designated personnel are present.
  - .3 Ensure equipment has been inspected and put into operation in accordance with Division.
  - .4 Ensure testing, adjusting, and balancing has been performed in accordance with Section 23 08 00 Commissioning of Mechanical Systems.
- .4 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 equipment location.
  - .2 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.
  - .3 Review contents of manual in detail to explain aspects of operation and maintenance.
  - .4 Prepare and insert additional data in operations and maintenance manuals when needed during instructions.
- .5 Time Allocated for Instructions: ensure adequate amount of time required for instruction of each item of equipment or system.

### 1.2 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit schedule of time and date for demonstration of each item of equipment and each system two 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 Give time and date of each demonstration, with list of persons present.
- .5 Provide electronic & hard copies (Refer to Section 01 78 00 Closeout Submittals) of completed operation and maintenance manuals for use in demonstrations and instructions.

1.3 QUALITY ASSURANCE

- .1 When specified in individual Sections requiring manufacturer to provide authorized representative to demonstrate operation of equipment and systems:
  - .1 Instruct Owner's personnel.
  - .2 Provide written report that demonstration and instructions have been completed.

**END OF SECTION 01 79 00**

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**Part 1            GENERAL**

1.1            RELATED REQUIREMENTS

- .1            Section 01 33 00 – Submittal Procedures
- .2            Section 01 35 33 – Health and Safety Requirements
- .3            Section 01 74 19 – Construction/Demolition Waste Management Disposal
- .4            Section 01 74 11 – Cleaning
- .5            Section 02 82 00 – Asbestos Abatement – Minimum Precautions

1.2            REFERENCES

- .1            Reports:
  - .1            Hazardous Building Materials Assessment, Implement and Equipment Storage Shed, Agriculture and Agri-Food Canada Research Facility, Abbotsford, BC, by SNC-Lavalin Inc., dated November 16, 2017 (further referred to herein as the Assessment Report). The Assessment Report is attached in the Appendix of the Project Specifications.
- .2            Definitions:
  - .1            Dangerous Goods: product, substance, or organism specifically listed or meets hazard criteria established in Transportation of Dangerous Goods Regulations.
  - .2            Hazardous Material: product, substance, or organism used for its original purpose; and is either dangerous goods or material that will cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.
  - .3            Hazardous Waste: hazardous material no longer used for its original purpose and that is intended for recycling, treatment or disposal.
  - .4            Hazardous Building Material: component of a building or structure that will cause adverse impact to environment or adversely affect health of persons, animals, or plant life when altered, disturbed or removed during maintenance, renovation or demolition.
- .3            Reference Standards:
  - .1            Canadian Environmental Protection Act, 1999 (CEPA 1999)
    - .1            Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2005-149).
  - .2            Department of Justice Canada
    - .1            Transportation of Dangerous Goods Act, 1992 (TDG Act) [1992], (c. 34).
    - .2            Transportation of Dangerous Goods Regulations (T-19.01-SOR/2001-286).
  - .3            Health Canada / Workplace Hazardous Materials Information System (WHMIS)
    - .1            Material Safety Data Sheets (MSDS).

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- .4 National Research Council Canada Institute for Research in Construction (NRC-IRC)
    - .1 National Fire Code of Canada (2010).
  - .5 WorkSafeBC
    - .1 British Columbia's Occupational Health and Safety Regulation (BC Reg. 296/97, including amendments to date of work)
    - .2 "Safe Work Practices for Handling Asbestos" (2017)
    - .3 "Safe Work Practices for Handling Lead" (2017)
  - .6 British Columbia Hazardous Waste Regulation (BC Reg. 63/88, including amendments to date of work)
  - .7 The Federal PCB Regulations (SOR/2008-273, including amendments to date of work)
  - .8 The British Columbia Environmental Management Act - Ozone Depleting Substances and Other Halocarbons Regulation (BC Reg. 387/99, including amendments to date of work)
  - .9 The Federal Halocarbons Regulation (July 2003) and Regulations Amending the Federal Halocarbon Regulations, 2003 (SOR/2009-221)
  - .10 Canadian Construction Association
    - .1 Standard Construction Document CCA 82 "Mould Guidelines for the Canadian Construction Industry" (2004)
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Product Data for hazardous materials to be used by the Contractor to complete the Work:
    - .1 Submit manufacturer's instructions, printed product literature and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.
    - .2 Submit two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements to Departmental Representative for each hazardous material required prior to bringing hazardous material on site.
    - .3 Submit exposure control plan to Departmental Representative that identifies hazardous materials, usage, location, personal protective equipment requirements, and disposal arrangements.
    - .4 Construction/Demolition Waste Management:
      - .1 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating percentage of construction/demolition wastes were recycled or salvaged
    - .5 Low-Emitting Materials: submit listing of adhesives and sealants used in building, comply with VOC and chemical component limits or restrictions requirements.
- 1.4 DELIVERY, STORAGE AND HANDLING
- .1 Deliver, store and handle hazardous materials to be used by the Contractor to complete the Work in accordance with manufacturer's written instructions.
  - .2 Delivery and Acceptance Requirements: deliver hazardous materials to be used by the Contractor to site in original factory packaging, labelled with manufacturer's name and address.

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- .3 Transport hazardous materials and wastes in accordance with Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations..
  - .4 Storage and Handling Requirements:
    - .1 Co-ordinate storage of hazardous materials to be used by the Contractor to complete the Work with Departmental Representative and abide by internal requirements for labelling and storage of materials and wastes.
    - .2 Store and handle hazardous materials and wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.
    - .3 Store and handle flammable and combustible materials in accordance with National Fire Code of Canada requirements.
    - .4 Keep no more than 45 litres of flammable and combustible liquids such as gasoline, kerosene and naphtha for ready use.
      - .1 Store flammable and combustible liquids in approved safety cans bearing the Underwriters' Laboratory of Canada or Factory Mutual seal of approval.
      - .2 Storage of quantities of flammable and combustible liquids exceeding 45 litres for work purposes requires the written approval of the Departmental Representative.
    - .5 Transfer of flammable and combustible liquids is prohibited within buildings.
    - .6 Transfer flammable and combustible liquids away from open flames or heat-producing devices.
    - .7 Solvents or cleaning agents must be non-flammable or have flash point above 38 degrees C.
    - .8 Store flammable and combustible waste liquids for disposal in approved containers located in safe, ventilated area. Keep quantities to minimum.
    - .9 Observe smoking regulations, smoking is prohibited in areas where hazardous materials are stored, used, or handled.
    - .10 Storage requirements for quantities of hazardous materials and wastes in excess of 5 kg for solids, and 5 litres for liquids:
      - .1 Store hazardous materials and wastes in closed and sealed containers.
      - .2 Label containers of hazardous materials and wastes in accordance with WHMIS.
      - .3 Store hazardous materials and wastes in containers compatible with that material or waste.
      - .4 Segregate incompatible materials and wastes.
      - .5 Ensure that different hazardous materials or hazardous wastes are stored in separate containers.
      - .6 Store hazardous materials and wastes in secure storage area with controlled access.
      - .7 Maintain clear egress from storage area.
      - .8 Store hazardous materials and wastes in location that will prevent them from spilling into environment.
      - .9 Have appropriate emergency spill response equipment available near storage area, including personal protective equipment.
      - .10 Maintain inventory of hazardous materials and wastes, including product name, quantity, and date when storage began.

- .11 When hazardous waste is generated on site:
  - .1 Co-ordinate transportation and disposal with Departmental Representative.
  - .2 Comply with applicable federal, provincial and municipal laws and regulations for generators of hazardous waste.
  - .3 Use licensed carrier authorized by provincial authorities to accept subject material.
  - .4 Before shipping material obtain written notice from intended hazardous waste treatment or disposal facility it will accept material and it is licensed to accept this material.
  - .5 Label containers with legible, visible safety marks as prescribed by federal and provincial regulations.
  - .6 Only trained personnel handle, offer for transport, or transport dangerous goods.
  - .7 Provide photocopy of shipping documents and waste manifests to Departmental Representative.
  - .8 Track receipt of completed manifest from consignee after shipping dangerous goods. Provide photocopy of completed manifest to Departmental Representative.
  - .9 Report discharge, emission, or escape of hazardous materials immediately to Departmental Representative and appropriate provincial authority. Take reasonable measures to control release.
- .12 Ensure personnel have been trained in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements.
- .13 Report spills or accidents immediately to Departmental Representative. Submit a written spill report to Departmental Representative within 24 hours of incident.
- .5 Include provisions for Work of this Section in Waste Reduction Workplan as outlined in Section 01 74 19 – Construction/Demolition Waste Management and Disposal.

**Part 2 PRODUCTS**

2.1 MATERIALS

- .1 Description:
  - .1 Bring on site only quantities hazardous material required to perform Work.
  - .2 Maintain MSDS in proximity to where materials are being used. Communicate this location to personnel who may have contact with hazardous materials.

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**Part 3 EXECUTION**

**3.1 HAZARDOUS MATERIALS ABATEMENT**

**.1 Scope of Abatement Activities.**

- .1 Abatement shall be conducted to handle, alter, remove and/or dispose of hazardous building materials as identified in the Assessment Report in accordance with applicable regulations, guidelines, standards and/or best practices for such work, where such identified hazardous building materials will be impacted (handled, altered, damaged, removed) by the Work.
- .2 Contractor is responsible for reviewing plans, specifications and reports such that they understand the locations and amounts of hazardous materials that will be impacted by the Work of this contract, and such that appropriate plans and budgets can be included in their overall bids.
- .3 The listing below is a summary of the identified hazardous building material categories and associated removal and disposal regulations, guidelines and/or standards.
  - .1 Asbestos-Containing Materials (ACMs)
    - .1 Refer to the Assessment Report for identities and locations of ACMs that may require disturbance during the Work.
    - .2 Actions that will disturb identified ACMs are to be conducted in accordance with the requirements of the 2017 WorkSafeBC publication "Safe Work Practices for Handling Asbestos", by appropriately trained personnel.
    - .3 Waste transportation to be conducted in accordance with BC Reg. 63/88 and the Federal Transportation of Dangerous Goods Regulation.
    - .4 Waste disposal to be conducted in accordance with BC Reg. 63/88.
    - .5 Notify Departmental Representative of suspected ACM discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material pending instructions from Departmental Representative.
  - .2 Lead and Lead-Containing Paints (LCPs)
    - .1 Refer to the Assessment Report for identities and locations of lead-containing materials (including LCPs) that may require disturbance during the Work.
    - .2 Actions that will disturb lead-containing materials (including paints and materials coated with LCPs) are to be conducted in accordance with the requirements of the current version of the WorkSafeBC publication "Safe Work Practices for Handling Lead", keeping airborne exposure to lead dust to less than the 8-hour Occupational Exposure Limit (OEL) for lead of 0.05 milligram per cubic metre of air (mg/m<sup>3</sup>).
    - .3 Although LCPs and items coated with LCPs will be disturbed and/or removed for disposal during the Work, unless deemed necessary through risk assessment or cost analysis conducted by the Contractor, comprehensive removal of LCPs from items or surfaces is not expected to be required during the Work.

- .1 Refer to the provisions of the 2017 WorkSafeBC publication "Safe Work Practices for Handling Lead" for removal of LCPs from surfaces before any welding and torch-cutting, should the Contractor plan to use such methods to complete the Work.
  - .1 Contractor will be responsible for verification testing of surfaces where LCPs have been removed. Confirmation of acceptable results is to be provided to the Departmental Representative for review before proceeding with any welding or torch-cutting on surfaces where LCPs were present.
- .4 Waste transportation to be conducted in accordance with BC Reg. 63/88 and the Federal Transportation of Dangerous Goods Regulation.
- .5 Waste disposal to be conducted in accordance with BC Reg. 63/88.
- .3 Polychlorinated Biphenyls (PCBs)
  - .1 When decommissioned, verify the PCB content of high intensity discharge lamp ballasts as per the Environment Canada publication Identification of Lamp Ballasts Containing PCBs, 1991.
  - .2 Should a material suspected to contain PCBs become uncovered during renovation activities (i.e., dielectric fluids, hydraulic fluids), all work in the areas that may disturb the material should be stopped. Samples of the suspect material should be submitted for laboratory analysis to determine if PCBs are present.
  - .3 PCB-containing items identified for removal and disposal should be handled, transported, stored and disposed of in accordance with the following:
    - .1 The transportation and disposal requirements of BC Reg. 63/88 .
    - .2 The transportation requirements of the Federal Transportation of Dangerous Goods Regulation.
    - .3 The Federal PCB Regulations (SOR/2008-273)
- .4 Mould
  - .1 Removal, alteration and/or disposal of mould-impacted materials is not anticipated to be required during the Work.
- .5 Mercury
  - .1 When mercury-containing items are removed, ensure all mercury waste is handled, stored and disposed of in accordance with the requirements the following:
    - .1 The transportation and disposal requirements of BC Reg. 63/88.
    - .2 The transportation requirements of the Federal Transportation of Dangerous Goods Regulation.



- .2 Precautions should be taken if workers may potentially be exposed to mercury or mercury vapours to ensure that workers exposure levels do not exceed the occupational exposure limit of 0.025 mg/m<sup>3</sup> as per the BC Reg. 296/97. This can be achieved by providing respiratory and skin protection applicable to the hazard and task to be completed.
- .6 Ozone-Depleting Substances (ODSs)
  - .1 When ODS-containing equipment is to be removed, ODSs must be recovered, handled, recycled, stored, and/or disposed of in accordance with the requirements of the following:
    - .1 British Columbia Environmental Management Act—Ozone Depleting Substances and Other Halocarbons Regulation (BC Reg. 387/99 as amended by BC Reg. 317/2012).
    - .2 The transportation requirements of the Federal Transportation of Dangerous Goods Act and Regulations.
    - .3 The Federal Halocarbons Regulations.
- .7 Silica
  - .1 When silica-containing materials are to be disturbed and/or removed (e.g., demolition of concrete slabs and concrete foundations), ensure dust control measures are employed such that airborne silica dust concentrations do not exceed 50% of the exposure limit as stipulated by BC Reg. 296/97. This would include, but not be limited to, the following:
    - .1 Development of an exposure control plan
    - .2 Providing workers with respiratory protection
    - .3 Wetting the surface of the materials, use of water or dust suppressing agents to prevent dust emissions
    - .4 Providing workers with facilities to properly wash prior to exiting the work area.

### 3.2 AIR MONITORING

- .1 From beginning of Work until completion of cleaning operations, Departmental Representative to take air samples inside and outside of Asbestos Work Area enclosure[s] in accordance with British Columbia's Occupational Health and Safety Regulation and the current version of the WorkSafeBC Manual entitled "Safe Work Practices for Handling Asbestos".
  - .1 Departmental Representative will be responsible for monitoring inside enclosure in accordance with applicable Provincial Occupational Health and Safety Regulations.
- .2 If air monitoring shows that areas outside Asbestos Work Area enclosure[s] are contaminated, enclose, maintain and clean these areas in same manner as that applicable to Asbestos Work Area, at no additional cost to the Contract
- .3 Ensure that respiratory safety factors are not exceeded.

- 3.3 CLEANING
- .1 Progress Cleaning: clean in accordance with Section 01 74 11 – Cleaning. 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 – Cleaning.
  - .3 Waste Management: separate waste materials for reuse and recycling.
    - .1 Dispose of hazardous waste materials in accordance with applicable federal and provincial acts, regulations, and guidelines.
    - .2 Recycle hazardous wastes for which there is approved, cost effective recycling process available.
    - .3 Send hazardous wastes to authorized hazardous waste disposal or treatment facilities.
    - .4 Burning, diluting, or mixing hazardous wastes for purpose of disposal is prohibited.
    - .5 Disposal of hazardous materials in waterways, storm or sanitary sewers, or in municipal solid waste landfills is prohibited.
    - .6 Dispose of hazardous wastes in timely fashion in accordance with applicable federal and provincial regulations.
    - .7 Minimize generation of hazardous waste to maximum extent practicable. Take necessary precautions to avoid mixing clean and contaminated wastes.
    - .8 Identify and evaluate recycling and reclamation options as alternatives to land disposal, such as:
      - .1 Hazardous wastes recycled in manner constituting disposal.
      - .2 Hazardous waste burned for energy recovery.
      - .3 Lead-acid battery recycling.
      - .4 Hazardous wastes with economically recoverable precious metals.

**END OF SECTION 02 81 01**

**Part 1 GENERAL**

1.1 SUMMARY

- .1 Refer to the Assessment Report(s) the Appendix for information pertaining to the asbestos-containing materials (ACMs) that have been identified and that may be impacted by the Work.
- .2 Unless otherwise determined through risk assessment conducted by a qualified person, comply with requirements of this Section when disturbance to the following materials is required to complete the Work:
  - .1 Asbestos-containing mastics
    - .1 Black mastic located around the perimeter of the window frame (i.e., between the metal siding and the wooden frame and casing).
    - .2 Tan window putty located between the window pane and frame.

1.2 SECTION INCLUDES

- .1 Requirements and procedures for applicable procedures and personal protective equipment to be utilized during set-up of asbestos abatement work areas and for abatement of ACMs of the type described within.

1.3 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 35 33 - Health and Safety Requirements
- .3 Section 02 81 01 – Hazardous Materials Use and Abatement

1.4 REFERENCES

- .1 Department of Justice Canada (Jus)
  - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .3 Transport Canada (TC)
  - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
- .4 Underwriters' Laboratories of Canada (ULC)
- .5 WorkSafe BC
  - .1 British Columbia's Occupational Health and Safety Regulation (BC Reg. 296/97, including amendments to date of work)
  - .2 "Safe Work Practices for Handling Asbestos" (2017 Edition)
- .6 The current version of the British Columbia Hazardous Waste Regulation (BC Reg. 63/88)

1.5 DEFINITIONS

- .1 Air Monitoring - The process of measuring the fibre content of a known volume of air collected during a specific period of time, in accordance with the Workers Compensation Board of British Columbia Occupational Health and Safety Regulation.
- .2 Amended Water: water with non-ionic surfactant wetting agent added to reduce water tension to allow thorough wetting of fibres.
- .3 Asbestos-Containing Materials (ACMs): materials that contain 0.5 per cent or more asbestos by dry weight (or vermiculite insulation materials with any asbestos) and are identified under Existing Conditions including fallen materials and settled dust.
- .4 Asbestos Work Area: area where work takes place which will, or may, disturb ACMs.
- .5 Authorized Visitors: Departmental Representative and representatives of regulatory agencies
- .6 Competent worker: in relation to specific work, means a worker who:
  - .1 Is qualified because of knowledge, training and experience to perform the work.
  - .2 Is familiar with the provincial and federal laws and with the provisions of the regulations that apply to the work.
  - .3 Has knowledge of all potential or actual danger to health or safety in the work.
- .7 Friable material: means material that:
  - .1 When dry, can be crumbled, pulverized or powdered by hand pressure, or
  - .2 is crumbled, pulverized or powdered.
- .8 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.
- .9 Non-Friable Material: material that when dry cannot be crumbled, pulverized or powdered by hand pressure.
- .10 Occupied Area: any area of the building or work site that is outside Asbestos Work Area.
- .11 Polyethylene: polyethylene sheeting or rip-proof polyethylene sheeting with tape along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide protection and isolation.
- .12 Qualified Person: means a person who:
  - .1 Has knowledge of the management and control of asbestos hazards through education and training.
  - .2 Has experience in the management and control of asbestos hazards.
- .13 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must have appropriate capacity for work.

1.6 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 – Submittal Procedures.

- .2 Submit proof satisfactory to Departmental Representative that suitable arrangements have been made to dispose of asbestos-containing waste in accordance with requirements of authority having jurisdiction.
- .3 Submit Provincial and/or local requirements for Notice of Project for Work Involving Asbestos (NOPA) Form.
- .4 Submit WorkSafeBC status and transcription of insurance.
- .5 Submit proof of Contractor's Asbestos Liability Insurance.
- .6 Submit to Departmental Representative necessary permits for transportation and disposal of asbestos-containing waste and proof that asbestos-containing waste has been received and properly disposed.
- .7 Submit proof that all asbestos workers and/or supervisor have received appropriate training and education by a competent person in the hazards of asbestos exposure, good personal hygiene and work practices while working in Asbestos Work Areas, and the use, cleaning and disposal of respirators and protective clothing.
- .8 Submit proof satisfactory to Departmental Representative that employees have respirator fitting and testing. Workers must be fit tested (irritant smoke test) with respirator that is personally issued.
- .9 Submit documentation including test results, fire and flammability data, and Safety Data Sheets (SDS) for chemicals or materials including but not limited to:
  - .1 Encapsulants.
  - .2 Amended water.
  - .3 Slow drying sealer.
- .10 Submit documentation that HEPA filtered equipment (vacuums and negative air units) have been certified by DOP testing (or similar)

1.7 **QUALITY ASSURANCE**

- .1 Regulatory Requirements: comply with Federal, Provincial, and local requirements pertaining to asbestos, provided that in case of conflict among these requirements or with these specifications, more stringent requirement applies. Comply with regulations in effect at time Work is performed.
- .2 Health and Safety:
  - .1 Perform construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.
  - .2 Safety Requirements: worker protection.
    - .1 Protective equipment and clothing to be worn by workers while in Asbestos Work Area include:
      - .1 Air purifying half-mask respirator with N-100, R-100 or P-100 particulate filter, personally issued to worker and marked as to efficiency and purpose, suitable for protection against asbestos and acceptable to Provincial Authority having jurisdiction. The respirator

to 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. The respirator to 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. The respirator to have damaged or deteriorated parts replaced prior to being used by a worker; and, when not in use, to be stored in a convenient, clean and sanitary location. The employer to establish written procedures regarding the selection, use and care of respirators, and a copy of the procedures to be provided to and reviewed with each worker who is required to wear a respirator. A worker not to 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.

- .2 Disposable-type protective clothing that does not readily retain or permit penetration of asbestos fibres. Protective clothing to be provided by the employer and worn by every worker who enters the work area, and the protective clothing shall consist of a head covering and full body covering that fits snugly at the ankles, wrists and neck, in order to prevent asbestos fibres from reaching the garments and skin under the protective clothing to include suitable footwear, and to be repaired or replaced if torn.
  - .2 Eating, drinking, chewing, and smoking are not permitted in Asbestos Work Area.
  - .3 Before leaving Asbestos Work Area, the worker can decontaminate his or her protective clothing by using a vacuum equipped with a HEPA filter, or by damp wiping, before removing the protective clothing, or, if the protective clothing will not be reused, place it in a container for dust and waste. The container to be dust tight, suitable for asbestos waste, impervious to asbestos, identified as asbestos waste, cleaned with a damp cloth or a vacuum equipped with a HEPA filter immediately before removal from the work area, and removed from the work area frequently and at regular intervals.
  - .4 Facilities for washing hands and face shall be provided within or close to the Asbestos Work Area.
  - .5 Ensure workers wash hands and face when leaving Asbestos Work Area. Facilities for washing are to be supplied by the Contractor.
  - .6 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.
- 1.8 WASTE MANAGEMENT AND DISPOSAL
- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 – Waste Management and Disposal.
  - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
  - .3 Collect and separate for disposal packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
  - .4 Separate and place in designated containers steel metal plastic waste in accordance with Waste Management Plan.

- .5 Place materials defined as hazardous or toxic in designated containers.
- .6 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.
- .7 Fold up metal banding, flatten and place in designated area for recycling.
- .8 Disposal of asbestos waste generated by removal activities must comply with Federal, Provincial, and Municipal regulations. Dispose of asbestos waste in sealed double thickness 6 mil bags or leak proof drums. Label containers with appropriate warning labels.
- .9 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.

1.9 EXISTING CONDITIONS

- .1 Reports and information pertaining to ACMs that may be handled, removed, or otherwise disturbed and disposed of during this project are bound into this specification in the Appendix.
- .2 Notify Departmental Representative of additional suspected ACMs discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material pending instructions from Departmental Representative.

1.10 SCHEDULING

- .1 Hours of Work: perform work during normal working hours.
- .2 Not later than 48 hours before beginning Work on this Project notify the following in writing:
  - .1 WorkSafeBC
- .3 Inform sub-trades of presence of asbestos-containing materials identified in Existing Conditions.

1.11 OWNER'S INSTRUCTIONS

- .1 Before beginning Work, provide Departmental Representative satisfactory proof that every worker has had instruction and training in hazards of asbestos exposure, in personal hygiene and work practices, and in use, cleaning, and disposal of respirators and protective clothing.
- .2 Instruction and training related to respirators includes, following minimum requirements:
  - .1 Fitting of equipment.
  - .2 Inspection and maintenance of equipment.
  - .3 Disinfecting of equipment.
  - .4 Limitations of equipment.
- .3 Instruction and training must be provided by a competent, qualified person.

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**Part 2            PRODUCTS**

2.1            MATERIALS

- .1    Drop Sheets:
  - .1    Polyethylene: 0.15 mm thick.
  - .2    FR polyethylene: 0.15 mm thick woven fibre reinforced fabric bonded both sides with polyethylene.
- .2    Wetting Agent: 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with water in a concentration to provide thorough wetting of asbestos-containing material.
- .3    Waste Containers: contain waste in two separate containers.
  - .1    Inner container: 0.15 mm thick sealable polyethylene waste bag.
  - .2    Outer container: sealable metal or fibre type where there are sharp objects included in waste material; otherwise outer container may be sealable metal or fibre type or second 0.15 mm thick sealable polyethylene bag.
  - .3    Labelling requirements: affix pre-printed cautionary asbestos warning in both official languages that is visible when ready for removal to disposal site.
- .4    Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual asbestos fibres.
- .5    Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under both dry conditions and wet conditions using amended water.
- .6    Provide ground fault interrupter (GFI) circuits on power source for electrical lighting and tools, in accordance with applicable CSA Standard. Ensure safe installation of electrical cables and equipment.

**Part 3            EXECUTION**

3.1            PROCEDURES

- .1    Do construction occupational health and safety in accordance Section 01 35 33 - Health and Safety Requirements.
- .2    Before beginning Work, isolate Asbestos Work Area using, minimum, preprinted cautionary asbestos warning signs in both official languages that are visible at access routes to Asbestos Work Area.
  - .1    Remove visible dust from surfaces in the work area where dust is likely to be disturbed during course of work.
  - .2    Use HEPA vacuum or damp cloths where damp cleaning does not create a hazard and is otherwise appropriate.
  - .3    Do not use compressed air to clean up or remove dust from any surface.



- .3 Prevent spread of dust from Asbestos Work Area using measures appropriate to work to be done.
  - .1 Use FR polyethylene drop sheets over flooring such as carpeting that absorbs dust and over flooring in Asbestos Work Area where dust and contamination cannot otherwise be safely contained. Drop sheets are not to be reused.
- .4 Wet materials containing asbestos to be cut, ground, abraded, scraped, drilled, or otherwise disturbed unless wetting creates hazard or causes damage.
  - .1 Use garden reservoir type low - velocity fine - mist sprayer.
  - .2 Perform Work to reduce dust creation to lowest levels practicable.
  - .3 Work will be subject to visual inspection and air monitoring.
  - .4 Contamination of surrounding areas indicated by visual inspection or air monitoring will require complete enclosure and clean-up of affected areas.
- .5 Frequently and at regular intervals during Work and immediately on completion of work:
  - .1 Dust and waste to be cleaned up and removed using a vacuum equipped with a HEPA filter, or by damp mopping or wet sweeping, and placed in a waste container, and
  - .2 Drop sheets to be wetted and placed in a waste container as soon as practicable.
- .6 Cleanup:
  - .1 Place dust and asbestos containing waste in sealed dust-tight waste bags. Treat drop sheets and disposable protective clothing as asbestos waste; wet and fold these items to contain dust, and then place in plastic bags.
  - .2 Clean exterior of each waste-filled bag using damp cloths or HEPA vacuum and place in second clean waste bag immediately prior to removal from Asbestos Work Area.
  - .3 Seal waste bags and remove from site. Dispose of in accordance with requirements of Provincial and Federal Authority having jurisdiction. Supervise dumping and ensure that dump operator is fully aware of hazardous nature of material to be dumped and that the appropriate guidelines and regulations for asbestos disposal are followed.
  - .4 Perform final thorough clean-up of Work areas and adjacent areas affected by Work using HEPA vacuum.
- 3.2 AIR MONITORING (not required, but may be conducted)
  - .1 From beginning of Work until completion of cleaning operations, Departmental Representative will separately engage an Environmental Specialist to take air samples inside and outside of Asbestos Work Area enclosure[s] in accordance with British Columbia's Occupational Health and Safety Regulation and the current version of the WorkSafeBC Manual entitled "Safe Work Practices for Handling Asbestos".
    - .1 Departmental Representative will be responsible for monitoring inside enclosure in accordance with applicable Provincial Occupational Health and Safety Regulations.
  - .2 If air monitoring shows that areas outside Asbestos Work Area enclosure[s] are contaminated, enclose, maintain and clean these areas in same manner as that applicable to Asbestos Work Area, at no additional cost to the Contract

- .3 Ensure that respiratory safety factors are not exceeded.

**END OF SECTION 02 82 00**

**PART 1 - GENERAL**

1.1 REFERENCES

- .1 CAN/CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
- .2 CAN/CGSB-25.20, Surface Sealer for Floors.
- .3 American Concrete Institute ACI 303R, Guide to Cast-In-Place Architectural Concrete Practice.
- .4 American Concrete Institute ACI 303.1, Standard Specification for Cast-In-Place Architectural Concrete.

1.2 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data
  - .1 Provide manufacturer's printed product literature and data sheets for concrete finishes and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Include application instructions for concrete floor treatment.
  - .3 Submit WHMIS MSDS - Material Safety Data Sheets for each product. Indicate VOC levels.

1.3 QUALITY ASSURANCE

- .1 Standards: Conform to CAN/CSA-A23.1, for concrete finishes.
- .2 Qualifications: Work shall be carried out by personnel having proven experience in this type of work in accordance with the drawings and specifications.

1.4 ENVIRONMENTAL REQUIREMENTS

- .1 Temporary lighting:
  - .1 Minimum 1200 W light source, placed 2.5 m above floor surface, for each 40 sq m of floor being treated.
- .2 Electrical power:
  - .1 Provide sufficient electrical power to operate equipment normally used during construction.
- .3 Work area:
  - .1 Make work area water tight protected against rain and detrimental weather conditions.
- .4 Temperature:
  - .1 Maintain ambient temperature of not less than 10 degrees C from 7 days before installation to at least 48 hours after completion of work and maintain relative humidity not higher than 40% during same period.
- .5 Moisture:
  - .1 Ensure concrete substrate is within moisture limits prescribed by flooring manufacturer.

- .6 Safety:
  - .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.
- .7 Ventilation:
  - .1 Departmental Representative will arrange for ventilation system to be operated during installation of concrete floor treatment materials. Ventilate area of work as directed by Departmental Representative by use of approved portable supply and exhaust fans.
  - .2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.
  - .3 Provide continuous ventilation during and after coating application

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver materials to site in containers sealed and labeled by manufacturers in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding storage, handling and disposal of hazardous materials.
- .3 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

### **PART 2 - PRODUCTS**

#### 2.1 MATERIALS

- .1 Concrete materials shall conform to requirements of Section 03 30 00 - Cast-In-Place Concrete and CAN/CSA - A23.1.
- .2 Bonding Agent: Formulated for bonding new concrete to cured concrete.
- .3 Concrete Curing & Sealing Compound:
  - .1 Water clear, high gloss, non-yellowing, acrylic emulsion cure and seal.
  - .2 Cure and seal shall meet the moisture retention requirements of ASTM C309 Type 1, Clear.
  - .3 Acid resistant, adhesion-promoting qualities and UV light degradation properties of ASTM C1315 Type 1, Class A.
  - .4 Yield: 7.4 m<sup>2</sup>/L.

### **PART 3 - EXECUTION**

#### 3.1 EXAMINATION

- .1 Verify that slab surfaces are ready to receive work recommended by manufacturer's written instructions.

#### 3.2 PLAIN FLOOR FINISH (TROWELLED)

- .1 Roll or tamp concrete to force coarse aggregate into concrete mix and then screed.
- .2 Float surface with wood or metal floats or with power finishing machine and bring surface to true grade.
- .3 Steel trowel to smooth and even surface.

- .4 Follow with second steel trowelling to produce smooth burnished surface to within tolerance described in CAN/CSA-A23.1, Clause 22.1.3 - F-Number Method/Table 19 for Class B Finish Classification to all floors receiving carpet, resilient flooring. All other floors shall be finished to a Class A Finish Classification. Check conformance to tolerance limits within 72 hours of curing.
- .5 Sprinkling of dry cement or dry cement and sand mixture over concrete surfaces is not acceptable.
- .6 Apply curing compound in accordance with manufacturer's instructions to all areas not scheduled to receive further floor finish.
- .7 Protect surfaces which will be exposed to direct sunlight during the curing period in accordance with manufacturer's instructions.

### 3.3 APPLICATION CURING/SEALING COMPOUNDS

- .1 Apply only when air temperature is above 5°C and tests show less than 5% moisture present on surfaces to be treated.
- .2 Apply sealing and curing compound to concrete floors in accordance with manufacturer's directions using low pressure sprayer at a minimum application rate of 10 m<sup>2</sup> per litre for smooth steel trowelled surfaces and at 5 to 7.5 m<sup>2</sup> per litre for float or broom finished surfaces.

### 3.4 DEFECTIVE CONCRETE

- .1 Repair honeycombing, rock pockets, chips, spalls, rain damaged areas and other voids in exposed concrete surfaces, using patching materials as specified to provide a smooth surface. Remove fins and other protrusions in concrete surfaces.
- .2 Consult with Departmental Representative on the repair of defective concrete surfaces prior to execution of the work.
- .3 Patch form tie holes in all exposed concrete surfaces and surfaces designated to receive waterproofing.

### 3.5 PROTECTION

- .1 Take every precaution to protect finished surfaces from stains and abrasions. Surfaces and edges likely to be damaged during the construction period shall be especially protected.
- .2 Protect Work of other sections from damage resulting from Work of this Section.
- .3 Provide suitable enclosures for collecting grit and dust from sandblasting operation.
- .4 Erect barricades to prevent traffic on newly finished surfaces.

### 3.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

### 3.7 ADJUSTING & CLEANING

- .1 At completion and during progress of the Work maintain premises in a neat and orderly manner. Rubbish and debris resulting from work of this Section shall be collected regularly, and removed

from the project site and disposed of.

- .2 Repair, remove and clean all drips or smears resulting from the work of this section on exposed, finished surfaces or surfaces to be subsequently finished.

**END OF SECTION 03 35 00**

**PART 1 - GENERAL**

1.1 RELATED WORK

- .1 Metal Doors and Frames: Section 08 10 00
- .2 Sectional Overhead Doors Section 08 36 13
- .3 Structural Systems: Section 13 34 25
- .4 Painting: Section 09 90 00

1.2 REFERENCE STANDARDS

- .1 ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
- .2 ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.
- .3 CAN/CGSB-1.40, Anti-Corrosive Structural Steel Alkyd Primer.
- .4 CAN/CGSB-1.108, Bituminous Solvent Type Paint.
- .5 CAN/CGSB-1.181, Ready-Mixed, Organic Zinc-Rich Coating.
- .6 CAN/CSA-G40.20-G40.21, General Requirements for Rolled or Welded Structural Quality Steel.
- .7 CAN/CSA-G164 Hot Dip Galvanizing of Irregularly Shaped Articles.
- .8 CAN/CSA-S16.1, Limit States Design of Steel Structures.
- .9 CSA W59, Welded Steel Construction (Metal Arc Welding).
- .10 CSA W48-01, Filler Metals and Allied Materials for Metal Arc Welding
- .11 The Society of Protective Coatings (SSPC)
- .12 CCD-047a-98, Paints, Surface Coatings.
- .13 CCD-048-98, Surface Coatings - Recycled Water-borne.
- .14 British Columbia Building Code (BCBC).
- .15 Master Painters Institute Green Performance Standard GPS-1-08

1.3 SUBMITTALS

- .1 Shop Drawings
  - .1 Prepare shop drawings by, or under the direct supervision of, a Registered Professional licenced in the Province of British Columbia.
  - .2 Submit shop drawings in accordance with Section 01 33 00.
  - .3 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details and accessories.

- .2 Record Drawings (As-builts)
  - .1 Submit record drawings (as-builts) in accordance with Section 01 33 00.
  - .2 Submit shop paint primer manufacturer's product data verifying compliance with MPI Green Performance Standard GPS-1-08, for VOC content.

#### 1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in in accordance with Section 01 74 19 - Waste Management and Disposal.

#### 1.5 PROJECT CONDITIONS

- .1 Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit, by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of work.
- .2 Where field measurements cannot be made without delaying the work, guarantee dimensions and proceed with fabrication of products without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

### **PART 2 - PRODUCTS**

#### 2.1 MATERIALS

- .1 Metal Surfaces, General: Form metal fabrications exposed to view upon completion of the work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for steel sheet, variations in flatness exceeding those permitted by referenced standards for stretcher-leveled sheet.
- .2 Miscellaneous steel: to ASTM A36/A36M or to CAN/CSA-G40.20 and CAN/CSA-G40.21, 300W yield strength.
- .3 Structural steel: to ASTM A36/A36M or to CAN/CSA-G40.20 and CAN/CSA-G40.21, 350W yield strength.
- .4 Steel sections and plates: to CAN/CSA-G40.21 Grade 300W.
- .5 Steel pipe: to ASTM A53 standard weight galvanized finish.
- .6 Steel angles: galvanized, sizes indicated for openings.



- .7 Welding materials: to CSA W59.
- .8 Shop primer: to suit exposure location and material and of a type as specified for such work within Painting specification Section 09 90 00. Where non-complying primers are used this section of work shall completely remove same from all surfaces and prepare and prime surfaces in accordance with the requirements of Section 09 90 00 for painted steel work at no additional cost to the Owner.
- .9 Galvanizing: hot dipped galvanizing with minimum zinc coating of 600 g/m<sup>2</sup> to CSA G164.
- .10 Galvanize touch-up primer: zinc rich, organic, ready mixed type to CAN/CGSB-1.181.
- .11 Isolation Coating: alkali resistant bituminous paint to CAN/CGSB-1.108.

## 2.2 GROUT

- .1 Non-Shrink Grout: Premixed, factory packaged, non-ferrous aggregate, non-staining, shrinkage resistant, non-corrosive, non-gaseous, ASTM C1107.
  - .1 Minimum Strength at 28 Days: 5000 PSI.

## 2.3 ANCHORS

- .1 Flush or Shield Type Expansion Anchor Sleeve:
  - .1 Size: As indicated on Drawings.
  - .2 Finish: Zinc plated.

## 2.4 FASTENERS

- .1 General: Provide zinc-coated fasteners for exterior use or where built into exterior walls. Select fasteners for type, grade and class required.
- .2 Bolts and Nuts: Regular hexagon head type, ASTM A307, Grade A.
- .3 Lag Bolts: Square head type, FS FF-B-561.
- .4 Machine Screws: Cadmium plated steel, FS FF-S-92.
- .5 Plain Washers: Round, carbon steel, FS FF-W-92.
- .6 Toggle Bolts: Tumble-wing type, FS FF-B-588, type, class and style as required.
- .7 Lock Washers: Helical spring type carbon steel, FS FF-W-84.

## 2.5 FABRICATION

- .1 Build items square, true, straight and accurate to required size, with joints fitted closely and secured properly.
- .2 Fabricate items from steel and use galvanized steel for exterior items, unless indicated otherwise.
- .3 Use self-tapping shake-proof countersunk flat headed screws on items requiring assembly by screws or as indicated. Use security screws in all exposed locations.
- .4 Where possible, fit and shop assemble items, ready for erection.

- .5 Ensure exposed welds are continuous and non-porous for length of each joint. File or grind exposed welds smooth and flush.

## 2.6 OVERHEAD DOOR FRAME

- .1 Fabricate and install overhead door frame as detailed on the drawings and reviewed shop drawings.
- .2 Fabricate and install for openings at locations indicated.
- .3 Fabricate and install to withstand all superimposed loading.
- .4 Fabricate and install of sizes indicated and for attachment to adjacent structure.

## 2.7 PIPE BOLLARDS

- .1 Fixed Pipe Bollard: Standard weight Schedule 40 steel pipe, ASTM A53, sizes as indicated
- .2 For bollards with concrete fill: 3000 PSI, air-entrained concrete.
- .3 Concrete Foundation: 3000 PSI, air-entrained concrete.

## 2.8 CLEANING OF STEEL SURFACES

- .1 Thoroughly clean all steel surfaces after fabrication and prior to galvanizing, priming and/or painting or pre-painting in strict accordance with The Society of Protective Coatings (SSPC) and Section 09 90 00 requirements.
- .2 Remove all oil, grease and other foreign matter from surfaces and solvent wash in accordance with SSPC 1 and SSPC 2 requirements.
- .3 Clean steel work to be painted in accordance with the requirements of Section 09 90 00 and minimum SSPC 6 (abrasive blast) cleaning specifications.

## 2.9 GALVANIZING

- .1 Items designated on the drawings as galvanized including all connecting materials, exterior steel and interior steel in high humidity locations shall be hot-dipped galvanized as specified herein.
- .2 Hot dip galvanize all such items after fabrication as specified herein.
- .3 Locate galvanizing drain/vent holes such that all holes will be to underside of installed item in final position.
- .4 After steel is erected or welded, any damage to galvanizing shall be made good by applying two coats of specified zinc rich paint in accordance with manufacturer's specifications.

## 2.10 PRIMING

- .1 Shop prime all steel surfaces, except stainless steel, aluminum, and those surfaces to be galvanized or which are encased in concrete, after fabrication and cleaning.
- .2 Use primer unadulterated and apply on clean dry surfaces, within manufacturer's temperature application requirements.

- .3 Apply a minimum of (1) one coat of primer thoroughly and evenly, worked well into joints and open spaces to a minimum dry film thickness of 0.08 mm.
- .4 Provide a field touch up coat of primer to all surfaces that have been scraped or chipped after erection and after connections are completed.
- .5 Thoroughly coat the heads of all bolts previously set in concrete with two (2) coats of specified zinc rich paint after nuts and washers are in place.
- .6 Bolts, nuts and other threaded fasteners and their accessories such as washers, shall have heavy galvanized finish.
- .7 Coat surfaces next to concrete and masonry with two coats of isolation coating.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for metal fabrications 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, GENERAL**

- .1 Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; include threaded fasteners for concrete inserts, toggle bolts, through-bolts, lag bolts and other connectors as required.
- .2 Cutting, Fitting and Placement: Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- .3 Provide temporary bracing or anchors in formwork for items that are to be built into concrete or similar construction.
- .4 Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints, but cannot be shop-welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.
- .5 Field welding:
  - .1 Make field connections with high tensile bolts or weld to CAN/CSA-S16.1. appearance and quality of welds made, methods used in correcting welding work, and the following:
  - .2 Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - .3 Obtain fusion without undercut or overlap.
  - .4 Remove welding flux immediately.

- .5 At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surfaces matches those adjacent.
- .6 Grout: Follow manufacturer's recommendations for substrate preparation and application.
- .7 Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, or dissimilar metals with a heavy coat of bituminous paint.
- .8 Touch up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection using primer.
- .9 Touch up galvanized surfaces with zinc rich primer where burned by field welding.
- .10 Miscellaneous metal items which will be exposed to view in the completed building shall have smooth, high quality finish.

### 3.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

### 3.4 ITEMS

- .1 Provide and install all non-structural metal fabrication items specified and as shown on the drawings.

**END OF SECTION 05 50 00**

## **PART 1 - GENERAL**

### 1.1 RELATED WORK

- .1 Foamed-in-Place Insulation: Section 07 21 19
- .2 Synthetic Sheathing Membrane: Section 07 27 00
- .3 Structural Systems: Section 13 34 25
- .4 Gypsum Board: Section 09 29 00

### 1.2 REFERENCE STANDARDS

- .1 NLGA - Standard Grading Rules for Canadian Lumber
- .2 CSA B111 - Wire Nails, Spikes and Staples
- .3 CSA G164 - Hot Dip Galvanized of Irregularly Shaped Articles
- .4 CSA O80 Series - Wood Preservation
- .5 CSA O121 - Douglas Fir Plywood
- .6 CAN4-S102, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
- .7 ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.

### 1.3 SOURCE QUALITY CONTROL

- .1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood identification: by grade mark in accordance with applicable CSA standards.

## **PART 2 - PRODUCTS**

### 2.1 LUMBER MATERIAL

- .1 Douglas Fir Plywood to CSA O121, good one side (G1S).
- .2 Refer to Section 13 34 25 \_ Structural Systems.

### 2.2 THERMAL BLANKET INSULATION

- .1 Mineral wool fibre insulation made from basalt rock and steel slag, conforming to CAN/ULC-S702, type 1, 32 kg/m density, EcoLogo 3 certified; non-combustible, thermal resistance value shall be RSI 0.71 per 25 mm.

### 2.3 VAPOUR BARRIER

- .1 Polyethylene film: to CAN/CGSB 51.34, Vapour Barrier, Polyethylene Sheet for Use in Building Construction, 0.15 mm thick.

- .2 Joint sealing tape: air resistant pressure sensitive adhesive tape, 50 mm wide for lap joints and perimeter seals, 25 mm wide elsewhere.

#### 2.4 FASTENERS

- .1 Nails, spikes and staples: to CSA B111.
- .2 Bolt, nut, washer, screw and pin type fasteners: with hot-dip galvanized finish to CSA G164.
- .3 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, explosive actuated fastening devices, recommended for purpose by manufacturer.
- .4 Use hot galvanized finish steel for exterior work, interior highly humid areas and for pressure treated lumber, unless stated otherwise.
- .5 Fasteners for fire retardant plywood shall be galvanized steel, stainless steel, silicon bronze or copper.

#### 2.5 PRESERVATIVE TREATMENT

- .1 ACQ Ammoniacal copper quaternary compound: Pressure-injected wood that does not use arsenic or chromium. Above-ground: 4.0 kg/m<sup>3</sup> retention (0.25 lbs. retention/cu.ft.)
- .2 All pressure treated lumber shall carry the Canadian Wood Preserver's Bureau Quality Mark.
- .3 Following water-borne preservative treatment, dry material to maximum moisture content of 19%.
- .4 Treat following items in accordance with applicable CSA O80 commodity standard:
  - .1 ACQ
    - .1 Exterior curbs and stakes in contact with ground (ACQ only)
  - .5 Fasteners, connectors, and flashing:
    - .1 In contact with ACQ preservative treated wood, shall be stainless steel or hot dipped galvanized steel fasteners to ASTM A153 and connectors to ASTM A653 with a minimum G-185 coating.

### **PART 3 - EXECUTION**

#### 3.1 FIELD TREATMENT OF PRESERVATIVE TREATED PRODUCTS

- .1 Treat field cuts made in preservative treated items, in accordance with AWPA.M4-80.

#### 3.2 INSTALLATION VAPOUR BARRIER

- .1 Install sheet vapour barriers to form continuous vapour resistant barriers as indicated on the drawings.
- .2 Use sheets of largest practical size to minimize joints. Arrange all joints to occur on solid bearing.
- .3 Cut and tailor sheet to form openings and ensure material is lapped and sealed to frames.

- .4 Inspect sheets for continuity. Repair punctures and tears with sealing tape before installations are concealed.
  
- .5 Seal perimeter of polyethylene film vapour barrier as follows:
  - .1 Apply continuous bead of sealant to substrate at perimeter of sheets.
  - .2 Lap sheet over sealant and press into sealant bead.
  - .3 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.
  
- .6 Seal lap joints of polyethylene film vapour barrier as follows:
  - .1 Attach 1st sheet to substrate.
  - .2 Apply continuous bead of sealant over solid backing at joint.
  - .3 Lap adjoining sheet minimum 150 mm and press into sealant bead.
  - .4 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

### 3.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

**END OF SECTION 06 10 00**

## **PART 1 - GENERAL**

### **1.1 REFERENCE**

- .1 CAN/ULC-705.1: Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density, Material Specification.
- .2 CAN/ULC-S705.2: Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density, Installer's Responsibilities - Specification.
- .3 CAN/ULC-S101: Fire Endurance Tests of Building Construction and Materials.
- .4 CAN/ULC-S102: Surface Burning Characteristics of Building Materials and Assemblies
- .5 ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials.

### **1.2 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, steel strapping, plastic, polystyrene, corrugated cardboard packaging material in appropriate on site bins for recycling in accordance with Waste Management Plan.
- .4 Divert waste materials from landfill to approved recycling facility.

### **1.3 QUALITY ASSURANCE**

- .1 Insulation: use experienced applicators trained and approved by insulation manufacturer, who are members of Canadian Urethane Foam Contractors Association Inc. (CUFCA).
- .2 Tests shall be conducted daily on both core density and cohesion/adhesion to the substrate, following procedures established by CUFCA/NECA.

### **1.4 TEST REPORTS**

- .1 Submit product information and test reports in accordance with Section 01 33 00.
- .2 Insulation: submit product data on insulation proposed for use on this project.

### **1.5 PROTECTION**

- .1 Ventilate areas to receive insulation and by introducing fresh air and exhausting air continuously during and 24 hours after application to maintain non-toxic, unpolluted, safe working conditions.
- .2 Provide temporary enclosures to prevent spray and noxious vapours from contaminating air beyond application area.
- .3 Protect workers as recommended by insulation manufacturers.
- .4 Protect adjacent surfaces and equipment from damage by overspray, fall-out and dusting of insulation materials.



- .5 Dispose of waste insulation material daily in safe manner and decontaminate empty drums, both in accordance with health and environment regulations.

## **PART 2 - PRODUCTS**

### 2.1 MATERIALS

- .1 Sprayed polyurethane foam material, when tested, shall meet the requirements of CAN/ULC S705.1 Standard for Thermal Insulation-Spray Applied Rigid Polyurethane Foam, Medium Density, Material- Specification, with the following physical properties:
  - .1 Density minimum: 1.9 lb/ft.<sup>3</sup>
  - .2 Compressive strength, parallel to rise (10% compression): 32 psi.
  - .3 Tensile strength: 49 psi.
  - .4 Open cell content: <1%
  - .5 Water absorption % by volume: 2.5%
  - .6 Water vapour permeance, without the skins, core only: 125 ng/Pa.s.m<sup>2</sup>
  - .7 Flame spread classification: 375
  - .8 Smoke determined: 288
- .2 Prime substrate when required by spray polyurethane manufacturer. The type of primer and the installation of the primer shall follow the requirements of the manufacturer for the surface conditions.

## **PART 3 - EXECUTION**

### 3.1 PROTECTION

- .1 Mask and cover adjacent areas to protect from over spray.
- .2 Ensure any required foam stop or back up material are in place to prevent over spray and achieve complete seal.

### 3.2 PREPARATION

- .1 The substrate being sprayed should have no traces of oil, grease, wax, rust, oxidization, dirt, or water. Apply primer in order to promote adhesion of the foam as required.
- .2 Surface temperature shall be minimum 21°C. Water (in the form of rain, fog, condensation, etc.) reacts with the isocyanate and will affect the foam and the product's properties, particularly its adhesive qualities, protect the work area against rain, snow, dew, etc. The foam shall not be sprayed when relative humidity is higher than 80%, as this will also affect the properties of the foam.
- .3 Cold weather applications: prior to applying sprayed insulation in cold weather, notify the Departmental Representative. Insulation shall not be applied until proper precautions have been taken to prevent inadequate adhesion to the substrate and complete curing of the spray foam.

### 3.3 APPLICATION

- .1 Apply insulation to clean surfaces in accordance with CAN/ULC-705.2 and manufacturer's directions to seal junctions of building components against thermal and air leakage.
- .2 Apply only when surfaces and environmental conditions are within limits prescribed by the material manufacturer and the CAN/ULC S705.2-05 Installation standard.

- .3 Apply in consecutive passes as recommended by manufacturer to thickness as indicated on drawings.
- .4 Finished surface of foam insulation to be free of voids and imbedded foreign objects.
- .5 Remove masking materials and over spray from adjacent areas immediately after foam surface has hardened. Ensure cleaning methods do not damage work performed by other sections.
- .6 Trim, as required, any excess thickness that would interfere with the cladding/covering system by other trades.

**END OF SECTION 07 21 19**

## **PART 1 - GENERAL**

### 1.1 RELATED WORK

- .1 Rough Carpentry: Section 06 10 00
- .2 Preformed Metal Siding: Section 07 46 13
- .3 Structural Systems: Section 13 34 25

### 1.2 REFERENCES

- .1 ASTM D1117; Standard Guide for Evaluating Non-woven Fabrics
- .2 ASTM E84; Test Method for Surface Burning Characteristics of Building Materials
- .3 ASTM E96; Test Method for Water Vapor Transmission of Materials
- .4 ASTM E1677; Specification for Air Retarder Material or System for Framed Building Walls
- .5 ASTM E2178; Test Method for Air Permeance of Building Materials

### 1.3 SUBMITTALS

- .1 Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with indicated requirements.
- .2 Manufacturer Instructions: Provide manufacturer's written installation instructions.

### 1.4 QUALITY ASSURANCE

- .1 Installer shall have experience with installation of commercial sheathing membrane assemblies under similar conditions.
- .2 Installation shall be in accordance with sheathing membrane manufacturer's installation guidelines and recommendations.

### 1.5 MOCK-UP

- .1 Install 3 m x 3 m mock-up using approved sheathing membrane assembly including fasteners, flashing, tape and related accessories per manufacturer's current printed instructions and recommendations.
- .2 Mock-up may remain as part of the work.

## **PART 2 - PRODUCTS**

### 2.1 MATERIALS

- .1 Performance Characteristics:
  - .1 Air Penetration: 0.001 cfm/ft<sup>2</sup> at 75 Pa, when tested in accordance with ASTM E2178. Type I per ASTM E1677. ?0.04 cfm/ft<sup>2</sup> at 75 Pa, when tested in accordance with ASTM E2357
  - .2 Water Vapor Transmission: 28 perms, when tested in accordance with ASTM E96, Method B.

- .3 Water Penetration Resistance: 280 cm when tested in accordance with AATCC Test Method 127.
  - .4 Basis Weight: 2.7 oz/yd<sup>2</sup>, when tested in accordance with TAPPI Test Method T-410.
  - .5 Air Resistance: Air infiltration at >1500 seconds, when tested in accordance with TAPPI Test Method T-460.
  - .6 Tensile Strength: 38/35 lbs/in., when tested in accordance with ASTM D882, Method A.
  - .7 Tear Resistance: 12/10 lbs., when tested in accordance with ASTM D1117.
  - .8 Surface Burning Characteristics: Class A, when tested in accordance with ASTM E 84. Flame Spread: 10, Smoke Developed: 10.
- 
- .2 Sheathing membrane (Synthetic Sheathing Membrane (SSM): High-performance, spunbonded polyolefin, non-woven, non-perforated, building/sheathing paper and related assembly components.
  - .3 Seam Tape: DuPont Tyvek Tape; Intertape Polymer's Sheathing Tape; CCMC 11955-R: Tuck 20502 Contractor's Sheathing Tape.
  - .4 Fasteners: 41 mm rust resistant screw with 2" diameter plastic cap or manufacturer approved 32 mm or 50 mm metal gasketed washer.
  - .5 Sealants: comply with ASTM C920, elastomeric polymer sealant to maintain watertight conditions recommended by the sheathing membrane manufacturer.
  - .6 Adhesives: Provide adhesive recommended by sheathing membrane manufacturer.
  - .7 Primers: Provide flashing manufacturer recommended primer to assist in adhesion between substrate and flashing.
  - .8 Flashing: provide as required and recommended by membrane manufacturer.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- .1 Install sheathing membrane over exterior face of exterior wall substrate in accordance with the details and manufacturer recommendations.
- .2 Review requirements for sequencing of installation of sheathing membrane assembly with installation of windows, doors, louvers and flashings to provide a weather-tight barrier assembly.
- .3 Start sheathing membrane installation at a building corner, leaving 150 mm to 300 mm of building/sheathing paper extended beyond corner to overlap.
- .4 Install sheathing membrane in a horizontal manner starting at the lower portion of the wall surface with subsequent layers installed in a shingling manner to overlap lower layers. Maintain sheathing membrane plumb and level.
- .5 Sill Plate Interface: Extend lower edge of sheathing membrane over sill plate interface 75 mm - 150 mm. Secure to foundation with elastomeric sealant as recommended by membrane manufacturer.
- .6 Attach sheathing membrane to studs through exterior sheathing. Secure using building/sheathing paper manufacturer recommended fasteners, space 300 mm - 460 mm vertically on centre along stud line, and 600 mm on centre, maximum horizontally.

- .7 Seal seams of sheathing membrane with seam tape at all vertical and horizontal overlapping seams.
- .8 Seal outside corners with 100 mm self-adhesive corner tape.
- .9 Ensure sheathing membrane laps over all horizontal flashing.
- .10 Seal any tears or cuts as recommended by sheathing membrane manufacturer.

**3.2 PROTECTION**

- .1 Protect installed sheathing membrane from damage.

**END OF SECTION 07 27 00**

**PART 1 - GENERAL**

1.1 RELATED WORK

- .1 Rough Carpentry: Section 06 10 00
- .2 Synthetic Sheathing Membrane: Section 07 27 00
- .3 Sheet Metal Roofing: Section 07 61 00
- .4 Structural Systems: Section 13 34 25

1.2 REFERENCES

- .1 CSA-S136 for the design of Cold Formed Steel Structural Members
- .2 Canadian Sheet Steel Building Institute Standards 20M.
- .3 British Columbia Building Code (BCBC).

1.3 PERFORMANCE CRITERIA

- .1 Design siding system to:
  - .1 withstand local windload,
  - .2 accommodate local temperature extremes,
  - .3 accommodate building movement and
  - .4 produce watertight installations.

1.4 DESIGN CRITERIA

- .1 Provide siding system that:
  - .1 uses factory formed siding profiles.
  - .2 is not dependant on sealants for primary exclusion of water,
  - .3 uses concealed fasteners to retain panels,
  - .4 is complete with custom tailored corners and flashings.
  - .5 Deflection of the wall system is not to exceed 1/180th of the span for the wind load based on serviceability limit states.
  - .6 Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, overstressing of components, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime sky heat loss.
  - .7 Design expansion joints to accommodate movement in cladding and between cladding and structure to prevent permanent distortion or damage to the cladding.
  - .8 Maximum variation from plane or location shown on shop drawings: 20 mm/10 m.
  - .9 Maximum offset from true alignment between two adjacent members abutting end to end in line: 1 mm.

1.5 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00.
- .2 Submit samples for colour verification prior to ordering actual project material.

1.6 MOCK-UPS

- .1 Produce 3 metre x 3 metre mock-up on site in location directed by Departmental Representative.
- .2 Incorporate inside and outside corner details, flashings and head transitions.
- .3 Departmental Representative accepted mock-up may form part of Work.

1.7 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00.
- .2 Arrange shop drawings to indicate following clearly by wall elevations, sections, details:
  - .1 Material thicknesses, finishes.
  - .2 Connections, joint conditions, anchorage methods, numbers/locations of anchors, supports, fastenings, reinforcements.
  - .3 Flashings/trims, special pieces, corners.
  - .4 Sealants.
- .3 Submit shop drawings to siding system manufacturer prior to submitting to Departmental Representative. Include with submission to Departmental Representative evidence of siding system manufacturer's shop drawing review.
- .4 Submit shop drawings under seal of qualified Registered Professional engineer licensed in British Columbia.

1.8 LETTERS OF ASSURANCE

- .1 The Supporting Registered Professional responsible for sealing engineered shop drawings shall submit to the Registered Professional of Record, Schedule S-B Assurance of Professional Design and Commitment for Field Review with the shop drawings.
- .2 The Supporting Registered Professional shall provide field review of the installation and submit to the Registered Professional of Record, Schedule S-C Assurance of Professional Field Review and Compliance upon completion of the Work.

1.9 QUALITY ASSURANCE

- .1 Manufacturer's qualifications: siding system manufacturer must provide following services as part of siding system.
  - .1 Provide in-house technical service for design of installation details; installation methods, procedures, recommendations and enquiries.
- .2 Installer's qualifications: use experienced installers approved in writing by siding system manufacturer.

1.10 DELIVERY, HANDLING AND STORAGE

- .1 Cover and protect siding and related flashings to prevent damage and marking.
- .2 Store siding and related flashings off ground, braced to prevent wracking and covered to shed precipitation.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- .1 Sheet steel: ASTM Standard Specification A792 / A792M, Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process, minimum Grade 33, with a design thickness of 22 gauge.
- .2 Coating designation: AZM150 Galvalume, sheet steel conforming to ASTM A792M Grade 230 or 340.
- .3 Fasteners: non-corroding alloy self-drilling metal screws.
- .4 Sealants: CAN2-19.24M sealant in accordance with Section 07 90 00.
- .5 Touch-up paint: type compatible with and matching factory applied panel finish.

### **2.2 SIDING**

- .1 38 mm Corrugated Metal Cladding, colour TBD.

### **2.3 FINISHES**

- .1 Two-coat, shop applied, high performance, 70% Polyvinylidene Fluoride (PVDF) coating based Kynar 500 resin, formulated by a licensed manufacturer and applied by manufacturer's approved applicator.
- .2 Colour: as selected by Departmental Representative from complete colour range.
- .3 Provide a 20-year manufacturers finish warranty for the Kynar 500 Hylar 5000 PVDF resin-based coatings.

### **2.4 ACCESSORIES**

- .1 Flashing: Material to match cladding in exposed locations. Custom fabricated to suit architectural details, as required. Use preformed corner pieces only. Double back exposed edges.
- .2 Closures: Metal closures to suit profiles selected, to manufacturer's recommendations.
- .3 Sealants:
  - .1 Concealed: Tape or compound, non-skinning, non-drying, butyl rubber.
  - .2 Exposed: Acrylic co-polymer to CGSB 19GP-5M.

### **2.5 FABRICATION**

- .1 Siding:
  - .1 Use 22 ga. metal thickness pre-finished sheet steel.
  - .2 Factory form with straight crisp lines, square corners/smooth bends; free from twists, warps, kinks, dents and any other imperfections which would detract from appearance.
  - .3 Factory punch siding profiles with 10 x 30 drainage slots spaced 300 mm o.c. along returns.
  - .4 Limit siding lengths to 8 metres maximum.



- .2 Flashings:
  - .1 Use minimum 0.91 mm (20 ga.) metal thickness pre-finished sheet steel.
  - .2 Factory form as per siding wherever practical. Where factory forming is impractical, use professional metal bending equipment in order to obtain straight crisp lines.
- .3 Install sealants at junctions with adjoining work, and where shown on the drawings.
- .4 Fabricate items in accordance with reviewed shop drawings.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- .1 Siding:
  - .1 Conceal all fixings.
  - .2 Install with even and true joints and reveals.
- .2 Flashings:
  - .1 Install related metal flashings to complement system.
- .3 Caulking:
  - .1 Apply sealant to locations required to ensure proper functioning rain screen design.
- .4 Touch up and make good damaged pre-finished surfaces.

#### **3.2 CLEANING**

- .1 Wash siding surfaces using solution of mild domestic detergent in warm water, applied with soft clean wiping cloths.
- .2 Remove excess sealants using recommended solvents.

**END OF SECTION 07 46 13**

## **PART 1 - GENERAL**

### 1.1 RELATED WORK

- .1 Rough Carpentry: Section 06 10 00
- .2 Foamed-in-Place Insulation: Section 07 21 19
- .3 Synthetic Sheathing Membrane: Section 07 27 00
- .4 Preformed Metal Siding: Section 07 46 13
- .5 Structural Systems: Section 13 34 25

### 1.2 PERFORMANCE CRITERIA

- .1 Design metal roofing to:
  - .1 withstand local windload, snowload and uplift conditions,
  - .2 accommodate local temperature extremes,
  - .3 accommodate building movement and
  - .4 produce watertight installations.

### 1.3 DESIGN CRITERIA

- .1 Provide metal roofing system that is:
  - .1 machine formed system with overlapping snap lock concealed fastener roofing panel.
  - .2 continuous from ridge to eaves without horizontal lap or seam,
  - .3 free of through fasteners, except at ridges where all such fasteners must be covered by cap flashings,
  - .4 not dependant on sealants for primary exclusion of water and
  - .5 complete with custom tailored weatherproof upturns at all metal roofing terminations, overlapped and covered by companion metal flashings with custom tailored weatherproof downturns.

### 1.4 QUALITY ASSURANCE

- .1 Manufacturer's qualifications: metal roofing system manufacturer must provide following services as part of metal roofing system.
  - .1 Provide in-house technical service for design of installation details; installation methods, procedures, recommendations and enquiries.
  - .2 Provide in-house technical services for design against uplift, sliding and overall roofing retention.
  - .3 Provide qualified experienced factory representative to visit site during installation of metal roofing system, to inspect and witness actual field installation procedures against factory recommendations.
- .2 Installer's qualifications:
  - .1 Use installers with minimum 3 years experience with respective metal roofing system product.
  - .2 Use installers having installed minimum of 4 satisfactory roofs similar to roof requirements of this project.
  - .3 Use installers approved in writing by metal roofing system manufacturer and which have been in metal roofing installation business for minimum 5 years.

- .3 Conform to the latest Guarantee Standards of the Roofing Contractors Association of British Columbia (RCABC), as published in the RGC Roofing Practices Manual.

#### 1.5 SUBMITTALS

- .1 Provide the Departmental Representative with one set of any required Material Safety Data Sheets (MSDS) prior to commencement of work, for review and posting on job site.
- .2 Samples:
  - .1 Submit 300 mm long x panel width size samples of roofing panels representative of project profiles and colour, in accordance with Section 01 33 00.
- .3 Shop Drawings
  - .1 Submit shop drawings in accordance with Section 01 33 00.
- .4 Indicate sheet arrangements, fasteners, special shapes and flashings.
- .5 Indicate roof terminations showing flashings, change of direction details and caps.
- .6 Submit shop drawings to metal roofing system manufacturer prior to submitting to Departmental Representative. Include with submission to Departmental Representative evidence of metal roofing system manufacturer's shop drawing review. Failure to provide evidence of manufacturer's review will result in rejection of shop drawings.
- .7 Submit shop drawings under seal of qualified Supporting Registered Professional registered in British Columbia and experienced in metal roofing systems. Failure to provide shop drawings under seal will result in rejection of shop drawings.

#### 1.6 LETTERS OF ASSURANCE

- .1 The Supporting Registered Professional responsible for sealing engineered shop drawings shall submit to the Registered Professional of Record, Schedule S-B Assurance of Professional Design and Commitment for Field Review with the shop drawings.
- .2 The Supporting Registered Professional shall provide field review of the installation and submit to the Registered Professional of Record, Schedule S-C Assurance of Professional Field Review and Compliance upon completion of the Work.

#### 1.7 GUARANTEES

- .1 Provide roofing system manufacturer's written guarantee that system coating will meet respective published performance level for 25 years, from date of Substantial Performance of Work.

### **PART 2 - PRODUCTS**

#### 2.1 MATERIAL

- .1 Standards: conform to the RGC Guarantee Standards and to the appropriate CSA, CGSB, ULC, and ASTM Standards for the materials used in the roofing system specified.
- .2 Underlayment: Self-adhesive membrane in accordance with Sheet Membrane Air/Vapour Seal - Section 07 26 50.

- .3 Sheet steel roofing and flashing shall be formed of steel conforming to the following material specifications, as applicable:
  - .1 ASTM Standard Specification A792 / A792M, Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process, minimum Grade 33, with a design thickness of 24 gauge and minimum coating designation AZM165 (AZ55).
- .4 Metal roofing system: site rolled standing seam system consisting of following components.
  - .1 Variable width: 295 mm.
  - .2 Roof panels: 24 ga. Concealed snap on roof panel with concealed fasteners.
- .5 Closures: Weatherproof, laminated, semi-rigid, cross-linked polyethylene foam, tightly fit to panel profile.
- .6 Sealants: CAN2-19.24 epoxidized polyurethane terpolymer in accordance with Section 07 90 00.
- .7 Touch-up paint: type compatible with and matching factory applied panel finish.

## 2.2 GUTTERS AND DOWNPIPES

- .1 Gutters: Pre-finished Commercial grade minimum 0.32 aluminum or 24 gauge steel.
  - .1 Gutter: minimum 5" wide.
  - .2 Finish: to match metal roofing.
- .2 Downpipes: 3" x 3" pre-finished commercial grade minimum 0.32 aluminum or 24 ga. Galv. Steel. Fix to the wall using minimum three pipe clips per length using non-corrosive screws.
- .3 Provide all end caps, spikes and ferrules, brackets, straps, mitred corners, elbows and strainers as required for complete rainwater system.

## 2.3 UNDERLAYMENT MATERIALS

- .1 Minimum 1 mm (40 mils) thick reinforced elastomeric SBS modified bitumen membrane bonded to cross laminated polyethylene facing sheet, with peel-off protective paper to self-adhesive face, with companion primers and penetration sealing mastics, manufactured for air/vapour seal use.
- .2 Performance Requirements:

Attribute	Criterion	Test Method
.1 Tensile & lap joint strength machine & cross-direction:	Min. 17 N/cm	CGSB 37GP56M
.2 Elongation at break, machine & cross-direction:	Min. 4%	ASTM D41206ae2 (Die C)
.3 Peel adhesion of self-adhering membranes:	Min. 8 N/cm	ASTM D903, CGSB37GP56M
.4 Flexibility, low temperature:	Pass	
.5 Crack bridging capability:	No evidence of cracking or splitting	CGSB37GP56M
.6 Water vapour permeance:	Maximum 5 ng/(Pa)(m <sup>2</sup> )(s)	ASTM E96/E96M, water method
- .3 Primer for self-adhering membranes: Polymer emulsion based adhesive type, quick setting, having the following physical properties:
  - .1 Weight: 1.0 kg/l;

- .2 Solids by weight: 53%;
- .3 Water based, no solvent odours, low VOC;
- .4 Drying time (initial set): 30 minutes;
  
- .4 Mastic: Polymer modified sealing compound having the following characteristics:
  - .1 Compatible with sheet waterproofing membrane, substrate and insulation materials,
  - .2 Solids by volume: 70%
  - .3 Vapour permeance: 2.9 ng/Pa.m<sup>2</sup>.s, ASTM E96,
  - .4 Complies with CGSB 37.29,
  - .5 Remains flexible with ageing,
  - .6 Adheres to wet surfaces,
  - .7 Chemical resistance: Alkalis, calcium chloride, mild acid and salt solutions.

#### 2.4 METAL FINISHES

- .1 Two-coat, shop applied, high performance, 70% Polyvinylidene Fluoride (PVDF) coating based Kynar 500 resin, formulated by a licensed manufacturer and applied by manufacturer's approved applicator.
- .2 Colour: as selected by Departmental Representative from complete colour range.
- .3 Provide a 20-year manufacturers finish warranty for the Kynar 500 Hylar 5000 PVDF resin-based coatings.

#### 2.5 FABRICATION

- .1 Form sections and pieces square, true and accurate to size, free from distortion and other - defects detrimental to appearance and performance.
- .2 Fabricate all components in sizes required to produce least number of joints.
- .3 Trim, edging, flashings:
  - .1 Fabricate using minimum 24 ga. metal thickness sheet steel, unless noted otherwise.
  - .2 Fabricate flashings required for metal roof areas. Produce in accordance with standards and details of RGC Guarantee Standards.
  - .3 Provide matching flat stock required for fabrication of metal flashings.

### **PART 3 - EXECUTION**

#### 3.1 MEMBRANE INSTALLATION

- .1 Inspect sheets for continuity. Repair punctures and tears before installations are concealed.
- .2 Install Joint Membrane, minimum 200 mm wide, centred over joints and gaps.
- .3 Lap ends of Joint Membranes minimum 150 mm.
- .4 Cut membrane to ensure it is installed tight to penetrations.
- .5 Provide flanged membrane collar around mechanical and electrical penetrations. Flange shall be at plane of surrounding membrane.
- .6 Apply mastic where membrane has been cut to fit around penetrations.

- .7 Lap membranes minimum 50 mm membrane to membrane and minimum 100 mm membrane to any other substrate.

### 3.2 METAL ROOFING INSTALLATION

- .1 All installation work shall be carried out by trained crews all in accordance with the manufacturer's and these specifications.
- .2 Metal roofing systems shall be adjusted to final position before being permanently fastened to structural supports. If such supports are improperly aligned, levelled or plumbed, the problem shall be reported to the Construction Manager in order that the necessary corrections be made before proceeding with the work.
- .3 Endlaps shall be located over supports.
- .4 Openings, and any necessary flashing, shall be provided as called for by the tender documents.
- .5 When cutting or drilling material, care shall be exercised to ensure that cuttings do not remain to rust on exposed surfaces. Where practicable, cutting and drilling shall be conducted so that cuttings do not strike or accumulate on exposed cladding surfaces. Edges cut with an abrasive blade must be hand trimmed.
- .6 Underlay should be applied parallel to the eaves, however if applied perpendicular to the eaves, the laps must be sealed with a suitable lap cement.

### 3.3 CLEANING

- .1 Wash panel surfaces using solution of mild domestic detergent in warm water, applied with soft clean wiping cloths.
- .2 Remove excess sealants using recommended solvents.

**END OF SECTION 07 61 00**

**PART 1 - GENERAL**

1.1 RELATED WORK

- .1 Joint Protection: Section 07 90 00
- .2 Finish Hardware: Section 08 70 00
- .3 Painting: Section 09 90 00
- .4 Electrical: Division 26

1.2 REFERENCE STANDARDS

- .1 American Society for Testing and Materials (ASTM)
  - .1 ASTM A653/A653M, Specification for Steel Sheet Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvanized) by the Hot Dip Process.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB1.181, Ready Mixed Organic Zinc Rich Coating.
  - .2 CGSB 41GP19Ma, Rigid Vinyl Extrusions for Windows and Doors.
- .3 Canadian Standards Association (CSA International)
  - .1 G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2 CSA W59, Welded Steel Construction (Metal Arc Welding).
- .4 Canadian Steel Door Manufacturers' Association, (CSDMA).
  - .1 CSDMA, Specifications for Commercial Steel Doors and Frames.
  - .2 CSDMA, Recommended Selection and Usage Guide for Commercial Steel Doors.
- .5 National Fire Protection Association (NFPA)
  - .1 NFPA 80, Standard for Fire Doors and Fire Windows.
  - .2 NFPA 252, Standard Methods of Fire Tests of Door Assemblies.
- .6 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN4S104M, Fire Tests of Door Assemblies.
  - .2 CAN4S105M, Fire Door Frames Meeting the Performance Required by CAN4S104.
  - .3 CAN/ULCS701, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
  - .4 CAN/ULCS702, Thermal Insulation, Mineral Fibre, for Buildings.
  - .5 CAN/ULCS704, Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

1.3 SYSTEM DESCRIPTION

- .1 Design Requirements:
  - .1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35 degrees C to 35 degrees C.
  - .2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175th of span.

1.4 SUBMITTALS

- .1 Provide product data: in accordance with Section 01 33 00 - Submittal Procedures.

- .2 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.

#### 1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Inspect all materials for discrepancies, deficiencies, and damage.
- .3 Store materials on planks, away from water and moisture and cover to protect from damage.
- .4 Store doors in vertical position and space with blocking to permit air circulation.
- .5 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Construction/Demolition Waste Management and Disposal.

### **PART 2 - PRODUCTS**

#### 2.1 MATERIALS

- .1 Commercial grade steel to ASTM A653, CS, Type B, Coating Designation ZF75 (A25) minimum. Minimum steel thicknesses shall be in accordance with Appendix 1 of the CSDMA, Recommended Specifications for Commercial Steel Door and Frame Products. Steel shall be free from scale pitting, coil breaks or other surface blemishes and also be free of buckles, waves or any other defects caused by use of improper levelled sheets.
- .2 Reinforcement channel: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A653M, ZF75.
- .3 Thickness for steel components:
  - .1 Shall be in accordance with the CSDFMA specification 'Table 1 - Minimum Steel Gauges for Component Parts', unless otherwise specified.
  - .2 Door faces:
    - .1 Standard duty: 20 ga.
  - .3 Door frames:
    - .1 Standard duty: 18 ga.

#### 2.2 DOOR CORE MATERIALS

- .1 Honeycomb construction:
  - .1 Structural small cell, 24.5 mm maximum kraft paper honeycomb, weight: 36.3 kg per ream minimum, density: 16.5 kg/m<sup>3</sup> minimum sanded to required thickness.
- .2 Stiffened: face sheets laminated insulated core.
  - .1 Polyurethane: to CAN/ULC-S704 rigid, modified poly/isocyanurate, closed cell board. Density 32 kg/m<sup>3</sup>.

#### 2.3 ADHESIVES

- .1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.
  - .1 Adhesive: maximum VOC content 50 g/L to SCAQMD Rule 1168.



- .2 Polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.

#### 2.4 PRIMER

- .1 Touch-up prime CAN/CGSB-1.181.

#### 2.5 PAINT

- .1 Field paint steel doors and frames in accordance with Sections 09 90 00 - Painting. Protect weatherstrips from paint. Provide final finish free of scratches or other blemishes.
- .2 Maximum VOC emission level 50 g/L to GS-11.

#### 2.6 ACCESSORIES

- .1 Door silencers: single stud rubber/neoprene type.
- .2 Exterior top caps: steel.
- .3 Metallic paste filler: to manufacturer's standard.
- .4 Glazing: in accordance with Section 08 80 00.
- .5 Make provisions for glazing as indicated and provide necessary glazing stops.

#### 2.7 FRAMES FABRICATION GENERAL

- .1 Fabricate frames in accordance with CSDMA specifications.
- .2 Fabricate frames to profiles and maximum face sizes as indicated.
- .3 Blank, reinforce, drill and tap frames for mortised, templated hardware, using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.
- .4 Protect mortised cutouts with steel guard boxes.
- .5 Prepare frame for door silencers, 3 for single door, 2 at head for double door.
- .6 Manufacturer's nameplates on frames and screens are not permitted.
- .7 Conceal fastenings except where exposed fastenings are indicated.
- .8 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.
- .9 Insulate exterior frame components with polyurethane insulation.

#### 2.8 FRAME ANCHORAGE

- .1 Provide appropriate anchorage to floor and wall construction.
- .2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.

2.9 FRAMES: WELDED TYPE

- .1 Welding in accordance with CSA W59.
- .2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.
- .3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.
- .4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.
- .5 Securely attach floor anchors to inside of each jamb profile.
- .6 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.

2.10 DOOR FABRICATION GENERAL

- .1 Doors: swing type, flush.
- .2 Exterior doors: polyurethane construction. Interior doors: honeycomb construction.
- .3 Fabricate doors with longitudinal edges welded. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.
- .4 Blank, reinforce, drill doors and tap for mortised, templated hardware.
- .5 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.
- .6 Reinforce doors where required, for surface mounted hardware. Provide flush steel top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.
- .7 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.
- .8 Manufacturer's nameplates on doors are not permitted.

**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 GENERAL

- .1 Install doors and frames to CSDMA Installation Guide.

3.3 FRAME INSTALLATION

- .1 Set frames plumb, square, level and at correct elevation.
- .2 Secure anchorages and connections to adjacent construction.

- .3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width.
- .4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.
- .5 Caulk perimeter of frames between frame and adjacent material.

#### 3.4 DOOR INSTALLATION

- .1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Door Hardware.
- .2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.
  - .1 Hinge side: 1.0 mm.
  - .2 Latchside and head: 1.5 mm.
  - .3 Finished floor, top of thresholds: 13 mm.
- .3 Adjust operable parts for correct function.

#### 3.5 FINISH REPAIRS

- .1 Touch up with primer finishes damaged during installation.
- .2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

**END OF SECTION 08 10 00**

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**PART 1 - GENERAL**

1.1 RELATED WORK

- .1 Structural Systems: Section 13 34 25

1.2 REFERENCES

- .1 ASTM A653/A653M-11, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 ASTM E330-02(2010) - Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- .3 CSA G164-M92(R2003) - Hot Dip Galvanizing of Irregularly Shaped Articles.
- .4 UL - List of Equipment and Materials Fire Resistance
- .5 ULC - List of Equipment and Materials Fire Resistance

1.3 SYSTEM DESCRIPTION

- .1 Loads: Design and size components to withstand dead and live loads caused by pressure and suction of wind acting normal to plane of wall to a design pressure of <0.95 kPa> <<20 lb/sq ft>> as measured in accordance with ASTM E330.
- .2 Design door panel assemblies with a minimum thermal insulation factor of 3.0 RSI and .41 mm steel sheet panels with 1.6 mm steel end caps.
- .3 Design door assembly to withstand minimum 100,000 open close cycles.
- .4 Supply and install all equipment required.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit submittals in accordance with Section 01 33 00.
- .2 Product Data: Submit manufacturer's printed product literature, specifications and data sheet.
- .3 Shop Drawings: Indicate sizes, service rating, types, materials, operating mechanisms, locations and details, hardware and accessories, required clearances.
- .4 Manufacturer's Instructions: Submit manufacturer's installation instructions
- .5 Closeout submittals: Provide operation and maintenance data for overhead door hardware for incorporation into manual.
- .6 Submit shop drawings under seal of qualified Supporting Registered Professional registered in British Columbia and experienced in metal roofing systems. Failure to provide shop drawings under seal will result in rejection of shop drawings.

1.5 LETTERS OF ASSURANCE

- .1 The Supporting Registered Professional responsible for sealing engineered shop drawings shall submit to the Registered Professional of Record, AIBC/APEGBC Schedule S-B Assurance of Professional Design and Commitment for Field Review with the shop drawings.

- 
- .2 The Supporting Registered Professional shall provide field review of the installation and submit to the Registered Professional of Record, AIBC/APEGBC Schedule S-C Assurance of Professional Field Review and Compliance upon completion of the Work.

#### 1.6 QUALITY ASSURANCE

- .1 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .2 Single-Source Responsibility: Provide doors, tracks, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components

#### 1.7 WARRANTY

- .1 Warranty: Manufacturer's ten (10) year warranty against materials and workmanship of door sections. Include coverage of delamination, including discolouration, and loss of strength due to weathering.

### **PART 2 - PRODUCTS**

#### 2.1 MATERIALS

- .1 Steel sheet: commercial quality sheet steel to ASTM A653/A653M with Z180 designation zinc coating to ASTM A924/A924M; minimum 0.455 mm (26 gauge) base metal thickness sheet steel to both sides, Total thickness 44.5 mm.
- .2 Insulation: High-pressure, CFC and HCFC-Free, polyurethane foam injected between the walls of each panel, with a density of 40.4 kg/m (2.5 lb/ft ) and a thermal resistance factor 3.3 of RSI 1.6 per 25 mm (1") of thickness. Minimum total insulation factor is, RSI 2.8 (R-16) ( $k = 0.357$  W/m K) (ASTM C518).

#### 2.2 DOORS

- .1 Fabricate 44.5 mm thick insulated ribbed flush panel doors of galvanized steel sections as indicated.
- .2 Fabricate panel frames by a continuous foamed-in-place polyurethane lamination process to form a homogenous sandwich panel of even textured polyurethane insulation of metal/foam/metal. Roll form sections to produce a thermal break.
- .3 Assemble components by means of spot or arc welding or coated rivet system or adhesive and self tapping screws.
- .4 Provide sections with 1.6 mm base metal thickness steel end caps for bracket and hinge attachment

#### 2.3 HARDWARE

- .1 Finish: all hinges, brackets, tracks shaft brackets etc., to be commercially galvanized to Z275 designation.
- .2 Track: standard lift, with 79.4 mm size 2.8 mm core thickness track for torsion spring lifting and include ancillary hardware items.
- .3 Track Brackets: 3.2 mm base metal thickness galvanized steel, rib reinforced.

- .4 Track angles: continuous track angles to attach tracks to structure, fix welded or bolted adjustable type, running full height of opening, fabricated of galvanized steel 2.4 mm base metal thickness.
- .5 Track hangers: 25 mm x 25 mm x 2.4 mm thick galvanized steel perforated angles.
- .6 Rollers: full floating hardened steel, with inner and outer ball races of hardened steel, 75 mm diameter complete with ten (10) 7.9 mm diameter ball bearings and 11.1 mm diameter roller axle.
- .6 Roller brackets: adjustable, minimum 3.2 mm galvanized steel.
- .7 Hinges: heavy duty, secure with rivets or self tapping screws minimum 3.2 mm galvanized steel.
- .8 Counterbalance: torsion springs, grooved precision drums and flexible aircraft cables. Mount units on tubular or solid steel shaft, fully keyed full length and run on ball bearings. Shaft sizes to be 31.8 mm diameter.
- .9 Accessories:
  - .1 3 mm core thickness continuous steel angle track supports.
  - .2 5 mm thick formed sheet 1500 mm high track guards.
  - .3 Pusher springs.
  - .4 Pillow block bearing plates for high cycle door.
  - .5 Double contact Bulb type extruded neoprene weatherstrip for door sill section, full width.
  - .6 Extruded aluminum and arctic grade vinyl weatherstrip for jambs and head, to manufacturer's standard.
  - .7 Two horizontal sliding lock bolts on interior.
- .10 Finish ferrous hardware items with minimum zinc coating of 300 g/m to ASTM D123/A123M 2 or ASTM A385 as applicable.
- .11 The overhead door supplier is responsible for providing and installing door contacts in every door. Ensure door contacts are compatible with all overhead doors.

## 2.4 FINISH

- .1 Factory pre-finish door panels after fabrication to colour selected by Departmental Representative.
- .2 Coating to conform to CGSB 93-GP-3M as follows.
  - .1 Interior 0.2 mil white polyester wash coat.
  - .2 Exterior: two coat baked on polyester
  - .3 Site re-finish damaged panels with compatible coating.

## 2.5 OPERATION

- .1 Equip doors for operation by chain hoist with galvanized steel chain.

## **PART 3 - EXECUTION**

### 3.1 INSTALLATION

- .1 Install doors and hardware in accordance with manufacturer's instructions.

- 
- .2 Rigidly support rail and operator and secure to supporting structure.
  - .3 Touch-up pre finished steel doors with where finish is damaged during installation.
  - .4 Lubricate and adjust door operating components to ensure smooth opening and closing of doors.
  - .5 Adjust weatherstripping to form a weather tight seal.
  - .6 Adjust doors for smooth operation.

**3.2 DEMONSTRATION**

- .1 Test-operate and adjust doors to perform smoothly, free from warp, twist or distortion. Demonstrate the operation to the satisfaction of the commissioning agent at the same time of acceptance of the completed work.

**3.3 CLEANING**

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Remove traces of primer, caulking; clean doors and frames.

**END OF SECTION 08 36 13**

**PART 1 - GENERAL**

1.1 RELATED WORK

- .1 Rough Carpentry: Section 06 10 00
- .2 Structural Systems Section 13 34 25

1.2 REFERENCES

- .1 British Columbia Building Code (BCBC)
- .2 CAN3-S157 Strength Design in Aluminum.
- .3 CAN/CSA-A440, Windows.
- .4 AAMA/WDMA/CSA 101/I.S.2/A440, NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights (Harmonized Standard),
- .5 A440S1, Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440, NAFS – North American Fenestration Standard/Specification for Windows, Doors, and Skylights.

1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: Submit product data including manufacturer's literature for aluminum window frames, glazing, components and accessories, indicating compliance with specified requirements and material characteristics.
  - .1 Submit list on window manufacturer's letterhead of materials, components and accessories to be incorporated into Work.
  - .2 Include product names, types and series numbers.
  - .3 Include contact information for manufacturer and their representative for this Project.
- .3 Shop Drawings:
  - .1 Indicate materials and details in full size scale for head, jamb and sill, profiles of components, interior and exterior trim, junction between combination units, elevations of unit, anchorage details, description of related components and exposed finishes, fasteners, and caulking.
  - .2 Indicate location of manufacturer's nameplates.
- .4 Samples:
  - .1 Submit duplicate 300 x 300 mm sample sections showing aluminum surface, finish, colour and texture, and including frame corner details and hardware.
  - .2 Submit duplicate 300 x 300 mm sample sections of insulating glass unit showing glazing materials and edge and corner details.
- .5 Thermal Performance: Submit verification that Insulating Glass Units used meet RSI (R) values specified.
- .6 Test Reports: Submit test reports showing compliance with specified performance characteristics and physical properties including air and water infiltration.



- .7 Record Documentation: In accordance with Section 01 78 00 Closeout Submittals.
  - .1 List materials used in windows work.
  - .2 Warranty: Submit warranty documents specified.

#### 1.4 DELIVERY STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements:
  - .1 Deliver material in accordance with Section 01 61 00 - Common Product Requirements.
  - .2 Deliver aluminum windows in manufacturer's original packaging with identification labels intact and in sizes to suit project.
  - .3 Brace frames to maintain squareness and rigidity during shipment.
- .2 Material Handling: To AAMA CW-10.
- .3 Storage and Handling Requirements: Store materials off ground and protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
  - .1 Material storage: To AAMA CW-10.
- .4 Packaging Waste Management:
  - .1 Separate and recycle waste packaging materials in accordance with Section 01 74 19 Construction Waste Management and Disposal.
  - .2 Remove waste packaging materials from site and dispose of packaging materials at appropriate recycling facilities.

#### 1.5 WARRANTY

- .1 Provide manufacturers warranty in writing aluminum windows against leakage, defects and malfunction under normal usage for a period of 2 years from date of Substantial Performance of Work.
- .2 Insulating glass units: 10 years, on Date of Substantial Performance of Work..

### **PART 2 - PRODUCTS**

#### 2.1 DESIGN CRITERIA

- .1 Design aluminum components to CAN/CSA S157.
- .2 Window Classification: To NAFS 11 (North American Fenestration Standards)
  - .1 PG AW 85 (Fixed)
  - .2 Forced Entry: F40.

#### 2.2 MATERIALS

- .1 Main Frame: Extruded aluminum: To ASTM B221, 6063 alloy with T5 temper, anodizing quality and 1.6 mm minimum thickness.
- .2 Insulating glass units: To CAN/CGSB-12.8, double, hermetically sealed, argon filled insulating glass units with low conductance stainless steel warm edge spacer and arissed edge minimum quality.
  - .1 Outer lite: 6 mm clear float glass.
  - .2 Inner lite: 6 mm clear float glass.
  - .3 Secondary seal: Silicone.
- .3 Acceptable product: Alumicor Ltd., Integra 6000 Series or other pre-approved

## 2.3 FABRICATION

- .1 Fabricate windows to CAN/CSA A440/A440.1.
  - .1 Do glazing in accordance with Section [08 80 00 - Glazing].
  - .2 Site glazing is not permitted.
- .2 Do aluminum welding to CAN/CSA W59.2.
  - .1 Fabricate aluminum assemblies of extruded sections to sizes and profiles indicated.
- .3 Construct units square, plumb and free from distortion, waves, twists, buckles or other defects detrimental to performance or appearance.
  - .1 Brace frames to maintain squareness and rigidity during installation.
- .4 Fabricate units square and true with tolerance of plus or minus 1.5 mm maximum for units with diagonal measurement of 1800 mm maximum and plus or minus 3 mm maximum for units with diagonal measurement greater than 1800 mm.
- .5 Accurately fit and secure joints and corners.
  - .1 Mitre joints in frames and sash and secure using integrally captured crimped corner keys.
  - .2 Ensure joints are flush, hairline, and weatherproof.
  - .3 Seal joints in accordance with manufacturer's written recommendations.
- .6 Face dimensions detailed are maximum permissible sizes.
- .7 Use only concealed tamperproof fasteners
  - .1 Where fasteners cannot be concealed, countersunk screws finished to match adjacent material may be used upon receipt of written approval from Departmental Representative.
- .8 Provide pressure equalized sill weep system to ensure water does not accumulate in sill area.

## 2.4 ALUMINUM FINISHES

- .1 Finish aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes:
  - .1 Clear (natural) anodic finish: AA-M12 C22 A31.

## 2.5 ACCESSORIES

- .1 Gasketing: To [CCD-45] Silicone compatible rubber or extruded silicone gaskets or peroxide cure EPDM.
- .2 Setting Blocks: To ASTM D2240, 80 - 90 Shore A Durometer hardness.
- .3 Spacers: To ASTM D2240, extruded silicone compatible, peroxide cure EPDM, 50 - 60 Shore A Durometer hardness.
- .4 Sealant: To CAN/CGSB-19.13, Class 40, one-component, cold-applied, non-sagging silicone.
- .5 Fasteners: Tamperproof, cadmium plated stainless steel series to meet window requirements and as recommended by manufacturer.

**PART 3 - EXECUTION**

**3.1 WINDOW INSTALLATION**

- .1 Install windows in accordance with reviewed shop drawings, manufacturer's standards and applicable standards to achieve CAN/CSA-A440 acceptance levels of performance.
- .2 Install sills to all locations, unless indicated otherwise. Set all sills to drain 15% slope. All flashing and subsill assemblies to have watertight end dams.

**3.2 CAULKING**

- .1 Seal joints between frame members and other non-operating components with sealant to provide weathertight seal at outside and air/vapour seal at inside.
- .2 Conceal sealant within aluminum work.

**END OF SECTION 08 51 13**

**PART 1 - GENERAL**

1.1 RELATED WORK

- .1 Rough Carpentry: Section 06 10 00
- .2 Metal Doors and Frames: Section 08 10 00
- .3 Painting: Section 09 91 23

1.2 REFERENCES

- .1 DHI 141 - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; Door and Hardware Institute.
- .2 Canadian General Standards Board (CGSB).
  - .1 CAN/CGSB-69.18-M90/ANSI/BHMA A156.1-1981, Butts and Hinges.
  - .2 CAN/CGSB-69.20-M90/ANSI/BHMA A156.4-1986, Door Controls (Closers).
  - .3 CAN/CGSB-69.29-93/ANSI/BHMA A156.13-1987, Mortise Locks and Latches.

1.3 REFERENCES

- .1 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Hardware List:
  - .1 Submit contract hardware list in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.
- .3 Manufacturer's Instructions:
  - .1 Submit manufacturer's installation instructions.
- .4 Closeout Submittals
  - .1 Provide operation and maintenance data for door closers, locksets, door holders for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordinate the manufacture, fabrication, and installation of products onto which door hardware will be installed.

1.5 QUALITY ASSURANCE

- .1 CGSB (Canadian Government Specifications Board), CSA (Canadian Standards Association), ASTM (American Society for Testing and Materials), or other standards shall be the latest edition of that standard including all revisions.
- .2 Conform to materials specified, in brand and quality, unless otherwise approved in writing by the Consultant.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Packing, Shipping, Handling and Unloading:
  - .1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Common Product Requirements.
  - .2 Package each item of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.
    - .1 Storage and Protection:
    - .2 Store finishing hardware in locked, clean and dry area.

1.7 TEMPLATES

- .1 Hardware supplier shall supply templates to all trades requiring them.

**PART 2 - PRODUCTS**

2.1 MATERIALS

- .1 Hardware shall be best grade, entirely free from imperfections in manufacture and finish and shall be supplied in accordance with the hardware list specified herein.

2.2 FASTENINGS

- .1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.
- .2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.
- .3 Exposed fastening devices to match finish of hardware.
- .4 Use fasteners compatible with material through which they pass.

2.3 KEYING

- .1 Door locks to be keyed by Owner.
- .2 Provide blank keys in duplicate for every lock in this Contract.
- .3 Provide all permanent cores and keys to Departmental Representative.

**PART 3 - EXECUTION**

3.1 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.

**PART 4 - SCHEDULE**

4.1 SINGLE EXTERIOR DOORS WITH SECURITY - Heading 01

- .1 Doors: 100B Heated Bay / Exterior  
101E Unheated Bays / Exterior

914 x 2134 x 45 x HMD x PSF

- .2 Each assembly to have:

3	HW Hinge	5BB1HW 114x114 NRP	630	IVE
1	Elec HW Hinge	5BB1HW 114x114 CON TW4	630	IVE
1	Elec Fire Exit Hardware	RX-ALK-99-L-F-17-CON	626	VON
1	Mortise Cylinder	20-001 114	626	SCH
1	Rim Cylinder	20-021	626	SCH
1	Electric Strike	6111 FSE DS CON	630	VON
1	OH Stop	90S	630	GLY
1	Surface Closer	4040XP	689	LCN
1	Flush Ceiling Mt. Plt	4040XP-18G	689	LCN
1	Kick Plate	8400 254mm x 40mm LDW B-CS	630	IVE
1	Gasketing	328AA	AA	ZER
1	Door Sweep	39A	A	ZER
1	Threshold	545A-MSLA-10	A	ZER

4.2 SINGLE INTERIOR DOOR - Heading 02

- .1 Doors: 101F Unheated Bays / Heated Bay

914 x 2134 x 45 x HMD x PSF

- .2 Each assembly to have:

3	Hinge	5BB1 114x102	652	IVE
1	Passage Set	L9010 17B	626	SCH
1	Surface Closer	1461	689	LCN
1	Kick Plate	8400 254mm x 40mm LDW B-CS	630	IVE
1	Wall Stop	WS401/402CVX	626	IVE
3	Silencer	SR64	GRY	IVE

**END OF SECTION 08 71 00**

**PART 1 - GENERAL**

1.1 RELATED WORK

- .1 Rough Carpentry: Section 06 10 00
- .2 Synthetic Sheathing Membrane: Section 07 27 00
- .3 Preformed Metal Siding: Section 07 46 13
- .4 Painting: Section 09 90 00
- .5 Structural Systems: Section 13 34 25

1.2 REFERENCE STANDARDS

- .1 Association of Wall and Ceiling Contractors (AWCC) of British Columbia.
- .2 ASTM C36 - Standard Specification for Gypsum Wallboard.
- .3 ASTM C79 - Standard Specification for Treated Core and Nontreated Core Gypsum Sheathing Board.
- .4 ASTM C442 - Standard Specification for Gypsum Backing Board, Gypsum Coreboard, and Gypsum Shaftliner Board.
- .5 ASTM C475 - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
- .6 ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- .7 ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.
- .8 ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications.
- .9 ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
- .10 ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base
- .11 CAN/ULC-S102-07, Standard Method of Test of Surface Burning Characteristics of Building Materials and Assemblies.

1.3 FIRE PROTECTION REQUIREMENTS

- .1 Provide fire rated gypsum board components and assemblies as indicated on the drawings. Rated assemblies shall comply in all respects to the applicable ULC tested assemblies.

1.4 DELIVERY, HANDLING AND STORAGE

- .1 Use all means necessary to protect gypsum board materials before, during and after installation and to protect the installed work and materials of other trades affected by this work.

- .2 Store materials in a dry area inside the building. Do not remove wrapping until ready for use. Prevent damage to all edges and surfaces.
- .3 In the event of damage, immediately make all repairs and replacements necessary to the approval of the Departmental Representative and at no additional cost to the Owner.

#### 1.5 ENVIRONMENTAL REQUIREMENTS

- .1 Maintain temperature minimum 10°C, maximum 21°C for 48 hours prior to and during application of gypsum boards and joint treatment, and for at least 48 hours after completion of joint treatment.
- .2 Apply board and joint treatment to dry, frost free surfaces.

### **PART 2 - PRODUCTS**

#### 2.1 GYPSUM BOARD

- .1 Fire Resistant (Type X) Gypsum Board: Meeting requirements of ASTM C1396M; having mould resistant facers meeting a rating of 10 (zero mould growth) in accordance with ASTM D3273 with long edges tapered; thickness 16 mm.
- .2 Exterior Sheathing: Type X, Glass mat gypsum substrate: to ASTM C 1177/C 1177M, 15.9 mm thick, 1200 mm wide x maximum practical length.

#### 2.2 FASTENINGS AND ADHESIVES

- .1 Screws: to ASTM C954
- .2 Nails: to ASTM C514.
- .3 Laminating compound: asbestos-free.
- .4 Casing beads, corner beads, control joints and edge trim: to ASTM C 1047, metal, zinc-coated by hot-dip process, 0.5 mm base thickness, perforated flanges, one piece length per location.

### **PART 3 - EXECUTION**

#### 3.1 GYPSUM BOARD APPLICATION

- .1 Do not apply gypsum board until bucks, anchors, blocking, electrical and mechanical work are approved by Departmental Representative.
- .2 Apply board to furring and framing using screw fasteners.
  - .1 Walls: install screws 200 mm o.c. along board edges, 300 mm o.c. throughout board fields.
  - .2 Ceilings: install screws 200 mm o.c. along board edges and throughout board fields.
- .3 Where interior partitions intersect with exterior walls, run gypsum board through intersection on exterior wall prior to applying gypsum board to partition.
- .4 Sealing for air barrier performance: seal perimeter of and penetrations through exterior walls to achieve building air barrier plane at gypsum board face.
  - .1 Seal full perimeter of window/door openings.



- .5 Do not use router tool to trim drywall openings on exterior walls. Poly membrane will be compromised. Full removal of drywall and replacement of poly will be required at no cost to the Owner and will be reviewed by the Departmental Representative.
- .6 Gypsum Board Finish: finish gypsum board walls to following levels in accordance with AWCI Levels of Gypsum Board Finish:
  - .1 Levels of finish: At typical wall locations. 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 edges.

### 3.2 WASTE MANAGEMENT

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Construction Waste Management and Disposal.
- .2 Do not include wood, plastic, metal, asphalt-impregnated gypsum board, or any gypsum board coated with glass fiber, vinyl, decorative paper, paint, or other finish. Place in designated area and protect from moisture and contamination.
- .3 Recycle clean waste gypsum products.
- .4 Separate metal waste and place in designated areas for recycling or reuse.

**END OF SECTION 09 29 00**

## **PART 1 - GENERAL**

### 1.1 RELATED WORK

- .1 Metal Fabrications: Section 05 50 00
- .2 Rough Carpentry: Section 06 10 00
- .3 Metal Doors and Frames Section 08 10 00
- .4 Gypsum Board: Section 09 29 00

### 1.2 REFERENCE STANDARD

- .1 Master Painters Institute (MPI), Architectural Painting Specification Manual of the Master Painters and Decorators Association (MPDA), referenced as MPI Manual.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS): Material Safety Data Sheets (MSDS).
- .3 Society for Protective Coatings (SSPC): Systems and Specifications, SSPC Painting Manual.

### 1.3 QUALITY ASSURANCE

- .1 All materials, preparation and workmanship shall conform to requirements of the latest edition of the Architectural Painting Specification Manual by the Master Painters Institute (MPI) (hereafter referred to as the MPI Painting Manual) as issued by the local MPI Accredited Quality Assurance Association having jurisdiction.
- .2 All paint manufacturers and products used shall be as listed under the Approved Product List section of the MPI Painting Manual.
- .3 All painting and decorating work shall be inspected by a Paint Inspection Agency (inspector) acceptable to the Departmental Representative and the local MPI Accredited Quality Assurance Association. The painting contractor shall notify the Paint Inspection Agency a minimum of one week prior to commencement of work and provide a copy of the project painting specification, plans and elevation drawings (including pertinent details) as well as a Finish Schedule.
- .4 All surfaces requiring painting shall be inspected by the Paint Inspection Agency who shall notify the Departmental Representative in writing of any defects or problems, prior to commencing painting work, or after the prime coat shows defects in the substrate.
- .5 Retain purchase orders, invoices and documents to prove conformance with noted MPI requirements when requested by Departmental Representative.

### 1.4 SCHEDULING

- .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 changes in work schedule.

### 1.5 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

- .2 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and data sheets.
  - .2 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOCs during application and curing.
- .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 Manufacturer's Material Safety Data Sheets (MSDS).
- .4 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Submit duplicate mm sample panels of each paint 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 finishes over wood surfaces.
  - .2 When approved, samples shall become acceptable standard of quality for appropriate on site surface with one of each sample retained on site.
  - .3 Submit full range of available colours where colour availability is restricted

#### 1.6 QUALITY CONTROL

- .1 When requested by Departmental Representative, prepare and paint designated surface, area, room or item to requirements specified herein, with specified paint or coating showing selected colours, number of coats, 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

#### 1.7 MAINTENANCE

- .1 Extra Materials:
  - .1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Submit one, one litre can of each type and colour of finish coating. Identify colour and paint type in relation to established colour schedule and finish system

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Delivery and Acceptance Requirements:
  - .1 Deliver materials in sealed original labelled containers bearing manufacturer's name, type of material, brand name, colour designation, and where applicable, instructions for mixing and reducing.
  - .2 Labels: to 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.
- .2 Storage and Handling Requirements:
  - .1 Store paint and other materials in a single heated and well ventilated area with a minimum ambient temperature of 7°C.

- .2 Take precautionary measures to prevent fire hazards or spontaneous combustion.
- .3 Provide one 9 kg Type ABC fire extinguisher adjacent to storage area.
- .3 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
  - .2 Separate for reuse and recycling and place in designated containers.
  - .3 Place materials defined as hazardous or toxic in designated containers.
  - .4 Handle and dispose of hazardous materials in accordance with Regional and Municipal regulations.
  - .5 Ensure emptied containers are sealed and stored safely.
  - .6 Unused paint materials must be disposed of at official hazardous material collections site.
  - .7 Paint, stain and wood preservative finishes and related materials (thinners and solvents) are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.
  - .8 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.
  - .9 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.
  - .10 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into ground follow these procedures:
    - .1 Retain cleaning water for water-based materials to allow sediments to be filtered out.
    - .2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
    - .3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
    - .4 Dispose of contaminants in approved legal manner in accordance with hazardous waste regulations.
    - .5 Empty paint cans are to be dry prior to disposal or recycling (where available).
  - .11 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.

## 1.9 ENVIRONMENTAL CONDITIONS

- .1 In accordance with (Exterior) Chapter 2, Section 3, Item 1.1 and (Interior) Chapter 3, Section 3, Item 1.1 of the MPI Manual.
- .2 Do not apply paint finish in areas where dust is being generated.

## **PART 2 - PRODUCTS**

### 2.1 MATERIALS

- .1 Use only MPI approved products from the MPI Approved Product Lists corresponding to the specified finishing systems.
- .2 Use paint materials of single manufacturer for each paint system.

### **PART 3 - EXECUTION**

#### 3.1 PREPARATION OF SURFACES

- .1 Prepare exterior and interior surfaces to receive paint per Chapter 2 - Section 3 and Chapter 3 - Section 3 of the MPI manual.

#### 3.2 COLOURS

- .1 Submit proposed Colour Schedule to Departmental Representative for approval.
- .2 Colour schedule will be based upon selection of five base colours and three accent colours. No more than eight colours will be selected for entire project and no more than three colours will be selected in each area.
- .3 Selection of colours will be from manufacturers full range of colours.
- .4 Where specific products are available in restricted range of colours, selection will be based on limited range.
- .5 Second coat in three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

#### 3.3 APPLICATION

- .1 Sand and dust between each coat to remove defects visible from distance up to 1.5 metres.
- .2 Finish closets and alcoves as specified for adjoining rooms.
- .3 Continue paint finishes through behind wall mounted items.

#### 3.4 PAINT SYSTEMS

- .1 System references listed are based on Exterior Systems Chapter 2 - Section 2 and Interior Systems Chapter 3 - Section 2 of MPI Manual, and are MPI Premium Grade, unless noted otherwise.
- .2 Use systems referenced for interior and exterior finishes listed.

#### 3.5 EXTERIOR SYSTEMS

- .1 Structural steel and metal fabrications: columns, beams, joists, etc.
  - .1 EXT 5.1C - WB Light Industrial Coating, (G5).
- .2 Galvanized metal:
  - .1 EXT 5.3J: W.B. Light Industrial Coating, Prime with MPI #134- W.B. Galvanized primer, follow with 2 coats of MPI #163- W.B. Light industrial Coating - Semi-gloss

#### 3.6 INTERIOR SYSTEMS

- .1 Structural steel and metal fabrications:
  - .1 INT 5.1B WB Light Industrial Coating. (G5)
- .2 Galvanized metal:
  - .1 INT 5.3M High performance architectural latex finish.

- .3 Gypsum board:
  - .1 INT 9.2B: high performance latex, GL 3.
  
- .4 Pressure treated interior wood panelling:
  - .1 Prior to painting ensure moisture content is below 15%.
  - .2 Primer: Acrylic latex stain blocking
    - .1 Acceptable products: Dulux Gripper Interior/exterior Primer Sealer 60000; Prime Solution Interior/ Exterior Latex Stain Blocking Primer 05130 by Cloverdale Paint.
  - .3 Topcoat: G5
    - .1 Acceptable products: Interior - Exterior 100% Acrylic Latex Pearl Finish 70653 by Cloverdale Paint; Dulux X-Pert Interior Acrylic Latex Paint 13010.

**END OF SECTION 09 90 00**

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## **PART 1 - GENERAL**

### 1.1 SUMMARY

- .1 Section includes materials and requirements for chemical fire extinguishers.

### 1.2 RELATED SECTIONS

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

### 1.3 SUBMITTALS

- .1 Shop Drawings:
  - .1 Submit shop drawings for each type of fire extinguisher.
- .2 Closeout Submittals
  - .1 Provide maintenance data for incorporation into Operational and Maintenance manual.

## **PART 2 - PRODUCTS**

### 2.1 MULTI-PURPOSE DRY CHEMICAL EXTINGUISHERS

- .1 4.5 kg [10 lbs] Extinguisher: Multipurpose stored pressure rechargeable fire extinguisher, squeeze grip positive on/off operation, heavy duty glossy enamel finish steel cylinder, pull pin safety lock, forged valve, rating for 4-A, 60-B, C with universal wall mounting bracket..
- .2 Extinguisher Brackets
  - .1 Universal wall mounting bracket as recommended by extinguisher manufacturer.

### 2.2 IDENTIFICATION

- .1 Identify extinguishers in accordance with recommendations of ANSI/NFPA 10.
- .2 Attach tag or label to extinguishers, indicating month and year of installation. Provide space for service dates.

## **PART 3 - EXECUTION**

### 3.1 INSTALLATION

- .1 Install or mount extinguishers on brackets as indicated.

**END OF SECTION 10 44 20**

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**Part 1            General**

**1.1                REFERENCE STANDARDS**

- .1    American Concrete Institute (ACI)
  - .1        SP-66-04, ACI Detailing Manual.
- .2    ASTM International
  - .1        ASTM A123/A123M-17 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
  - .2        ASTM A143/A143M-07(2014) Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
  - .3        ASTM A153/A153M-16a, Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.
  - .4        ASTM A193/A193M-19, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature or High-Pressure Service and Other Special Purpose Applications.
  - .5        ASTM A307-14e1, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
  - .6        ASTM A641/A641M-19, Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
  - .7        ASTM A653/A653M-19a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .8        ASTM A767/A767M-19 Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
  - .9        ASTM A775/A775M-19, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
  - .10       ASTM A792/A792M-10(2015), Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
  - .11       ASTM A884/A884M-19 Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
  - .12       ASTM A924/A924M-19 Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
  - .13       ASTM A1011/A1011M-18a Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
  - .14       ASTM A1064/A1064M-18a, Standard Specification for Carbon Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
  - .15       ASTM C260/C260M-10a(2016), Standard Specification for Air-Entraining Admixtures for Concrete.



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- .16 ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - .17 ASTM C494/C494M-17, Standard Specification for Chemical Admixtures for Concrete.
  - .18 ASTM C1017/C1017M-13e1, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
  - .19 ASTM D412-16, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
  - .20 ASTM D624-00(2012), Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
  - .21 ASTM D1751-04(2013)e1, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
  - .22 ASTM D1752-04a(2013), Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
  - .23 ASTM D5456-17e1, Standard Specification for Evaluation of Structural Composite Lumber Products.
  - .24 ASTM E1643-18a, Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
  - .25 ASTM E1745-17, Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
  - .26 ASTM F1554-17e1, Standard Specification for Anchor Bolts, Steel 36, 55 and 105 ksi Yield Strength.
  - .27 ASTM F1667-17, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.
  - .28 ASTM F2329/F2329M-15 Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners
  - .29 ASTM F3125/ F3125M-15a, Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (930 MPa) and 150 ksi (1040 MPa) Minimum Strength, inch and metric dimensions.
  - .3 Canadian General Standards Board (CGSB)
    - .1 CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
    - .2 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
  - .4 CSA International
    - .1 CSA-A23.1/A23.2-19, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

- .2 CSA-A23.3-14, Design of Concrete Structures.
- .3 CSA A283-19, Qualification Code for Concrete Testing Laboratories.
- .4 CSA A3000-18, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
- .5 CSA-G30.18-09 (R2019), Carbon Steel Bars for Concrete Reinforcement.
- .6 CSA G40.20/G40.21-13 (R2019), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .7 CAN/CSA O80 Series-15, Wood Preservation.
- .8 CSA-O86-19, Engineering Design in Wood.
- .9 CSA O112.9-10 (R2019), Evaluation of Adhesives for Structural Wood Products (Exterior Exposure).
- .10 CSA O121-17, Douglas Fir Plywood.
- .11 CSA O141-05 (R2019), Softwood Lumber.
- .12 CSA-O325-19, Construction Sheathing.
- .13 CSA-S16-14, Design of Steel Structures.
- .14 CSA-S136-16, North American Specifications for the Design of Cold Formed Steel Structural Members.
- .15 CSA S269.1-16, Falsework and Formwork.
- .16 CSA S307-M1980 (R2006), Load Test Procedure for Wood Roof Trusses for Houses and Small Buildings.
- .17 CSA S347-14 (R2018), Method of Test for Evaluation of Truss Plates Used in Lumber Joints.
- .18 CSA W47.1-19, Certification of Companies for Fusion Welding of Steel.
- .19 CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding.
- .20 CSA W55.3-08 (R2018), Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
- .21 CSA W59-18, Welded Steel Construction (Metal Arc Welding).
- .22 CSA W186-M1990 (R2016), Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .5 Canadian Wood Council
  - .1 Wood Design Manual 2018 Edition
  - .2 Engineering Guide for Wood Frame Construction 2014 Edition.
- .6 National Lumber Grades Authority (NLGA)
  - .1 Standard Grading Rules for Canadian Lumber 2017.
- .7 National Research Council Canada (NRC)
  - .1 National Building Code of Canada 2015 (NBC).
  - .2 Structural Commentaries (User's guide – NBC 2015: Part 4 of Division B).

- .8 Reinforcing Steel Institute of Canada (RSIC)
  - .1 RSIC-2018, Reinforcing Steel Manual of Standard Practice.
- .9 Truss Plate Institute of Canada (TPIC)
  - .1 TPIC - 2019, Truss Design Procedures and Specifications for Light Metal Plate Connected Wood Trusses (Limit States Design).
- .10 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S701-2017, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

## **1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Structural Drawings:
  - .1 Submit structural drawings sealed and signed by a Professional Engineer registered or licensed in British Columbia, Canada.
  - .2 Submit structural Letter of Assurance (Schedule B and Schedule C-B).
  - .3 Submit structural Letter of Assurance (Schedule S) for delegated design.
- .2 Cast-in-place Concrete Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for proprietary materials used in Cast-In-Place Concrete and additives and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit cast-in-place concrete mix designs for review by Departmental Representative.
  - .3 When Chromate solution used as replacement for galvanizing non-prestressed reinforcement, provide product description for review by Departmental Representative prior to its use.
- .3 Wood Framing Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for wood framing work, wood products, and accessories and include product characteristics, performance criteria, physical size, finish and limitations.
- .4 Wood Truss Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for wood trusses and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Provide certification that trusses meet requirements of CSA S307 and CSA S347.
  - .3 Test reports: submit certified test reports for prefabricated wood trusses from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
  - .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

- 
- .5 Shop Drawings:
    - .1 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice and SP-66.
    - .2 Submit wood truss shop drawings sealed and signed by Professional Engineer registered or licensed in British Columbia, Canada.
    - .3 Submit structural steel shop drawings in accordance with S16 and S136.
  - .6 Site Quality Control Submittals:
    - .1 Submit soil compaction testing results for review by Departmental Representative within 3 days of testing.
    - .2 Submit concrete testing results for review by Departmental Representative within 3 days of testing.
    - .3 Submit construction review reports to Departmental Representative within 3 days of review, verifying compliance of Work.

### **1.3 QUALITY ASSURANCE**

- .1 Upon request, submit to Departmental Representative certified copy of mill test report of reinforcing steel, minimum 2 weeks prior to beginning reinforcing work.
- .2 Upon request, submit to Departmental Representative certified copy of structural steel, minimum 2 weeks prior to fabrication of structural steel.
  - .1 Mill test reports to show chemical and physical properties and other details of steel to be incorporated in project.
  - .2 Provide mill test reports certified by metallurgist qualified to practise in Province of British Columbia, Canada.
- .3 Qualifications:
  - .1 Concrete supplier to be a member of Concrete BC.
  - .2 Fabricator for trusses to show evidence of quality control program such as provided by regional wood truss associations, or equivalent.
  - .3 Structural steel fabricator to be certified by the Canadian Welding Bureau under the requirements of CSA W47.1, Division 1 or 2 for fusion welding and/or CSA W55.3 for resistance welding of structural steel components, and to have CWB approved procedure for welding rebar (Grade 400W) to structural steel.
  - .4 Welders to be CWB approved, working under supervision of a CWB approved firm.
- .4 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .5 Plywood identification: by grade mark in accordance with applicable CSA standards.

### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Storage and Handling Requirements:

- .1 Handle and protect galvanized materials from damage to zinc coating.
  - .1 During storage space surfaces of galvanized materials to permit free circulation of air.
- .2 Store materials off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .3 Store materials off ground with moisture barrier at both ground level and as a cover forming a well-ventilated enclosure, with drainage to prevent standing water.
- .4 Stack, lift, brace, cut and notch engineered lumber products in strict accordance with manufacturer's instructions and recommendations.
- .5 Provide bearing supports and bracings. Prevent bending, warping and overturning of trusses.
- .6 Store and protect materials from nicks, scratches, and blemishes.
- .7 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 STRUCTURAL SYSTEMS DESCRIPTION**

- .1 Bearing Walls: Plywood sheathing on wood stud framing with wood beams and built-up studs or timber posts or structural steel framing at openings.
- .2 Shear Walls: Plywood sheathing on wood stud framing complete with blocked plywood panel edges, built-up studs chords, and connection hardware to transfer lateral loads to foundations.
- .3 Roof: Plywood sheathing on prefabricated wood trusses supported by wood beams and stud walls.
- .4 Roof Diaphragm: Plywood sheathing on prefabricated wood trusses complete with connection hardware to transfer lateral loads to shearwalls. Based on indicative design shearwalls are anticipated on Grids 1, 2, A, B, and F.
- .5 Ground Floor: Reinforced concrete slab on grade.
- .6 Foundation: Reinforced concrete foundation walls supported by shallow conventional reinforced concrete pad and strip footings.

### **2.2 DESIGN REQUIREMENTS**

- .1 Design building foundations to support the loads from the super-structure in accordance with the National Building Code of Canada 2015 and the Geotechnical Report prepared by Western Geotechnical Consultants Ltd dated November 24, 2017. The minimum exposure class for foundation wall, piers, and footings concrete shall be F-2.
- .2 Design interior slab on grade shall be to support a uniform live load of 6.0 kPa, uniform partition load of 1.0 kPa, and equipment wheel loads. Floor surface tolerance shall meet Class A requirements. Provide crack control joints. The minimum exposure class for slab

- on grade concrete shall be C-2. Design, detail, and construct slab to minimize shrinkage cracks.
- .3 Design building structure to withstand dead loads and live loads including ceilings, overhead doors, mechanical systems, and electrical systems.
  - .4 Design building structure in accordance with 2015 National Building Code of Canada. Site specific design parameters are as follows:
    - .1 Building Importance Category: Low
    - .2 Roof Snow:  $S_s = 2.0$  kPa,  $S_r = 0.3$  kPa,  $S = 1.52$  kPa + accumulation
    - .3 Wind:  $q_{1/50} = 0.44$  kPa, Terrain = open, Internal Pressure Category = 3
    - .4 Seismic: Site Class = D,  $S_a(0.2) = 0.701$ ,  $S_a(0.5) = 0.597$ ,  $S_a(1.0) = 0.350$ ,  $S_a(2.0) = 0.215$ ,  $S(5.0) = 0.071$ , PGA = 0.306, PGV = 0.445
  - .5 Maximum deflections:
    - .1 Roof trusses vertical deflection due to snow or wind load: 1/360 of span.
    - .2 Roof joists vertical deflection due to total load: 1/300 of span.
    - .3 Roof beams vertical deflection due to snow or wind load: 1/480 of span.
    - .4 Roof beams vertical deflection due to total load: 1/360 of span.
    - .5 Wall lateral deflection (out-of-plane) due to specified wind loads: 1/300 of span.
    - .6 Shearwall lateral deflection (in-plane) under wind loads: 1/400 of height.
    - .7 Shearwall lateral deflection (in-plane) under seismic loads: 1/40 of height.
  - .6 Design building enclosure elements to accommodate, by means of expansion joints, any movement in element itself and between element and building structure caused by structural movements without permanent distortion, damage to infills, racking of joints, breakage of seals, water penetration or glass breakage.
  - .7 Design steel frame and foundation to support exterior electrical panel.
  - .8 Design steel frame and foundation to support components of existing water irrigation filling station.
  - .9 Design concrete to CSA-A23.3.
  - .10 Design wood framing to CSA-O86.
  - .11 Design structural steel to CSA-S16.
  - .12 Design light metal plate connected wood trusses in accordance with TPIC truss design procedures for wood truss chords and webs in accordance with engineering properties in CSA-O86.
  - .13 Design light metal plate connected wood trusses in accordance with TPIC truss design procedures for truss joint designs to test engineering properties in accordance with CSA S347 and listed in CCMC Registry of Product Evaluations.

## **2.3 MATERIALS**

- .1 Formwork and Falsework materials: to CSA-S269.1.

- .2 Concrete: to CSA A23.1/A23.2.
- .3 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA A23.1/A23.2.
  - .1 Minimum compressive strength: 50 MPa at 28 days.
- .4 Curing compound: to CSA A23.1/A23.2 and ASTM C309.
- .5 Polyethylene film to: ASTM E1745 Class A, minimum 0.25mm thickness.
- .6 Typical reinforcing steel: billet steel, grade 400, deformed bars to CSA-G30.18.
- .7 Weldable reinforcing steel: weldable low alloy steel deformed bars to CSA-G30.18.
- .8 Cold-drawn annealed steel wire ties: to ASTM A1064/A1064M.
- .9 Deformed steel wire for concrete reinforcement: to ASTM A1064/A1064M.
- .10 Welded steel wire fabric and welded deformed steel wire fabric: to ASTM A1064/A1064M.
  - .1 Provide in flat sheets only.
- .11 Plain round bars: to CSA-G40.20/G40.21.
- .12 Structural steel: to CSA G40.21, shop primed, grey colour, components exposed to weather to be hot dipped galvanized coated to ASTM A153/A153M to 600 g/m<sup>2</sup>.
- .13 Structural steel framing bolts: to ASTM F3125/ F3125M, Grade A325/A325M complete with nuts and washers, galvanized.
- .14 Anchor bolts: to ASTM F1554 Grade 36 or 55, or CSA-G40.20/G40.21, Grade 300W, galvanized.
- .15 High strength anchor bolts: to ASTM A193/A193M, Grade B7, galvanized.
- .16 Welding materials: to CSA W59.
- .17 Lumber: softwood, S4S, moisture content 19% (S-dry) or less in accordance with following standards:
  - .1 CSA O141.
  - .2 NLGA Standard Grading Rules for Canadian Lumber.
- .18 Glued end-jointed (finger-jointed) lumber are not acceptable for structural framing.
- .19 Structural Composite Lumber (SCL) in accordance with ASTM D5456.
- .20 Roof sheathing:
  - .1 Plywood, DFP sheathing grade, T&G edge, 15.5mm thick minimum.
  - .2 OSB will not be permitted.
- .21 Exterior wall sheathing:
  - .1 Plywood, DFP sheathing grade, square edge, 12.5 mm thick minimum.
  - .2 OSB will not be permitted.



- .22 Nails, spikes and staples: to ASTM F1667.
- .23 Wood framing bolts: to ASTM A307, galvanized, minimum 12.7 mm diameter, complete with nuts and washers.
- .24 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws, explosive actuated fastening devices, recommended for purpose by manufacturer.
- .25 Joist hangers, connectors and fasteners: in accordance with accepted shop drawings, minimum 0.91 mm thick sheet steel, galvanized to minimum ASTM A123 Class D coating designation.
- .26 Nailing discs: flat caps, minimum 25 mm diameter, minimum 0.4 mm thick, sheet metal, formed to prevent dishing. Bell or cup shapes not acceptable.
- .27 Fastener Finishes:
  - .1 Galvanizing: to ASTM A123/A123M, use galvanized fasteners for all work.
  - .2 Power driven galvanized fasteners will not be permitted.
  - .3 Stainless steel: use stainless steel 304 or 316 alloy.
  - .4 Fasteners in contact with preservative treated wood: galvanized or stainless steel.
- .28 Wood Preservative: to CSA-080, alkaline copper quaternary (ACQ) or copper azole (CA). ACQ maybe either type ACQ-B (ammoniacal) or type ACQ-D (amine).
- .29 Sill Plate Gasket: Closed cell polyethylene foam gasket in width to match sill plate width, 6 mm thick.

## **2.4 FABRICATION**

- .1 Fabricate formwork and falsework in accordance with CSA S269.1.
- .2 Fabricate reinforcing steel in accordance with Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada and CSA-A23.1/A23.2.
- .3 Fabricate structural steel framing in accordance to CAN/CSA-S16 and with reviewed shop drawings.
- .4 Fabricate wood trusses in accordance CSA-O86 and with reviewed shop drawings.

## **2.5 FINISHES**

- .1 Clean, prepare surfaces and shop prime structural steel to CAN/CSA-S16, except where members are zinc coated or zinc-aluminum alloy coated or are to be encased in concrete.

## **Part 3 Execution**

### **3.1 INSTALLATION AND ERECTION**

- .1 Do cast-in-place concrete work to CSA A23.1/A23.2.
  - .1 Concrete slab on grade surface tolerance to CSA A23.1 Straightedge Method to tolerance of 8mm in 3000mm.



- .2 Place reinforcing steel as indicated on placing drawings and in accordance with CSA-A23.1/A23.2.
- .3 Anchor bolts:
  - .1 Set anchor bolts to templates in co-ordination with appropriate trade prior to placing concrete.
- .4 Erect structural steel framing in accordance to CAN/CSA-S16 and with reviewed shop drawings.
- .5 Install sill plate gasket in continuous lengths between concrete surfaces and wood framing.
- .6 Construct wood framing as indicated on reviewed shop drawings and in accordance with CSA-O86.
- .7 Erect wood trusses as indicated on reviewed shop drawings and in accordance with manufacturers' instructions and CSA-O86.

### **3.2 FIELD QUALITY CONTROL**

- .1 Testing of materials and compaction of granular fill to be carried out by testing agency approved by Departmental Representative.
  - .1 Ensure test results are distributed for review by the Departmental Representative.
- .2 Inspection and testing of concrete and concrete materials to be carried out by testing laboratory approved by Departmental Representative, to CSA A23.1/A23.2.
  - .1 Ensure testing laboratory is certified to CSA A283.
  - .2 Ensure test results are distributed for review by the Departmental Representative.
- .3 Sufficient review of structural components during construction to be carried out by the Structural Engineering Consultant to ensure general conformance with the construction documents.
  - .1 Ensure construction review reports are distributed for review by the Departmental Representative.

**END OF SECTION**

## **PART 1 - GENERAL**

### 1.1 SUMMARY

- .1 Section includes materials, requirements and installation for water service used in the following:
  - .1 Plastic irrigation water service.

### 1.2 RELATED SECTIONS

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

### 1.3 SUBMITTALS

- .1 Shop Drawings:
  - .1 Submit a list of all valves, manufacturer and model number, of all types used.
- .2 Closeout Submittals:
  - .1 Provide maintenance data for incorporation into Operational and Maintenance manual.

## **PART 2 - PRODUCTS**

### 2.1 PIPING AND FITTINGS

- .1 PVC Pressure Water Pipe, elastomeric seal gasket joints, working pressure 1380 kPa [200 psi].

### 2.2 VALVES - GENERAL

- .1 All valves shall be rated for 860 kPa [125 psi] service unless noted otherwise.
- .2 Ball Valves
  - .1 50 mm [2"] and smaller: Lever handle, brass two piece body, blow-out proof stem, PTFE seats, brass ball chrome plated.

### 2.3 HOSE BIBB (HB1):

- .1 Brass faucet with hose end spout.
- .2 Vacuum breaker on outlet.

## **PART 3 - EXECUTION**

### 3.1 INSTALLATION

- .1 Install in accordance with National Building Code and local Authority Having Jurisdiction.
- .2 Buried Piping:
  - .1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.

### 3.2 PRESSURE TESTS

- .1 Perform a hydrostatic test on all domestic water piping at 1380 kPa [200 psi] for 8 hours.
- .2 Comply with all requirements of the Building Code and local Authority Having Jurisdiction.

3.3 FLUSHING AND CLEANING

- .1 Flush entire system for 8 h. Ensure outlets flushed for 2 h.

**END OF SECTION 22 11 18**

## **PART 1 - GENERAL**

### 1.1 SUMMARY

- .1 Section includes common work results for Divisions 22 and 23.

### 1.2 RELATED SECTIONS

- .1 These common works apply for Divisions 22 and 23. Should there be any conflict between any requirement of this Section and the General Conditions, Supplements and Amendments, the more stringent shall apply.
- .2 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

### 1.3 DEFINITIONS

- .1 Provide means supply and install.
- .2 Departmental Representative means Public Works and Government Services Canada (PWGSC).
- .3 Work means material and labour.
- .4 The specification sections are titled and divided under the headings of General, Products and Execution and under clause headings. These titles and headings are for general organization only and shall in no way limit or restrict the specification requirements.

### 1.4 GENERAL SCOPE

- .1 Provide the work indicated in the Contract Documents and as required to provide complete, tested and fully operational systems including all work not normally indicated but necessary for a complete and operational installation.
- .2 The Contractor is expected to be experienced and competent and knowledgeable about the trades and applicable codes, ordinances and industry standards and shall perform the work accordingly, on schedule and fully coordinated with all other trades.
- .3 Except where precisely indicated, the Contract Documents are diagrammatic and generally indicating the scope of work, general arrangement, and establishing minimum quality and performance requirements. Where there are conflicting requirements the Contractor shall allow for and provide the better quality and/or greater quantity unless the conflicting requirements are interpreted otherwise in writing by the Departmental Representative.
- .4 The Contract Documents for this Division are an integral part of the complete Contract Documents for the project and will be interpreted in conjunction with all other Divisions.

### 1.5 CODES, REGULATIONS AND STANDARDS

- .1 Mechanical work shall conform to the following Codes, Regulations and Standards, and all other Codes in effect at the time of award of Contract, and any others having jurisdiction. The revision of each Code and Standard and their amendments which are adopted by the Authority Having Jurisdiction shall apply unless otherwise specified in the Contract Documents.
- .2 Design shall comply with National Building Code and BC Building Code, local authority having jurisdiction requirements. In cases of conflicting requirements, the most stringent shall apply per PSPC requirements.
  - .1 Bylaws
    - .1 Local Building Bylaws.

- .2 National Fire Codes
  - .1 NFPA 10 Portable Fire Extinguishers.
- .3 National Research Council of Canada
  - .1 National Building Code of Canada - 2015.
  - .2 National Plumbing Code of Canada - 2015.
  - .3 National Fire Code of Canada - 2015.
- .4 Province of British Columbia
  - .1 BC Building and Plumbing Code - 2012.
  - .2 BC Industrial Health & Safety Regulations, WorkSafeBC.
- .5 SMACNA Publications
  - .1 HVAC Duct Construction Standards.
  - .2 Guidelines for seismic restraints of mechanical systems.
- .3 All specification references to the Building Code refer to the National and/or BC Building Code.

#### 1.6 PERMITS AND FEES

- .1 Obtain all required permits and pay all fees including service connection fees as applicable to the mechanical work. Comply with all Provincial, Municipal and other legal regulations and bylaws applicable to the work.
- .2 Arrange for inspection of all Work by the Authorities Having Jurisdiction. On completion of the Work, furnish final unconditional certificates of approval by the inspecting authorities.

#### 1.7 DRAWINGS AND MEASUREMENTS

- .1 Drawings are generally diagrammatic and are intended to indicate the scope and general arrangement of work. They are not detailed installation drawings.
- .2 Do not scale the drawings.
- .3 Obtain accurate dimensions from the Architectural and Structural Drawings.
- .4 Consult the Architectural drawings for exact locations of fixtures and equipment. Obtain this information from the Departmental Representative where not obtainable from the drawings.
- .5 Field measure as required to size and locate services and equipment.

#### 1.8 SITE VISIT

- .1 Visit the site before tendering.
- .2 Examine all local and existing conditions on which the work is dependent. No consideration will be granted for any misunderstanding of work to be done where the necessary information could have reasonably been obtained by an examination of the site.

#### 1.9 PROGRESS CLAIMS

- .1 Submit a single figure for a Progress Claim showing total contract, previous approved claims total, amount of current claim and remaining amount, all both in dollar value and as a percent of the total.
- .2 To assist and enable the Departmental Representative to review the Progress Claim amount, provide along with the claim a separate breakdown of the claim in the same categories as required under Price Breakdown showing the total, previous, current and remaining amounts in dollars and percent for each category. Also show the claims for each Change Order being progressed.
- .3 The Departmental Representative's review is of the single figure total claim-to-date only. The Departmental Representative bears no responsibility for review of the breakdown portions.

- .4 Progress Claims beyond 95% of the mechanical work may not be certified for payment until the commissioning is complete. This is to allow for holdback for deficiencies which are identified during commissioning.

#### 1.10 WARRANTY

- .1 Use of installed equipment during construction shall not shorten or alter the warranty period as specified in the General Conditions.
- .2 Take note of and submit written information for any extended warranties specified.

#### 1.11 WORKMANSHIP

- .1 Workmanship shall be in accordance with well-established practice and with standards accepted and recognized by the Departmental Representative and the Trade.
- .2 The Departmental Representative may reject any work not conforming to the Contract Documents or to accepted standards of performance, quietness of operation, finish or appearance.
- .3 Employ only tradesmen with valid Provincial Trade Qualification Certificates. Tradesmen shall perform only work permitted by their certificates. Certificates shall be available for review by the Departmental Representative.

#### 1.12 ACCESSIBILITY

- .1 All work shall be readily accessible for adjustment, operation and maintenance. Supply access doors where required in building surfaces for installation by building trades.

#### 1.13 SUBMITTALS

- .1 Shop Drawings:
  - .1 Process:
    - .1 Shop drawings/product data shall be submitted as elsewhere specified.
    - .2 Shop drawings/product data shall be reviewed, signed and processed as described in the General Conditions and as further described by the Mechanical Contractors Association of British Columbia.
  - .2 Coordination: Where mechanical equipment requires electrical connections, power or other services, the shop drawings shall also be circulated through the Electrical Contractor prior to submission to the Departmental Representative.
  - .3 Keep one (1) copy of shop drawings and product data, on site, available for reference
  - .4 Review or non-review of shop drawings does not alter the requirements of the equipment and materials provided to conform to the specification.
- .2 Closeout Submittals:
  - .1 Operating and Maintenance Manuals:
    - .1 Provide maintenance data for incorporation into Operational and Maintenance manual.
    - .2 Allow sufficient time to provide the final reviewed manuals to the Owner before Substantial Performance.
    - .3 Provide one draft copy of the manuals to the Departmental Representative for review. Make all required changes and resubmit to the Departmental Representative. Repeat until accepted. Then submit the following, identical to the accepted copy, to the Departmental Representative:
      - .1 Three (3) hard copies - organized in binders.

- .2 Two (2) PDF electronic copies of full binder contents on CD, DVD, or flash drive. Scanned documents to done using OCR option on scanner, and to have minimum resolution of 300 dpi.
- .4 Obtain a receipt and send a copy to the Departmental Representative.
- .5 The binders shall be 3-ring binder. The maximum overall thickness of the filled binder shall be 100 mm [4"]. Provide multiple binders for each manual as required.
- .6 Each binder shall have large clear lettering in a clear label insert on the front cover indicating the name of the project and "OPERATING AND MAINTENANCE MANUAL - MECHANICAL".
- .7 Provide an index and tab each section.
- .8 The manual shall include:
  - .1 Air and water balance report.
  - .2 Commissioning report.
  - .3 Copy of any required approvals, certifications and acceptance by Authorities Having Jurisdiction.
  - .4 All shop drawings.
  - .5 List of local source of supply.
  - .6 Manufacturer's operating and maintenance literature and wiring and control diagrams.
- .2 Site Records:
  - .1 Keep a set of contract prints on site for the sole purpose of keeping an up-to-date record marked in red of the installation of the mechanical work where they vary from the drawings.
  - .2 Changes for all mechanical work and piped site service trades, including sketches for Change Orders and Site Instructions shall be kept on this set of drawings.
  - .3 For all buried new services and all existing services exposed by the work indicate the inverts and dimensioned locations at all connections and changes in direction.
  - .4 Services shall not be buried or concealed until the Site Drawings are up-to-date for the services.
  - .5 All inaccessible concealed services shall be accurately located.
  - .6 Identify each drawing in lower right hand corner in letters at least 10 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" and under this add the Contractor's name, an authorized signature and the date.
  - .7 Submit the prints for review by the Departmental Representative. Make any additional changes identified by the Departmental Representative including returning to the site if necessary to make measurements and/or to confirm installation locations and details. Resubmit to the Departmental Representative.
- .3 Record Drawings:
  - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
  - .2 Upon completion of the Departmental Representative's review, submit final Record Drawings to the Departmental Representative. Final record drawings shall include revised CAD files prepared by a qualified draftsman to the same standards as the original drawings.

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## **PART 2 - PRODUCTS**

### 2.1 MISCELLANEOUS METAL

- .1 Be responsible for all miscellaneous steel work relative to the mechanical work of the Specifications, including but not limited to:
  - .1 Support of equipment.
  - .2 Hanging, supporting, anchoring, guiding and related work as it applies to piping, ductwork and mechanical equipment.
  - .3 Earthquake restraint devices.
- .2 All exterior miscellaneous steel shall be hot-dipped galvanized.
- .3 All steelwork not galvanized shall be prime and undercoat painted ready for finish under Painting Division. On galvanized materials that are subsequently welded apply galvicon. Refer to drawings for details.

## **PART 3 - EXECUTION**

### 3.1 COORDINATION

- .1 Examine all Contract Drawings to verify space and headroom limitations for the required work. Coordinate the work with all trades and modify without changing the design intent to facilitate a satisfactory installation. Make no changes to the design intent involving extra cost to the Owner, without the Departmental Representative's prior written approval.
- .2 The drawings indicate the general location and route to be followed by the piping and ductwork. Where details are not shown on the drawings or are only shown diagrammatically, the pipes and ductwork shall be installed in such a way as to conserve headroom and interfere as little as possible with the free use of space through which they pass. Service lines shall run parallel to building lines. All ducts and pipes in the ceiling shall be kept as tight as possible to beams or other limiting members at high level. All pipes and ducts shall be coordinated in elevation to ensure that they are concealed unless indicated otherwise.
- .3 Work out jointly all interference problems on the site and coordinate all work before fabricating, or installing any material or equipment. No consideration of payment will be made for additional work due to fabricating or installing materials before a coordination issue was identified and resolved. Where necessary produce interference drawings showing exact locations of mechanical equipment within service areas, shafts and the ceiling space. Ensure that all materials and equipment fit into the allotted spaces and that all equipment can be properly serviced and replaced, if and when required. Advise the Departmental Representative of space problems before fabricating, or installing any material or equipment. Demonstrate to the Departmental Representative on completion of the work that all equipment installed can be properly, safely serviced and replaced, if and when required.

### 3.2 PROTECTION OF WORK

- .1 Protect equipment and materials, stored or installed, from the weather, moisture, dust and physical damage.
- .2 Mask machined surfaces. Secure temporary covers over equipment openings and open ends of piping, ductwork and conduits, as required to keep them clean.
- .3 Rusting, pitting or physical damage will be cause for rejecting equipment.
- .4 Make good damaged or marred factory finish.



**3.3 EQUIPMENT INSTALLATION**

- .1 Provide means of access for servicing equipment.
- .2 Align equipment and similar items with building lines wherever possible.
- .3 Ensure that equipment does not transmit noise or vibration to other parts of the building as a result of poor installation practices.

**3.4 CUTTING, PATCHING, DIGGING, CANNING AND CORING**

- .1 Lay out all cutting, patching, digging, canning and coring required to accommodate the mechanical services. Coordinate with other Divisions. The performance of actual cutting, patching, digging, canning and coring is specified under other Divisions.
- .2 Be responsible for correct location and sizing of all openings required under the mechanical work.
- .3 Openings through structural members of the building shall not be made without the approval of the Departmental Representative.

**3.5 DUCT AND PIPE MOUNTED CONTROL EQUIPMENT**

- .1 The automatic control dampers shall be supplied by the Controls trade but installed by the appropriate trade sections of mechanical work.

**3.6 CLEANING AND FINAL ADJUSTMENT**

- .1 Clean mechanical systems daily.
- .2 Clean and refurbish all equipment and leave in first class operating condition.
- .3 Balance and adjust all systems and each piece of equipment to operate efficiently.

**3.7 DEMOLITION**

- .1 All piping, ducting and equipment which becomes redundant and is no longer required due to the work shall become the property of the Contractor and shall be completely removed from the site.

**3.8 RE-USED EQUIPMENT**

- .1 Where existing equipment is being relocated and reused check and report on the condition before removal to the Departmental Representative. Any damage by the work of this contract is the responsibility of the Contractor.

**3.9 DEMONSTRATION AND INSTRUCTION TO OWNER**

- .1 Provide certified personnel to demonstrate the mechanical systems and to instruct operating staff on operation of mechanical equipment. Provide maintenance specialist personnel to instruct operating staff on maintenance and adjustment of mechanical equipment and any changes or modification in equipment made under terms of guarantee.

**END OF SECTION 23 03 00**

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## **PART 1 - GENERAL**

### 1.1 SUMMARY

- .1 Section includes seismic control measures and their installation.

### 1.2 RELATED SECTIONS

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

### 1.3 SUBMITTALS

- .1 Shop Drawings:
  - .1 Submit shop drawings and product data for all seismic restraint components, assemblies, and attachments.
  - .2 Where specific restraints are to be installed to the SMACNA Guidelines include a list of all such points of restraint and reference the appropriate SMACNA detail including attachments. No further shop drawing submittal for those specific points of restraint will be required.
  - .3 Shop drawings shall include the Seismic Engineer's requirements for any additional members required for attachment to the structure.
  - .4 Shop drawings shall indicate the calculated maximum forces at the points of attachment to the building structure during a seismic event.
- .2 Closeout Submittals:
  - .1 Provide maintenance data for incorporation into Operational and Maintenance manual.

### 1.4 REGULATORY CODES, GUIDELINES

- .1 SMACNA "Seismic Restraint Manual Guidelines for Mechanical Systems" referred to in this section as SMACNA Guidelines.

### 1.5 DEFINITIONS

- .1 Seismic event means a seismic event of any magnitude up to the Building Code design magnitude for the specific location.

### 1.6 GENERAL SCOPE

- .1 Provide seismic restraints for the piping and ductwork systems and all equipment specified in Mechanical Division to meet the requirements of the BC Building Code, to be in general conformance to SMACNA Guidelines, to keep the equipment in place during a seismic event, to minimize damage to the systems and equipment from a seismic event, to prevent systems and equipment from causing personal injury during a seismic event. Do not provide seismic restraint where it is identified in the SMACNA Guidelines as not required.

### 1.7 SEISMIC RESTRAINT - GENERAL

- .1 Seismic restraint may either be factory manufactured assemblies or custom field fabricated assemblies. All factory manufactured assemblies shall be tested and pre-approved by an independent testing agency to OSHPD test and pre-approval standards and bear the pre-approved number.

- .2 Arrange and pay for the services of a structural professional engineer registered in British Columbia referred to here as the Seismic Engineer. The Seismic Engineer shall review, seal and sign all submittals required for all components, assemblies, attachments and installation procedures for the seismic restraint of all piping, ductwork and equipment installed under Mechanical Division. The Seismic Engineer shall provide all necessary direction to the contractor during installation of the seismic restraint installation and submit a statutory declaration that the final seismic restraint installation conforms to the submittal documents sealed by the Seismic Engineer and satisfies all regulatory requirements.
- .3 The Seismic Engineer shall submit Letters of Assurance for the seismic restraint of the Mechanical Division installation.
- .4 The Seismic Engineer shall coordinate attachment to the equipment with the equipment manufacturer to ensure the method and location of attachment of the seismic restraint to the equipment does not compromise the structural integrity of the equipment.
- .5 The Seismic Engineer shall be responsible for coordinating all attachments for seismic restraint to the building structure with the structural documents and as necessary with the structural consulting engineer responsible for the design of the building structure. Ensure that the method and location of attachment of seismic restraint to the structure does not compromise the structure and that the structure can withstand the connected design seismic forces. The Seismic Engineer's responsibility includes clear instructions as to the point of attachment (e.g., top cord of OWSJ, concrete wall, bottom of joist, bottom of beam, etc). Where additional members are required for attachment the Seismic Engineer shall designate their size, location and method of attachment and they shall be provided under this Section.
- .6 Seismic restraints shall provide restraint from seismic forces in all directions.

#### 1.8 EQUIPMENT REQUIREMENTS

- .1 The requirements of this section shall apply to seismic restraint that are factory supplied integral with the equipment.
- .2 It is the responsibility of the manufacturer of equipment which is to be seismically restrained to ensure that:
  - .1 The attachment points for seismic restraints will withstand without damage the forces generated by seismic restraint.

### **PART 2 - PRODUCTS**

#### 2.1 SEISMIC RESTRAINTS

- .1 Slack cable restraints may be as detailed in the SMACNA Guidelines.
- .2 Rigid restraints may be as detailed in the SMACNA Guidelines for the appropriate Seismic Hazard Level.
- .3 SMACNA Guidelines restraints modified by the Seismic Engineer.
- .4 Custom restraints designed by the Seismic Engineer.

### **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 GENERAL

- .1 Hangers shall not buckle under vertical seismic movement. Where the rod length is 50 times or more than the rod diameter it shall be reinforced in accordance with SMACNA Guidelines.
- .2 Where threaded nuts secure seismic restraints use double nuts, locking nuts or loctite.
- .3 Slack cables shall be as tight as possible without supporting the weight of the duct or equipment.

3.3 RESTRAINT OF NON-ISOLATED EQUIPMENT

- .1 Floor or wall mounted equipment shall be anchored to the structure. Anchors shall be designed for seismic acceleration in all directions acting through the centre of gravity. If the equipment is subject to resonances (e.g., internal isolation, partially filled tanks) increase the seismic acceleration to 9 times the ground acceleration.
- .2 Suspended equipment may have rigid or slack cable restraints.

**END OF SECTION 23 05 48**

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## **PART 1 - GENERAL**

### 1.1 SUMMARY

- .1 Section includes materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems.

### 1.2 RELATED SECTIONS

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

### 1.3 SUBMITTALS

- .1 Closeout Submittals:
  - .1 Provide maintenance data for incorporation into Operational and Maintenance manual.
- .2 Samples:
  - .1 Samples to include nameplates, labels, tags, lists of proposed legends.

## **PART 2 - PRODUCTS**

### 2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

- .1 Each piece of manufactured equipment shall have a metal nameplate, with embossed letters, mechanically fastened to the equipment.
- .2 Manufacturer's nameplates shall indicate:
  - .1 Manufacturer's name.
  - .2 Equipment.
  - .3 Model, size.
  - .4 Serial number.
  - .5 Electrical characteristics.
  - .6 Motor: voltage, Hz, phase, power factor, duty, frame size.
  - .7 Other services characteristics.
- .3 Include ULC, CSA and other agency registration logos that apply.
- .4 Nameplates shall be easily read.

### 2.2 SYSTEM NAMEPLATES

- .1 Painted identification letters shall be 50 mm [2"] high black letters on a white background.
- .2 Lamicaid labels (black background white letters) shall be 35 x 200 mm [1-1/2"x 8"] with 20 mm [3/4"] high letters or proportionally smaller as appropriate to fit equipment.
- .3 Identify systems, and areas or zones of building being serviced.

### 2.3 IDENTIFICATION DUCTWORK SYSTEMS

- .1 Identify automatic control dampers concealed in ductwork. Identify the 'open' and 'closed' position of the operator arm where clearly visible on the outside of the duct.

2.4 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.

**PART 3 - EXECUTION**

3.1 NAMEPLATES

- .1 Locations:
  - .1 Each piece of equipment shall be identified with its equipment schedule identification, e.g. EF-100.
  - .2 In conspicuous location, on cool surfaces, to facilitate easy reading and identification from operating floor.
- .2 Standoffs: Provide for nameplates on hot and/or insulated surfaces.
- .3 Protection: Do not paint, insulate or cover.

3.2 IDENTIFICATION SCHEDULES

- .1 Submit schedules of the following for review, prior to laminating.
  - .1 Valve Tag List.
- .2 Include one copy of schedules in each operating and maintenance manual.

**END OF SECTION 23 05 54**

## **PART 1 - GENERAL**

### 1.1 SUMMARY

- .1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.
- .2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

### 1.2 RELATED SECTIONS

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

### 1.3 QUALIFICATIONS OF TAB PERSONNEL

- .1 Submit names of personnel to perform TAB to the Departmental Representative within 90 days after award of the Contract.
- .2 Provide documentation confirming qualifications, successful experience.

### 1.4 PURPOSE OF TAB

- .1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads.
- .2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.
- .3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

### 1.5 TESTS

- .1 Scope of Tests:
  - .1 The performance testing of equipment shall be the responsibility of the supplying trade. The tests are specified under the appropriate specification section.
- .2 General Requirements:
  - .1 Give written minimum 48 hour notice of date for tests to Departmental Representative and to any Authorities Having Jurisdiction.
  - .2 Do not externally insulate or conceal work until tested and reviewed.
  - .3 Make good and retest as required until test is successful.
  - .4 Tests shall be to applicable Codes, to the requirements of Authorities Having Jurisdiction and in accordance with recognized industry standards.
  - .5 Obtain and provide certificates of approval where applicable from Authorities Having Jurisdiction.

### 1.6 BALANCING - AIR SYSTEMS

- .1 Adjust or change drive sheaves to balance exhaust air systems to provide the design air quantities (within +10%/-5%).

- .2 Submit a report to the Departmental Representative indicating final fan speed, motor operating amperages, system static pressure, filter static pressure and final air quantities obtained.

#### 1.7 COMMISSIONING AND DEMONSTRATION

- .1 Be responsible for the performance and commissioning of all equipment supplied under the HVAC Sections of Mechanical Division. Commissioning is the process of advancing the installation from the stage of static completion to full working order in accordance with the Contract Documents and design intent. It is the activation of the completed installation.
- .2 The commissioning shall be executed in accordance with the intent of ASHRAE Standard 1 "Guideline for Commissioning of HVAC Systems".
- .3 In consultation with the General Contractor, ensure that sufficient time is allowed and fully identified on the construction schedule for the proper commissioning of all mechanical systems.
- .4 Submit a schedule for the commissioning phase of the work. This schedule shall show:
  - .1 Equipment start-up schedule.
  - .2 Submission dates for the various documents required prior to substantial completion.
  - .3 Timing of the various phases of the commissioning, testing, balancing and demonstration process.
- .5 Commissioning is concluded when air systems have been balanced and the installation is in full working order and acceptable for use. The work will include the following:
  - .1 Balancing of the air systems as specified in this section.
  - .2 Set up fans.
  - .3 Adjust earthquake restraints for optimum performance.
  - .4 Verification of water tightness of all exterior wall penetrations.
  - .5 Set up all automatic control dampers and automatic temperature control devices.
- .6 At the conclusion of commissioning, demonstrate the operation of the systems to the Departmental Representative and then to the Owner's Operating Staff. For demonstration and instruction to Operating staff requirements, refer to this section of the specification and also to Division 25 (Controls Systems).

#### **PART 2 - PRODUCTS**

- .1 NOT APPLICABLE

#### **PART 3 - EXECUTION**

- .1 NOT APPLICABLE

**END OF SECTION 23 05 93**



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## **PART 1 - GENERAL**

### 1.1 SUMMARY

- .1 Section includes materials and installation procedures for heating controls.

### 1.2 RELATED SECTIONS

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

### 1.3 SUBMITTALS

- .1 Shop Drawings:
  - .1 Submit shop drawings for all electric and electronic control system equipment and components.
- .2 Closeout Submittals:
  - .1 Provide maintenance data for incorporation into Operational and Maintenance manual.

## **PART 2 - PRODUCTS**

### 2.1 CONTROL DAMPERS

- .1 Parallel type blade.
- .2 Extruded aluminum or formed galvanized steel blades, frames, gussets and blade stops.
- .3 Shafts - galvanized steel with keyways for securing blades to shafts.
- .4 Hardware - keyed to prevent blade slippage and to provide smooth blade movement.
- .5 Bearings - oil impregnated sintered bronze. Provide additional thrust bearings for vertical blades. Confirm in advance with Departmental Representative any vertical blade dampers.
- .6 Assemblies - rigid and adequately braced with corner gussets.
- .7 Maximum frame dimensions - 1220 mm [48"] wide and 1220 mm [48"] high, unless otherwise indicated. Multiple sections to have stiffening mullions.
- .8 Bearings and seals - suitable for exposure to a minimum of -30°C [-22°F] and a maximum of 100°C [212°F].
- .9 Maximum blade width - 200 mm [8"].
- .10 Low leakage type with blade and frame seals.
- .11 Maximum leakage in closed position shall be 50 L/s per square metre [10 CFM per square ft.] of face area at 1000 Pa [4" w.g.] pressure differential. For smoke control purposes dampers to be labelled to ULC Standard S112.1 (UL-555S) level 1 leakage.
- .12 Galvanized coating on all sheared edges of galvanized steel frames and blades exposed to outside atmosphere.
- .13 Indicated size is outside frame dimension. Confirm with installer before fabrication.
- .14 Blades to be horizontal in vertical mounted dampers. Refer to drawings for orientation of dampers.
- .15 Provide an additional drive shaft bearing if the drive shaft is longer than 75 mm [3"].

- .16 Dampers shall be adequate for the maximum system pressure. Refer to the appropriate section of the specification.
- .17 Damper Actuators:
  - .1 Damper actuators for all control dampers shall be supplied by this trade.
  - .2 Spring return for "fail-safe" in Normally Open or Normally Closed position.
  - .3 Size actuators to control dampers against maximum pressure or dynamic closing pressure whichever is greater.
  - .4 Size damper actuators so that they will provide smooth and full travel of the dampers while stroking in both directions.

### **PART 3 - EXECUTION**

#### 3.1 SEQUENCE OF OPERATION

- .1 Exhaust Fans (EF-100)
  - .1 The system consists of:
    - .1 Exhaust fan (EF-100) and motorized backdraft damper (CD-EF100-1).
    - .2 Outdoor intake damper (CD-EF100-2).
  - .2 Electrical shall provide a wall mounted switch to operate the fan.
  - .3 When the fan is ON then interlock OPEN CD-EF100-1 and CD-EF100-2.
  - .4 When the fan is OFF the dampers shall be closed.

#### 3.2 INSTALLATION

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.
- .2 Install control devices.
- .3 On outside wall, mount thermostats on bracket or insulated pad.

#### 3.3 CONTROL DAMPER INSTALLATION

- .1 Install in accordance with recommendations of SMACNA and manufacturer's instructions.
- .2 Hand over to and instruct the installer on damper installation.
- .3 Check that dampers are installed square and true and that blades close tightly against seals and stops.
- .4 Ensure that damper end-linkages are easily accessible (coordinate with installer).
- .5 Where individual dampers are installed, provide a separate damper actuator for each damper.
- .6 Locate damper actuators so that they are easily accessible for testing and servicing.
- .7 Where damper actuator operates outdoor or exhaust air dampers, pretension the damper drive linkage to ensure tight closure.
- .8 Ensure dampers are observable and accessible.

**END OF SECTION 23 09 33**

## **PART 1 - GENERAL**

### 1.1 SUMMARY

- .1 Section includes materials, requirements and installation of low-pressure metallic ductwork, joints and accessories where working static pressure does not exceed 500 Pa [2" w.g.].

### 1.2 RELATED SECTIONS

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

### 1.3 SUBMITTALS

- .1 Closeout Submittals:
  - .1 Provide maintenance data for incorporation into Operational and Maintenance manual.

## **PART 2 - PRODUCTS**

### 2.1 GALVANIZED STEEL

- .1 Galvanized steel shall be lock forming quality with galvanizing coat both sides to ASTM A653/A653M, G90 zinc coating.
- .2 Thickness, fabrication and reinforcement: to SMACNA.
- .3 Joints: to SMACNA.

### 2.2 DUCTS - GALVANIZED STEEL

- .1 All ductwork shall be constructed and sealed to withstand without damage or permanent deformation at least 150% of the working static pressure.
- .2 Construct rectangular ducts in accordance with Section I of the SMACNA Duct Standards.
- .3 500 Pa [2" w.g.] working static pressure.

### 2.3 HANGERS AND SUPPORTS

- .1 Support ductwork to SMACNA using:
  - .1 Galvanized steel straps.
  - .2 Cadmium plated threaded rods.
  - .3 Flat bar or angle hangers.
- .2 Attachments to the structure shall be compatible with the structure and selected for the load of the ductwork.
- .3 Install ductwork hangers in accordance SMACNA Duct Standards.

### 2.4 ROTARY VANE ROOF VENTILATORS (RV-xxx)

- .1 All aluminum construction, internally braced with upper and lower stainless steel ball bearings.
- .2 Bearings: Encased design to prevent dirt, dust, sand, and other foreign materials from damaging the bearings.
- .3 Designed to prevent metal-to-metal contact.

- .4 Shaft: Case hardened steel.
- .5 Base: One-piece design adjustable up to 12:12 pitch without removing turbine.
- .6 Flashing: Extra-large flashing.
- .7 Finish: Colour to Departmental Representative's approval.

## 2.5 WIRE MESH SCREENS

- .1 Provide wire mesh screens in all air intake openings.
- .2 Screens shall be constructed from 16 ga aluminum wire.
- .3 Screen mesh shall be 12 mm [1/2"] grid.
- .4 Mount screens in 20 ga folded aluminum frames.

## 2.6 SEALANT

- .1 SMACNA Seal Classification B for ductwork 500 Pa [2" w.g.] and under working static pressure.
- .2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant.
- .3 Oil resistant, water borne, polymer type flame resistant duct sealant. Temperature range of -30°C to 93°C.

## **PART 3 - EXECUTION**

### 3.1 GENERAL

- .1 The project drawings are diagrammatic. Effort has been made to indicate offsets and transitions, but not all are necessarily shown. Changes may be required to ductwork to avoid interference with structure and other services. Determine all required adjustments prior to fabrication and provided the adjustments without additional cost to the Contract.
- .2 Working static pressure means the maximum pressure that could be created by the equipment when operating at the speed required to achieve the specified performance, by the closure (including closure due to failure) of any specified devices in the ductwork.
- .3 Flash and counterflash ducts through exterior walls.
- .4 Arrange openings for ductwork through walls to accommodate insulation, packing, sleeves as appropriate.
- .5 During construction, protect ductwork openings from the entry of dirt, dust and debris with suitable covers.
- .6 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

### 3.2 DUCTWORK INSTALLATION

- .1 Square throated - radius heel elbows shall not to be used.
- .2 Cross-break or bead all metal ductwork panels unless otherwise noted.
- .3 Arrange ductwork so that equipment can be easily serviced and removed.

### 3.3 SEALING

- .1 Apply sealant to outside of joint to manufacturer's recommendations.
- .2 Where accessible, apply sealer to inside of joints on ductwork under positive pressure.

- .3 Apply sealer to outside of joints on ductwork under negative pressure.
- .4 Duct tape is not a permitted sealing method.

**3.4 DUCTWORK CLEANING**

- .1 It is the intent that the ductwork system shall be clean. No dirt, debris or dust shall be evident in a visual examination.
- .2 Protect ductwork from fabrication to the completion of the project to keep it clean. Any dust, dirt or debris in the systems shall be removed.
- .3 If in the opinion of the Departmental Representative the systems are not clean, provide cleaning as required including, if necessary, retaining a Cleaning Agency to do the work.
- .4 Cleaning shall be to the satisfaction of the Departmental Representative.
- .5 Submit a letter signed by a principal of the ductwork installing company certifying that all ductwork systems are clean.

**END OF SECTION 23 31 14**

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## **PART 1 - GENERAL**

### 1.1 SUMMARY

- .1 Section includes materials, requirements and installation for wall exhaust fans.

### 1.2 RELATED SECTIONS

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

### 1.3 SUBMITTALS

- .1 Shop Drawings:
  - .1 Submit shop drawings for all fans.
  - .2 Indicate, at minimum, the following:
    - .1 Sound rating data.
    - .2 Fan curves showing operating point plotted on curves.
    - .3 Motor efficiencies.
    - .4 Motors, sheaves, bearings, shaft details.
    - .5 Sound rating data at point of operation.
- .2 Closeout Submittals:
  - .1 Provide maintenance data for incorporation into Operational and Maintenance manual.

### 1.4 PERFORMANCE REQUIREMENTS

- .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.
- .2 Capacity: flow rate, total static pressure, BHP, W, efficiency, RPM, power, model, size, sound power data and as indicated on schedule.
- .3 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99. Dynamically balance fans to 1.5 mm/s [0.06 in/s] vibration amplitude, maximum measured on bearing housings. Provide fan shafts with critical speed at least 1.5 times operational speed.
- .4 Submit fan sound power levels with shop drawings, measured to AMCA 300 and calculated to AMCA 301, or other data acceptable to the Departmental Representative. Provide test data if requested. Fans exceeding design levels may be rejected.
- .5 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210 and ASHRAE 51. Units shall bear AMCA certified rating seal.
- .6 If fan power levels exceed design levels, provide the location of a similar existing fan installation with Tender. Coordinate with Departmental Representative to obtain access for acoustical measurements. These measurements, with corrections for volume, static pressure, efficiency, blade passage tone and room effect will form a basis of evaluation of the fans. The corrections will be based on the ASHRAE Guide and an ILG RSS comparison of room effect. Approval will be based on fans being similar to the fans evaluated, not on submitted fan sound power levels.

### 1.5 MAINTENANCE

- .1 Obtain signed receipt from the Owner when spare parts are handed over.

- .2 Provide the following spare parts:
  - .1 Matched sets of belts for each fan.

## **PART 2 - PRODUCTS**

### **2.1 PROPELLER FANS (EF-100)**

- .1 Formed steel or aluminum propeller blades.
- .2 Spun steel venturi.
- .3 Grease lubricated ball bearings suitable for operating in any position.
- .4 Belt driven with adjustable drive sheave and belt guard or direct driven as scheduled.
- .5 Motor mounting brackets.
- .6 Totally enclosed motor.
- .7 Accessories:
  - .1 Fan guard as scheduled.
  - .2 Motorized control damper.
  - .3 Wall sleeve.
  - .4 Louvre.

## **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 FAN INSTALLATION**

- .1 Install fans as indicated, complete with vibration isolators and seismic restraints.
- .2 Provide and install sheaves and belts required for final air balance.

**END OF SECTION 23 34 25**

## **PART 1 - GENERAL**

### 1.1 SUMMARY

- .1 Section includes materials, requirements and installation for louvres.

### 1.2 RELATED SECTIONS

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

### 1.3 SUBMITTALS

#### .1 Shop Drawings:

- .1 Submit shop drawings for louvres.
- .2 Indicate, at minimum, the following:
  - .1 Pressure drop.
  - .2 Face area.
  - .3 Free area.

#### .2 Test Reports:

- .1 Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

#### .3 Closeout Submittals:

- .1 Provide maintenance data for incorporation into Operational and Maintenance manual.

### 1.4 PERFORMANCE REQUIREMENTS

- .1 Catalogued or published ratings shall be those obtained from tests carried out by the manufacturer or those ordered by him from an independent testing agency signifying adherence to codes and standards.

## **PART 2 - PRODUCTS**

### 2.1 FIXED LOUVRES - ALUMINUM

- .1 Material: extruded aluminium alloy (6063-T5).
- .2 Blades: 100 mm [4"] deep at 45° and 90 mm [3-1/2"] centres. Upturned rain stop at trailing edge, drip channel at leading edge.
- .3 Frame, head, sill and jamb: 100 mm [4"] deep one piece extruded aluminium, minimum 12 ga. Channel type frame, no flange. Jamb drainage channel.
- .4 Mullions: at 1.5 m [5 ft] maximum centres, continuous blade.
- .5 Fastenings: stainless steel (Society of Automotive Engineers) SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminium and head of bolt, or between nut, SS washer and aluminium body.
- .6 Screen: 12 mm [1/2"] mesh, 16 ga wire aluminium birdscreen on inside face of louvres in formed 20 ga aluminium U-frame, removable.
- .7 Finish: Factory applied enamel, colour to Departmental Representative's approval.



- .8 Provide welded security bars and frame on the garage side of the low level louvres. Refer to the drawings.

### **PART 3 - EXECUTION**

#### **3.1 MANUFACTURER'S INSTRUCTIONS**

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

#### **3.2 LOUVRE INSTALLATION**

- .1 Install in accordance with manufacture's and SMACNA's recommendations.
- .2 Provide all necessary flashing and counter flashing.
- .3 Anchor securely into opening from inside. Seal with caulking all around to ensure weather tightness.

**END OF SECTION 23 37 20**

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## **PART 1 - GENERAL**

- 1.1 RELATED SECTIONS & SUMMARY
- .1 The General Conditions, Supplements and Amendments shall govern this Section (read in conjunction with Instructions to Tenderers / Bidders). This section covers items common to all Electrical sections and is intended only to supplement the requirements of Division 01.
  - .2 Reference to "Electrical Divisions" shall mean all sections of Divisions 26, 27, 28, 33 & 34 in the Master Format or the Canadian Master Specifications.
  - .3 The word "Provide" shall mean "Supply and Install" the products and services specified. "As Indicated" means that the item(s) specified are shown on the drawings.
  - .4 Provide materials, equipment and plant, of specified design, performance and quality; and, current models with published certified ratings for which replacement parts are readily available. Provide project management and on-site supervision to undertake administration, meet schedules, ensure timely performance, ensure coordination, and establish orderly completion and the delivery of a fully commissioned installation.
  - .5 The most stringent requirements of this and other electrical sections shall govern.
  - .6 All work shall be in accordance with the PROJECT Drawings and Specifications and their intent, complete with all necessary components, including those not normally shown or specified, but required for a complete installation.
  - .7 Provide seismic restraints for all required fixtures, devices, equipment, pathway, and wiring systems as required by the BC Building Code.
  - .8 Connect to equipment specified in other Sections and to equipment supplied and installed by other Contractors or by the Owner. Uncrate equipment, move in place and install complete; start-up and test. Include all field assembly of loosely/separately packaged accessories
  - .9 Summary of Work:
    - .1 The work shall include and not limited to the following:
      - .1 Upgrade of main electrical service.
      - .2 Electrical distribution.
      - .3 Interior lighting.
      - .4 Exterior lighting.
      - .5 Connections to Mechanical specified equipment.
      - .6 GPR (Ground Penetrating Radar) survey of the proposed feeder route to identify existing underground obstacles prior to trench excavation.
- 1.2 CODES AND STANDARDS
- .1 Comply with all laws, ordinances, rules, regulations and codes of all authorities having jurisdiction relative to this project.
  - .2 The project will be constructed to the current adopted edition of applicable standards, including:
  - .3 CSA C22.1, Canadian Electrical Code (CEC)
  - .4 British Columbia Building Code (BCBC)
  - .5 National Fire Code of Canada (NFCC)
  - .6 CSA 282 Emergency Electrical Power Supply for Buildings

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- .7 ASHRAE 90.1, Standard for Energy Efficient Design of New Buildings
  - .8 WorkSafe BC Regulations
  - .9 Applicable NFPA Regulations

### 1.3 REFERENCES

- .1 Install in accordance with CSA C22.1 (current adopted edition) – except where specified otherwise.
- .2 Refer to CSA C22.1 Appendix A “Safety Standards for Electrical Equipment” for applicable codes and the related revisions
- .3 Refer to CSA C22.1 Pages xxix – xxxii for related ‘Reference Publications’
- .4 Refer to NBCC Table 1.3.1.2 for applicable codes and the related revisions.
- .5 Comply with Local Electrical Bulletins and by-laws relating to the Authority having Jurisdiction.
- .6 Install overhead and underground systems in accordance with CSA C22.3 No.1 (current adopted edition) – except where specified otherwise.
- .7 Preferred Voltage Levels for AC Systems, 0-50,000V in accordance with CAN3-C235 (current adopted edition)

### 1.4 PERMITS

- .1 Submit to the Electrical Inspection Authority having jurisdiction the necessary number of drawings and specifications for review and approval prior to commencement of the project.
- .2 Pay all associated fees and obtain all permits, licenses etc. to complete the project.
- .3 Obtain a Certificated of Acceptance from the Inspection Authority having jurisdiction upon completion of the project and include in the O&M manual.

### 1.5 DESIGN REQUIREMENTS

- .1 Operating voltages: to CAN3-C235- current edition
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 All electrical work to be installed with common work practices and methods.

### 1.6 SUBMITTALS

- .1 Submittals to be in accordance with Division 01.
- .2 Shop Drawings:
  - .1 The term “shop drawing” means drawings, diagrams, illustrations, schedules, performance characteristics, brochures and other data which are to be provided by the contractor to illustrate details of a portion of the work.
  - .2 Prior to submitting the shop drawings to the Departmental Representative, the contractor shall review the shop drawings to determine that the equipment complies with the requirements of the specifications and drawings.

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- .3 Submit shop drawings, product data and samples for all electrical equipment and materials in accordance with Division 01. The submission shall be reviewed, signed and processed as described in Division 01.
  - .4 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.
  - .5 Where applicable, include wiring, line and schematic diagrams. Include wiring drawings or diagrams showing interconnection with work of other Sections.
  - .6 Manufacturer of products shall conform to revised shop drawings.
  - .3 Content
    - .1 Shop drawings submitted title sheet.
    - .2 Data shall be specific and technical.
    - .3 Identify each piece of equipment including specific options selected for each type to be included in the project.
    - .4 Information shall include all scheduled data.
    - .5 Advertising literature will be rejected.
    - .6 The project and equipment designations shall be identified on each document.
    - .7 The shop drawings/product data shall include:
      - .1 Dimensioned construction drawings with plans and sections showing size, arrangement and necessary clearances, with all equipment weights and mounting point loads.
      - .2 Mounting arrangements.
      - .3 Control explanation and internal wiring diagrams for packaged equipment.
      - .4 A written description of control sequences relating to the schematic diagrams.
      - .5 Copies of factory tests, where applicable.
  - .4 Format
    - .1 Shop Drawings to be submitted in PDF format; larger submittals may be submitted on flash drives or uploaded to an FTP site set up the contractor.
  - .5 Coordination
    - .1 Where electrical equipment requires support or backing by other trades or mechanical connections, the shop drawings shall also be circulated through the other "services" contractor(s) prior to submission to the Departmental Representative.
  - .6 Keep one [1] copy of shop drawings and product data, on site, available for reference.
  - .7 Quality Control: in accordance with Division 01 - Quality Control
    - .1 Provide CSA certified equipment and material. Where CSA certified equipment and/or material is not available, submit such equipment and/or material to the authority having jurisdiction for special approval before delivery to site.
    - .2 Submit test results of installed electrical systems and instrumentation.
    - .3 Submit, upon completion of Work, the electrical "load balance" report.

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- .8 Permits and Fees:
    - .1 Submit to Electrical Inspection Department, Local Fire Authorities and Supply Authority the necessary number of drawings and specifications for examination and approval prior to commencement of work. Obtain all required permits and pay all fees.
    - .2 Arrange for inspection of all Work by the authorities having jurisdiction. On completion of the Work, furnish final unconditional certificates of approval by the inspecting authorities.

#### 1.7 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Division 01 - Quality Control
- .2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial and/or Territorial Act.
  - .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: in accordance with Division 01 - Construction Progress Schedule
  - .1 Site Meetings: as part of Manufacturer's Field Services: schedule site visits, to review Work, at stages listed below:
    - .1 At time of initial shop drawing submission to confirm any existing conditions and to coordinate with the project schedule and any cross discipline requirements.
    - .2 After delivery and storage of products, and when preparatory Work is complete but before installation begins.
    - .3 During progress of Work at key schedule points as determined.
    - .4 At commissioning.
    - .5 Upon completion of Work, after cleaning is carried out.
- .4 Health and Safety Requirements: do construction occupational health and safety in accordance with Division 01 - Health and Safety Requirements.

#### 1.8 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
- .4 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .5 Store and protect equipment and materials from nicks, scratches, and damage. Protect from dust where applicable.
- .6 Replace defective or damaged materials with new.

#### 1.9 SYSTEM START-UP

- .1 Refer to Division 01 and as follows.

- .2 Instruct Departmental Representative and operating personnel in the operation, care and maintenance of equipment.
- .3 Arrange and pay for services of manufacturer's factory service Engineer to supervise start-up of installation, check, adjust, balance and calibrate components, where required in these specifications.
- .4 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

1.10 OPERATING INSTRUCTIONS

- .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
- .2 Operating instructions to include following:
  - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
  - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
  - .3 Safety precautions.
  - .4 Procedures to be followed in event of equipment failure.
  - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
- .3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.
- .4 Post instructions where directed.
- .5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.
- .6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

1.11 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Division 01 - Construction/Demolition Waste Management and Disposal and with the Waste Reduction Work plan.
- .2 Avoid using landfill waste disposal procedures when recycling facilities are available.
- .3 Place materials defined as hazardous or toxic waste in designated containers.

1.12 DRAWINGS AND MEASUREMENTS

- .1 Drawings are generally diagrammatic and are intended to indicate the scope and general arrangement of work and are not detailed installation drawings. Do not scale the drawings. Obtain accurate dimensions from the Architectural and Structural drawings.
- .2 Consult the architectural drawings and details for exact locations of fixtures and equipment. Obtain this information from the Departmental Representative where definite locations are not indicated.
- .3 Take field measurements, where equipment and material dimensions are dependent upon building dimensions.

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- .4 Where imperial units have been indicated in brackets [ ] following the requirements in SI units, the conversion is approximate and provided for convenience. The SI units shall govern.

#### 1.13 PROJECT COORDINATION

- .1 Check drawings of all trades to verify space and headroom limitations for work to be installed. Coordinate work with all trades and make changes to facilitate a satisfactory installation. Make no deviations to the design intent involving extra cost to the Owner, without the Departmental Representative's written approval.
- .2 The drawings indicate the general location and route to be followed by the electrical services. Where details are not shown on the drawings or only shown diagrammatically, the services shall be installed in such a way as to conserve head room and interfere as little as possible with the free use of space through which they pass. Service lines shall run parallel to building lines. All services in the ceiling shall be kept as tight as possible to beams or other limiting members at high level. All electrical services shall be coordinated in elevation to ensure that they are concealed in the ceiling or structural space provided unless detailed otherwise on drawings.
- .3 Work out jointly all interference problems on the site and coordinate all work before fabricating, or installing any material or equipment. Where necessary, produce interference/coordination drawings showing exact locations of electrical systems or equipment within service areas, shafts and the ceiling space. Distribute copies of the final interference/coordination drawings to the Architect and Departmental Representative and all affected parties.
- .4 Ensure that all materials and equipment fit into the allotted spaces and that all equipment can be properly serviced and replaced, if and when required. Advise the Departmental Representative of space problems before installing any material or equipment. Demonstrate to the
- .5 Departmental Representative on completion of the work that all equipment installed can be properly, safely serviced and replaced, if and when required.

#### 1.14 EXISTING SERVICES

- .1 Retain the services of a testing agency to perform a GPR (Ground Penetrating Radar) survey of the proposed shed feeder route in order to establish existing underground obstacles. The survey report must be submitted to and approved by the Departmental Representative prior to the commencement of excavation. Survey results to be submitted in addition to the "As Built" drawing at project closeout.

#### 1.15 PROVISION FOR FUTURE EQUIPMENT AND CONSTRUCTION

- .1 Leave clear spaces designated for future equipment or building expansion where indicated. Plan for the installation under this contract and ensure clear accessible, unhindered access to the space is allowed for.
- .2 Were contract documents don't clearly indicate the future expansion requirements, but known services are required, provide written "request for information" to the Departmental Representative before making assumptions as to intent.

#### 1.16 EQUIPMENT RESTRAINT

- .1 Related Section: 26 05 05 Seismic Restraint.
- .2 It is the entire responsibility of equipment manufacturers to design their equipment so that the strength and anchorage of internal components of the equipment exceeds the force level used to restrain and anchor the unit itself to the supporting structure.

1.17 PHASED CONSTRUCTION

- .1 See Architectural specifications and drawings for construction phasing. Make all allowances to phase the work in accordance with the project phasing.
- .2 All trades in this Division shall make allowance for the implications of having to totally complete all work in the new addition before proceeding with work in the existing building.

1.18 WARRANTY

- .1 Use of installed equipment during construction shall not shorten or alter the warranty period as specified in the Division 01.
- .2 Take note of any extended warranties specified in other sections of this Division or in Division 27.
- .3 Furnish a written warranty stating that all work executed under this Division will be free from defects of material and workmanship for a period of one (1) year from the date of substantial performance and include in O&M manual.
- .4 Promptly investigate any electrical or control malfunction, and repair or replace all such defective work and all other damages thereby which becomes defective during the time of the warranty.

1.19 TENDER INQUIRIES

- .1 All contractor queries during the tender period shall be made in writing to the Departmental Representative. Contractor queries will be collected and suitable addenda will be issued for clarification. No verbal information will be considered valid or issued by the Departmental Representative's office during tender. All tender queries may be emailed, mailed or couriered to the Departmental Representative's office. No telephone questions will be answered.

1.20 RESPONSIBILITIES

- .1 Provide temporary lighting, power and systems for construction services and remove after construction is complete.
- .2 Ensure that equipment does not transmit noise and/or vibration to other parts of the building, as a result of poor installation practice.
- .3 Where the Contract Documents do not contain sufficient information for the proper selection of equipment for bidding, notify the Departmental Representative during the tendering period. If clarification is not obtainable, allow for the most expensive arrangement. Failure to do this shall not relieve the Contractor of responsibility to provide the intended equipment.
- .4 Protect equipment and material from the weather, moisture, dust and physical damage.
- .5 Cover equipment openings and open ends of conduit, piping and pullboxes as work progresses. Failure to do so will result in the Trade being required to adequately clean or replace materials and equipment at no extra cost to the Owner.
- .6 Refinish damaged or marred factory finish to factory finish.
- .7 The specifications and drawings form an integral part of the Contract Documents. Neither the drawings nor the specifications shall be used alone. Work omitted from the drawings but mentioned or reasonably implied in the specifications, vice versa, shall be considered as properly and sufficiently specified and shall be provided. Misinterpretation of any requirement of either plans or specifications shall not relieve this Contractor of the responsibility of properly completing his trade to the approval of the Departmental Representative.



1.21 STANDARD OF ACCEPTANCE

- .1 Standard of Acceptance means that the item named and specified by manufacturer and/or catalogue number forms part of specification and sets standard regarding performance, quality of material and workmanship and when used in conjunction with a referenced standard, shall be deemed to supplement the standard.
- .2 Where a manufacturer's equipment is listed, the manufacturer's listed equipment was used in preparing the base design. Tenders may be based on the listed equipment or preapproved alternate manufacturer's equivalent products, provided that they meet every aspect of the base design and every aspect of the drawings and specifications.
- .3 Where other than the listed manufacturer's equipment is selected or approved, include for the cost of any resulting work (both under this Division and other Divisions) and any necessary redesign of installation or structure. Submit redesign drawings for review with Shop Drawings. Maintain installation, access and servicing clearances. Equipment/materials shall not exceed the available space limitations. Redesign drawings shall be to scale and of a standard equal to the Project Drawings.
- .4 A visible manufacturer's nameplate shall indicate manufacturer's name, model number, serial number, capacity data, electrical characteristics and approval stamps.
- .5 All materials shall be new, of the quality specified and shall confirm to the standards of the Canadian Standards Association. Where equipment or materials are specified by technical description only, they shall be of the best quality for the listed application in which it is to be installed.
- .6 All work shall be executed in a neat and workmanlike manner by qualified tradespersons. Electrical contractor shall keep a competent foreman and necessary assistants all satisfactory to the Departmental Representative during the progress of the work.

1.22 ADDITION OF ACCEPTABLE MANUFACTURERS

- .1 Material/products considered to satisfy the specification, but of a manufacturer other than those named may be submitted to the Departmental Representative for consideration not later than five (5) working days prior to closing of tender or of bid depository subtrade tender whichever is earlier.
- .2 Alternate approvals will be given by written addendum only. No other substitution will be permitted after closing of tenders.
- .3 Alternate approvals granted before the closing of tenders will be limited to a manufacturer's system and/or series only. This limited approval will not preclude substitute equipment/material from complying with specific features included with equipment/material specified. Determine that the alternate product meets the specification intent before basing a tender on the product
- .4 Where alternate equipment/materials are selected, allow for effects on other parts of the work of this Trade and other Trades. Where substantial changes in arrangement are required, submit shop drawings of the proposed changes with Plan and Section views and show effects on work of other Trades. Alternate equipment/materials shall not exceed the available space limitations. Maintain installation, access and servicing clearances. No extra will be allowed due to the use of alternate equipment/materials.
- .5 Where two or more items of equipment and/or material, of the same type, are required, provide products of a single manufacturer.
- .6 Install and test all equipment and material, in accordance with the detailed recommendations of the manufacturer.

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- 1.23            PROGRESS CLAIM AND CHANGEORDER BREAKDOWNS
- .1            In particular cases more detail may be necessary to properly assess a change order or progress claims. This additional information could include all suppliers and all sub-contractors when requested by the Departmental Representative. Provide details for each section of the electrical work listed for each separate electrical change order item.
  - .2            Mark-up information is required for change orders but is optional on the original tender price.
  - .3            Progress claims will not be certified nor payment made beyond 90% of the overall Electrical contract until commissioning and verification of the systems are complete. This procedure is to allow for any necessary deficiency holdbacks on items which do not become apparent until the systems are commissioned.
- 1.24            PROJECT CLOSE-OUT REQUIREMENTS
- .1            Refer to detailed specifications in each section for detailed requirements. Record drawings to be submitted to Departmental Representative and all life safety systems must be operational, verified and tested and demonstrated to Departmental Representative prior to issuance of Schedule C.
- 1.25            SUBSTANTIAL PERFORMANCE REQUIREMENTS
- .1            Before the Departmental Representative is requested to make a site review for substantial performance of the work:
    - .1            Commission all systems and prove out all components, interlocks and safety devices.
    - .2            Submit a letter certifying that all work is complete for the intended use, operational, clean and all required submissions have been completed.
    - .3            A complete list of incomplete or deficient items shall be provided. If, in the opinion of the Departmental Representative, this list indicates the project is excessively incomplete, a substantial completion review will not be performed.
  - .2            The work will not be considered to be ready for use or substantially complete until the following requirements have been met:
    - .1            All reported deficiencies have been corrected.
    - .2            Operating and Maintenance Manuals completed.
    - .3            "As Built" Record Drawing ready for review.
    - .4            Systems Commissioning has been completed and has been verified by Departmental Representative.
    - .5            All demonstrations to the owner have been completed.
  - .3            Letters of Assurance will not be issued until the following requirements have been met:
    - .1            All items listed in .1 above have been completed or addressed.
    - .2            Certificate of Penetrations through separations.
    - .3            Provincial or City Electrical Inspection - Certificate of inspection.
    - .4            Seismic Engineers letter of Assurance and final inspection report.
    - .5            Certificate of Substantial Performance.
    - .6            Signed off copy of Departmental Representative final site review report.
    - .7            Emergency and Exit Lighting test letter.

- 1.26 DEFICIENCY HOLDBACKS AND DEFICIENCY INSPECTIONS
- .1 Work under this Division which is still outstanding when substantial performance is certified will be considered deficient and a sum equal to at least twice the estimated cost of completing that work will be held back.
  - .2 It is expected that outstanding work will be completed in an expeditious manner and the entire holdback sum will be retained until the requirements for Total Performance of Division 26, 27, 28, 33 (electrical) work have been met and verified.

## **PART 2 - PRODUCTS**

- 2.1 MATERIALS AND EQUIPMENT
- .1 Provide materials and equipment in accordance with Division 01 and as follows.
  - .2 Material and equipment to be CSA certified. Where CSA certified material or equipment is not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval.
  - .3 Where equipment or materials are specified by technical description only, they are to be of the best quality available for the application for which it is to be installed.
- 2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS
- .1 Provide all power and control wiring, conduit, wire, fittings, disconnect switches, motor starters, for all mechanical equipment unless otherwise specified.
  - .2 Bond all motors to conduit system with separate bonding conductor in flexible conduit or bonding conductor in the flexible conduit.
  - .3 Connections shall be made with watertight flexible conduit with watertight connectors.
  - .4 Control wiring and conduit standards are specified in the Electrical Divisions. Refer to Section 26 24 21 – Mechanical Equipment Controls and the Mechanical Divisions for scope of work and particular details.
- 2.3 WARNING SIGNS
- .1 Provide warning signs, as specified or to meet the requirements of Inspection Department, Authority having Jurisdiction, and Departmental Representative.
  - .2 Use decal signs, minimum 175 x 250 mm [7" x 10"] size
- 2.4 EQUIPMENT IDENTIFICATION
- .1 Identify all electrical equipment including but not limited to starters, disconnects, remote ballasts and controls with nameplates and labels as follows:
  - .2 Nameplates:
    - .1 Lamicoid 3 mm [0.125"] thick plastic engraving sheet, white face, black core, self adhesive unless specified otherwise. Provide white face, red core for all essential distribution equipment.
    - .2 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

- .3 Wording on nameplates to be approved prior to manufacture.
  - .4 Allow for average of twenty-five (25) letters per nameplate.
  - .5 Disconnects, starters and contactors: indicate equipment being controlled and voltage and CCT.
  - .6 Terminal cabinets and pull boxes: indicate system and voltage and source.
  - .7 Transformers: indicate capacity, primary and secondary voltages, source and lead.
- .3 Labels:
- .1 Identify each outlet, starter, disconnect and all items of fixed equipment with the appropriate panel and circuit number origin by means of a small but good quality vinyl, self-laminating label such as T & B E-Z Code WSL, Dymo Letratag or Brother P-Touch equivalent printable markers. Embossed Dymo or any labels with edges and corners that are prone to lift will be rejected. Confirm location of labels with Departmental Representative before installing. Circuit number to agree with Record Drawings.
  - .4 Provide plastic covered panel directory with circuits and areas served typed in, and mounted on inside of door. Directory to conform to Record Drawings.

2.5 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, either numbered or 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 code: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.6 CONDUIT, CABLE AND PULLBOX IDENTIFICATION

- .1 Colour code conduits, metallic sheathed cables, pullboxes and junction boxes.
- .2 Code with 25 mm plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor and at 15 m intervals.
- .3 Colour coding to be as follows unless otherwise specified (note, not all systems may be present in this project):

SYSTEM	MAJOR BAND	MINOR BAND	CHARACTERS
347/600V Normal	Dark Blue	Black	
120/208V Normal	Light Blue	Black	
Ground	Dark Green		GR
Fire Alarm	Red		FA
Computer/Data	Light Green		COM
Telephone	Light Green	Black	TEL
AV/TV Systems	Light Brown		AV/TV
Security Systems	Purple		SEC

Building Alarm	Purple	White	BA
CCTV	Purple	Yellow	CCTV
Door Lock Release	Purple	Black	ED
Low Voltage Control	White	Yellow	LVC

2.7 FINISHES

- .1 Shop finish metal enclosure surfaces by removal of rust and scale, cleaning, application of rust resistant primer inside and outside and at least two coats of finish enamel.
- .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original finish.
- .3 Clean and prime paint exposed hangers, racks, fastenings to prevent rusting. Finish painting shall be provided by Division 09.
- .4 Paint outdoor electrical equipment "equipment green" finish.
- .5 Paint indoor switchgear and distribution enclosures light gray unless otherwise indicated in particular specification sections for specialised or emergency power equipment.

2.8 ACCESS PANELS (DOORS)

- .1 Unless otherwise noted, access doors shall be minimum: 450mmx450mm [18"x18"] for body entry; 300mmx300mm [12"x 12"] for hand entry.
- .2 Access doors in fire separations of 3/4 hour rating, and higher, and firewalls shall have a compatible fire rating and a ULC label with tamper-proof latch, self closing.

2.9 ANCHOR BOLTS AND TEMPLATES

- .1 Supply anchor bolts and templates for installation by other Divisions.

2.10 FASTENING TO BUILDING STRUCTURE

- .1 General:
  - .1 Do not use inserts in base material with a compressive strength less than 13.79 MPa [2000 psi].
  - .2 All inserts supporting conduit racks shall have a factor of safety of 5. All other inserts shall have a factor of safety of 4.
- .2 Types:
  - .1 Cast-in-place type:
    - .1 Channel type - Burndy, Canadian Strut, Unistrut, Cantruss or Hilti Channel.
    - .2 Wedge type galvanized steel concrete insert, Grinnell Fig. 281 for up to 200 mm [8"] pipe size.
    - .3 Universal type malleable iron body insert, Grinnell Fig. 282 for up to 200 mm [8"] pipe size.
  - .2 Drilled, mechanical expansion type:
    - .1 Hilti HSL or UCAN LHL heavy duty anchor for use in concrete with compressive strength not less than 19.6 MPa [2840 psi].

- .2 Hilti Kwik-Bolt or UCAN WED stud anchor for concrete. (Do not use in seismic restraint applications).
- .3 Hilti HDI or UCAN IPA drop-in anchor for concrete.
- .4 Hilti or UCAN Sleeve Anchor (medium and light duty) for concrete and masonry.
- .5 Hilti ZBP or UCAN Zamac pin bolt (light duty) for concrete and masonry.
- .3 Drilled, adhesive type:
  - .1 Hilti HVA or UCAN Adhesive Anchor consisting of anchor rod assembly with a capsule containing a two-component adhesive, resin and hardener.
  - .2 Hilti HY150 consisting of anchor rod with a 2 part adhesive system.
  - .3 For use in concrete housekeeping bases (in vertical downward position) where the distance to the edge of the concrete base could cause weakness if a mechanical expansion type anchor were used.
  - .4 Rod assemblies shall extend a minimum of 50 mm [2"] into the concrete slab below the housekeeping bases.
- .3 Note:
  - .1 All drilling for inserts shall be performed using the appropriate tool specifically designed for the particular insert. The diameter and depth of each drilled hole shall be to the exact dimensions as specified by the insert manufacturer.
  - .2 Refer to manufacturer's recommendations for tightening torques to be applied to inserts.
  - .3 Where specifically called for, drills shall include a dust vacuum system, Hilti SAV Dust Vacuum System.

## 2.11 EQUIPMENT SUPPORTS

- .1 Provide stands and supports for equipment and materials supplied.
- .2 Lay out concrete bases and curbs required under Electrical Divisions. Coordinate with Concrete Divisions.
- .3 Concrete bases shall be a minimum of 100 mm [4"] thick, or as noted and shall project at least 150 mm [6"] outside the equipment base, unless otherwise directed. Bases and curbs shall be keyed to the floor and incorporate reinforcing bars and/or steel mesh. Chamfer edges of bases at 45 degrees.
- .4 Equipment with bedplates shall have metal wedges placed under the edges of the bedplates to raise them 25mm [1"] above the base after levelling. The wedges shall be left permanently in place. Fill the space between the bedplate and the base with non-shrink grout - Embecco or In-Pakt.
- .5 Construct equipment supports of structural steel. Securely brace. Employ only welded construction. Bolt mounting plates to the structure.
- .6 Support ceiling hung equipment with rod hangers and/or structural steel.

## 2.12 MISCELLANEOUS METAL

- .1 Be responsible for all miscellaneous steel work relative to Electrical Divisions of the Specifications, including but not limited to:
  - .1 Support of equipment.
  - .2 Hanging, support, anchoring, guiding and relative work as it applies to wiring raceways and electrical equipment.
  - .3 Earthquake restraint devices - refer also to "Seismic Restraint" sections

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- .4 Bridle rings - secure to structure or steel supports.
  - .2 All steel work shall be prime and undercoat painted ready for finish under the related Division.
- 2.13 MAINTENANCE MATERIALS AND CABINET
- .1 Provide maintenance materials in accordance with Division 01 and specified in appropriate Sections.
  - .2 Provide a finished painted sheet steel "spare equipment cabinet". Cabinet to have a continuous hinge and complete with shelves and hasp to suit padlock. Minimum size 600 [24"] x 900 [36"] x 200 [8"] deep. Mount on wall in the Electrical Room. Provide a plastic covered typewritten list of spare parts and affix to the inside of the door.
- 2.14 OPERATION AND MAINTENANCE DATA
- .1 Refer to Section 01 78 00 – Closeout Submittals for Operation and Maintenance Manual requirements.
  - .2 Refer to Section 26 05 03 – Operation and Maintenance Manual for detailed submittal requirements.
  - .3 Provide operation and maintenance data for incorporation into maintenance manual specified in Division 01 and as follows.
  - .4 Include in operations and maintenance data:
    - .1 Details of design elements, construction features, component function and maintenance requirements, to permit effective operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.
    - .2 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature not acceptable.
    - .3 Wiring and schematic diagrams.
    - .4 Names and addresses of local suppliers for items included in maintenance manuals.
  - .5 Include in the manual the following major sections:
    - .1 Title page (in plastic cover).
    - .2 Comprehensive description of the operation of the systems, including the function of each item of equipment within the system.
    - .3 Detailed instructions for the normal maintenance of all systems and equipment installed including procedures and frequency of operational checks and service and troubleshooting instructions.
    - .4 Local source of supply for each item of equipment.
    - .5 Wiring and control diagrams.
    - .6 Spare parts list.
    - .7 Copies of guarantees and certificates.
    - .8 Manufacturer's maintenance brochures and shop drawings.
- 2.15 PROJECT RECORD DRAWINGS
- .1 Provide project record documents as specified in Division 01 as further called for in this Division.



- .2 The contractor shall keep a complete set of white prints at the site office, including all addendums, change orders, site instructions, clarifications and revisions for the purpose of record drawings. As the work on site proceeds, the contractor shall clearly record in Red all as-built conditions which deviate from the original contract documents. Record drawings to include cable runs (complete with number of cables and ID number) and locations of all telecommunications equipment.
- .3 Prior to substantial performance, the Contractor shall submit completed red-line record drawings to the Departmental Representative. The Contractor shall certify, in writing that the as-built record drawings are complete and that they accurately indicate all electrical services and electrical pathway, including exposed as well as concealed items.
- .4 Preparation of record drawings in AutoCAD shall be performed by the Contractor after Departmental Representative reviews and accepts contractor prepared red-lines based on the red-line record drawings submitted by the Contractor.

### **PART 3 - EXECUTION**

#### 3.1 INSTALLATION

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

#### 3.2 NAMEPLATES AND LABELS

- .1 Ensure manufacturers nameplates and CSA labels to be visible and legible after equipment is installed.

#### 3.3 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit and protruding 50 mm [2"].
- .2 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.
- .3 Install roof jacks where conduit and cables penetrate roofs. Apply sealant after installation. Install roof stand offs where conduit or teck is installed on roof.
- .4 All cables and conduits to be installed concealed in finished areas.

#### 3.4 LOCATION OF OUTLETS

- .1 Do not install outlets back-to-back or in the same stud space in wall; allow minimum 400mm [16"] horizontal clearance between boxes.
- .2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000mm [10'- 0"] and information is given before installation.
- .3 Locate light switches on latch side of doors unless otherwise indicated.
- .4 Locate disconnect devices in mechanical room on latch side of door.

#### 3.5 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not indicated verify before proceeding with installation.
- .3 Adjust mounting heights to accessible heights to meet the BC Building Code where applicable.



- .4 Refer to detail on drawings; in the absence of a drawing detail or drawing note, use the following (note, not all devices may be present in this project):

Device	Height		Comment
Local switches	1200	[48"]	
Wall receptacles/data	460	[18"]	General
Wall receptacles/data	200	[8"]	Above top of continuous baseboard heater
Wall receptacles/data	175	[7"]	Above top of counters or counter splash backs – coordinate with Architectural detail
Wall receptacles/data	900	[36"]	In mechanical rooms
Exterior receptacles	600	[24"]	
Panelboards	2000	[80"]	Panelboards: as required by Code or as indicated.
Wall mtd telephone	1500	[60"]	
Card Readers/T'Stat	1200	[48"]	Confirm before installation
Fire alarm stations	1200	[48"]	ULC S524 requires not less than 1200mm or more than 1400mm.
Wall Mounted Luminaires	2140	[82"]	
Fire alarm horns/audio	2300	[92"]	ULC S524 requires not less than 1800mm to centre. In any event not closer than 50mm to the ceiling
Fire alarm visual devices	2000	[80"]	ULC S524 requires not more than 2000mm to centre. In any event not closer than 150mm to the ceiling
Fire alarm Annunciator	1800 Top	[72"]	ULC S524 requires not more than 1800mm above finished floor.
End of line resistors	1800	[72"]	
Emergency Lighting (wall mounted)			300mm below ceiling or 2300mm max.
Exit Lights			300mm below ceiling or 450mm max. above door.

### 3.6 FIELD QUALITY CONTROL

- .1 Load and Balance:
- .1 Measure voltage and phase & neutral currents to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
  - .2 Measure phase and neutral currents to dry-core transformers and motor control centres, operating under normal load,
  - .3 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

- .2 Conduct and pay for the following tests:
  - .1 Power generation and distribution system including phasing, voltage, grounding and load balancing.
  - .2 Circuits originating from branch distribution panels.
  - .3 Lighting and its control to ASHRAE 90.1 – 10 requirements; this commissioning shall be conducted by the manufacture and the Departmental Representative shall receive a letter from the manufacturer detailing the commissioning and it's certification.
  - .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
  - .5 Systems: fire alarm system and communications.
  - .6 Main ground resistance (at all grounding locations).
  - .7 Insulation resistance testing:
    - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
    - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
    - .3 Check resistance to ground before energizing.
- .3 Provide Departmental Representative with at least one week's notice prior to testing.
- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .5 Reports:
  - .1 Provide written reports in a timely manner upon completion of the testing and load balance. Indicate test hour and date.

### 3.7 CLEANING

- .1 Do final cleaning in accordance with Division 01.
- .2 At time of final cleaning, clean lighting reflectors, lenses and other lighting surfaces that have been exposed to construction dust and dirt.
- .3 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .4 Clean and prime paint exposed non-galvanised hangers, racks, fastenings to prevent rusting. Coordinate finish painting with Division 09.

### 3.8 WORKMANSHIP

- .1 Workmanship shall be in accordance with well-established practice and standards accepted and recognized by the Departmental Representative and the Trade.
- .2 The Departmental Representative shall have the right to reject any item of work that does not conform to the Contract Documents and accepted standards of performance, quietness of operation, finish and appearance.
- .3 Employ only tradesmen holding valid Provincial Trade Qualification Certificates. Tradesmen shall perform only work that their certificate permits. Certificates shall be available for inspection by the Departmental Representative.

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- 3.9 PROTECTION OF WORK
- .1 Protect equipment and materials, stored or in place, from the weather, moisture, dust and physical damage.
  - .2 Mask machined surfaces. Secure covers over equipment openings and open ends of equipment and conduit, as the installation work progresses.
  - .3 Equipment having operating parts, bearings or machined surfaces, showing signs of rusting, pitting or physical damage will be rejected.
  - .4 Refinish damaged or marred factory finish.
- 3.10 PROTECTION OF ELECTRICAL EQUIPMENT
- .1 Protect exposed live equipment during construction for personnel safety.
  - .2 Shield and mark live parts, e.g. "LIVE 120 VOLTS".
  - .3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of electrician.
- 3.11 CONCEALMENT
- .1 Conceal wiring and conduit in partitions, walls, crawlspaces and ceiling spaces, unless otherwise noted.
  - .2 Do not install wiring and conduit on outside walls or on roofs unless specifically directed.
- 3.12 SERVICE PENETRATIONS IN RATED FIRE SEPARATIONS
- .1 All fire stopping materials shall be of one manufacturer; pre-approved manufactures are Hilti and STI.
  - .2 All cabling, wiring, conduits, cable trays, etc. passing through rated fire separations shall be smoke and fire stopped to a ULC or cUL tested assembly system, in accordance with CAN4-S115-95, that meets the requirements of the Building Code in effect.
  - .3 Firestop System installation must meet requirements of ASTM E 814 or UL 1479 tested assemblies that provide a fire rating equal to that of construction being penetrated.
  - .4 Install firestopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions. The Applicator shall be approved, licensed and supervised by the manufacturer in the installation of firestopping and are to follow the requirements of a rated system; installer to be FM 4991 Approved Contractor, UL Approved Contractor or Hilti Accredited Fire Stop Specialty Contractor.
  - .5 Contractors are expected to submit system information detailing firestopping product, backing, penetrant, penetrated assembly, Fire (F) and Temperature (T) rating, and ULC or cUL system number during shop drawing stage.
  - .6 Provide fire stopping material and system information in the maintenance manuals and via labels at major penetrations that are likely to be re-penetrated.
  - .7 All penetrations for communication cabling are to be firestopped using re-penetrable EZ Path System (Specified Technologies Inc - STI) or re-penetrable Hilti Firestop Systems designated and installed for each specific application.
  - .8 Allow openings for 100% capacity of raceway or 200% capacity of J-hooks (if applicable).

- .9 Provide Firestopping approval certificate in including a Building Code / By-Law Schedule B & C-B signed by a BC registered Professional Engineer. Submit a letter certifying that all work is complete and in accordance with this specification.
- .10 A manufacturer's direct representative (account manager, fire protection specialist, not distributor or agent) to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details. Manufacturer's fire protection specialist to work with Departmental Representative to determine frequency of site walk-throughs to be submitted to construction manager and Departmental Representative.
- .11 Inspection of through-penetration firestopping by the manufacturer shall be performed in accordance with ASTM E 2174, "Standard Practice for On-Site Inspection of Installed Fire Stops" or other recognized standard and a field report shall be issued by the manufacturer to the Departmental Representative.
- .12 Electrical Contractor to provide for a 10% deconstruction test by the Departmental Representative during walk-through.

3.13 SERVICE PENETRATIONS IN NON-RATED SEPARATIONS

- .1 All cabling, wiring, conduits, cable trays, etc. passing through non-rated fire separations and non-rated walls and floors shall be tightly fitted and sealed on both sides of the separation with caulking or silicon sealant to prevent the passage of smoke and/or transmission of sound.

3.14 CONDUIT SLEEVES

- .1 Provide conduit sleeves for all conduit and wiring passing through rated walls and floors. Sleeves to be concentric with conduit or wiring.
- .2 Except as otherwise noted conduit sleeves are not required for holes formed or cored in interior concrete walls or floors.
- .3 Conduit sleeves shall extend 50 mm [2"] above floors in unfinished areas and wet areas and 6 mm [1/4"] above floors in finished areas.
- .4 Conduit sleeves shall extend 25 mm [1"] on each side of walls in unfinished areas and 6 mm [1/4"] in finished areas.
- .5 Conduit sleeves shall extend 25mm [1"] beyond exterior face of building. Caulk with flexible caulking compound.
- .6 Sleeve Size: 12 mm [1/2"] clearance all around, between sleeve and conduit or wiring.
- .7 Paint exterior surfaces of ferrous sleeves with heavy application of rust inhibiting primer.
- .8 Packing of Sleeves:
  - .1 Where sleeves pass through foundation walls and perimeter walls the space between sleeve and conduit shall be caulked with waterproof fire retardant non-hardening mastic.
  - .2 Pack future-use sleeves with mineral wool insulation and then seal with ULC approved fire stop sealant for rated fire separations.

3.15 ACCESSIBILITY AND ACCESS PANELS

- .1 Install all equipment, controls and junction boxes so as to be readily accessible for future modification, adjustment, operation and maintenance as appropriate.

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- .2 Provide access panels where required in building surfaces. Do not locate access panels in panelled or special finish walls, without prior approval of the Departmental Representative.
  - .3 Access panels in U.L.C. fire separations and fire walls shall have a compatible fire rating and U.L.C. label. Acquire approval in writing from the local fire authority if required.
  - .4 Access panels shall be painted with a primer coat if applicable and then with a finish coat, colour and type to the Departmental Representative's approval.
  - .5 Locate equipment and junction boxes in service areas wherever possible.

3.16 EQUIPMENT INSTALLATION

- .1 Provide means of access for servicing equipment.
- .2 CSA identification and equipment labels to be clearly visible after installation.

3.17 CUTTING, PATCHING, DIGGING, CANNING, CORING & CONCRETE

- .1 Lay out all cutting, patching, digging, canning and coring required to accommodate the electrical services. Coordinate with other Divisions. The performance of actual cutting, patching, digging, canning and coring is specified under other Divisions.
- .2 The Electrical Contractor shall be responsible for all cutting, patching, digging, canning and coring required to accommodate the electrical services.
- .3 The Electrical Contractor shall be responsible for correct location and sizing of all openings required under Electrical Divisions, including piped sleeves.
- .4 Verify the location of existing and planned service runs and structural components within concrete floor and walls prior to core drilling and/or cutting.
- .5 Openings through structural members of the building shall not be made without the approval of the Structural Consultant.
- .6 Openings in Concrete:
  - .1 Be responsible for the layout of all openings in concrete, where openings are not left ready under previous contract.
  - .2 All openings shall be core drilled or diamond saw cut.
  - .3 Refer to structural drawings for permissible locations of openings and permissible opening sizes in concrete floors and walls.
  - .4 Refer to structural drawings for locations of steel reinforcing.
  - .5 Be responsible for repairing any damage to steel reinforcing.
- .7 Openings in building surfaces other than concrete:
  - .1 Lay out all openings required.
- .8 Poured concrete for duct encasements, pole bases, transformer pads and housekeeping pads shall be provided by other Divisions, coordinated and supervised by the Electrical Divisions.
- .9 Precast concrete items such as transformer pad bases, pull boxes and light pole bases to be provided and installed by the Electrical Divisions unless otherwise specified.
- .10 Excavation and backfilling will be provided by other Divisions. This Division to supervise the work and provide all layouts and parameters.

- 3.18            PAINTING
- .1            Clean exposed bare metal surfaces supplied under the Electrical Divisions removing all dirt, dust, grease and millscale. Apply at least one coat of corrosion resistant primer paint to all supports and equipment fabricated from ferrous metal.
  - .2            Paint all hangers and exposed sleeves, in exposed areas, with a rust inhibiting primer, as they are installed.
  - .3            Repaint all marred factory finished equipment supplied under the Electrical Divisions, to match the original factory finish.

**END OF SECTION 26 05 00**

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## **PART 1 - GENERAL**

### 1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

### 1.2 SCOPE

- .1 Electrical operations and maintenance manuals (hereinafter referred to as O&M manuals) shall be prepared by a firm specializing in this type of work.
- .2 Specialty firm to be responsible for:
  - .1 The supply and preparation of four sets of O&M manual binders and tabs as specified in the index below.
  - .2 The preparation of all written system descriptions and schematics (neatly drafted) for each tab section identified as article 1.4. Format as directed by the Owner, utilizing proportional typewritten format, with schematics in appendices at the end of each section. System description shall include an overview of basic design philosophy, description of future expansion capability, general construction of components, electrical characteristics not readily deduced from the contract documents, basic system configuration and interfaces with other systems existing or new.
  - .3 Securing and assembling all necessary literature describing operational and maintenance procedures for all equipment into the O&M manual binders, including Preventative Maintenance data as described below. Preventative maintenance data and maintenance suggestions to be compiled in tabular format in applicable section to provide a comprehensive overview of maintenance procedures.
  - .4 Preparing in coordination with Electrical Divisions and equipment manufacturer's technical specialist, scheduled maintenance sheets and check lists. Scheduled maintenance sheets shall include safety in maintenance data plus detailed daily, monthly and yearly scheduled maintenance information. Format as directed by the Owner.
  - .5 Preparation of safety in maintenance suggestions and procedures.
  - .6 Summarized daily, monthly and yearly maintenance charts.
  - .7 Prestonia No. 2047-10 plastic sheet protectors for all drawings larger than 210 mm × 275 mm. Locate drawing title block on lower right hand corner.
- .3 Division 26 shall be responsible for:
  - .1 Supply of four (4) copies of all information as described below:
    - .1 Final shop drawings.
    - .2 All wiring diagrams.
    - .3 List of all major trades, sub-trades and suppliers including names of equipment supplied and by whom, addresses, phone numbers, facsimile numbers and contact persons.
    - .4 Obtaining all data necessary to compile a complete comprehensive Preventative Maintenance program. Data gathered shall be neatly handwritten on forms provided by the Owner. Data to be collected for all systems described in the index below.

- .5 Spare/replacement parts lists for all of the above. Copies of the electrical contractor's data collection sheets available during tendering period when requested.
- .6 Test results and verification reports as outlined in other sections of this specification.
- .7 Warranties as outlined in this and other sections of the Specifications.

### 1.3 ELECTRONIC FORMAT

- .1 In addition to the specified hardcopy, provide an electronic copy in pdf format. Electronic copy to be produced on a CD-ROM in the latest version of Acrobat.
- .2 CD-ROM to be reproducible by owner as required to carry out his duties.
- .3 Electronic copy to consist of a single pdf file divided into chapters to allow a quick and easy access to the different sections of the manual.
- .4 All log sheet, maintenance tables, preventative maintenance sheets, intended to be completed by the Owner are to be completely interactive allowing the Owner to complete all pertinent information and save, print or modify these forms as required.
- .5 Provide a proposed layout to the Departmental Representative for approval prior to the construction of the O&M manuals.
- .6 Electrical contractor to submit complete system description and schematics by 50% complete stage of construction. O&M manuals to be submitted to the Owner 90% complete three (3) months prior to substantial completion review.
- .7 Electrical O&M manuals to be assembled in 210 mm × 275 mm capacity, expanding spine catalogue binders complete with plated piano hinges, bound in heavy fabric, hot stamped lettering on front and spine. Electrical contractor to provide sufficient quantity to allow all binders to hold system data while in full closed position (not expanded).
- .8 Electrical contractor to provide sample of art work and fabric cover (before having binders constructed) to the Owner.
- .9 In addition to the specified hardcopy, provide an electronic copy in pdf format. Electronic copy to be produced on a CD-ROM in the latest version of Acrobat.
  - .1 CD-ROM to be reproducible by owner as required to carry out his duties.
  - .2 Electronic copy to consist of a single .pdf file divided into chapters to allow a quick and easy access to the different sections of the manual.
  - .3 All log sheet, maintenance tables preventative maintenance sheets, intended to be completed by the Owner are to be completely interactive allowing the Owner to complete all pertinent information and save, print or modify these forms as required.
  - .4 Provide a proposed layout to the Departmental Representative for approval prior to the construction.

**END OF SECTION 26 05 03**



## **PART 1 - GENERAL**

### **1.1 RELATED WORK**

- .1 This Section of the Specification is to be read, coordinated and implemented in conjunction with all other parts of the Contract Documents.

### **1.2 REGULATORY REQUIREMENTS**

- .1 Restraints shall meet the requirements of the latest edition of the British Columbia Building Code and amendments.
- .2 The Seismic Consulting Engineer should be able to provide a proof of professional insurance and the related practice credentials if requested by the Electrical Consultant. The Seismic Consulting Engineer should be familiar with SMACNA, ECABC & NFPA guidelines as well as BCBC and VBBL requirements.
- .3 The Contractors' Seismic Consultant shall submit original signed BC Building Code "Letters of Assurance" "Schedules B and C-B" to the Prime Consultant or Electrical Consultant.
- .4 Project shall comply with the local bylaw where applicable.
- .5 The above requirements shall not restrict or supplant the requirements of any local bylaws, codes, or other certified agencies which may have jurisdiction over all or part of the installation.

### **1.3 SCOPE**

- .1 It is the responsibility of equipment manufacturers to design their equipment so that the strength and anchorage of internal components of the equipment exceeds the force level used to restrain and anchor the unit itself to the supporting structure.
- .2 Manufacturer's shop drawings to be submitted with seismic information on equipment structure, bracing and internal components and as required by Division 01.
- .3 Provide restraint on all equipment and machinery, which is part of the building electrical services and systems, to prevent injury or hazard to persons and equipment in and around the structure. Restrain all such equipment in its normal position in the event of an earthquake.
- .4 The total electrical seismic restraint design and field review and inspection will be by a B.C. registered professional structural engineer who specializes in the restraint of building elements. Contractor to allow for coordination, provision of seismic restraints, as well as all costs for the services of the Seismic Restraint Engineer. This engineer, herein referred to as the Seismic Consultant, will provide normal engineering functions as they pertain to seismic restraint of electrical installations.
- .5 The Contractor shall be aware of, and comply with, all current seismic restraining requirements and make provision for those that may come into effect during construction of the project. Make proper allowance for such conditions in the tender.
- .6 The Seismic Consultant shall provide detailed seismic restraint installation shop drawings to the Contractor. Copies of the shop drawings to be included in the final project manual.
- .7 Provide seismic restraints on all equipment, and/or installations or assemblies, which are suspended, pendant, shelf mounted, freestanding and/or bolted to the building structure or support slabs.

- .8 The Seismic Consultant shall provide inspections during and after installation. The Contractor shall correct any deficiencies noted without additional cost to the contract.
- .9 Include all costs associated with the Seismic installation and certification in the base tender.

## **PART 2 - PRODUCTS**

### 2.1 SLACK CABLE SYSTEMS

- .1 Slack cable restraint systems shall be as designed and supplied by Vibra-Sonic Control or equal.
- .2 Slack cable restraints shall be provided on suspended and shelf mounted transformers along with associated equipment and assemblies connected to them at the points of vertical support (4 points). The restraint wires shall be oriented at approximately 90 degrees to each other (in plan), and tied back to the ceiling slab or its structure at approximately 45 degrees to the slab or basic structure. The restraints shall be selected for a 1 g earthquake loading, i.e. each wire shall have a working load capacity equal to the weight of the transformer. The anchors in the structure shall be selected for a load equal to the weight of the transformers at a 45 degree pull.
- .3 Slack cable systems to allow normal maintenance of equipment and shall not create additional hazard by their location or configurations. Contractor shall rectify any such installations at no additional cost, all to the satisfaction of the engineer and inspection authority having jurisdiction.
- .4 Coordinate requirements of slack cables with suppliers prior to installation.

## **PART 3 - EXECUTION**

### 3.1 GENERAL

- .1 All seismic restraints systems shall conform to local authority having jurisdiction and all applicable code requirements.

### 3.2 CONDUITS

- .1 Provide restraint installation information and details on conduit and equipment as indicated below:
- .2 Vertical Conduit:
  - .1 Attachment - Secure vertical conduit at sufficiently close intervals to keep the conduit in alignment and carry the weight of the conduits and wiring. Stacks shall be supported at their bases and, if over 2 stories in height, at each floor by approved metal floor clamps.
  - .2 At vertical conduit risers, wherever possible, support the weight of the riser, at a point or points above the center of gravity of the riser. Provide lateral guides at the top and bottom of the riser, and at intermediate points not to exceed 9.2 m.
- .3 Riser joints shall be braced or stabilized between floors.
- .4 Horizontal Conduits:
  - .1 Supports - Horizontal conduit shall be supported at sufficiently close intervals to keep it in alignment and prevent sagging.
  - .2 EMT tubing - tubing shall be supported at approximately 1.2 m [4 ft] intervals for tubing.
- .5 Do not brace conduit runs against each other. Use separate support and restraint system.
- .6 Support all conduits in accordance with the capability of the pipe to resist seismic load requirements indicated.

- .7 Trapeze hangers may be used. Provide flexible conduit connections where conduits pass through building seismic or expansion joints, or where rigidly supported conduits connect to equipment with vibration or seismic isolators.
- .8 A conduit system shall not be braced to dissimilar parts of a building or two dissimilar building systems that may respond in a different mode during an earthquake. Examples: wall and a roof; solid concrete wall and a metal deck with lightweight concrete fill.
- .9 Provide large enough conduit sleeves through walls or floors to allow for anticipated differential movements with firestopping where required.
- .10 It is the responsibility of the contractor to ascertain that an appropriate size restraint device be selected for each individual piece of equipment. Submit details on shop drawings. Review with Seismic Consultant and submit shop drawings to Departmental Representative for their reference.

### 3.3 FLOOR MOUNTED EQUIPMENT

- .1 Bolt all equipment, e.g. transformers, switchgear, generators, motor control centres, free standing panelboards, control panels, capacitor banks, etc. to the structure. Design anchors and bolts for seismic force applied horizontally through the center of gravity to a seismic force of 0.5g. For equipment which may be subject to resonances, use a nominal 1.0 g seismic force.
- .2 Provide flexible conduit connections between floor mounted equipment to be restrained and its adjacent associated electrical equipment.

### 3.4 LIGHT FIXTURES

- .1 Fixtures in suspended ceilings shall be hung independently of the ceiling system. Fixtures shall be secured to concrete or structural deck above by at least two taut cables which are connected to the fixture at diagonal points.
- .2 Surface and recessed style fixtures shall be hung independently of the ceiling system. Fixtures shall be secured to concrete or structural framing above by taut cables.
- .3 Fixtures which are hung independently of ceiling systems shall have minimum of one seismic cable in addition to the chain or cable used to support the fixture. Seismic restraint cables shall be secured into the concrete or structural deck above.
- .4 Cables shall be corrosion resistant and approved for the application.
- .5 Fixtures which are rod hung shall have seismic ball alignment fittings at the ceiling and fixture.

**END OF SECTION 26 06 06**

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## **PART 1 - GENERAL**

### 1.1 RELATED SECTIONS

- .1 This section of the specification forms part of the Contract Document and is to be read, interpreted and coordinated with all other parts.

### 1.2 EXCAVATION AND BACKFILL

- .1 Check the drawings of other Divisions of the work for the existence of underground services, and report any serious interference before proceeding with the work. The services of Utility Authorities shall be engaged to accurately determine the location of any underground services prior to excavation.
- .2 Carefully coordinate duct bank location below building with the structure.
- .3 In the execution of this work, or any extra work in connection therewith, do not move any structure or services without the consent of the proper parties. In crossing or running parallel with said structures or services, secure same in place until the work is completed. Any damage to structures or services of this kind caused by neglect to attend to same shall be paid for by the Contractor.
- .4 Keep excavations dry at all times by bailing, pumping, or other means as is necessary.
- .5 Prove grades and the route of ductwork and conduits and the location of manholes far enough along the route in advance of forming and concrete pour so that any relocation or re-design necessitated by unforeseen obstacles may be carried out.
- .6 Grade the bottom of trenches for ducts, duct banks and conduit and level with pit-run gravel and sand, graded from coarse to fine with a maximum size of 38mm [1½"]. Where excavation is carried out to a depth greater than that required for the proper elevation for the ducts, duct bank, or conduit, backfill with carefully compacted and power-tamped sand and pit-run gravel as specified to the required grade.
- .7 Backfill trenches under building floor areas with sand placed in layers in an approved manner to achieve 95% modified Proctor compaction. Material from excavation shall not be used for backfilling.
- .8 In locations other than under building floor areas, thoroughly tamp same around and over ducts and conduits to a height of at least 300mm [12"] above. Fill remainder of trench and consolidate on 450mm [18"] layers with approved excavated materials, free from stone and foreign materials.
- .9 Except where beneath the building, supply and install polyethylene HIGH VOLTAGE marking tape over and along the full length of underground services at a depth of 300mm [12"] below grade.
- .10 Backfill the top 150mm [6"] of the excavation with pit-run gravel where the excavation is situated on a paved or travelled road; crushed rock screenings where the excavation is situated on a concrete sidewalk; black loam where the excavation is on a developed grass boulevard; and sand or earth free of clay, extraneous material, or rock no larger than 38mm [1½"] in any dimensions elsewhere. All shall be thoroughly tamped. Where area was originally grassed, rake loam clear of all stones and debris and leave ready for re-sodding.
- .11 Backfill as soon as possible, so that regular traffic in and around the work will not be inconvenienced.
- .12 Fill depressions to restore the correct grade after a period adequate to reveal settlement has passed. Restore all surfaces (paving, sidewalk, grass) to same quality as the surroundings. Assume responsibility for making good any subsequent settlement of such fill. Pay costs involved

in making good pavement, surfacing lawns, curbs and all other surfaces damaged by such settlement and subsequent restoration.

- .13 Store materials excavated during the progress of the work in such locations as directed by the Departmental Representative and in such a manner as to produce a minimum of inconvenience, damage or disfigurement of existing ground.
- .14 Remove and dispose of excess excavated material remaining on completion of the work and leave site clear and unencumbered.

### 1.3 WATERPROOFING/VAPOUR BARRIERS

- .1 Generally penetrations through waterproofing members and vapour barriers will not be permitted. However, where any work must pierce vapour barriers and waterproofing membranes including waterproofed concrete, the method of installation, colour of caulking material and location of penetration shall be as approved by the Departmental Representative and as coordinated with Division 07 prior to proceeding with the work. Supply and install all necessary sleeves, caulking and flashing and make the penetrations watertight. For penetrations of vapour barrier, maintain integrity of the system. Restore penetrations through existing surfaces to match the surroundings.
- .2 Provide specified caulking around all exterior recessed lighting fixtures in concrete steps, walls, etc.
- .3 Provide clear silicon bead on top and down both sides of all exterior wall mounted devices (e.g. light fixtures and gongs) where devices are exposed to the weather.

### 1.4 EQUIPMENT FINISHES

- .1 Thoroughly degrease all metalwork and apply one overall coat of zinc chromate primer to all electrical equipment enclosures, supports, switchgear cubicles, bus ducts, gutters, panelboards, low tension and other cabinets. Unless otherwise directed, apply one overall coat of grey enamel and a second coat of gloss enamel. Paint all exposed surfaces Grey ASA #61 unless matching existing equipment in which case colour shall match existing.
- .2 Unless otherwise directed, paint outdoor electrical equipment "equipment green" finish to EEMAC Y1-1-1955.
- .3 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint. Ensure that equipment finishes are not defaced during installation. Scratched or otherwise marred surfaces shall be refinished before the job will be accepted. Other surfaces shall be completely repaired to match original paint. Patching of damaged area will not be accepted.
- .4 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.
- .5 Generally, equipment finishes shall be as outlined under applicable sections of the specifications.

### 1.5 VIBRATION AND NOISE CONTROL

- .1 Mounting
  - .1 Vibrating electrical equipment, such as transformers and standby diesel engine generators, shall be mounted using vibration isolators to prevent the transmission of vibration and mechanically transmitted sound to the building structure. Vibration isolators shall be selected in accordance with the weight distribution of equipment so as to produce the manufacturers' recommended uniform deflection. Such equipment shall be restrained

at each isolator pad using bolts into the floor slab with neoprene washers and clearance holes to prevent short circuiting.

.2 Connections

- .1 Connections to rotating, vibrating, or other noise-producing equipment such as motors, generators and transformers shall be by means of flexible conduit and flexible stranded conductors so as to minimize transmitted noise and vibration. Where equipment is mounted by means of resilient supports and is subject to physical displacement under such conditions as energizing a motor, the flexible conduit connections shall be formed into a loop of sufficient length to permit freedom of travel.

.3 Vibration Isolators and Hangers

- .1 For floor-mounted transformers, use Mason Industries bridge bearing quality neoprene "Super W" waffle pads Type SWMW, SWML, or SWM as appropriate, or approved equal, anchored to the structure through Mason hemispherical grommets.
- .2 For transformers suspended from the ceiling, use hanger rod assemblies, fitted with Mason Industries Type 30N, or approved equal, vibration hangers with 30° misalignment capability.
- .3 For dry type transformers 750kVA and larger, use Mason Industries SSLFH spring type vibration isolators.

.4 General

- .1 In other than Mechanical or Electrical Rooms or closets, electrically held relays, contactors and starters shall be provided with vibration isolation mounts and sound enclosures.
- .2 All parts of all fluorescent lighting fixtures and remote ballast boxes or racks shall be securely fastened and, if necessary, fitted with neoprene spacers to minimize ballast noise amplification.

1.6 ACOUSTICAL SPECIFICATIONS FOR TRANSFORMER

.1 General

- .1 Supply transformers generating a space average noise level in the respective Electrical Rooms not exceeding 70 decibels (re: 20 microPa) measured in any third octave band between 50Hz and 1,000Hz based on a 300kVA transformer. Other sizes shall meet equivalent noise level with noise correction based on 10 Log kVA re: 300kVA. Use a room absorption equivalent to 1/3 of the floor area. Supply the name of a similar installation.
- .2 Sound level measurements made at the project site will be made in general accordance with ANSI Standard S1.32, recognizing that the respective Electrical Rooms may not meet the full requirements of the Standard.
- .3 Supply vibration isolation such that the airborne noise isolation provided by the building structure is not limited by structure-borne noise transmission. The following are minimum isolation requirements:
- .1 Mount the transformer core on 25mm deflection spring isolators, including in-series neoprene elements with an effective deflection of 2.5mm. Use restraints meeting the National Building Code with respect to seismic requirements. (Also refer to Section 26 05 30 Seismic Restraints).
- .2 Where a transformer is located on a slab on grade, use pad isolators sized for a minimum 2.5mm deflection, with seismic restraints.

- .3 If the transformer core is mounted on separate transverse steel supporting members independent of the transformer enclosure, size the members for a 140Hz cantilever resonant frequency under the dead load of the member (0.013mm dead load cantilever deflection) and the isolator stiffness.
  - .4 Where smaller transformers are supplied with core bolted into steel supports within the cabinet, supply neoprene pad isolation within cabinet with minimum 2.5mm deflection working against the vibration isolation provided the isolator/pad supports is not limited by the braided connectors. If such flexibility is impractical, isolate the cabinets and all other associated equipment on the neoprene pads with 2.5mm deflection and isolate the conduit to meet the requirement.
  - .5 For 10 metres in all directions from the transformer, provide neoprene hangers with 0.1" Static deflection in threaded rod supports for conduit, cable trays, etc. Avoid rigid connections to the structure.
  - .6 Submit shop drawings detailing proposed isolation.
- .2 Standard of Acceptance:
- .1 Mason MAS or MT air mounts
  - .2 Mason Z-1011 seismic restraints
  - .3 Mason SLFH open spring isolators
  - .4 Mason Super W pad isolator, 50 durometer
  - .5 Mason HD hangers
- .3 Execution
- .1 Locate all mechanical equipment, electrical conduit and lighting at least 300mm below the ceiling slab, including wall-mounted equipment. Do not locate mechanical ducts over transformer cabinets.

**END OF SECTION 26 05 10**



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**PART 1 - GENERAL**

1.1 RELATED WORK

- .1 This section of the specification forms part of the Contract Document and is to be read, interpreted and coordinated with all other parts.

1.2 BRANCH WIRING

- .1 Adhere to the circuit numbers indicated on the drawings. Provide all branch circuit wiring using materials and methods described herein and in consultation with the Departmental Representative.
- .2 Calculate volt drop of all feeders and branch circuit wiring and increase wire sizes based on actual wire run to meet the minimum requirements of the Canadian Electrical Code.
- .3 Install a green insulated bonding conductor in all conduits; do not rely on metallic conduit for bonding continuity. Size bonding conductor as per the Canadian Electrical Code.
- .4 Phase all panelboard buses throughout the building such that the left, centre, and right hand buses represent phase A, B, and C respectively. Identify all indicating meters to this sequence.
- .5 Provide all conduits and wiring including flexible connections, outlet boxes complete with wiring devices and surface raceways for all casework and millwork as shown on the drawings, unless otherwise noted. Arrange conduit so that it will be completely concealed along the entire run to the outlet.
- .6 Where wiring devices are indicated on free-standing benches or tables, locate conduit so that it will be concealed along the entire run to the outlet. Location of conduit floor penetrations shall be to the approval of the Departmental Representative. Conduits will not be permitted to run in concrete floor or topping or below slab on grade.
- .7 Prior to cutting of millwork for outlets/devices, prepare a "mock-up" at each location using paper cutouts to indicate the outlet/device layout. The paper cutouts shall be of the same overall size as the outlet/device that they represent and be complete with identification. The Contractor shall attach the paper cutouts to the millwork such that they are easily removable and in positions that are as generally indicated on the drawings. After each piece of millwork has all paper cutouts mounted, advise the Owner and the Departmental Representative and relocated as directed by the Departmental Representative prior to performing cutting of millwork.
- .8 Wire to all electrical appliances indicated on the drawings. The word appliance is intended to include cooking equipment not of 'plug-in' nature, laundry equipment, stills, hot water tanks, and other special equipment throughout the building for which outlets are indicated on the drawings or noted in the equipment schedule. Use flexible conduit or liquid-tight flexible conduit for connection from outlets to appliances.
- .9 Unless otherwise noted, appliances will be supplied and set in place in the rooms by others. Check with the trades involved and with the Owner to determine correct orientation of the appliances, the final and exact location and electrical requirements of each outlet (both control and supply) before proceeding with the installation.
- .10 Prior to rough-in of outlet boxes confirm final furniture layout with the Architect.
- .11 Prior to installation of switch outlets, confirm door swing on Architectural Drawings. Where switch cannot be located on latch side of door, install the outlet box a minimum of three feet from the door swing, do not install switch behind door.
- .12 Wiring circuits for electronic equipment, such as computers, printers and Communications equipment shall have a separate dedicated neutral for each and every circuit.

**END OF SECTION 26 05 11**



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**PART 1 - GENERAL**

1.1 RELATED SECTIONS

- .1 This Section of the Specifications forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-C22.2No.18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
  - .2 CSA C22.2No.65, Wire Connectors.
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
  - .1 EEMAC 1Y-2, 1961 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA)

**PART 2 - PRODUCTS**

2.1 MATERIALS

- .1 Pressure type wire connectors to: CSA C22.2No.65, with current carrying parts of copper alloy sized to fit copper conductors as required.
- .2 Fixture type splicing connectors to: CSA C22.2No.65, with current carrying parts of copper alloy sized to fit copper conductors 10 AWG or less.
- .3 Bushing stud connectors: to EEMAC 1Y-2/NEMA to consist of:
  - .1 Connector body and stud clamp for round copper conductors.
  - .2 Clamp for round copper conductors.
  - .3 Clamp for stranded aluminum conductors round aluminum bar.
  - .4 Stud clamp bolts.
  - .5 Bolts for copper conductors and bar.
  - .6 Bolts for aluminum conductors and bar.
  - .7 Sized for conductors or bars as indicated.
- .4 Clamps or connectors for armoured cable, aluminum sheathed cable, flexible conduit as required to: CAN/CSA-C22.2No.18.

**PART 3 - EXECUTION**

3.1 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and:
  - .1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.
  - .2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2No.65.
  - .3 Install fixture type connectors and tighten. Replace insulating cap.
  - .4 Install bushing stud connectors in accordance with EEMAC 1Y-2/NEMA.

**END OF SECTION 26 05 20**

## **PART 1 - GENERAL**

### 1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.
- .2 Refer to Division 27 & 28 for particular Communications, Electronic Safety & Security wiring systems and types.

### 1.2 TERMS OF REFERENCE

- .1 Typically use insulated 98% conductivity copper conductor wiring enclosed in EMT (steel) conduit for the general wiring systems unless otherwise indicated. Refer to "Site Services" Section for allowable site conduits as an alternative to steel.
- .2 Teck cable may only be used where specifically indicated on the drawings or in the specifications. Where permitted, Teck wiring up to 750 system volts to be PVC jacketed armoured cable, multi-copper conductor type Teck90 1000 volt having a PVC jacket with FT-4 flame spread rating.
- .3 Flexible armoured cabling (BX) shall not be used for the general wiring system other than final drops to light fixtures in ceilings.
- .4 Provide all control wiring except mechanical equipment controls as specified in Section 26 24 21 Mechanical Equipment Controls and the Mechanical Divisions.
- .5 Refer to Equipment Schedule(s) for detailed responsibilities.
- .6 Non-metallic sheathed wiring is not to be used on this project.

### 1.3 PRODUCT DATA

- .1 Provide product data in accordance with Division 01

## **PART 2 - PRODUCTS**

### 2.1 WIRING & CABLES – GENERAL

- .1 Conductors: stranded for 10 AWG and larger. Minimum size #12 AWG.
- .2 Insulation to be 600 volt RW75XLPE (X link) for the general building wiring in conduit.
- .3 Use RWU75XLPE for underground installations.
- .4 Site services sub-circuits, including site lighting, to be minimum #10 AWG for power and #12 AWG for controls. Increase wiring size for lengthy and/or loaded circuits so that system will not exceed the maximum voltage drop as recommended by the Canadian Electrical Code CSA 22.1.
- .5 Main feeders to be conduit and copper insulated wiring unless otherwise noted on drawings. Provide bond wiring for all conduits. Increase conduit size as required.
- .6 Armoured (AC-90) cable may only be utilized for recessed tee bar luminaire drops from ceiling mounted outlet boxes. "Tite Bite" connectors and their counterparts of other manufacturers shall not be used. Use anti-short connectors. Cable from luminaire to luminaire is not permitted. Allow nominally 900mm [3'] extra cable looped and supported in the ceiling space to permit fixture relocations of one tile space.

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- .7 TBS75 #14 AWG stranded shall be used in all switchgear assemblies. Current transformer secondary wiring shall be #12 AWG stranded. Current transformer leads shall incorporate ring type tongues for termination purposes
  - .8 Conductors to be colour-coded. Conductors #10 AWG and smaller shall have colour impregnated into insulation at time of manufacture. Conductors size #8 AWG and larger may be colour-coded with adhesive colour coding tape, but only black insulated conductors shall be employed in this case, except for neutrals which shall be white wherever possible. Where colour-coding tape is utilized, it shall be applied for a minimum of 50 mm at terminations, junctions and pullboxes and conduit fittings. Conductors shall not be painted.
- 2.2 ARMoured CABLE (AC-90) – DROPS TO LUMINAIRES IN T'BAR SUSPENDED CEILINGS ONLY.
- .1 Conductors: insulated, copper, size as indicated.
  - .2 Type: AC90 600 V rated.
  - .3 Armour: interlocking type fabricated from galvanized steel.
  - .4 Anti-short connectors.
- 2.3 WIRE & BOX CONNECTORS
- .1 Pressure type wire connector current carrying parts to be copper and sized to fit conductors used.
  - .2 Fixture type splicing connector current carrying parts to be copper sized to fit conductors 10 AWG or less.
  - .3 Bushing stud connectors to EEMAC 1Y-2 and suitable for stranded copper conductors
  - .4 Clamps or connectors for armoured cable, flexible conduit, as required.

### **PART 3 - EXECUTION**

#### 3.1 INSTALLATION

- .1 Install all cables and wiring.
- .2 Conductor length for parallel feeders to be identical. Provide permanent plastic nametag indicating load fed.
- .3 Group Teck, Armoured, MI & Sheathed cables on channels wherever possible.
- .4 Lace or clip groups of feeder conductors at all distribution centres, pullboxes, and termination points.
- .5 Wiring in walls should typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls should be avoided unless indicated.
- .6 All grounding and bonding conductors and straps to be copper. All bonding conductors to have green insulation jacket.
- .7 Colour coding to be strictly in accordance with Section 26 05 00 – Common Work Results.
- .8 Provide sleeves where cables enter or exit cast concrete or masonry.

- .9 Power wiring up to and including #6 AWG shall be spliced with nylon-insulated expandable spring-type connectors. Large conductors shall be spliced using split-bolt or other compression type connectors wrapped with cambric tape then PVC tape.
- .10 Wires shall be sized for 2% maximum voltage drop to farthest outlet on a loaded circuit. Increase home run cable size to meet these requirements.
- .11 All 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.
- .12 Install all control cables in conduit.
- .13 Provide numbered wire collars for all control wiring. Numbers to correspond to control drawing legend. Obtain wiring diagram for control wiring of other Divisions.

### 3.2 VOLTAGE REGULATION

- .1 The drawings are diagrammatic and indicate the general routing of conduit runs and not exact routing, either horizontally or vertically.
- .2 Branch circuit conductor sizes shall be #12 AWG or larger based on the Canadian Electrical Code CSA 22.1 Section 8, which allows a maximum 3% voltage drop for branch circuits.

### 3.3 WIRE & BOX CONNECTORS

- .1 Remove insulation carefully from ends of conductors and:
  - .1 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
  - .2 Install fixture type connectors and tighten. Replace insulating cap.
  - .3 Install bushing stud connectors in accordance with EEMAC 1Y-2

**END OF SECTION 26 05 21**

## **PART 1 - GENERAL**

### 1.1 RELATED REQUIREMENTS

- .1 This section of the Specification forms part of the Contract Document and is to be read, interpreted and coordinated with all other parts.

### 1.2 REFERENCES

- .1 American National Standards Institute /Institute of Electrical and Electronics Engineers (ANSI/IEEE) – most recent version
  - .1 ANSI/IEEE 837, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.
  - .2 Grounding equipment to: CSA C22.2 No.41.
  - .3 All grounding conductors to be stranded soft annealed copper unless otherwise noted.
  - .4 Install complete grounding and bonding system in accordance with Canadian Electrical Code and local inspection authority requirements.
  - .5 ANSI/TIA 607B Generic Telecommunications Bonding and Grounding for Customer Premises.

## **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 indicated.
- .3 Rod electrodes: copper clad steel 19 mm diameter by minimum 3 m long.
- .4 Plate electrodes: to CSA Standard 41.
- .5 Grounding conductors: bare stranded copper, tinned, soft annealed, size as per C.E.C.
- .6 Insulated grounding conductors: green, copper conductors, sized as per C.E.C.
- .7 Ground bus: copper, complete with insulated supports, fastenings, connectors.
- .8 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.

### 2.2 STANDARDS OF ACCEPTANCE

- .1 Acceptable manufacturers:

- .1 Burndy Corp.
- .2 Erico Inc.
- .3 Cadweld.

### **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 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .2 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 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process, permanent mechanical connectors or inspectable wrought copper compression connectors to ANSI/IEEE 837.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Install bonding wire in EMT conduits.
- .7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .9 Install separate ground conductor to outdoor lighting standards.
- .10 Connect building structural steel and metal siding to ground by welding copper to steel.
- .11 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .12 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.
- .13 Ground secondary service pedestals.
- .14 Provide a grounding/bonding bus in electrical room. Connect a #2/0cu bonding conductor or as shown on the drawings between grounding/bonding buses.
- .15 All bonding and grounding connections to be compression type unless noted otherwise.
- .16 Bond bonding bus of switchboard to the grounding grid with a #3/0 copper conductor.
- .17 Ground the secondary winding of potential and current transformers.

- .18 Supply and install complete grounding and bonding system as indicated and as required by Canadian Electrical Code and the local electrical inspection authorities.
- .19 Provide grounding/bonding bus bars mounted on standoff insulators or as shown on the drawings.
- .20 All components shall be securely and adequately bonded and where required to accomplish this, bonding jumpers, grounding studs and bushings shall be used.
- .21 Ensure that all raceways, terminal panels, etc. for fire alarm, etc. are securely and adequately bonded and provide grounding conductor to main ground bus where called for or when required.
- .22 All interior metallic gas piping which may become energized to be made electrically continuous and to be bonded in accordance with requirements of Canadian Electrical Code.
- .23 Bond all low tension equipment with #6 AWG green insulated bonding conductor.
- .24 Bond all structural steel, all concrete reinforcing steel and all metal systems with a #6 AWG copper bonding conductor. Connect to closest ground bus or bonding point.
- .25 All metallic conduits longer than 1m in length, containing a single grounding or bonding conductor, shall be bonded as per the Canadian Electrical Code.

### 3.3 MAINTENANCE HOLES

- .1 Install conveniently located grounding stud, electrode, size as indicated stranded copper conductor in each maintenance hole.
- .2 Install ground rod in each maintenance hole so that top projects through bottom of maintenance hole. Provide with lug to which grounding connection can be made. Confirm ground resistance meets or exceeds Canadian Electrical Code minimum requirements.

### 3.4 ELECTRODES

- .1 Make ground connections to continuously conductive underground water pipe on street side of water meter.
- .2 Install water meter shunt.
- .3 Install concrete encased electrodes in building foundation footings, with terminal connected to grounding network.
- .4 Install rod electrodes and make grounding connections as indicated.
- .5 Bond separate, multiple electrodes together.
- .6 Copper conductors for connections to electrodes in accordance with C.E.C.
- .7 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

### 3.5 EQUIPMENT BONDING

- .1 Install bonding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, UPS units, elevators and escalators, distribution panels, outdoor lighting and cable trays.
- .2 Provide a bonding conductor from the secondary of every distribution transformer to the grounding system. Bond conductor to be sized and installed in accordance with Canadian Electrical Code.

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### 3.6 GROUNDING BUS

- .1 Provide a ground bus in the main electrical and communications equipment room. Ground bus shall consist of suitable length of 50mm x 6mm [2"x ¼"] copper bus mounted on a 25mm [1"] insulating standoffs. This bus shall be drilled and tapped to receive all the bonding conductors indicated and an engraved nameplate or tag installed above or below individual conductors indicating their function.
- .2 Bond items of electrical equipment in electrical room and IT equipment in communication equipment room to ground bus with individual bare stranded copper connections size 2/0AWG.

### 3.7 MECHANICAL EQUIPMENT BONDING

- .1 Provide a #2 bond conductor from the mechanical room ground bus to each MCC.
- .2 Provide a #6 bond conductor from the mechanical room ground bus to each VFD
- .3 Bond wires to be installed in all conduit serving motor feeder circuits and to extend to ground screws on junction and outlet boxes for bonding.

### 3.8 COMMUNICATION SYSTEMS

- .1 Install Bonding connections for telephone, sound, fire alarm, security systems, intercommunication systems as required in ANIS/TIA 607B:
  - .1 Utility Provider grounding system in accordance with telephone company's requirements.
  - .2 Communication, sound, fire alarm, security systems, intercommunication systems as indicated.

### 3.9 SYSTEMS BONDING

- .1 Install a home run #6 AWG insulated bonding conductor in conduit from the main ground bus to the:
  - .1 Main Fire Alarm panel
  - .2 Main Security panel.
  - .3 Communication systems head end.

### 3.10 CABLE TRAY BONDING

- .1 Install 1#6 green insulated copper bond cable to each cable tray from nearest ground bus.
- .2 Install 1#6 green insulated copper bond cable, for full length of tray bonded to tray at 15m [50'] intervals and to ground bus at each termination point as specified..

### 3.11 LABELLING

- .1 Provide equipment identification labelling nameplates for grounding bus bar, bonding and grounding conductors.
- .2 Apply identification and warning labels to grounding bus bar, bonding and grounding conductors.

### 3.12 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 08 00 – Commissioning and Demonstration.
- .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.
- .4 Disconnect ground fault indicator during tests.

**END OF SECTION 26 05 28**

## **PART 1 - GENERAL**

### 1.1 RELATED SECTIONS

- .1 This Section of the Specifications forms part of the Contract Documents and shall be read, interpreted and coordinated with all other parts.

## **PART 2 - PRODUCTS**

### 2.1 SUPPORT CHANNELS

- .1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted, suspended or set in poured concrete walls and ceilings.

## **PART 3 - EXECUTION**

### 3.1 INSTALLATION

- .1 Secure equipment to hollow and solid masonry, tile and plaster surfaces with lead anchors or nylon shields.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.
- .5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .6 Fasten exposed conduit or cables to building construction or support system using straps.
  - .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
  - .2 Two-hole steel straps for conduits and cables larger than 50 mm.
  - .3 Beam clamps to secure conduit to exposed steel work.
- .7 Suspended support systems.
  - .1 Support individual cable or conduit runs with 6 mm 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 26 05 29**

## **PART 1 - GENERAL**

### 1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

## **PART 2 - PRODUCTS**

### 2.1 SPLITTERS

- .1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2 Main and branch lugs, connection bars to match required size and number of incoming and outgoing conductors as indicated.
- .3 At least three spare terminals on each set of lugs in splitters less than 400 A.

### 2.2 JUNCTION AND PULL BOXES

- .1 Welded steel construction with screw-on flat covers for surface mounting.
- .2 Covers with 25 mm [1"] minimum extension all around, for flush-mounted pull and junction boxes.

### 2.3 CABINETS

- .1 Type E: sheet steel, hinged door and return flange overlapping sides, handle and catch, for surface mountings.
- .2 Type T: sheet steel cabinet, with full length hinged door, latch, lock, 2 keys, containing 19 mm G1S fir plywood backboard for surface or flush mounting as appropriate.
- .3 Include filtered vents and/or fan-cooling when enclosed equipment is heat producing.

## **PART 3 - EXECUTION**

### 3.1 SPLITTER INSTALLATION

- .1 Install splitters as indicated and mount plumb, true and square to the 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 spaces.
- .2 Only main junction and pull boxes are indicated. Provide pull boxes so as not to exceed 30 m of conduit run between pull boxes.
- .3 Provide pull boxes and junction boxes in locations shown on the drawings and as required to suit job conditions.
- .4 Locate pull boxes and junction boxes above removable ceilings, in electrical rooms, utility rooms or storage areas.

- .5 Junction boxes, when used, to be installed in areas that are accessible through luminaire openings, and/or access panels.
- .6 Where pull boxes are flush mounted, provide overlapping covers with flush head cover retaining screws, prime coated and painted to match wall or ceiling finish.
- .7 Where cast corrosion resistant boxes are used, covers to be of matching type and gasketed.
- .8 For special (not 100mm [4"] square or octagonal) pull boxes and/or junction boxes, paint identification for the system and provide lamicaid nametags to box covers with a size 2 nameplate 5mm [0.25"] lettering identifying system.
- .9 Interior of all pull boxes and junction boxes for each system to be spray painted with colour as specified in Section 26 05 00
- .10 All pull boxes, junction boxes and cabinets to be supported directly from building structure using one or a combination of galvanized screws, galvanized bolts, galvanized rods, and approved box clip.
- .11 Support of pull boxes, junction boxes by conduit fittings or wire is not acceptable.

### 3.3 CABINETS INSTALLATION

- .1 Mount cabinets with top not higher than 2 m [6'] above finished floor.
- .2 Cabinets shall be flush mounted in finished areas where depth can be accommodated in the walls. Provide flush trim to suit.
- .3 Provide fit up in Type T cabinets as indicated.

**END OF SECTION 26 05 31**

## **PART 1 - GENERAL**

### 1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

## **PART 2 - PRODUCTS**

### 2.1 OUTLET AND CONDUIT BOXES IN GENERAL

- .1 Size boxes in accordance with CSA C22.1.
- .2 102 mm [4"] square or larger outlet boxes as required for special devices.
- .3 Gang boxes where wiring devices are grouped. Do not use sectional boxes.
- .4 Blank cover plates for boxes without wiring devices.
- .5 347V outlet boxes for 347V switching devices.
- .6 Combination boxes with barriers where outlets for more than one system are grouped shall be equal to Spyder Technology multi-gang boxes.
- .7 Standard of acceptance is Thomas and Betts - Iberville.

### 2.2 SHEET STEEL OUTLET BOXES

- .1 Electro-galvanized steel single and multi-gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm [3" x 2" x 1.5"] or as indicated. Larger 102 mm square x 54mm deep [4"x 2"] outlet boxes (No. 52151 or 52171) to be used when more than one conduit enters one side. Provide extension and plaster rings as required.
- .2 For larger boxes use GSB solid type as required.
- .3 Boxes for surface mounted switches, receptacles, communications, telephone to be 100mm square No. 52151 or 52171 with Taylor 8300 series covers.
- .4 Lighting fixture outlets: 102 mm [4"] square outlet boxes (No 52151, 52171 or 72171) or octagonal outlet boxes (No 54151 or 54171).
- .5 103 mm [4"] square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster and/or tile walls.
- .6 Standard of acceptance is Thomas and Betts - Iberville.

### 2.3 MASONRY BOXES

- .1 Electro-galvanized steel masonry single and multi-gang type MDB boxes for devices flush mounted in exposed block walls.
- .2 Standard of acceptance is Thomas and Betts - Iberville.

### 2.4 CONCRETE BOXES

- .1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

- .2 Standard of acceptance is Thomas and Betts - Iberville.

## 2.5 SURFACE CONDUIT BOXES

- .1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles.
- .2 Standard of acceptance is Thomas and Betts - Iberville.

## 2.6 FITTINGS – GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of foreign materials.
- .3 Conduit outlet bodies for conduit up to 35 mm [1.25"] Use pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.
- .5 Standard of acceptance is Thomas and Betts - Iberville.

## **PART 3 - EXECUTION**

### 3.1 INSTALLATION

- .1 Typical outlet box mounting heights are indicated in Section 26 05 00 or refer to wiring device and communication specification sections and to architectural layouts for particular mounting heights of outlet boxes where indicated.
- .2 Support boxes independently of connecting conduits.
- .3 Ceiling outlet boxes to be provided for each surface mounted fixture or row of fixtures installed in other than T bar ceilings with removable tiles.
- .4 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm [0.25"] of opening.
- .5 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers not to be used.
- .6 All outlet boxes to be flush mounted in all areas, excluding mechanical rooms, electrical rooms, and above removable ceilings.
- .7 Adjust position of outlets in finished masonry walls to suit masonry course lines. Coordinate cutting of masonry walls to achieve neat openings for all boxes. All cutting of masonry work for installation of electrical fittings to be done using rotary cutting equipment.
- .8 No sectional or handy boxes to be installed.
- .9 When installed in wood walls, plastic outlet boxes shall only be used with permission of the Departmental Representative.
- .10 Provide vapour barrier wrap or boots behind outlets mounted in exterior walls. Maintain integrity of the vapour barrier and insulation to prevent condensation through boxes.
- .11 Coordinate location and mounting heights of outlets above counters, benches, splash-backs and with respect to heating units and plumbing fixtures. Coordinate with architectural details.
- .12 Outlets installed back to back in party stud walls to be off-set by one stud space.

- .13 Back-boxes for all communications systems equipment to be provided in accordance with specific manufacturer's recommendations and as specified in the communications sections of these specifications.
- .14 Separate outlets located immediately alongside one another to be mounted at exactly the same height above finished floor. Similarly, outlets mounted on a wall in the same general location at varying heights to be on the same vertical centre-line unless otherwise noted.
- .15 Where outlet boxes penetrate through a fire separation, ensure that the boxes are externally tightly fitted with an approved non-combustible material to prevent passage of smoke or flame in the event of a fire.
- .16 Conduit for floor mounted boxes shall terminate with a locknut and bushing in base of the fitting. Seal around conduit and the conduit itself after installation of conductors with heavy density fiberglass.

**END OF SECTION 26 05 32**



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## **PART 1 - GENERAL**

### 1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

### 1.2 SCOPE

- .1 Drawings do not show all conduits. Those shown are in diagrammatic form only.
- .2 Conceal all conduits where possible in finished areas. Conduits may be surface mounted either only where indicated or in service areas accessible only to authorized personnel.
- .3 Note particular requirements for routing of conduits where detailed.
- .4 Provide polypropylene pull cord in all "empty" conduits.

## **PART 2 - PRODUCTS**

### 2.1 CONDUITS

- .1 Rigid metal conduit: to CSA C22.2 No.45 Galvanized Steel.
- .2 Electrical Metallic Tubing (EMT): to CSA C22.2 No.83.
- .3 Rigid PVC conduit: to CSA C22.2 No.211.2.
- .4 Flexible metal conduit: to CSA C22.2 No.56 liquid-tight flexible metal conduit.

### 2.2 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 41mm [1.5"] and smaller. Use two hole steel straps to conduits larger than 41mm [1.5"].
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits.
- .4 10mm [3/8"] threaded rods to support suspended channels.

### 2.3 CONDUIT FITTINGS

- .1 Fittings manufactured for use with conduits specified. Coating same as conduit.
- .2 Provide factory "ells" where 90 degree bends are required for 27mm [1"] and larger conduits.
- .3 EMT couplings and connectors shall be steel, or Regal Die-cast zinc alloy. Couplings used on conduit containing fire-rated cable shall be steel. Regular die-cast alloy fittings and couplings are not acceptable. Provide plastic bushings (insulated throat) for all connectors for 27mm EMT or larger. Provide water-tight connectors in damp or wet locations and for surface equipment (e.g. Panelboards, MCC's, etc.) in rooms that are fire sprinkler protected.

### 2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable linear expansion.

- .2 Water-tight expansion fittings: with integral bonding jumper, suitable for linear expansion and 21mm [3/4"] deflection in all directions.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel as required.

## 2.5 RIGID P.V.C. CONDUIT

- .1 Conduit: rigid non-metallic conduit of unplasticized polyvinyl chloride as manufactured C.G.E. "Sceptre".
- .2 Fittings: threaded male or female solvent weld connectors and solvent weld couplings, as supplied by conduit manufacturer.
- .3 Solvent: as recommended by conduit manufacturer.

## **PART 3 - EXECUTION**

### 3.1 INSTALLATION - GENERAL

- .1 Generally use electrical metallic tubing (EMT) in the building interior and in above grade slabs except where subject to mechanical injury or where otherwise indicated.
- .2 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass. Set out the work and coordinate with other services prior to installation. Maintain access to junction and pull boxes.
- .3 Where practical conceal conduits.
- .4 Any exposed conduit in finished areas to be free of unnecessary labels and trademarks.
- .5 All conduit ends to be reamed to ensure a smooth interior finish that will not damage the insulation of the wiring.
- .6 Ensure bonding continuity in all conduit systems.
- .7 Surface conduits are acceptable in mechanical and electrical service rooms and in unfinished areas or where indicated.
- .8 Use rigid galvanized steel (RGS) threaded conduit where the installation is subject to mechanical injury. In any event, use RGS conduit for surface installations up to 1.5m [5'] above the finished floor.
- .9 Field threads on rigid conduit shall be sufficient length to draw conduits ends together.
- .10 Unless otherwise noted and where practical, all conduits to be routed through the ceiling space rather than in, or below, slabs or floor structures to facilitate future changes.
- .11 Conduits in walls should typically drop (or loop) vertically from above to better facilitate future renovations. Generally conduits from below and horizontal conduits in walls and concrete structures should be avoided unless indicated.
- .12 All home-run branch circuit conduit and communication conduits to be minimum 27 mm [1"] diameter unless otherwise indicated.
- .13 Generally use Rigid PVC conduits in or below ground level slab unless otherwise noted. Transition to RGS conduit in exposed locations: eg where conduits emerge from ground level slab.
- .14 Conduits are not permitted in terrazzo or concrete toppings.
- .15 Cap turned up conduits to prevent the entrance of dirt or moisture during construction.

- .16 Locate conduits more than 75mm [3"] parallel to steam or hot water lines with a minimum of 25mm [1"] at crossovers.
- .17 Bend conduits cold, so that conduit at any point is not flattened more than 1/10th of its original diameter. Conduits bent more than this or kinked to be replaced.
- .18 Provide polypropylene pull cord in empty conduits to facilitate pulling wiring in future.
- .19 Where conduits become blocked, the use of corrosive agents is prohibited. Remove and replace blocked section.
- .20 Damaged conduits to be repaired or replaced.
- .21 Dry conduits out thoroughly before installing wiring. Swab out conduit and thoroughly clean internally before wires and cables are pulled.
- .22 Conduits shall not pass through structural members except as indicated.
- .23 Conduit sizes indicated on drawings are minimum only. Increase sizes as required to suit alternative wiring types, to comply with Code or for ease of conductor installation.
- .24 Conduits and ducts crossing building expansion joints shall have approved conduit expansion fittings to suit the type of conduit used.
- .25 Seal conduits with approved sealant where conduits are run between heated and unheated areas.
- .26 Seal openings with approved sealant where conduits, cables, or cable trays pierce fire separations.
- .27 Where conduits pass through walls, they shall be grouped and installed through openings. After all conduits are installed, wall openings shall be closed with material compatible with the wall construction and/or to meet any fire separation integrity.
- .28 Where drawings show conduit designations, these conduits shall be identified at each point of termination with Thomas & Betts "Ty-Rap" No. TY532M labels.
- .29 Use "Condulet" fittings for power and telephone type conduit terminations in lieu of standard boxes where box support is not provided.
- .30 Provide necessary roof jacks or flashing where conduits pass through roof or watertight membranes. Apply approved sealant to maintain membrane integrity.
- .31 Use flexible metal conduit for connection to recessed luminaires without a prewired outlet box.
- .32 Use liquid tight flexible metal conduit for connection to motors sprinkler monitoring devices, and other vibrating equipment and transformers.
- .33 Use explosion proof flexible connection for connection to explosion proof motors.
- .34 Install conduit-sealing fittings in hazardous areas, such as Battery Charging Room and P.O.L. storage. Fill with compound.

### 3.2 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with minimum 1.5m [5'] clearance.
- .3 Conduits to be run in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended and/or surface channels.
- .5 Surface conduits will not be accepted in finished areas unless detailed.

### 3.3 SPARE CONDUITS

- .1 Provide spare conduits as indicated.
- .2 Provide 4x27 mm [1"] spare conduits up to ceiling space and 2x27 mm [1"] spare conduits down to ceiling space below from each flush panel tub. Terminate the conduits in 150x150x100 mm [6"x6"x4"] junction boxes in ceiling spaces or in case of an exposed concrete slab, terminate each conduit in a flush concrete box. Provide cover plates for all junction boxes.

### 3.4 CONDUITS IN CAST IN PLACE CONCRETE

- .1 Locate conduits to suit reinforcing steel. Install in centre third of slab.
- .2 Do not place conduit in concrete slabs in which slab thickness is less than four times conduit diameter. Place conduits larger than this size under the floor or slab. Conduits to have minimum 25 mm concrete cover. Conduits to be completely encased in concrete
- .3 Organize conduit in slabs to minimize crossovers. Obtain approval and minimum concrete cover required from structural engineer prior to installing conduits in slabs.
- .4 Protect conduits from damage where they stub out of concrete.
- .5 Tie down conduit to prevent shifting. All joints are to be made up tight to ensure ground continuity. To prevent concrete entry, seal EMT set screw fittings with tape, pack outlet boxes and cap conduit terminations both in boxes and stub-ups. Apply Polykin #940 tape to the conduit 150 mm [6"] at the point of leaving slab.
- .6 Carefully check and mark out set-backs of conduit(s) to be installed in floor slabs and to be stubbed up to equipment or motors. Verify conduit size and stub-up locations for mechanical and equipment from shop drawings or detail drawings. Brace all stub-ups. Stub-ups shall be RGS.
- .7 Install sleeves in advance of concrete pour where conduits pass through slab or wall.
- .8 Where conduits pass through waterproof membrane provide oversized sleeve before membrane installation. Use cold mastic between sleeve and conduit.

### 3.5 CONDUITS IN POURED SLABS ON GRADE

- .1 Use Rigid PVC conduit in the gravel or select fill base below concrete slabs. Provide mechanical protection around exposed stub-ups through slab and extend up to 150 mm [6"] beyond concrete. Transition to RGS conduit immediately above the slab.
- .2 In the event that rigid steel conduit is installed in contact with earth it shall be protected by Polykin #940 tape. Extend taping 300 mm above finished grade.
- .3 Conduits 27mm and larger to be run below slab and encased in 75mm concrete envelope. Provide 50mm of sand over concrete envelope below floor slab.

### 3.6 EXPANSION JOINT CONDUIT FITTINGS

- .1 Provide conduit expansion joint fittings at concrete expansion joint.

### 3.7 RIGID P.V.C. CONDUIT

- .1 Use in accordance with the Canadian Electrical Code and Building Codes and as noted below:
- .2 Use as raceways for following applications
  - .1 In poured slab on grade concrete floors and walls and for underground runs exterior to the buildings unless otherwise noted.

- .2 Wiring installed in areas subject to intermittent or continuous moisture but not surface mounted.
- .3 Rigid PVC conduit shall not be surface mounted or exposed within buildings.
- .3 Do not use in return air plenums or for exit light circuits and emergency lighting.
- .4 Provide insulated ground wire in all rigid PVC conduits in accordance with the Canadian Electrical Code.
- .5 Where rigid PVC conduit is set in poured concrete, solvent joints must be completed and allowed to set as per manufacturer's instructions before pour.
- .6 Bend rigid conduit in strict accordance with manufacturer's directions. Distorted bends will not be accepted.

**END OF SECTION 26 05 34**

## **PART 1 - GENERAL**

### 1.1 RELATED SECTIONS

- .1 This Section of the Specifications forms part of the Contract Documents and shall be read, interpreted and coordinated with all other parts.

### 1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
  - .1 CSAC22.2No.26, Construction and Test of Wireways, Auxiliary Gutters and Associated Fittings.

## **PART 2 - PRODUCTS**

### 2.1 WIREWAYS

- .1 Wireways and fittings: to CSA C22No.26.
- .2 Sheet steel with bolted cover to give uninterrupted access.
- .3 Finish: baked grey enamel.
- .4 Elbows, tees, couplings and hanger fittings manufactured as accessories to wireway supplied.

## **PART 3 - EXECUTION**

### 3.1 INSTALLATION

- .1 Install wireways and auxiliary gutters.
- .2 Keep number of elbows, offsets, connections to minimum.
- .3 Install supports, elbows, tees, connectors, fittings.
- .4 Install barriers where required.
- .5 Install gutter to full length of equipment.

**END OF SECTION 26 05 37**

## **PART 1 - GENERAL**

### 1.1 RELATED DOCUMENTS

- .1 This Section of the Specification forms part of the Contract Document and is to be read, interpreted and coordinated with all other parts.

### 1.2 DEFINITIONS

- .1 Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in fire rated wall and floor assemblies

### 1.3 REFERENCES

- .1 Test Requirements: Test Requirements: CAN/ULC-S115-11, "Standard Method of Fire Tests of Through Penetration Fire Stops".
- .2 Test Requirements: CAN/ULC-S102-M, "Standard Test Method for Surface Burning Characteristics of Building Materials".
- .3 Underwriters Laboratories of Canada (ULC) of Scarborough runs CAN/ULC-S115-11 under their designation of ULC-S115-11 and publishes the results in their "FIRE RESISTANCE RATINGS DIRECTORY" that is updated annually. Underwriters Laboratories (UL) of Northbrook, IL runs ASTM E-814 under their designation of UL 1479 and publishes the results in their "FIRE RESISTANCE DIRECTORY" that is updated annually. UL tests that meet the requirements of ULC-S115-11 are given a cUL listing and are published by UL in their "Products Certified for Canada (cUL) Directory."
  - 1. UL Fire Resistance Directory:
    - .1 Firestop Devices (XHJI7)
    - .2 Fire Resistance Ratings (BXRH7)
    - .3 Through-Penetration Firestop Systems (XHEZ7)
    - .4 Fill, Voids, or Cavity Material (XHHW7)
    - .5 Forming Materials (XHKU7)
- .4 International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments (referred to as Firestop Custom Details in BC).
- .5 Inspection Requirements: ASTM E 2174, "Standard Practice for On-site Inspection of Installed Fire Stops."
- .6 Test Requirements: ASTM E 90, "Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements"
- .7 Test Requirements: ASTM E 2178, "Standard Test Method for Air Permeance of Building Materials".
- .8 Test Requirements: ASTM E 84, "Standard Test Method for Surface Burning Characteristics of Building Materials."
- .9 Test Requirements: ASTM E 2178, "Standard Test Method for Air Permeance of Building Materials"

- .10 ASTM G-21, "Standard Test for Determining Resistance of Synthetic Polymeric Materials to Fungi".
- .11 British Columbia Building Code – most recent version.
- .12 NFPA 101 - Life Safety Code – most recent version.

#### 1.4 QUALITY ASSURANCE

- .1 A manufacturer's direct representative (account manager, fire protection specialist, not distributor or agent) to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.
- .2 Firestop System installation must meet requirements of ASTM E 814 or UL 1479 tested assemblies that provide a fire rating equal to that of construction being penetrated.
- .3 Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.
- .4 Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.
- .5 For those firestop applications that exist for which no UL tested system is available through a manufacturer, a manufacturer's firestop custom detail derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Firestop custom detail drawings must follow requirements set forth by the International Firestop Council.
- .6 Manufacturer's fire protection specialist to work with consultant to determine frequency of site walk-throughs to be submitted to Departmental Representative.

#### 1.5 SUBMITTALS

- .1 Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of UL firestop systems to be used and manufacturer's installation instructions to comply with Section 01 30 00 general requirements.
- .2 Submit qualified tested firestop system detail for each firestop application on the project.
- .3 Manufacturer's firestop custom detail identification number and drawing details when no UL system is available for an application. Firestop custom detail must include both project name and contractor's name who will install firestop system as described in drawing.
- .4 Submit material safety data sheets provided with product delivered to job-site.

#### 1.6 INSTALLER QUALIFICATIONS

- .1 Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.
- .2 The work is to be installed by a contractor with at least one of the following qualifications:  
FM 4991 Approved Contractor



UL Approved Contractor

Hilti Accredited Fire Stop Specialty Contractor

- .3 Installer shall have not less than 3 years' experience with fire stop installation

#### 1.7 PROJECT CONDITIONS

- .1 Do not use materials that contain flammable solvents.
- .2 Scheduling
- .1 Schedule installation of CAST IN PLACE firestop devices after completion of floor formwork, metal form deck, or composite deck but before placement of concrete.
- .2 Schedule installation of other firestopping materials after completion of penetrating item installation but prior to covering or concealing of openings.
- .3 Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
- .4 Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.
- .5 During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

### **PART 2 - PRODUCTS**

#### 2.1 FIRESTOPPING, GENERAL

- .1 Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.
- .2 Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.
- .3 Provide a round enclosed fire rated cable management device whenever cable bundles penetrate fire rated walls. The cable management device shall contain integrated intumescent firestop wrap strip materials sufficient to maintain the hourly rating of the barrier being penetrated. The cable management device shall contain a smoke seal fabric membrane or intumescent firestop plugs sufficient to achieve the L-Rating requirements of the barrier type.
- .4 Provide non-curing, re-penetrable, intumescent firestop materials around communications cable trays or ladder racks penetrating through a fire rated wall. The firestop system assembly shall be able accessible and re-installed from one side of the wall. The firestop material shall allow up to 12" of unreinforced annular space.
- .5 Penetrations in Fire Resistance Rated Walls: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.
- .1 F-Rating: Not less than the fire-resistance rating of the wall construction being penetrated.

- .6 Penetrations in Horizontal Assemblies: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.
  - .1 F-Rating: Minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.
  - .2 T-Rating: when penetrant is located outside of a wall cavity, minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.
  - .3 W-Rating: Class 1 rating in accordance with water leakage test per UL 1479.
- .7 Penetrations in Smoke Barriers: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.
  - .1 L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at both ambient and elevated temperatures.
- .8 Mold Resistance: Provide penetration firestopping with mold and mildew resistance rating of 0 as determined by ASTM G21.

## 2.2 ACCEPTABLE MANUFACTURERS

- .1 Subject to compliance with through penetration firestop systems (XHEZ) listed in Volume II of the UL Fire Resistance Directory, provide products of the following manufacturers as identified below:
  - .1 Hilti (Canada) Corporation,
  - .2 Specified Technologies Inc. (STI)
  - .3 Provide products from the above acceptable manufacturers; alternatives approved via a submittal confirming products meet the tested standards listed in section 1.05.

## 2.3 MATERIALS

- .1 Use only firestop products that have been UL 1479 or ASTM E 814 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
- .2 Re-penetrable, round cable management devices for use with new or existing cable bundles penetrating gypsum or masonry walls:
  - .1 Hilti Speed Sleeve (CP 653) or equivalent with integrated smoke seal fabric membrane.
  - .2 Hilti Firestop Sleeve (CFS-SL SK) or equivalent
  - .3 Hilti Retrofit Sleeve (CFS-SL RK) or equivalent for use with existing cable bundles.
  - .4 Hilti Cable Collar (CFS-CC) or equivalent surface mounted retrofit solution.
  - .5 Hilti Gangplate (CFS-SL GP) or equivalent for use with multiple cable management devices.
  - .6 Hilti Gangplate Cap (CFS-SL GP CAP) or equivalent for use at blank openings in gangplate for future penetrations.
- .3 Pre-installed firestop devices for use with non-combustible and combustible pipes (closed and open systems), conduit, and/or cable bundles penetrating concrete floors and/or gypsum walls:
  - .1 Hilti Cast-In Place Firestop Device (CP 680-P) or equivalent for use with combustible penetrants.
  - .2 Hilti Cast-In Place Firestop Device (CP 680-M) or equivalent for use with non-combustible penetrants.
  - .3 Hilti Speed Sleeve (CP 653) or equivalent for use with cable penetrations.

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- .4 Hilti Firestop Drop-In Device (CFS-DID) or equivalent for use with non-combustible and combustible penetrants.
  - .4 Sealants, foams or caulking materials for use with non-combustible items including rigid steel conduit and electrical metallic tubing (EMT):
    - .1 Hilti Intumescent Firestop Sealant (FS-ONE) or equivalent
    - .2 Hilti Fire Foam (CP 620) or equivalent
    - .3 Hilti Flexible Firestop Sealant (CP 606) or equivalent
    - .4 Hilti Elastomeric Firestop Sealant (CFS-S SIL GG) or equivalent
  - .5 Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including PVC jacketed, flexible cable or cable bundles, and plastic pipe:
    - .1 Hilti Intumescent Firestop Sealant (FS-ONE) or equivalent
  - .6 Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles:
    - .1 Hilti Intumescent Firestop Sealant (FS-ONE) or equivalent
    - .2 Hilti Fire Foam (CP 620) or equivalent
    - .3 Hilti Flexible Firestop Sealant (CP 606) or equivalent
    - .4 Hilti Elastomeric Firestop Sealant (CFS-S SIL GG) or equivalent
  - .7 Non curing, re-penetrable intumescent putty or foam materials for use with flexible cable or cable bundles:
    - .1 Hilti Firestop Putty Stick (CP 618) or equivalent
    - .2 Hilti Firestop Plug (CFS-PL) or equivalent
  - .8 Wall opening protective materials for use with U.L. listed metallic and specified non-metallic outlet boxes:
    - .1 Hilti Firestop Putty Pad (CFS-P PA) or equivalent
    - .2 Hilti Firestop Box Insert or equivalent
  - .9 Materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways:
    - .1 Hilti Firestop Mortar (CP 637) or equivalent
    - .2 Hilti Firestop Block (CFS-BL) or equivalent
    - .3 Hilti Fire Foam (CP 620) or equivalent
    - .4 Hilti Firestop Board (CP 675T) or equivalent
  - .10 Non curing, re-penetrable materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways:
    - .1 Hilti Firestop Block (CFS-BL) or equivalent
    - .2 Hilti Firestop Board (CP 675T) or equivalent
  - .11 For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits, or cables is expected:
    - .1 Hilti Firestop Block (CFS-BL) or equivalent
    - .2 Hilti Firestop Plug (CFS-PL) or equivalent

- .12 Provide a firestop system with a "F" Rating as determined by UL 1479 or ASTM E 814 which is equal to the time rating of construction being penetrated.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION**

- .1 Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
  - .1 Verify penetrations are properly sized and in suitable condition for application of materials.
  - .2 Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
  - .3 Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
  - .4 Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
  - .5 Do not proceed until unsatisfactory conditions have been corrected.

#### **3.2 COORDINATION**

- .1 Coordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.
- .2 Pre-construction firestop meeting with all stakeholders, including sub trades, code consultants, specifiers, manufacturers fire protection specialist and/or field engineer, to determine responsibility for handling such issues as FT rated partitions, firestop custom details, compatibility, complete submittals, mixed penetrations, ect.

#### **3.3 INSTALLATION**

- .1 Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory.
- .2 Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration materials.
  - .1 Seal all holes or voids made by penetrations to ensure an air and water resistant seal.
  - .2 Protect materials from damage on surfaces subjected to traffic.

#### **3.4 FIELD QUALITY CONTROL**

- .1 Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.
- .2 Keep areas of work accessible until inspection by applicable code authorities.
- .3 Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, "Standard Practice for On-Site Inspection of Installed Fire Stops" or other recognized standard.
- .4 Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

- .5 Install a warning card that is clearly visible adjacent to any openings that may be re-penetrated, have multiple penetrants, penetrate a FT rated partition, or any other critical area as deemed by the electrical consultant. This card should contain the following information:
  - .1 Warning that the opening has being fire stop protected
  - .2 Indicate the fire stop system used (ULC or cUL) or the firestop custom detail number
  - .3 F rating or FT rating
  - .4 Fire stop product(s) used
  - .5 Person to contact and phone number in case of modification or new penetration of fire stop system
- .6 Provide Firestopping approval certificate in including a Building Code / By-Law Schedule B & C-B signed by a BC registered Professional Consultant. Submit a letter certifying that all work is complete and in accordance with this specification.

**END OF SECTION 26 05 45**

## **PART 1 - GENERAL**

### 1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

### 1.2 PLANT ASSEMBLY

- .1 Install circuit breakers in panelboards before shipment from plant.
- .2 Install and prewire low voltage relays assemblies where indicated.
- .3 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .4 All panelboards to be of a common manufacturer.

### 1.3 FINISH

- .1 Apply finishes in accordance with Section 26 05 00.
- .2 Panel finish in electrical and equipment rooms and closets to be standard ASA Grey baked enamel for normal power service and confirm with Departmental Representative prior to shop finishing panels.
- .3 Panels in finished and/or public areas to be either as clause .2 above or prepared to accept painting to closely match surroundings as directed by the Architect. In the later instance, the final paint coat to be done by Division 09 but coordinated by the Electrical Division in particular for protection and masking of locks and sensitive parts. Confirm with Departmental Representative prior to paint finishing panels.

## **PART 2 - PRODUCTS**

### 2.1 PANELBOARDS, DOORS AND TRIMS

- .1 Bus and breakers rated for 22 KA symmetrical, minimum, interrupting capacity for 600V and 10kA symmetrical, minimum interrupting capacity for 208V or as indicated.
- .2 Copper bus with full size neutral.
- .3 Minimum 20% spare capacity.
- .4 Mains, number of circuits and number and size of branch circuit breakers as indicated.
- .5 Provide all necessary connectors and mounting hardware in every space to facilitate installation of future breakers. Provide blank fillers for all spaces.
- .6 Concealed hinges and concealed trim mounting screws, hinged locking door with flush catch.
- .7 Panelboards to have flush doors. (Gasketed where required).
- .8 Provide two keys for each panelboard and key similar voltage panelboards alike.
- .9 Panel tubs to be typically 600mm [20"] wide.
- .10 Provide "sprinkler-proof" design in areas where sprinkler fire protection is installed. In any event, all surface mounted enclosures to be complete with sprinkler drip cover.

- .11 Provide door within door trims where indicated to facilitate ease of service maintenance Each tub trim cover to be hinged and self-supporting and to swing out to expose breaker cable terminations and wireways. Hinged trim shall be secured with cover screws on opening side by concealed machine screws. Hinged breaker cover shall be recessed into the hinged overall tub cover. Breaker cover shall have latch type closures. Submit details on shop drawings prior to manufacturing.
- .12 Feed through lugs as indicated.
- .13 Integral Surge Protection Devices as indicated; refer to section 26 24 17.

## 2.2 BREAKERS

- .1 All breakers to be bolt on type, moulded case, non-adjustable and non-interchangeable trip, single, two and three pole, 120/208(240)V or 347/600V and with trip free position separate from "On" or "Off" positions.
- .2 Two and three pole breakers to have common simultaneous trip and able to be located in any circuit position within the panelboard. Minimum interrupting rating of breakers to be as follows:
  - .1 347/600V panelboards - 22,000 Amps at 347 volts.
  - .2 120/208V panelboards - 10,000 Amps at 250 volts.
- .3 Main breaker to be separately mounted at top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
- .4 Provide circuit breakers with indicated trip ratings as shown in the panelboard schedules.
- .5 Provide at least 10% spare 15 Amp single pole breakers whether indicated or not.
- .6 Provide GFI type breakers as indicated.
- .7 Provide Lock-on devices as indicated and in any event for Fire Alarm circuits, Security equipment circuits, EXIT sign circuits and Emergency Battery equipment circuits.

## 2.3 PANELBOARD IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00.
- .2 Nameplate for each panelboard size 5 (2 line) engraved as indicated and include panel designation and voltage/phase.
- .3 Complete circuit directory with typewritten card(s) located in slide-in plastic pocket(s) fixed to the back of the related door. Directory card to indicate the panel designation, mains size, voltage/phase and the location and load controlled of each circuit. Include a "letter sized" paper copy of each directory in the project maintenance manual.
- .4 Provide a plasticized typewritten information card fixed to the back of the each panel door. Information card to indicate the panel designation and location, feeder type and size and locations of any controlling contactors and feeder pullboxes. Include a "letter sized" paper copy of each information card in the project maintenance manual.

## **PART 3 -EXECUTION**

### 3.1 INSTALLATION

- .1 Locate panelboards as indicated and mount securely, plumb true and square, to adjoining surfaces.

- .2 Panelboards located in service rooms, mechanical rooms, and electrical rooms to be mounted on unistrut supports.
- .3 Connect loads to circuits as indicated.
- .4 Connect neutral conductors to common neutral bus with respective neutral identified.
- .5 Install 4x27mm [1"] empty conduits (or equivalent) from each flush mounted panelboard single tub to ceiling space above and 2x27mm [1"] empty conduits (or equivalent) from each flush mounted panelboard single tub down to ceiling or space below where space exists.

**END OF SECTION 26 24 16**



## **PART 1 - GENERAL**

### 1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

### 1.2 REFERENCES

- .1 Canadian Standards Association (CSA International) – most recent version
  - .1 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.
  - .2 CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
  - .3 CSA-C22.2 No.55, Special Use Switches.
  - .4 CSA-C22.2 No.111, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

## **PART 2 - PRODUCTS**

### 2.1 SWITCHES

- .1 20 A, 120 V or 347 V, single pole, double pole, three-way, four-way switches as indicated, ivory specification grade.
- .2 Switches of one manufacturer throughout project.
- .3 Provide 3 way switches/dimmers as required and as shown.

### 2.2 RECEPTACLES – GENERAL

- .1 Duplex receptacles, CSA type 5-15R, 125 V, 15 A, U ground, ivory specification grade.
- .2 T-Slot duplex receptacles, CSA type 5-20R, 125 V, 20 A, U ground, ivory specification grade.
- .3 Use tamper resistant receptacles where required by Code and as indicated.
- .4 Receptacles of one manufacturer throughout project.

### 2.3 RECEPTACLES – PARTICULAR APPLICATION

- .1 Ground Fault Interrupter type to be 15 Amp, 125 volt duplex receptacles to be 2 pole, 3 wire, U ground, impact resistant nylon face, complete with breaker and reset button. Ivory specification grade.
- .2 Ground Fault Interrupter located outside shall come with wet location cover plates.
- .3 Use tamper resistant receptacles where required by Code and as indicated.
- .4 Receptacles of one manufacture throughout project.
- .5 Surge Protective type to be T slot 5-20R, 125 volt duplex receptacles to be 2 pole, 3 wire hospital grade, blue face, parallel blade, U ground, impact resistant nylon face audible and LED indicator.
- .6 All other single outlet and special purpose receptacles to be similar to the grade and series indicated above. Confirm ampacity, voltage and pin configuration prior to installation.

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## 2.4 COVER PLATES

- .1 Cover plates for devices shall be stainless steel. In service rooms, shops and other like applications, provide stamped steel cover plates.
- .2 Wall plates to be flush mounting with "positive bow" feature to ensure that all edges of plate are flush with wall or surface box when installed.
- .3 All plates to be bevelled type with smooth rolled outer edge and smooth face. Exposed sharp edges are not acceptable.
- .4 Cover plates for all wiring devices to be from one manufacturer throughout project.

## **PART 3 - EXECUTION**

### 3.1 INSTALLATION GENERAL

- .1 Mount wiring devices to height specified in Section 26 05 00 or as indicated.
- .2 Upper edge of plates located on separate outlets immediately alongside one another to be at exactly the same height above finished floor.
- .3 All plates to be installed parallel or perpendicular to building lines.

### 3.2 INSTALLATION PARTICULAR

- .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 Install on latch side of door; coordinate with Architectural drawings prior to install.
- .2 Receptacles:
  - .1 Install all receptacles in the vertical plane unless otherwise noted.
  - .2 Generally install the 5-15/20R U ground pin down unless otherwise noted. Neutral up when receptacle in mounted horizontal.
  - .3 Install receptacles vertically in gang type outlet box when more than one receptacle is required in one location.
  - .4 Install receptacles near mechanical equipment mounted on the roof as per the CEC. Provide wet location rated cover plates.
  - .5 Ground fault interrupter duplex receptacles to be used whenever within 1.5 meters of all sinks or water sources.
  - .6 Utilize tamper resistant receptacles in public areas and in all areas dedicated for children.
- .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 Provide wet location cover plates which provide a seal whether or not a plug is inserted into the receptacle.
  - .4 Provide labels on all receptacle cover plates indicating circuit number.

- .4 In-Floor Devices:
  - .1 Conduit for floor mounted boxes shall terminate with a locknut and bushing in base of the fitting. Seal around conduit and the conduit itself after installation of conductors with heavy density fiberglass.

**END OF SECTION 26 27 26**

## **PART 1 - GENERAL**

### 1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

### 1.2 REFERENCES

- .1 Canadian Standards Association (CSA International):
  - .1 CAN/CSA C22.2 No.4, Enclosed Switches.
  - .2 CSA C22.2 No.39, Fuseholder Assemblies.

## **PART 2 - PRODUCTS**

### 2.1 DISCONNECT EQUIPMENT

- .1 "Heavy Duty" class, enclosed manual air break switches in non-hazardous locations: to CSA C22.2 No.4
- .2 Fuseholder assemblies to CSA C22.2 No.39.
- .3 Fusible and non-fusible disconnect switch in CSA enclosure.
- .4 Provision for padlocking in off switch position.
- .5 Fuses as indicated. Allow for Class J or L for general circuits, Class RK5 for transformer, motor or other high inrush current circuits
- .6 Fuseholders in each switch suitable without adaptors, for type of fuse as indicated.
- .7 Quick-make, quick-break action.
- .8 ON-OFF switch position indication on switch enclosure cover.
- .9 Weatherproof as required.
- .10 NEMA-3 rated disconnect for roof top.

### 2.2 EQUIPMENT IDENTIFICATION

- .1 Indicate name of load controlled on size 4 name plate to Section 26 05 00.

## **PART 3 - EXECUTION**

### 3.1 INSTALLATION

- .1 Provide and locate safety disconnect switches to isolate individual items of equipment in accordance with Canadian Electrical Code CSA 22.1 whether indicated on not on the contract drawings.
- .2 Install disconnect switches complete with fuses where indicated or required.
- .3 All disconnect switches for elevator machine rooms shall be fused in accordance with the equipment supplier's requirements.

- .4 Provide and locate safety disconnect switches to isolate individual items of equipment in accordance with Canadian Electrical Code CSA 22.1 whether indicated on not on the contract drawings.

3.2 MOTOR PLUG/RECEPTACLE AND QUICK DISCONNECTS

- .1 Motor quick disconnects do not negate the requirement for a switched safety disconnect as specified in this Division. A separate disconnect is still required unless the Departmental Representative has given a special pre-approved circumstance.

**END OF SECTION 26 28 23**

## **PART 1 - GENERAL**

### 1.1 RELATED SECTIONS

- .1 This Section of the Specifications forms part of the Contract Documents and shall be read, interpreted and coordinated with all other parts.

### 1.2 REFERENCES

- .1 International Electrotechnical Commission (IEC)
  - .1 IEC 947-4-1, Part 4: Contactors and motor-starters.

### 1.3 EXTRA MATERIALS

- .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

## **PART 2 - PRODUCTS**

### 2.1 MATERIALS

- .1 Starters: to IEC 947-4 with AC4 utilization category.

### 2.2 MANUAL MOTOR STARTERS

- .1 Single and Three phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:
  - .1 Switching mechanism, quick make and break.
  - .2 One or Three overload heater[s], manual reset, trip indicating handle.
- .2 Accessories:
  - .1 Pushbutton: heavy duty labelled as indicated.
  - .2 Indicating light: heavy duty type and colour as indicated.
  - .3 Locking tab to permit padlocking in "ON" or "OFF" position.

### 2.3 FULL VOLTAGE MAGNETIC STARTERS

- .1 Combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:
  - .1 Contactor solenoid operated, rapid action type.
  - .2 Motor overload protective device in each phase, manually reset from outside enclosure.
  - .3 Wiring and schematic diagram inside starter enclosure in visible location.
  - .4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.
- .2 Combination type starters to include circuit breaker with operating lever on outside of enclosure to control circuit breaker, and provision for:
  - .1 Locking in "OFF" position with up to 3 padlocks.
  - .2 Independent locking of enclosure door.
  - .3 Provision for preventing switching to "ON" position while enclosure door open.

- .3 Accessories:
  - .1 Selector switches: heavy duty labelled as indicated.
  - .2 Indicating lights: heavy duty type and color as indicated.
  - .3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.

#### 2.4 FULL VOLTAGE REVERSING MAGNETIC STARTERS

- .1 Full voltage reversing magnetic starters of size, type, rating and enclosure type as indicated with components as follows:
  - .1 Two - 3 pole magnetic contactors mounted on common base.
  - .2 Mechanical and electrical interlocks to prevent both contactors from operating at same time.
  - .3 Three overload relays with heater elements, automatic reset.
- .2 Accessories:
  - .1 Selector switches: heavy duty labelled as indicated.
  - .2 Indicating lights: heavy duty type and color as indicated.
  - .3 Auxiliary control devices as indicated.

#### 2.5 MULTI-SPEED STARTERS

- .1 2 speed starters of size, type, rating and enclosure type as indicated. Starter suitable for variable torque type motor and with components as follows:
  - .1 One-3 pole contactor for each winding for separate winding motors.
  - .2 One-3 pole and one-5 pole contactor for each reconnectable winding for consequent pole type motors.
  - .3 Three overload relays with 3 heater elements and manual reset for each speed.
- .2 Accessories:
  - .1 Selector switches: heavy duty labelled as indicated.
  - .2 Indicating lights: heavy duty, type and color as indicated.
  - .3 Auxiliary control devices as indicated.

#### 2.6 CONTROL TRANSFORMER

- .1 Single phase, dry type, control transformer with primary voltage as indicated and 120 V secondary, complete with secondary fuse, installed in with starter as indicated.
- .2 Size control transformer for control circuit load plus 20% spare capacity.

### **PART 3 - EXECUTION**

#### 3.1 INSTALLATION

- .1 Install starters, connect power and control as indicated.
- .2 Ensure correct fuses and overload devices elements installed.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 08 00 – Commissioning and Demonstrations and manufacturer's instructions.
- .2 Operate switches, contactors to verify correct functioning.
- .3 Perform starting and stopping sequences of contactors and relays.
- .4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

**END OF SECTION 26 29 10**



## **PART 1 - GENERAL**

### 1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

### 1.2 REFERENCES

- .1 CAN/CSA C22.1, Canadian Electrical Code, Part I - most recent version
- .2 CAN/CSA C22.2 No.9.0, General Requirements for Luminaires.
- .3 IESNA Illuminating Engineering Society of North America - Lighting Handbook – most recent version
- .4 ASHRAE 90.1 – American Society of Heating, Refrigerating and Air-Conditioning Engineers – most recent version.
- .5 IES RP-1 – Lighting for Offices – most recent version.
- .6 IES RP-33 Lighting for the Exterior Environment – most recent version.

### 1.3 INTENT

- .1 Provide lighting fixtures and accessories for all outlets as listed in the Fixture Schedule and as shown on drawings.
- .2 Lighting fixtures shall be structurally well designed and constructed, using new parts and materials of the highest commercial grade available.
- .3 Bond all lighting equipment to grounding system.
- .4 Verify all ceiling types and finishes before ordering fixtures and provide fixtures suitable for mounting in or on ceilings being installed in each area, as specified. Where fixture types specified are not suitable for ceiling being installed, obtain written instructions from the Departmental Representative before ordering fixtures.
- .5 Fixtures of the same or similar type shall be supplied by the same manufacturer.
- .6 Electrical contractor shall supply and install all luminaires complete with lamps, mounting brackets, lenses, ballasts (dimming or otherwise), drivers and all necessary accessories in accordance with luminaire types shown on drawings and listed in luminaires schedule unless otherwise noted.
- .7 Supply and install complete and proper support and hangers for all luminaires in ceiling space where required for proper support of outlet boxes and luminaire hanger assemblies.

## **PART 2 - PRODUCTS**

### 2.1 LED DRIVERS

- .1 LED drivers shall be fully dimmable, Energy Star compliant, maximum THD of 20%, power factor to be greater than .95, have high voltage regulation and have internal surge protection.
- .2 LED lit luminaires shall meet the LM-79 and LM-80 test protocols (70% output at 50,000 hours), a minimum efficacy of 90 watts per lumen and shall meet or exceed ENERGY STAR SSL standards to ensure lumen and color consistency between luminaires.

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2.2 FIXTURES

- .1 Provide fixtures as indicated on the fixture schedule.
- .2 All fixtures shall comply with CSA Standard C22.2 No.9. Accessories and components shall comply with relevant CSA Standards applicable to accessory or components.

2.3 SPARE PRODUCTS

- .1 Provide 2 - spare Type A and 3 – spare Type B luminaires to the Departmental Representative.

**PART 3 - EXECUTION**

3.1 VERIFICATION OF CONDITIONS

- .1 Confirm all ceiling depths against the final architectural ceiling plans and sections to ensure that recessed fixtures can be installed in all ceiling conditions and advise the Departmental Representative immediately of any discrepancies prior to ordering of the fixtures or proceeding with the work.

3.2 INSTALLATION - GENERAL

- .1 Lighting fixtures shall be installed as indicated on architectural reflected ceiling plans, Electrical Drawings, and per approved shop drawings.
- .2 Verify locations and spacing of lighting fixtures with reflected ceiling plans and notify Departmental Representative of any variance or conflict between the plans and field conditions. Do not proceed until conflict has been resolved.
- .3 Work shall be coordinated with other trades. Lighting fixture locations shall have priority over locations of ducts, diffusers, sprinklers, smoke detectors, and other non-structural obstructions.
- .4 All fixtures shall be supported directly from the building structural members or from bridging attached to the structural members by rod hangers and inserts. Provide all necessary hardware and blocking to ensure that fixtures hang true.
- .5 Lighting fixtures shall be adequately supported and braced to satisfy seismic codes. Refer to Section 26 05 05 Seismic Restraints.
- .6 Mount wall fixtures at elevations specified or as shown on Architectural or Electrical Drawings. Where no elevation is shown, confirm mounting height with the Departmental Representative prior to rough-in.

3.3 INSTALLATION AND SUPPORTS

- .1 Provide complete and proper support for all fixtures, fixture hangers, etc., including headers in ceiling space, where required, for proper support of outlet boxes and fixture hanger assemblies.
- .2 Support fixtures as shown on the drawings, level, plumb and true with the structure and other equipment in a horizontal or vertical position as intended. Wall or side bracket mounted fixture housings shall be rigidly installed and adjusted to give a neat flush fit to the surface on which it is mounted.
- .3 All hangers, supports, fastenings or accessory fittings shall be protected against corrosion. Care shall be taken during the installation to assure that insulation and corrosion protection is not damaged.

- .4 Self-aligning seismically rated ball joint hangers shall be used for rod suspended fixtures. Ceiling canopies or hood assemblies intended to cover the suspension attachments shall be installed to fit tightly to the ceiling without restricting the alignment of the hanger. Support fixtures by hangers and mounting arrangements which will not cause the fixture frame, housing, sides or lens frame to be distorted; or prevent complete alignment of several fixtures in a row.
- .5 The suspension length of all ceiling mounted suspended types of lighting fixtures as listed in the Fixture Schedule shall be the overall length from the ceiling to the lowest point of the fixture body, reflector or glassware in its hanging position.
- .6 Metal inserts, expansion bolts or toggle bolts in concrete slabs for stems which do not carry wiring must be accurately located in relation to the outlet boxes, to allow perfect alignment and spacing of suspension stems.
- .7 Where fixtures are surface mounted on the underside of an inverted tee bar ceiling, the fixture shall be supported either directly from the building structure by means of rod hangers and inserts or by means of metal angle headers, supported from the tee bar framing structure above the tile. Fixtures shall be supported from the quarter points.
- .8 Wiring from outlet boxes to fluorescent fixtures and wiring through fluorescent fixture channels shall be rated for 90 degrees C.
- .9 All recessed fixtures to be installed so that they are removable from below to gain access to outlet box or prewired fixture box. Connect all recessed fixtures to boxes with flexible conduit and approved fixture wire. Provide approved drywall enclosures in insulated ceilings. Volume of enclosure to comply with Electrical Code.
- .10 Install fixture lenses as late as possible to protect from dirt and dust. Remove and clean or replace lenses to the satisfaction of the Departmental Representative.
- .11 Provide and install all conduit, boxes, wire and make emergency power connection to all units and to unit controllers. Refer to architectural reflected ceiling plans for locations prior to conduit installation. Obtain all specialty backboxes, switches, controllers, etc. from contractor and coordinate installation as required.
- .12 Where ballasts are to be remotely located, they shall be racked together and labelled with size 3 lamicaid. Label shall bear the ballast number which has a corresponding location on an adjacent floor plan reference drawing. Labels and floor plans shall be provided by electrical contractor. Floor plans shall measure 280mm x 430mm (11"x17") and shall be framed and laminated.

**END OF SECTION 26 50 00**

## **PART 1 - GENERAL**

### 1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

### 1.2 GUARANTEE

- .1 Provide a written guarantee, stating that the battery for emergency lighting is guaranteed against defects in material and workmanship for a period of ten years, with a no-charge replacement during the first five years and a pro-rate charge on the second five years, from the date of the Final Certificate of Completion.

## **PART 2 - PRODUCTS**

### 2.1 BATTERY UNIT EQUIPMENT

- .1 Unit equipment for emergency lighting: to CSA C22.2 No.141.
- .2 Battery pack units shall be 12V DC complete with 2 LED emergency light heads. Units shall be sized as per Drawings.
- .3 Battery packs located in electrical rooms shall be sized for 2 hours, have self-diagnostic circuitry and a surge protection device on the supply side.
- .4 Battery packs require integral heater to prevent freezing. An example is the Lumacell LHZ series with cold weather option.

### 2.2 REMOTE LAMP HEADS

- .1 LED Remote Dual Head devices shall be 12V 6W. Do not provide single lamp devices.

### 2.3 WIRING FOR REMOTE EQUIPMENT

- .1 Wiring 12V battery standby circuits to all remote heads and exit signs.
- .2 Low voltage wiring to be installed so that the maximum volt drop does not exceed 5%. The following wiring/load sizes shall not be exceeded for the 12-volt system:
  - .1 #8 AWG not to exceed 6500 watt feet per run.
  - .2 #10 AWG not to exceed 4000 watt feet per run (minimum size).

## **PART 3 - EXECUTION**

### 3.1 INSTALLATION

- .1 Provide and install a fully functional emergency lighting system as detailed on the Drawings. Paint all junction boxes green for the emergency lighting system.
- .2 The emergency lighting system shall be tested for maintained luminance to a minimum of 2 hours. Provide written document verifying the operation of the system after the test.
- .3 The contractor shall ensure conductor size is suitable for the emergency lighting system to maintain a minimum of 3% volt drop to remote heads.
- .4 Install unit equipment for emergency lighting in accordance with CSA C22.1, Section 46.

- .5 Install unit equipment and remote mounted fixtures as indicated.
- .6 Direct heads as indicated.
- .7 Provide a junction box adjacent to the battery pack for the purpose of splicing the separate wiring runs together.
- .8 Provide a 15 Amp, 125 volt receptacle adjacent to each battery unit and connect circuit to lighting circuit in the area service by the batter pack.

**END OF SECTION 26 52 00**

## **PART 1 - GENERAL**

### 1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

### 1.2 REFERENCES

- .1 Canadian Standards Association:
  - .1 CSA C22.2 No.141, Unit Equipment for Emergency Lighting.
  - .2 CSA C860, Performance of Internally-Lighted Exit Signs.
  - .3 Canadian Electrical Code, Section 46.
- .2 BC Building Code, Part 3, Section 3.4.5

## **PART 2 - PRODUCTS**

### 2.1 SCHEDULE

- .1 Refer to drawings for location and types. Install in direction as indicated.

### 2.2 EXIT SIGNS GENERAL

- .1 Green and white coloured pictogram.
- .2 Wall, end, or ceiling mounted as shown on drawings.
- .3 Exit signs must meet CSA C860, 22.2 No. 141-10 and ISO 7010 standards.
- .4 Exit signs to have AC and DC connections.
- .5 Exit sign wiring to be installed in separate conduit and conductors to be #12 AWG with RW90 X-link insulation. Exit signs to be complete with LED lamps.
- .6 Single or double-faced as indicated
- .7 Faceplate and housing to have no visible unused knockouts.
- .8 Provide weatherproof exit signs for all exterior installations.
- .9 CSA 860-01 approved.

## **PART 3 - EXECUTION**

### 3.1 INSTALLATION

- .1 Install Exit Signs as indicated.
- .2 Connect Exit Sign 12V DC to battery unit located in the Heated Bay (Room 100).
- .3 Connect Exit Sign 120V AC to designated circuit in Panel B located in the Heated Bay (Room 100).
- .4 All Exit Sign wiring to be installed in separate conduit and boxes.

- .5 All conductors to be minimum #12 AWG with RW90 X-link insulation.
- .6 Wall mounted exit signs to be mounted 2290mm 7' 6" to underside or as detailed.
- .7 Ceiling mounted exit signs in all service spaces to be suspended to 2290mm 7' 6" to the underside.

3.2 FINAL ACCEPTANCE

- .1 Position exit signs to optimize viewing angles and to avoid line of site obstructions.
- .2 Attend the building occupancy review with the Authority Having Jurisdiction and adjust any locations as required.

**END OF SECTION 26 53 00**



# Hazardous Building Materials Assessment

Implement and Equipment Storage Shed, Agriculture and  
Agri-Food Canada Research Facility, Abbotsford, BC

November 20, 2017

Project No.: 650859

Prepared For:

Public Services Procurement Canada (PSPC)

Prepared By:



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# Executive Summary

On behalf of Public Services Procurement Canada (PSPC) for Agriculture and Agri-Food Canada (AAFC), SNC-Lavalin Inc. (SNC-Lavalin) completed a pre-demolition destructive hazardous building materials assessment (HBMA) to update the existing non-destructive HBMA that was previously completed by Stantec<sup>1</sup> (2013 Stantec Report) at the AAFC research facility implement/equipment storage shed (the “Building”) located at 510 Clearbrook Road in Abbotsford, BC (the “Site”). SNC-Lavalin understands that the purpose of the work was to complete a destructive HBMA of the Building to identify potential materials of concern prior to planned demolition activities.

On November 3, 2017, SNC-Lavalin completed a pre-demolition destructive HBMA of the Building at the Site to identify potential materials of concern in preparation for a future demolition. The Building was observed for the potential existence of hazardous materials including: asbestos, lead-containing paint, polychlorinated biphenyls (PCBs), liquid and vapour-phase mercury, ozone-depleting substances (ODSs), silica, and mould and/or moisture.

Based on the results of the current assessment and the 2013 Stantec Report, there are hazardous building materials within the Building requiring specific procedures prior to deconstruction/demolition for: handling; abatement; demolition; and disposal.

## Summary of Findings

The results of the HBMA are summarized in the following table.

Hazardous Material	Description and Location
Asbestos-Containing Materials	<u>ACMs Identified</u> <ul style="list-style-type: none"> <li>› Mastic (black) on the window casings on the Building exterior.</li> <li>› Mastic (tan) in the windows between the panes and the frames.</li> </ul>
	<u>Potential ACMs NOT Sampled</u> <ul style="list-style-type: none"> <li>› There is potential for underground asbestos-containing cement pipes at the Site. The identification of potential ACMs below ground was not within the scope of this report, and should be addressed during any excavation at the Site.</li> </ul>
Lead-Containing Paints (Total Lead)	<u>Lead-Containing Paints (&gt; 90 mg/kg)</u> <ul style="list-style-type: none"> <li>› White, exterior, sliding doors (per 2013 Stantec Report).</li> <li>› White, window frames, building exterior.</li> <li>› White, man-door, interior, east room.</li> <li>› Brown, metal roof support post, east room.</li> </ul>
Lead-Containing Paints (TCLP Lead)	<u>Paints With Leachable Lead</u> <ul style="list-style-type: none"> <li>› None of the paint samples analyzed contained concentrations of leachable lead greater than the applicable standard (5 mg/L).</li> </ul>

<sup>1</sup> Hazardous Building Materials Assessments, Buildings of the Pacific Agri-Food Research Centre Agassiz and Abbotsford (Clearbrook), BC, Final Report, Appendix 003/004: Findings and Recommendations – Building 003/004 Implement/Machinery Shed (Clearbrook,) dated January, 2013 by Stantec Consulting Ltd. (Stantec 2013)

Hazardous Material	Description and Location
Miscellaneous Solid and Liquid Wastes	<ul style="list-style-type: none"> <li>› Suspect lead-based nail grommets on the building siding.</li> <li>› Approximately two (2) lead-based batteries were identified on floor in the west room beneath the work bench.</li> <li>› Lithium-ion batteries for handheld power tools were identified in the west room of the Building.</li> <li>› Approximately four (4) fire extinguishers were observed throughout the Building.</li> <li>› Petroleum-based fuels, oils, and lubricants were identified in the west room of the Building.</li> <li>› Paint and paint sundries were identified in the west room of the Building.</li> <li>› Approximately one (1) propane tank was identified in the west room of the Building.</li> <li>› Approximately two (2) bags of fertilizer (urea and elemental sulphur) were identified in the west room of the Building.</li> <li>› Approximately two (2) partially filled 4 L containers of sodium hydroxide were identified in the west room of the Building.</li> <li>› Approximately one (1) aerosol container of insecticide was identified in the west room of the Building.</li> <li>› Multiple containers of PVC primer and cement were identified in the west room of the Building.</li> <li>› Consumer-packaged quantities of cleaning agents were identified in the west room of the Building.</li> <li>› Approximately two (2) containers of rodent bait (containing poisonous ingredients) were identified in the west room of the Building.</li> <li>› Stored machinery is suspected to contain hazardous materials (e.g., fuel, oils, lead-acid batteries, pesticides, herbicides, fertilizers, etc.).</li> </ul>
PCBs	<ul style="list-style-type: none"> <li>› Approximately five (5) high intensity discharge light fixtures with potentially PCB-containing ballasts were identified on the exterior of the Building.</li> </ul>
Ozone-Depleting Substances	<ul style="list-style-type: none"> <li>› Two freezers were identified in the west room.</li> </ul>
Mercury	<ul style="list-style-type: none"> <li>› No suspect liquid mercury was observed in the assessed areas.</li> <li>› Fluorescent light tubes, reportedly present during the 2013 Stantec Report, were not present during the current assessment.</li> <li>› Approximately five (5) high intensity discharge lights, each with a potentially mercury-containing bulb, were identified on the exterior of the Building.</li> </ul>
Silica	<ul style="list-style-type: none"> <li>› Concrete foundation was identified around the Building.</li> <li>› Two concrete slabs were identified, one in each of the east and west rooms on the interior of the Building.</li> </ul>
Mould and/or Moisture	<ul style="list-style-type: none"> <li>› Decaying wood was observed on the fascia boards and window trim; however, no evidence of mould was observed at either location or within the rest of the Building.</li> </ul>

The following should be noted:

- › All materials found in the building of similar colours as identified above as lead-containing paint should be considered as lead-containing.
- › All materials found in the building similar to those identified above as asbestos-containing should be considered as asbestos-containing.

#### Recommendations

A detailed summary and recommendations for the management of each hazardous material identified is presented in Table 1 of Section 6; results are included in Appendix I.

## Table of Contents

Executive Summary	i
1 Introduction	1
2 Scope of Work and Methodology	2
3 Previous Hazardous Building Material Assessments	5
4 Regulatory Framework	6
5 Results	9
6 Summary and Recommendations	10
7 Notice to Reader	15

## In-Text Table

Table 1: Summary Table of Hazardous Building Materials Identified in the Implement/Machinery Building – AAFC Research Centre, Abbotsford, BC	10
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## Appendices

- I: Results
  - › Table A: Detailed Inventory of Hazardous Materials – Implement and Equipment Building, Agriculture and Agri-Food Canada Research Centre, Abbotsford, BC
- II: Drawing
  - › 650859-BM01 – Building Material Survey Sampling Location Plan – Building 003/004 Implement/Equipment Shed
- III: Photographs
- IV: Laboratory Analytical Report (Asbestos)
- V: Laboratory Analytical Report (Lead)

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# 1 Introduction

On behalf of Public Services Procurement Canada (PSPC) for Agriculture and Agri-Food Canada (AAFC), SNC-Lavalin Inc. (SNC-Lavalin) completed a pre-demolition destructive hazardous building materials assessment (HBMA) of the implement/equipment storage shed (the “Building”) located at 510 Clearbrook Road, Abbotsford, BC (the “Site”). SNC-Lavalin understands that the purpose of the work was to complete a destructive HBMA of the Building to identify potential materials of concern prior to planned demolition activities.

The PSPC project number for this work is as follows:

- › Project Number R.089617.001 – Implement/Equipment Storage Shed (1965).

All work was completed as per the *Hazardous Materials Assessment Consulting Services Task Authorization – EZ113-150642/003/PWY* under Task Authorization No. 700395142.

## 2 Scope of Work and Methodology

On November 3, 2017, SNC-Lavalin personnel observed the Building at the Site to identify the potential existence of the following hazardous materials:

- › asbestos;
- › lead-containing paints;
- › polychlorinated biphenyls (PCBs);
- › liquid and vapour mercury;
- › ozone-depleting substances (ODSs);
- › miscellaneous solid and/or liquid wastes;
- › silica; and,
- › mould and/or moisture.

It should be noted that the following materials were excluded from the scope of work for the HBMA: formaldehyde; carbon monoxide; radon; biological hazards (i.e., rodent faeces); volatile organic compounds; very short-lived low-level radioactive waste; and, indoor air quality pollutants.

Representative samples were collected and laboratory analysis completed for suspected asbestos-containing materials (ACMs) and lead-containing paints.

The following sections outline the specific protocols followed when completing the survey.

### **Asbestos**

The methodology for completing the asbestos assessment was in accordance with WorkSafeBC guidelines and included the identification of suspect materials and collection of an adequate number of representative samples of these materials. All accessible areas of the Building were observed for possible ACMs.

On November 3, 2017, a total of seven (7) samples were collected from the Building. All samples were submitted for asbestos analysis to Crisp Analytical, LLC in Carrollton, TX, USA (CA Labs) and analyzed in accordance with the applicable regulations. The requested detection limit was < 0.5%, as per WorkSafeBC requirements. The analysis method for asbestos used was polarized light microscopy (PLM) detailed in the US Environmental Protection Agency (EPA) "Methods for Determination of Asbestos in Bulk Building Materials, US EPA Report No. 600/R93-116". CA is accredited through the National Voluntary Laboratory Accreditation Program (NVLAP) for bulk asbestos analyses.

### **Lead Paint**

Different paint colours may contain different concentrations of lead; therefore, SNC-Lavalin personnel inspected the Building to determine primary paint colour(s) that had been applied to major surfaces. The approach was to try to obtain samples from structures that may need to be cut or ground during demolition. Factory painted metal surfaces are not sampled as the paint is applied in thin layers, making it difficult to obtain a sufficient amount of paint to analyze.

On November 3, 2017, a total of three (3) lead paint samples and three (3) leachable lead paint samples were collected from the Building. Samples were submitted to Maxxam Analytics in Burnaby, BC (Maxxam) for analysis of total lead and/or leachable lead in accordance with the applicable regulations. Maxxam is accredited for both lead in paint and leachable lead through the Canadian Association for Laboratory Accreditation Inc. (CALA).

### **PCBs**

Historical use of PCBs in electrical equipment manufactured in Canada, such as transformers, fluorescent lamp ballasts, and capacitors, was common prior to approximately 1977. The use of PCBs was prohibited by the Canadian Environmental Protection Act in heat transfer and electrical equipment installed after August 1977, and in transformers and capacitors installed after June 1980. However, experience has shown that electrical equipment manufactured previously and held in inventory may still be in use.

The assessment included the observation of accessible areas of the Building for items or equipment that could possibly contain PCBs, such as fluorescent light fixtures, high intensity discharge (HID) lamps, and oil-filled electrical equipment.

SNC-Lavalin personnel identified (where possible) fluorescent light ballasts and noted the manufacturer and/or date codes on the ballast labels. These were compared to the Environment Canada publication, "Identification of Lamp Ballasts Containing PCBs, Report EPS 2/CC/2" (August 1991) to determine if they contain or are suspected of containing PCBs.

### **Ozone Depleting Substances**

The interior and exterior spaces of the Building were observed to identify if air conditioning units, refrigerators, freezers, or other ODSs were present in the equipment identified. If units were identified, the manufacturer's nameplate (if accessible) was observed to determine the type and amount of ODSs present in the unit.

### **Miscellaneous Solid and Liquid Wastes**

The accessible interior and exterior areas of the Building were observed for solid and/or liquid wastes and, if found, SNC-Lavalin compiled an inventory of these potentially hazardous materials. If encountered, aboveground storage tanks were photographed and assessed for volume, content, year of manufacture, and overall condition. It is assumed that the prior to demolition/deconstruction the majority of these materials will be removed. Any remaining hazardous materials should be properly disposed of by a qualified contractor prior to demolition/deconstruction.

### **Mercury**

Mercury has widespread use in commercial/residential products including fluorescent light tubes, HID lights (mercury vapour / high pressure sodium and metal halide), electrical switches, barometers, and thermometers. It also has many commercial, medical, and industrial applications. A potential concern of mercury is persistence in the environment when released at a landfill following disposal. Special considerations must be taken during the disposal of items containing liquid mercury.

The Building was observed for materials that may contain small amounts of liquid mercury and/or mercury vapour. The covers of thermostats found were opened to assess the presence of ampoules containing liquid mercury.

### **Silica**

Silica occurs naturally as a crystalline material in rock, sand, concrete, and cement; therefore, is likely present in poured concrete slabs/floors, concrete blocks, mortar, plaster, drywall, acoustic ceiling tiles, and ceramic tiles. Crystalline silica is significantly more toxic than amorphous silica; however, both are regulated. Crystalline silica dust can be generated through processes such as breaking, drilling, hammering, blasting, grinding, crushing, or sandblasting silica-containing materials. When breathed in, the crystalline silica dust can cause permanent damage to the lungs.

SNC-Lavalin personnel noted the presence of materials in the Building that are suspected of containing silica.

### **Mould and/or Moisture**

SNC-Lavalin personnel observed all accessible areas of the Building for the presence of mould and/or moisture. Any suspect areas identified (e.g., beneath sinks or adjacent hot water tanks) were noted and areas of concern were photographed.

## 3 Previous Hazardous Building Material Assessments

A previous report prepared for the Building was provided to SNC-Lavalin for review. The report is entitled *Hazardous Building Materials Assessments – Buildings of the Pacific Agri-Food Research Centre Agassiz and Abbotsford (Clearbrook), BC*, Final Report, Appendix 003/004: Findings and Recommendations – Building 003/004 Implement/Machinery Shed (Clearbrook), dated January 2013 by Stantec Consulting Ltd. (2013 Stantec Report).

SNC-Lavalin reviewed this report to identify any suspect materials previously assessed at the Site and incorporated the results in our report where appropriate. Any suspect materials that were not properly assessed were re-sampled as part of this assessment.

Previous findings have been included herein, where relevant.



## 4 Regulatory Framework

Federal and provincial regulations require that hazardous building materials be properly identified and managed to prevent potential exposure to workers. In addition, a more intrusive survey is required to identify materials of concern prior to renovations, salvage, or demolition of a building or structure. These materials must be properly controlled, removed, and/or disposed of at a suitably permitted facility in accordance with the applicable federal and provincial regulations. The following federal and provincial regulations relate to these materials:

### Federal

Various Regulations made under the Canadian Environmental Protection Act (CEPA), 1999, S.C. 1999, c. 33, last amended on June 2, 2017, including specialized handling and/or disposal requirements for materials including lead, PCBs, mercury, halocarbons (ozone depleting substances [ODS] and Non-ODS), radiological sources and/or substances and solid/hazardous wastes. Regulations include the following:

- › *Federal Halocarbon Regulations*, 2003 (SOR/2003-289) and Regulations Amending the Federal Halocarbon Regulations, 2003 (SOR/2009-221) defines the use and handling of halocarbons (including ODS) in refrigeration, air-conditioning, fire-extinguishing and solvent systems that are located on federal lands, or are owned by federal departments, boards and agencies, Crown corporations or federal works and undertakings.
- › *Ozone-Depleting Substances and Halocarbon Alternatives Regulations* (SOR/2016-137) defines the import, export, manufacture, use, sale and offer for sale of ODS.
- › *PCB Regulations* (SOR/2008-273), last amended on January 1, 2015, defines PCB containing materials, how they must be managed and disposed of.
- › *Transportation of Dangerous Goods Act* (TDG), enacted 1992, c. 34, last amended on January 1, 2017, Transportation of Dangerous Goods Regulations (SOR/2001-286), as amended, requires that radioactive materials must be transported in accordance with the provisions of the Act.
- › *Hazardous Products Act* (R.S.C., 198, c. H-3), as amended up to December 12, 2016, prohibits the sale or importation of urea formaldehyde foam insulation (UFFI) into Canada.
- › *Surface Coating Materials Regulations*, SOR/2005-109, as amended up to June 22, 2016, requires the concentration of total lead present in a surface coating material to be not more than 90 mg/kg.
- › *Mould Guidelines for the Canadian Construction Industry - CCA82*, Canadian Construction Association, 2004, provides guidance on minimizing and abating mould growth.
- › *Human Resources Social Development Canada* (HRSDC), *Canada Labour Code Part II*, Canada Occupational Health and Safety Regulations, Part X, Hazardous Substances, as amended, requires that all hazardous substances in the workplace, including asbestos, be identified and controlled to minimize potential exposure to workers. Under the Canada Labour Code Part II definitions, a “hazardous substance” includes a controlled product and a chemical, biological, or physical agent that, by reason of a property that the agent possess, is hazardous to the safety or health of a person exposed to it.

## **Provincial**

- › *WorkSafeBC Occupational Health and Safety Regulation* (OHSR), BC Reg. 296/97, includes amendments up to B.C. Reg. 9/2017, May 1, 2017, requires that materials including any asbestos, lead, or other heavy metal or toxic substance, biological agents (rodent droppings), and flammable or explosive materials that may be handled, disturbed or removed during demolition must be identified and removed or safely contained prior to demolition. In addition, a copy of the observation report identifying these materials must be available at the work site.
- › *Environmental Management Act* (EMA), B.C. Reg. 179/2016 / July 19, 2016, *Ozone Depleting Substances* (ODS) and *Other Halocarbons Regulation*, BC Reg. 387/99, including amendments up to BC Reg. 317/2012, requires ODS to be recovered from equipment prior to disposal.
- › *Hazardous Waste Regulation* (HWR), B.C. Reg. 63/88, including amendments up to B.C. Reg. 179/2016, requires all Hazardous Wastes (HW) must be properly managed and disposed of.

## **Asbestos**

We note that at the time of this report, the provincial OHSR defines ACM as any manufactured article or other material which contains 0.5% or more asbestos by weight and vermiculite insulation containing any amount of asbestos.

## **Lead Paint**

Federal and provincial guidelines limit lead concentrations in paint to 90 mg/kg for high risk individuals (i.e., pregnant women and children), and any concentrations that exceed this limit would be considered a lead-containing paint. WorkSafeBC suggests that improper removal of lead-containing paint can result in airborne lead concentrations that exceed 50% of the airborne lead exposure limit of 0.05 mg/m<sup>3</sup>; this would trigger the requirement for an employer to file a Notice of Project Lead (NOPL) and the development and implementation of an exposure control plan and safe work procedures prior to any work being completed. Therefore, for the purposes of this report we have identified paint as lead-containing if the total lead concentration is >90 mg/kg as per the federal regulations. An exposure control plan may be required if the paint is disturbed in such a manner that workers could be exposed to lead at >50% of the exposure limit.

There are no special disposal requirements for materials coated with lead paint unless the lead is found to be leachable in excess of the regulated standard of 5 mg/L in the HW regulations while considering the entire mass of the object the paint is coating (i.e., paint and substrate such as wood or drywall).

## **Silica**

WorkSafeBC indicates that employers are required under Section 5.54 of the OHSR to develop an exposure control plan when workers are or may be exposed to airborne silica dust in excess of 50% of the exposure limit. Exposure limits vary depending on the type of silica identified.

## **Mould**

WorkSafeBC outlines requirements for the management of indoor air quality under Sections 4.7 to 4.8 of the OHSR. WorkSafeBC has also developed an indoor air quality guideline (Part 4, Section G4.79 – *Moulds and Indoor Air Quality*) that outlines procedures for the assessment and abatement of mould impacted building materials in the workplace. Additionally, WorkSafeBC indicates that employers are required under Part 6 of the OHSR to develop and implement an exposure control plan when workers may be exposed to biological agents by any route of transmission.

Additional recommendations on how to minimize the presence of mould as well as abatement and remediation recommendations are contained within the *Mould Guidelines for the Canadian Construction Industry*. WorkSafeBC's 2005 publication *Indoor Air Quality: A Guide for Building Owners, Manager, and Occupants*<sup>2</sup> also provides recommendations for maintaining good indoor air quality in a workplace, preventing indoor air quality problems, and how to correct problems that may arise.

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<sup>2</sup> <https://www.worksafefbc.com/en/resources/health-safety/books-guides/indoor-air-quality-a-guide-for-building-owners-managers-and-occupants>

## 5 Results

Details of the results are presented for each hazardous material of concern in Table A, included as Appendix I. All suspect asbestos and lead paint samples were given the prefix “510-”; for conciseness, this prefix has been omitted in Table A.

## 6 Summary and Recommendations

Based on the results of the survey, there are hazardous building materials located on the Site requiring specific procedures prior to demolition for: handling; abatement; demolition; and disposal, as outlined below in Table 1. The sample locations are presented on Drawing 650859-BM01, included as Appendix II. Select photographs of the sample locations or other observations of note are included in Appendix III. Copies of the laboratory analytical reports for the results of the asbestos and lead analyses are included in Appendices IV and V, respectively.

General photographs of the Building are included as Photos 1 and 2.

A summary of the hazardous building materials identified on Site is included in Table 1 below:

**Table 1: Summary Table of Hazardous Building Materials Identified in the Implement/Machinery Building – AAFC Research Centre, Abbotsford, BC**

Description and Location	Recommendations	
<b>ASBESTOS-CONTAINING MATERIALS</b>		
<i>Current Assessment ACMs</i>		
<ul style="list-style-type: none"> <li>› <b>Mastic (black)</b>, beneath window casing on the Building exterior. (Photo 3)                             <ul style="list-style-type: none"> <li>- All similar mastics surrounding the windows or other perforations of the Building exterior should be considered asbestos-containing.</li> </ul> </li> <li>› <b>Mastic (tan)</b>, window putty (Photo 4).                             <ul style="list-style-type: none"> <li>- All similar mastics in the windows should be treated as asbestos-containing.</li> </ul> </li> </ul>	<p>SNC-Lavalin understands that PSPC (for AAFC) intends to complete demolition of the Site; therefore, SNC-Lavalin recommends that all known and suspect ACMs identified be removed and disposed of by a qualified contractor in accordance with applicable federal and/or provincial regulations. All work should be completed in accordance with the Canada Labour Code [Sections 124(1)y and 125(1)Z.14], which is in place to protect any person accessing the work place. Control of exposure to asbestos is governed by the WorkSafeBC Occupational Health and Safety Regulation (OHSR), BC Reg. 296/97 (as amended) and the provincial Hazardous Waste Regulation. Additional guidance is provided in the WorkSafeBC publication Safe Work Practices for Handling Asbestos.</p> <p>If required, the abatement contractor should file a Notice of Project – Asbestos (NOPA) with WorkSafeBC prior to any asbestos abatement work taking place. Documentation should be provided by the abatement contractor and retained by AAFC to verify compliance with the applicable regulations.</p> <p>All materials found at the Site of similar properties as those identified to be ACMs should be considered as ACMs.</p>	
<i>Potential ACMs NOT Sampled</i>		
<ul style="list-style-type: none"> <li>› There is potential for underground asbestos-containing cement pipes at the Site. The identification of potential ACMs below ground was not within the scope of this report, and should be addressed during any excavation at the Site.</li> </ul>		

**Table 1 (Cont'd): Summary Table of Hazardous Building Materials Identified in the Implement/Machinery Building – AAFC Research Centre, Abbotsford, BC**

Description and Location	Recommendations
<b>LEAD-CONTAINING PAINTS</b>	
<p><u>Lead-Containing Paints</u></p> <ul style="list-style-type: none"> <li>› <b>White</b>, exterior sliding doors (Photo 1) (2013 Stantec Report).</li> <li>› <b>White</b>, exterior window frames (Photo 5).</li> <li>› <b>White</b>, man-door, interior, east room (Photo 6).</li> <li>› <b>Brown</b>, metal roof support post, east room (Photo 7).</li> </ul>	<p>WorkSafeBC suggests that improper removal of lead-containing paint can result in airborne lead concentrations that exceed 50% of the airborne lead exposure limit of 0.05 mg/m<sup>3</sup>; this would trigger the requirement for an employer to file a Notice of Project – Lead (NOPL) and the development and implementation of an exposure control plan and safe work procedures prior to any work being completed.</p> <p>If required, the abatement contractor should file a NOPL with WorkSafeBC prior to any lead abatement work taking place. Documentation should be provided by the abatement contractor and retained by AAFC to verify compliance with the applicable regulations.</p> <p>All paints found at the Site of similar colours as those identified to be lead-containing paint should be considered lead-containing.</p>
<b>LEAD LEACHATE</b>	
<ul style="list-style-type: none"> <li>› No leachable lead paint was identified at the Site.</li> </ul>	<p>The waste generated from removal of paint and surface coatings may be hazardous. Given the possible need for off-site disposal of waste material during deconstruction activities, laboratory analysis for preliminary waste characterization of select samples (concentrations of lead in the leachate) was completed. Lead leachate analysis (Toxicity Characteristic Leaching Procedure [TCLP]) was conducted on the highest lead-containing paint samples and substrate to identify leachable lead paint exceeding the HWR standard of 5 mg/L.</p> <p>No TCLP exceedances above the HWR standard were identified; therefore, the painted material can be disposed of as non-hazardous construction waste. The disposal facility typically requires the laboratory report to confirm non-hazardous leachate results.</p>

**Table 1 (Cont'd): Summary Table of Hazardous Building Materials Identified in the Implement/Machinery Building – AAFC Research Centre, Abbotsford, BC**

Description and Location	Recommendations
<b>MISCELLANEOUS SOLID AND LIQUID WASTES</b>	
<ul style="list-style-type: none"> <li>› <b>Suspect lead-based nail grommets</b> were identified on the exterior of the Building (Photo 8).</li> <li>› <b>Approximately two (2) lead-based batteries</b> were identified on the floor of the west room beneath the work bench (Photo 9).</li> <li>› <b>Lithium-ion batteries</b> for use in handheld tools were identified in the west room (Photo 10).</li> <li>› <b>Approximately four (4) fire extinguishers</b> were identified throughout the Building.</li> <li>› <b>Petroleum-based fuels, oil, and lubricants</b> were identified in the west room of the Building (Photos 11 and 12).</li> <li>› <b>Paint and paint sundries</b> were identified in the west room of the Building (Photo 12).</li> <li>› <b>Approximately one (1) propane tank</b> was identified in the west room of the Building (Photo 13).</li> <li>› <b>Approximately two (2) partial bags of fertilizer</b> (urea and elemental sulphur) were identified in the west room of the Building (Photo 14).</li> <li>› <b>Approximately two (2) partial 4 L containers of sodium hydroxide</b> were identified in the west room of the Building.</li> <li>› <b>Approximately one (1) aerosol container of insecticide</b> was identified in the west room of the Building.</li> <li>› <b>Multiple containers of PVC primer and cement</b> were identified in the west room of the Building (Photo 15).</li> <li>› <b>Consumer-packaged quantities of cleaning agents</b> were identified in the west room of the Building (Photo 16).</li> <li>› <b>Approximately two (2) containers of rodent bait</b> (containing poisonous ingredients) were identified in the west room of the Building (Photo 17).</li> <li>› <b>Stored machinery</b> is suspected to contain hazardous materials (e.g., fuels, oils, lead-acid batteries, pesticides, herbicides, fertilizers, etc.) (Photo 18).</li> </ul>	<p>These materials must be removed prior to demolition. However, if these materials are to be disposed of or recycled, it is the responsibility of the qualified contractor to correctly identify and characterize the wastes observed and dispose of or recycle appropriately.</p>
<b>POLYCHLORINATED BIPHENYLS</b>	
<ul style="list-style-type: none"> <li>› <b>Approximately five (5) high intensity discharge light fixtures with potential PCB-containing ballasts</b> were identified on the exterior of the Building (Photo 1).</li> </ul>	<p>Prior to renovation/demolition, remove all light ballasts and/or capacitors. Inspect for PCB-containing and/or suspect PCB-containing ballasts as per Environment Canada publication, Identification of Lamp Ballasts Containing PCBs, Report EPS 2/CC/2, August 1991.</p> <p>Place known or suspect PCB-containing ballasts in an 18-gauge steel painted drum with a close fitting removable steel lid on top of a gasket of PCB-resistant material. Drums should be disposed of in Canada in accordance with the Hazardous Waste Regulation.</p> <p>A letter stating that PCBs disposal work was completed should be provided by the contractor and retained by AAFC to verify compliance with the applicable regulations.</p>

**Table 1 (Cont'd): Summary Table of Hazardous Building Materials Identified in the Implement/Machinery Building – AAFC Research Centre, Abbotsford, BC**

Description and Location	Recommendations
<b>OZONE DEPLETING SUBSTANCES</b>	
<ul style="list-style-type: none"> <li>› <b>R12</b> (Freon-12) is present in the Viking-brand freezer located in the west room (Photo 19).</li> <li>› <b>R134a</b> (Freon-134a) is present in the Frigidaire-brand freezer located in the west room (Photo 20).</li> <li>› <b>Four (4) fire extinguishers</b> located throughout the Building may contain ODSs.</li> </ul>	<p>ODS refrigerants (i.e., R12) should be recovered by qualified personnel and disposed of in accordance with Regulations made under CEPA. Non-ODS refrigerants (i.e., R134a) are regulated in the Federal Halocarbon Regulations as per Table 4 in Schedule 1 – List of Halocarbons. As a result, halocarbon-containing Non-ODS refrigerants should be recovered by qualified personnel and disposed of in accordance with Federal Regulations.</p>
<b>MERCURY</b>	
<ul style="list-style-type: none"> <li>› No thermostats were identified in the Building.</li> </ul>	<p>No renovation / pre-demolition requirements necessary.</p>
<ul style="list-style-type: none"> <li>› <b>High intensity discharge (HID) bulbs</b> (assumed to contain mercury vapour) were observed on the exterior of the Building in conjunction with potential PCB-containing HID light ballasts.</li> <li>› No fluorescent light fixtures were identified during the current assessment; this finding differed from the 2013 Stantec Report. All fixtures identified were either incandescent or HID.</li> </ul>	<p>The HID bulbs should be recycled, reused, or disposed of in accordance with the requirements of the BC Hazardous Waste Regulation and applicable Regulations made under CEPA.</p>
<b>SILICA</b>	
<ul style="list-style-type: none"> <li>› <b>Concrete foundation</b> was identified around the building.</li> <li>› <b>A concrete slab</b> was identified in the east room, covering the entire observed footprint.</li> <li>› <b>A concrete slab</b> was identified in the west room, covering approximately ¼ of the floor area.</li> </ul>	<p>Suspected silica-containing material, such as the concrete foundation, must be managed appropriately. Parts 5, 6, and 20 of the OHSR set out occupational exposure guidelines and controls for silica dust to eliminate, reduce, or manage workers' exposure risk. WorkSafeBC identifies the requirement to develop an exposure control plan to protect workers from overexposure to airborne silica dust in excess of 50% of the exposure limit (i.e., crystalline silica has an OHSR occupational exposure limit of 0.025 mg/m<sup>3</sup>).</p>



**Table 1 (Cont'd): Summary Table of Hazardous Building Materials Identified in the Implement/Machinery Building – AAFC Research Centre, Abbotsford, BC**

Description and Location	Recommendations
<b>MOULD / MOISTURE</b>	
<ul style="list-style-type: none"> <li>› <b>Water damaged fascia boards and window frames</b> were identified on the exterior of the Building (Photos 1 and 3, respectively).</li> <li>› No visible mould or moisture was identified.</li> </ul>	<p>WorkSafeBC outlines requirements for the management of indoor air quality under Sections 4.7 to 4.8 of the OHSR. WorkSafeBC has also developed an indoor air quality guideline (Part 4, Section G4.79 – <i>Moulds and Indoor Air Quality</i>) that outlines procedures for the assessment and abatement of mould impacted building materials in the workplace. Additionally, WorkSafeBC indicates that employers are required under Part 6 of the OHSR to develop and implement an exposure control plan when workers may be exposed to biological agents by any route of transmission.</p> <p>Additional recommendations on how to minimize the presence of mould as well as abatement and remediation recommendations are contained within the <i>Mould Guidelines for the Canadian Construction Industry</i>. WorkSafeBC's 2005 publication <i>Indoor Air Quality: A Guide for Building Owners, Manager, and Occupants</i> also provides recommendations for maintaining good indoor air quality in a workplace, preventing indoor air quality problems, and how to correct problems that may arise.</p>

- All relevant waste disposal documentation should be provided by the qualified contractors and retained by AAFC.
- Site-specific work procedures for materials of concern should be provided by the qualified contractors and retained by AAFC. Asbestos and lead procedures are included with NOPA and NOPL.

## 7 Notice to Reader

This report has been prepared by SNC-Lavalin Inc. (SNC-Lavalin) for Canada, who has been party to the development of the scope of work for this project and understands its limitations<sup>3</sup>. Copyright of this report vests with Her Majesty the Queen in Right of Canada. This report was prepared in accordance with a services contract between SNC-Lavalin and Canada, including General Conditions 2035 of the Standard Acquisition Clauses and Conditions (SACC) Manual.

This report is intended to provide information to Canada to assist it in making business decisions. SNC-Lavalin is not a party to the various considerations underlying the business decisions, and does not make recommendations regarding such business decisions.

The findings, conclusions and recommendations in this report have been developed in a manner consistent with the level of skill normally exercised by environmental professionals currently practising under similar conditions in the area. The findings contained in this report are based, in part, upon information provided by others. If any of the information is inaccurate, modifications to the findings, conclusions and recommendations may be necessary.

The findings, conclusions and recommendations presented by SNC-Lavalin in this report reflect SNC-Lavalin's best judgement based on the site conditions at the time of the site inspection on the date(s) set out in this report and on information available at the time of preparation of this report. They have been prepared for specific application to this site and are based, in part, upon visual observation of the site and specific analysis of hazardous building material samples as described in this report. Substances other than those described may exist within the site, reported substance parameters may exist in areas of the site not investigated, and concentrations of substances greater or less than those reported may exist between sample locations.

The findings and conclusions of this report are valid only as of the date of this report. If site conditions change, new information is discovered, or unexpected site conditions are encountered in future work, including excavations, borings, or other studies, the findings, conclusions and/or recommendations of this report should be re-evaluated. It is recommended that users of this report should engage a suitably qualified professional to assist in interpreting the significance, if any, of the findings.

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<sup>3</sup> © Her Majesty the Queen in Right of Canada (2017).



# Appendix I

## Results

Table A: Detailed Inventory of Hazardous Materials – Implement and Equipment Building, Agriculture and Agri-Food Canada Research Centre, Abbotsford, BC

**Table A: Detailed Inventory of Hazardous Materials – Implement and Equipment Building, Agriculture and Agri-Food Canada Research Centre, Abbotsford, BC**

Issue / Location	Results
<b>ASBESTOS-CONTAINING MATERIALS (ACMs)</b>	
<u>Asbestos Identified – Current Assessment:</u> > <b>A1 – Mastic, black, perimeter of exterior window frames.</b> > A2 & A3 collected from similar material and therefore considered to be ACMs. > <b>A4 – Mastic, off-white, suspect window putty, exterior window frames.</b> > A5 & A6 collected from similar material and therefore considered to be ACMs.	Analytical Result: > <b>3% Chrysotile</b>  > <b>2% Chrysotile</b>
<u>Asbestos NOT Identified – Current Assessment:</u> > A7 – Mastic, tan, electrical line perforation, building exterior.	Analytical Result: > non-asbestos
<u>Suspect ACMs not sampled:</u> > While no perimeter drainage system was evident, there is potential for underground asbestos-containing cement pipes at the Site. The identification of potential ACMs below ground was not within the scope of this report, and should be addressed during any excavation at the Site.	Analytical Result: > N/A
<b>LEAD PAINT (mg/kg)</b>	
<u>Lead-Containing Paint – 2013 Stantec Report:</u> > <b>P-004-01 – Exterior siding, white.</b>	Analytical Result: > <b>880 mg/kg</b>
<u>Lead-containing and Non-Lead-Containing Paint Sampled – Current Assessment:</u> > <b>P1 – Window frames, exterior, white.</b> > <b>P3 – Man-door, interior, white.</b> > <b>P4 – Metal roof support post, interior, brown.</b>	Analytical Result: > <b>1,770 mg/kg</b> > <b>7,460 mg/kg</b> > <b>904 mg/kg</b>
<b>LEAD PAINT – Leachable (mg/L)</b>	
<u>Suspect Lead-Containing and Non-Lead-Containing Paint Sampled:</u> > P1-TCLP – Window frames, exterior, white. > P2-TCLP – Exterior siding, white (represents TCLP for Stantec sample P-004-01). > P3-TCLP – Man-door, interior, white.	Analytical Result: > <0.10 mg/L > <0.10 mg/L  > 0.30 mg/L

\* **Bold** asbestos samples indicate asbestos content greater than or equal to 0.5%.

\* **Bold** lead paint samples indicate lead content greater than 90mg/kg

**Table A (Cont'd): Detailed Inventory of Hazardous Materials – Implement and Equipment Building, Agriculture and Agri-Food Canada Research Centre, Abbotsford, BC**

Issue / Location	Results
<b>MISCELLANEOUS SOLID AND LIQUID WASTES</b>	
<p><b>Suspect lead-based nail grommets</b> on the building siding.</p> <p><b>Approximately two (2) lead-based batteries</b> were identified on floor in the west room beneath the work bench.</p> <p><b>Lithium-ion batteries</b> for handheld power tools were identified in the west room of the Building.</p> <p><b>Approximately four (4) fire extinguishers</b> were observed throughout the Building.</p> <p><b>Petroleum-based fuels, oils, and lubricants</b> were identified in the west room of the Building.</p> <p><b>Paint and paint sundries</b> were identified in the west room of the Building.</p> <p><b>Approximately one (1) propane tank</b> was identified in the west room of the Building.</p> <p><b>Approximately two (2) bags of fertilizer</b> (urea and elemental sulphur) were identified in the west room of the Building.</p> <p><b>Approximately two (2) partially filled 4 L containers of sodium hydroxide</b> were identified in the west room of the Building.</p> <p><b>Approximately one (1) aerosol container of insecticide</b> was identified in the west room of the Building.</p> <p><b>Multiple containers of PVC primer and cement</b> were identified in the west room of the Building.</p> <p><b>Consumer-packaged quantities of cleaning agents</b> were identified in the west room of the Building.</p> <p><b>Approximately two (2) containers of rodent bait</b> (containing poisonous ingredients) were identified in the west room of the Building.</p> <p><b>Stored machinery</b> is suspected to contain hazardous materials (e.g., fuel, oils, lead-acid batteries, pesticides, herbicides, fertilizers, etc.).</p>	<ul style="list-style-type: none"> <li>› Potential for lead-containing material</li> <li>› Potential for lead-containing material.</li> <li>› Potential for heavy metal-containing material.</li> <li>› Potential for liquid and/or gas wastes.</li> <li>› Potential for liquid wastes.</li> <li>› Potential for liquid wastes.</li> <li>› Potential for gaseous wastes.</li> <li>› Potential for solid wastes.</li> <li>› Potential for liquid wastes.</li> <li>› Potential for liquid wastes.</li> <li>› Potential for liquid wastes.</li> <li>› Potential for liquid wastes.</li> <li>› Potential for liquid wastes.</li> <li>› Potential for hazardous waste.</li> <li>› Potential for liquid and/or lead-containing wastes.</li> </ul>
<b>POLYCHLORINATED BIPHENYLS</b>	
<p>High intensity discharge (HID) light ballasts were identified on the exterior of the Building.</p>	<ul style="list-style-type: none"> <li>› <b>Approximately 5 fluorescent light fixtures</b> were identified on the exterior of the Building.</li> </ul>
<p>No fluorescent light ballasts were identified in the Building (the 2013 Stantec Report reported 4 were present).</p>	<ul style="list-style-type: none"> <li>› None observed.</li> </ul>

**Table A (Cont'd): Detailed Inventory of Hazardous Materials – Implement and Equipment Building, Agriculture and Agri-Food Canada Research Centre, Abbotsford, BC**

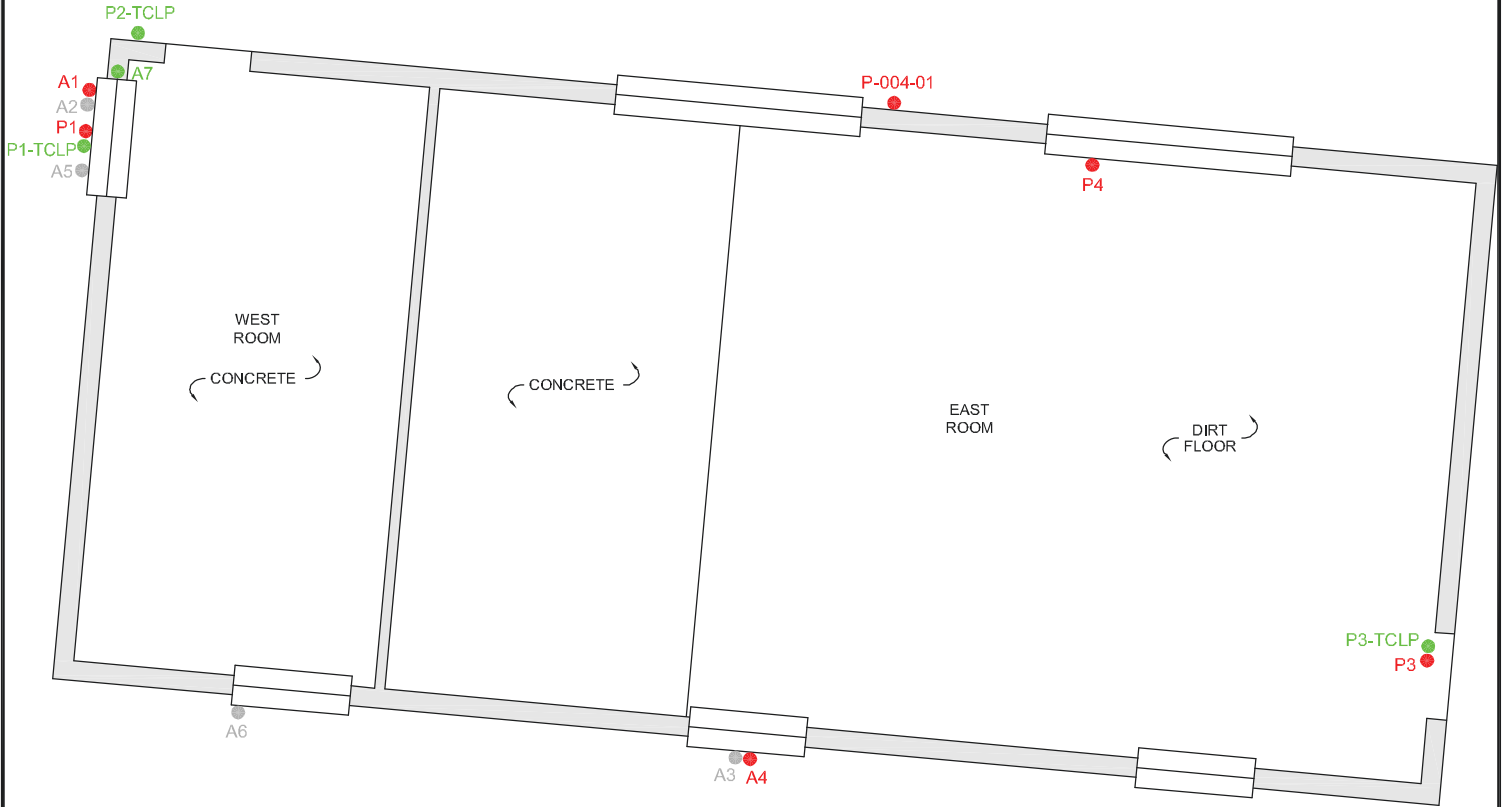
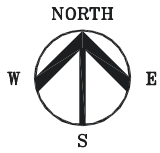
Issue / Location	Results
<b>OZONE DEPLETING SUBSTANCES</b>	
<p>ODS were observed in the following areas:</p> <ul style="list-style-type: none"> <li>› <b>Four (4) fire extinguishers</b> were identified throughout the Building.</li> <li>› <b>Two freezers</b> were identified in the west room: <ul style="list-style-type: none"> <li>- <b>Viking brand with Halocarbon Management Program identification number 051136.</b></li> <li>- <b>Frigidaire brand.</b></li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>› The manufacturer's tags did not indicate the presence or absence of ODSs in the units.</li> <li>› <b>Unknown amount of R12</b> stamped on compressor, inaccessible manufacturer's tag.</li> <li>› <b>8.1 oz. of R134a.</b></li> </ul>
<b>MERCURY</b>	
<p>No mercury-containing thermostats were observed in the Building.</p>	<ul style="list-style-type: none"> <li>› N/A</li> </ul>
<p><b>Potentially mercury-containing HID bulbs</b> were identified in conjunction with the HID light fixtures identified on the exterior of the Building.</p>	<ul style="list-style-type: none"> <li>› Approximately 5 HID light fixtures were identified containing potentially mercury-containing HID bulbs.</li> </ul>
<b>SILICA</b>	
<ul style="list-style-type: none"> <li>› <b>Concrete foundation</b> was identified around the building.</li> <li>› <b>Two (2) concrete slabs</b> were identified in the Building, one in the east room and one in the west room.</li> </ul>	<ul style="list-style-type: none"> <li>› N/A</li> </ul>
<b>MOULD AND/OR MOISTURE</b>	
<ul style="list-style-type: none"> <li>› <b>Some decaying wood</b> was identified on the exterior fascia boards and window frames. Mould was not identified in conjunction with the decaying wood.</li> <li>› No other evidence of mould and/or moisture was identified in the Building.</li> </ul>	<ul style="list-style-type: none"> <li>› N/A</li> </ul>



# Appendix II

## Drawing

- › 650859-BM01 – Building Material Survey Sampling Location Plan – Building 003/004  
Implement/Equipment Shed



**LEGEND**

- P-004-01 ● PAINT SAMPLE COLLECTED BY OTHERS
- P1 ● PAINT SAMPLE WITH LEAD CONCENTRATION LESS THAN OR EQUAL TO 90 mg/kg
- P1 ● PAINT SAMPLE WITH LEAD CONCENTRATION GREATER THAN 90 mg/kg
- P1-TCLP ● PAINT SAMPLE ANALYZED VIA TCLP METHODOLOGY WITH LEACHABLE LEAD CONCENTRATION LESS THAN 5 mg/L
- A1 ● ASBESTOS SAMPLE WITH CONCENTRATION LESS THAN 0.5%
- A1 ● ASBESTOS SAMPLE WITH CONCENTRATION GREATER THAN OR EQUAL TO 0.5%
- A1 ● SAMPLE NOT ANALYZED

**NOTES**

1. ORIGINAL DRAWING IN COLOUR.
2. ALL LOCATIONS ARE APPROXIMATE.



**REFERENCE DRAWINGS**

DWG. NO.	DATE	DESCRIPTION	BY	CHK
1	2012-12-01	STANTEC		
REVISIONS				
1	2017-11-20	ISSUED TO CLIENT	PES	TD
0	2017-11-16	ISSUED TO CLIENT AS DRAFT	PES	AH
REV.	DATE	DESCRIPTION	BY	CHK



CLIENT NAME: PUBLIC SERVICES PROCUREMENT CANADA		PROJECT LOCATION: PACIFIC AGRI-FOOD RESEARCH ABBOTSFORD, BC	
TITLE: <b>BUILDING MATERIAL SURVEY SAMPLING LOCATION PLAN - IMPLEMENT/EQUIPMENT STORAGE SHED</b>			
DWN BY: PES	SCALE: 1:100	DATE: 2017-11-15	DWG No: REV: <b>1</b>
CHK'D: AH	PLOT: 20171120.1108	CADFILE: 650859-BMG	<b>650859-BM01</b>





# Appendix III

Photographs



Photograph 1: Exterior of the Building looking southeast. The white paint on the sliding doors was sampled by Stantec and is lead-containing. Note the high-intensity discharge lights over the access doors and on the west side of the Building.



Photograph 2: Exterior of the Building looking generally to the east of the south side of the Building.



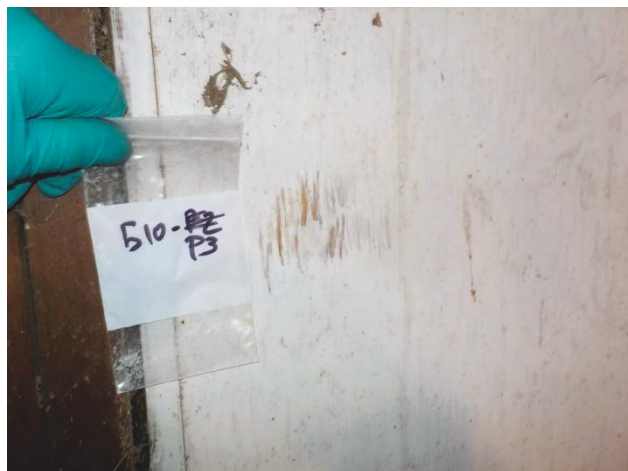
Photograph 3: Asbestos-containing black mastic beneath the window casing on the west side of the Building at sample location A1. The photograph was taken following removal of the casing for analysis of lead in paint via TCLP methodology.



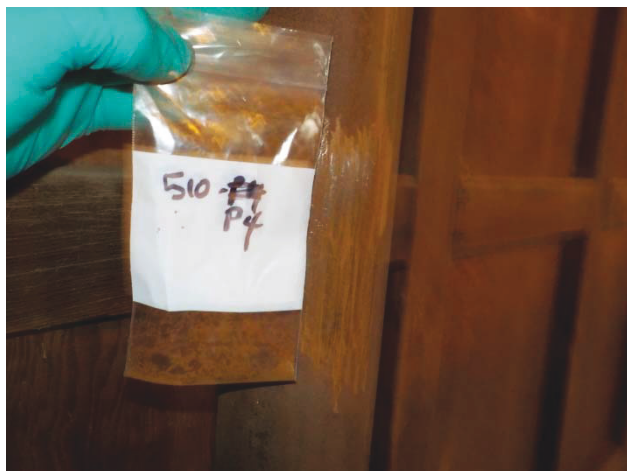
Photograph 4: Asbestos-containing tan mastic (window putty) on the window between the frame and the pane. The photograph of sample location A6 is used to represent sample A4 as it best depicts the position of the ACM in relation to window construction.



Photograph 5: Lead-containing white paint collected from the window frame on the west side of the Building.



Photograph 6: Lead-containing white paint on the interior side of the man-door in the east room.



Photograph 7: Lead-containing brown paint on a metal roof support post in the east room.

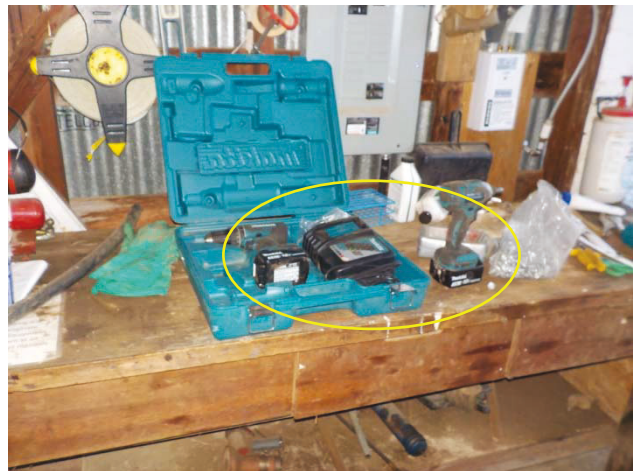


Photograph 8: Suspect lead grommets were identified on the exterior of the Building.





Photograph 9: Lead-based batteries were identified on the floor of the west room beneath the work bench.



Photograph 10: Lithium-ion batteries for use in handheld tools were identified in the west room.



Photograph 11: Petroleum-based fuels, oil, and lubricants were identified in the west room of the Building within a flammables cabinet or on the adjacent shelving.



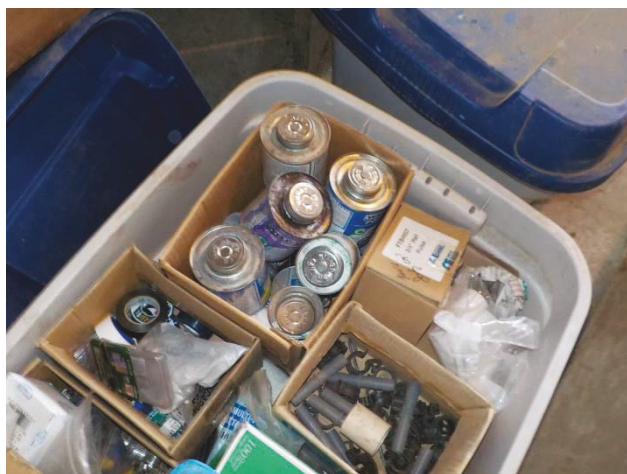
Photograph 12: Paint and paint sundries were identified on the shelving in the west room of the Building. Also note the containers of engine oil stored on the shelves.



Photograph 13: A 20-pound propane cylinder was identified on the floor of the west room beneath the shelving. The concrete floor slab of the west room is also visible.



Photograph 14: One of the two partial bags of fertilizer identified in the west room.



Photograph 15: Containers of PVC solvent and primer were identified in two of the bins stored in the west room.



Photograph 16: An example of the consumer packaged quantities of cleaning agents identified in the west room.





Photograph 17: One of the two containers of rodent bait identified in the west room.



Photograph 18: An example of the equipment in the east room which could potentially contain fertilizers, herbicides, or pesticide residues.



Photograph 19: The compressor of the Viking-branded freezer located in the east room. While the manufacturer's tag could not be accessed, the compressor clearly states that R12 is contained within the unit.



Photograph 20: The Frigidaire-branded freezer located in the east room. At the time of the assessment, this unit was not in use.

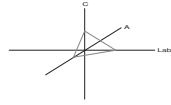


# Appendix IV

Laboratory Analytical Report (Asbestos)

**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**

#### **SNC-Lavalin Inc.**

8648 Commerce Court  
Burnaby, British Columbia  
Canada, V5A 4N6

Customer Project: 650859, 510 Clearbrook Rd.  
Reference #: CAL17117263AF Date: 11/15/2017

#### **Analysis and Method**

Summary of polarized 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 a stereomicroscope. Numerous liquid slide preparations are created for analysis under the polarized microscope where identifications and quantifications are performed. Calibrated liquid refractive oils are used as liquid mounting 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 conjunction 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 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 contain trace amounts of actinolite/tremolite. When not detected by PLM, these samples 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 contain a regulated 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 detectable 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.

Since allowable variation in quantification of samples close to 1% is high, <1% may be reported. Such results are ideal for point counting, and the technique is mandatory for friable samples (NESHAP, Nov. 1990 and clarification letter 8 May 1991) under 1% percent asbestos or "trace asbestos". **In order to make all initial PLM reports issued from CA Labs NESHAP compliant, all <1% asbestos results (except floor tiles) will be point counted at no additional charge.**

#### **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 completed college courses or hold a degree in a natural science (geology, biology, or environmental science). Recognition by a state professional board in one these disciplines is preferred, but not required. Extensive in-house training programs are used to augment the educational background of the analyst. The Laboratory Director and Quality Manager have 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**



Overview of Project Sample Material Containing Asbestos

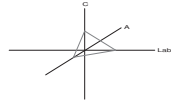
<b>Customer Project:</b> 650859, 510 Clearbrook Rd.		<b>CA Labs Project #:</b> CAL17117263AF		
Sample #	Layer #	Analysts Physical Description of Subsample	Asbestos type / calibrated visual estimate percent	List of Affected Building Material Types
510-A1	1-1	<b>Mastic/</b> silver surfaced black sealant	<b>3% Chrysotile</b>	<b>silver surfaced black sealant tan caulking</b>
510-A4	4-1	<b>Mastic/</b> tan caulking	<b>2% Chrysotile</b>	

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	pe - perlite	fg - fiberglass	pa - palygorskite (clay)
gypsum - gypsum	qu - quartz	mw - mineral wool	
bi - binder		wo - wollastinite	
or - organic		ta - talc	
ma - matrix		sy - synthetic	
mi - mica		ce - cellulose	
ve - vermiculite		br - brucite	
ot - other		ka - kaolin (clay)	

This report relates to the items tested. This report is not to be used by the customer to claim product certification, approval or endorsement by NVLAP, NIST, AIHA LAP, LLC, or any other agency of the federal government. This report may not be reproduced except in full without written permission from CA Labs. These results are submitted pursuant to CA Labs' current terms and sale, condition of sale, including the company's standard warranty and limitations 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 or handling fee may be assessed for the return of any samples.



## Polarized Light Asbestiform Materials Characterization

<b>Customer Info:</b>	<b>Attn:</b>	<b>Customer Project:</b>	<b>CA Labs Project #:</b>
<b>SNC-Lavalin Inc.</b>			CAL17117263AF
8648 Commerce Court		650859, 510 Clearbrook Rd.	<b>Date:</b> 11/15/2017
Burnaby, British Columbia		<b>Turnaround Time:</b>	<b>Samples Received:</b> 11/8/17 1:00pm
Canada, V5A 4N6		5 Days	<b>Date Of Sampling:</b> 11/3/2017
Phone # 604-515-5151			<b>Purchase Order #:</b>
Fax # 604-515-5150			

Sample #	Com ment	Layer #	Analysts Physical Description of Subsample	Homo- geneo us (Y/N)	Asbestos type / calibrated visual estimate percent	Non-asbestos fiber type / percent	Non-fibrous type / percent
510-A1		1-1	<i>Mastic/ silver surfaced black sealant</i>	n	<b>3% Chrysotile</b>		97% qu,gy,bi
510-A2		2-1	<i>Mastic/ silver surfaced black sealant</i>		<i>Positive Stop</i>		
510-A3		3-1	<i>Mastic/ silver surfaced black sealant</i>		<i>Positive Stop</i>		
510-A4		4-1	<i>Mastic/ tan caulking</i>	y	<b>2% Chrysotile</b>		98% qu,bi,ca
510-A5		5-1	<i>Mastic/ tan caulking</i>		<i>Positive Stop</i>		
510-A6		6-1	<i>Mastic/ tan caulking</i>		<i>Positive Stop</i>		
510-A7		7-1	<i>Mastic/ gray sealant</i>	y	<b>None Detected</b>	3% ce	97% qu,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
gy - gypsum	ve - vermiculite	mw - mineral wool	br - brucite
bi - binder	ot - other	wo - wollastonite	ka - kaolin (clay)
or - organic	pe - perlite	ta - talc	pa - palygorskite (clay)
ma - matrix	qu - quartz	sy - synthetic	

Approved Signatories:

Julio Robles  
Analyst

Tanner Rasmussen  
Analyst/Lab Supervisor

Chad Lytle  
Technical Manager

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



# Appendix V

Laboratory Analytical Report (Lead)

Your Project #: 650859  
 Site Location: 510 CLEARBROOK RD, ABBOTSFORD  
 Your C.O.C. #: G126190

**Attention: Tim Drozda**

SNC-LAVALIN INC.  
 BURNABY, ENVIRONMENT DIVISION  
 8648 COMMERCE COURT  
 BURNABY, BC  
 CANADA V5A 4N6

**Report Date: 2017/11/14**  
 Report #: R2476124  
 Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**MAXXAM JOB #: B798405**

**Received: 2017/11/03, 16:39**

Sample Matrix: PAINT  
 # Samples Received: 3

Analyses	Quantity	Date	Date	Laboratory Method	Analytical Method
		Extracted	Analyzed		
Elements by ICP-AES (acid extr. solid)	3	2017/11/10	2017/11/10	BBY7SOP-00018	EPA 6010c R3 m

Sample Matrix: Solid  
 # Samples Received: 3

Analyses	Quantity	Date	Date	Laboratory Method	Analytical Method
		Extracted	Analyzed		
Metals - TCLP	3	2017/11/09	2017/11/10	BBY7SOP-00005,	EPA 1311, 6020bR2 m
TCLP pH Measurements	3	N/A	2017/11/10	BBY7SOP-00005	EPA 1311 R1992

**Remarks:**

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

\* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Your Project #: 650859  
Site Location: 510 CLEARBROOK RD, ABBOTSFORD  
Your C.O.C. #: G126190

**Attention: Tim Drozda**

SNC-LAVALIN INC.  
BURNABY, ENVIRONMENT DIVISION  
8648 COMMERCE COURT  
BURNABY, BC  
CANADA V5A 4N6

**Report Date: 2017/11/14**  
Report #: R2476124  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**MAXXAM JOB #: B798405**  
**Received: 2017/11/03, 16:39**

Encryption Key



Dan Woolger  
Project Manager  
14 Nov 2017 12:44:17

Please direct all questions regarding this Certificate of Analysis to your Project Manager.  
Dan Woolger, Project Manager  
Email: [dwoolger@maxxam.ca](mailto:dwoolger@maxxam.ca)  
Phone# (604) 734 7276

=====

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B798405  
Report Date: 2017/11/14

SNC-LAVALIN INC.  
Client Project #: 650859  
Site Location: 510 CLEARBROOK RD, ABBOTSFORD  
Sampler Initials: MAH

**ELEMENTS BY ATOMIC SPECTROSCOPY (SOLID)**

Maxxam ID		SK3236	SK3237	SK3238	
Sampling Date		2017/11/03 08:30	2017/11/03 09:00	2017/11/03 09:30	
COC Number		G126190	G126190	G126190	
	<b>UNITS</b>	<b>510-P1-TCLP</b>	<b>510-P2-TCLP</b>	<b>510-P3-TCLP</b>	<b>QC Batch</b>
<b>TCLP Extraction Procedure</b>					
Initial pH of Sample	pH	4.76	4.98	4.50	8826071
Final pH of Leachate	pH	4.88	4.84	4.83	8826071
pH of Leaching Fluid	pH	4.94	4.94	4.94	8826071

Maxxam Job #: B798405  
Report Date: 2017/11/14

SNC-LAVALIN INC.  
Client Project #: 650859  
Site Location: 510 CLEARBROOK RD, ABBOTSFORD  
Sampler Initials: MAH

**TCLP METALS (SOLID)**

<b>Maxxam ID</b>		SK3236	SK3237	SK3238		
<b>Sampling Date</b>		2017/11/03 08:30	2017/11/03 09:00	2017/11/03 09:30		
<b>COC Number</b>		G126190	G126190	G126190		
	<b>UNITS</b>	<b>510-P1-TCLP</b>	<b>510-P2-TCLP</b>	<b>510-P3-TCLP</b>	<b>RDL</b>	<b>QC Batch</b>
<b>TCLP Extraction Procedure</b>						
LEACHATE Lead (Pb)	mg/L	<0.10	<0.10	0.30	0.10	8827464
RDL = Reportable Detection Limit						

Maxxam Job #: B798405  
Report Date: 2017/11/14

SNC-LAVALIN INC.  
Client Project #: 650859  
Site Location: 510 CLEARBROOK RD, ABBOTSFORD  
Sampler Initials: MAH

**LEAD IN PAINT CHIPS (PAINT)**

<b>Maxxam ID</b>		SK3233	SK3234	SK3235		
<b>Sampling Date</b>		2017/11/03 08:30	2017/11/03 09:30	2017/11/03 10:30		
<b>COC Number</b>		G126190	G126190	G126190		
	<b>UNITS</b>	<b>510-P1</b>	<b>510-P3</b>	<b>510-P4</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Total Metals by ICP</b>						
Total Lead (Pb)	mg/kg	1770 (1)	7460 (1)	904 (1)	6.0	8826131
RDL = Reportable Detection Limit (1) Detection limits raised based on sample weight used for analysis.						



Maxxam Job #: B798405  
Report Date: 2017/11/14

SNC-LAVALIN INC.  
Client Project #: 650859  
Site Location: 510 CLEARBROOK RD, ABBOTSFORD  
Sampler Initials: MAH

### GENERAL COMMENTS

**Results relate only to the items tested.**

Maxxam Job #: B798405  
Report Date: 2017/11/14

**QUALITY ASSURANCE REPORT**

SNC-LAVALIN INC.  
Client Project #: 650859  
Site Location: 510 CLEARBROOK RD, ABBOTSFORD  
Sampler Initials: MAH

QC Batch	Parameter	Date	Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
8826071	Final pH of Leachate	2017/11/10					4.94	pH	0	N/A		
8826071	Initial pH of Sample	2017/11/10					4.94	pH	0.55	N/A		
8826071	pH after HCl	2017/11/10							1.7	N/A		
8826071	pH of Leaching Fluid	2017/11/10					4.94	pH	0	N/A		
8826131	Total Lead (Pb)	2017/11/10					<3.0	mg/kg	14	35	89	80 - 120
8827464	LEACHATE Lead (Pb)	2017/11/10	106	75 - 125	111	75 - 125	<0.10	mg/L	NC	35		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

Invoice Information	Report Information (if differs from invoice)	Project Information (where applicable)	Turnaround Time (TAT) Required
Company Name: <u>SNO Lavalin Inc.</u> Contact Name: <u>Tim Drozda / Aaron Hall</u> Address: <u>8648 Commerce Court</u> <u>Burnaby BC PC: V5A 4H6</u> Phone: <u>604-515-5151</u> Email: <u>tim.drozda@snelavalin.com</u>	Company Name: <u>As AT LEFT</u> Contact Name: _____ Address: _____ PC: _____ Phone: <u>see results to</u> Email: <u>aaron.hall@snelavalin.com</u>	Quotation #: <u>SNO Lavalin Pricing</u> P.O. #/ AFE#: _____ Project #: <u>650859</u> Site Location: <u>510 Clearbrook Rd, Abbotsford</u> Site #: _____ Sampled By: <u>MAH</u>	Regular TAT 5 days (Most analyses) PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS Rush TAT (Surcharges will be applied) <input type="checkbox"/> Same Day <input type="checkbox"/> 2 Days <input type="checkbox"/> 1 Day <input type="checkbox"/> 3 Days Date Required: _____

Regulatory Criteria	Special Instructions	Analysis Requested	Rush Confirmation #:
<input type="checkbox"/> BC CSR Soil <input type="checkbox"/> BC CSR Water <input type="checkbox"/> YK CSR Soil <input type="checkbox"/> YK CSR Water <input type="checkbox"/> CCME (Specify) <input type="checkbox"/> Other (Specify) <u>Lead in Paint DL = &lt;90 mg/kg</u> <input type="checkbox"/> Drinking Water <input type="checkbox"/> BC Water Quality	<input type="checkbox"/> Return Cooler <input type="checkbox"/> Ship Sample Bottles (Please Specify)	<input type="checkbox"/> MTBE <input type="checkbox"/> VOC / BTEX / VPH <input type="checkbox"/> VOC / BTEX / F1 <input type="checkbox"/> LEPH/HEPH/PAH <input type="checkbox"/> TEH <input type="checkbox"/> F2 - FA <input type="checkbox"/> Filtered? Preserved? <input type="checkbox"/> Filtered? Preserved? <input type="checkbox"/> Field Preserved? <input type="checkbox"/> Field Preserved? <input type="checkbox"/> Chloride Sulphate <input type="checkbox"/> Fluoride <input type="checkbox"/> BOD <input type="checkbox"/> COD <input type="checkbox"/> TDS <input type="checkbox"/> Conductivity <input type="checkbox"/> Alkalinity <input type="checkbox"/> Nitrate <input type="checkbox"/> Ammonia	LABORATORY USE ONLY CUSTODY SEAL Y/N Present Intact NA NA NA COOLING MEDIA PRESENT Y / N COMMENTS

SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

Sample Identification	Date Sampled (YYYY/MM/DD)	Time Sampled (HH:MM)	Matrix	BTEX / VPH	BTEX / F1	PAH	TEH	F2 - FA	Filtered?	Preserved?	Field Preserved?	Total Metals	Total Mercury	Chloride	Fluoride	Sulphate	BOD	COD	TDS	Conductivity	Alkalinity	Nitrate	Ammonia	
1 510-P1	2017/11/03	0830	Paint																					
2 510-P3	2017/11/03	0930	Paint																					
3 510-P4	2017/11/03	1030	Paint																					
4 510-P1-TCLP	2017/11/03	0830	Wood																					
5 510-P2-TCLP	2017/11/03	0900	Wood																					
6 510-P3-TCLP	2017/11/03	0930	Wood																					
7																								
8																								
9																								
10																								

RELINQUISHED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)
	2017-Nov-3	1635		2017/11/03	16:39

Unless otherwise agreed to in writing, work submitted on this Chain of Custody is subject to Maxxam's standard Terms and Conditions. Signing of this Chain of Custody document is acknowledgment and acceptance of our terms which are available for viewing



B798405\_COC



**SNC-Lavalin Inc.**  
8648 Commerce Court  
Burnaby, British Columbia, Canada V5A 4N6  
☎ 604.515.5151 🌐 604.515.5150  
[www.snclavalin.com](http://www.snclavalin.com)



**SNC • LAVALIN**

November 24<sup>th</sup>, 2017  
Project No: WG1-1186

**Public Works and Government Services Canada**  
219 – 800 Burrard Street  
Vancouver, B.C.  
V6Z 0B9

**Attention: Mr. Patrick V Truong, P.Eng., Project Manager**  
Email: [patrick.truong@pwgsc-tpsgc.gc.ca](mailto:patrick.truong@pwgsc-tpsgc.gc.ca)  
Phone: 778.580.5706

**Re: Geotechnical Investigation and Report  
Proposed Clearbrook Equipment Storage Shed  
510 Clearbrook Road, Abbotsford, B.C.**

## 1. INTRODUCTION

This report presents the results of a geotechnical investigation conducted by Western Geotechnical Consultants Ltd. (WesternGeo) for the proposed equipment storage shed located at the above referenced project site. The purpose of the investigation was to evaluate the soil conditions in order to provide comments and geotechnical recommendations for:

- Depth to competent subgrade for the proposed building;
- Soil bearing capacity for building foundations;
- Compaction requirements for structural fill; and,
- Observed groundwater conditions.

Attachments to this report include a Borehole Location Plan and Soil Logs. Environmental considerations are outside the scope of this report. This report may be used by the City of Abbotsford for development and building planning purposes.

**British Columbia Locations:**  
Abbotsford, Burnaby, Sechelt,  
Surrey (Head Office), and Squamish.

**Alberta Locations:**  
Calgary



GEOTECHNICAL

GEOLOGICAL

GEOENVIRONMENTAL



## 2. SITE DESCRIPTION AND PROPOSED DEVELOPMENT

The subject site is located at the civil address 510 Clearbrook Road, Abbotsford, B.C. It is rectangular in shape, measuring approximately 390 m E-W and 200 m N-S. The property is bounded by Clearbrook Road to the west. The remainder of the property is surrounded by land located within the Agricultural Land Reserve (ALR). At time of investigation two (2) building were located along the southern property line of the site. The remainder of the site is occupied by agricultural fields. The terrain is generally flat lying.

WesternGeo has not reviewed a site plan or drawings of the proposed building during preparation of this report. However, it is understood that the building will consist of a single storey storage shed, with a slab-on-grade foundation.

## 3. FIELD WORK

A member of WesternGeo's technical staff visited the site on November 22<sup>nd</sup>, 2017 to complete site reconnaissance, subsurface soil investigation and percolation testing. The subsurface soil investigation included drilling four (4) boreholes, using a locally subcontracted track-mounted solid stem auger. Dynamic Cone Penetration Tests (DCPTs) were performed at each borehole. WesternGeo's staff visually logged and classified the soil excavated from each borehole. Representative soil samples were obtained for further classification and testing in the laboratory. The subject site was traversed by foot in accessible areas and any features of engineering geological significance were recorded. Boreholes were immediately filled with excavated soil and filter sand after the completion of drilling and soil logging.

A Borehole Location Plan (Figure 1) and Soil Logs of the individual boreholes are appended to the report.

## 4. SOIL AND GROUNDWATER CONDITIONS

According to the Geological Survey of Canada Map the property is situated in Sumas Drift sediments consisting of sand and gravel soil. This is consistent to the observations during investigation.

The following describes the specific soil conditions in the boreholes and is representative of the general soil condition in the immediate vicinity of each respective borehole. Interpretation of soil conditions between boreholes is based on an assumed continuity of the subsurface conditions. The soil conditions described are generalized and are based on the available borehole information. Variation in soil stratigraphy can occur between borehole locations, and in the areas not investigated. The soil logs should only be referenced for soil and groundwater conditions at the specific borehole locations.



Based on the conditions observed in the boreholes and the general characterizations of the geological maps, the general stratigraphy for the development in order of increasing depth is summarized below. See attached soil logs for information at each borehole location.

- **TOPSOIL:** silty, some sand, organics and rootlets, loose, dark brown, moist;
- **SILT:** trace sand, soft to firm, low plasticity, medium brown, moist;
- **SAND:** gravelly to some gravel, medium to coarse grained, sub-rounded, compact to very dense, brownish grey, moist

Groundwater was not encountered at any of the borehole locations during investigation. Seasonal fluctuations in the groundwater table are expected.

## 5. DISCUSSION AND RECOMMENDATIONS

Based on our findings and within the limits as discussed in this report, the proposed building and construction on this site is feasible from a geotechnical engineering standpoint. The land can be used safely for their intended purposes provided the following recommendations in this report are incorporated into the final design and construction.

### 5.1 Seismicity

According to the B.C. Building Code (BCBC 2012), the Site Classification for this property is 'D' – Stiff Soil. The National Building Code (NBCC 2010) Seismic Hazard Calculation for the coordinates 49.01 North and 122.34 West gives a Peak Ground Acceleration (PGA) of 0.491 g for a return period equivalent to 2 % in 50 years. The design Spectral Accelerations for this seismic event are given in Table 1.

Table 1: Seismic spectral coefficients from NBCC (2010)

$S_A(0.2)$ (s)	$S_A(0.5)$ (s)	$S_A(1.0)$ (s)	$S_A(2.0)$ (s)	PGA (g)
0.997	0.669	0.320	0.168	0.491

$F_a$  and  $F_v$  values of 1.1 and 1.2 should be used, respectively. The site has low liquefaction potential due to the observed soil consistency and absence of groundwater.

### 5.2 Site Preparation

Areas within the building envelope should be stripped and cleared of fill, topsoil, organics, loose soils and other deleterious material, in order to expose undisturbed native competent soil. The estimated stripping depth for the placement of the footings of the proposed building is approximately 0.6 m to 1.0 m from existing grade on the competent, dense gravelly sand soil. Actual stripping depth may vary throughout the site during construction.





**All subgrade soils must be reviewed onsite by the Geotechnical Engineer once stripping is complete.**

In order to minimize the disturbance to the exposed subgrade, the following recommendations should be followed during construction:

- Site preparation should be undertaken during extended periods of dry weather.
- All loose or deleterious material should be stripped to expose the load bearing surfaces, to a distance beyond the building footprint equal to at least the depth of the excavation. Recommended maximum cut slopes should be 1.5 H to 1 V (Horizontal: Vertical) for slopes not exceeding a depth of 1.2 m.
- If any excavated area will remain open during extended period of time, rainfall protection measures are recommended. Polyethylene Sheeting should be used to cover all cut faces and slopes. Temporary berms and channels shall be constructed to divert water away from excavations.
- A bedding layer of 100 mm (minimum thickness) of 19 mm clear crush gravel, or approved equivalent, should be placed directly on the excavated surface.
- All water-softened or disturbed soils should be removed and replaced with compacted clean cohesionless well-grade structural fill, or as directed by the Geotechnical Engineer.

### 5.3 Foundations

The proposed building should be supported on shallow footings founded on the undisturbed gravelly sand soil, or on well-compacted structural fill (within any over-excavated areas). Geotechnical recommendations for footings are provided below:

- Footings placed directly on native undisturbed gravelly sand or on well-compacted structural fill should be designed for a Factored Ultimate Limit State (ULS) bearing capacity is 150 kPa, for a resistance factor of 0.5 in accordance with Table 8.2 of the Canadian Foundation Engineering Manual (CFEM). The Serviceability Limit State (SLS) bearing capacity is 100 kPa. The estimated total settlement of the building should not exceed 25 mm and the corresponding differential settlement should not exceed 20 mm over a 6 m span.
- Minimum footing widths should be 0.45 m for strip footings and 0.9 m for spread footings, and are subject to the requirements of the British Columbia Building Code (BCBC 2012).
- Footings should have a minimum embedment of 0.45 m below final grade, for frost protection and confinement.
- Footing subgrade should be free of any water-softened or loose soil prior to placing concrete. Placement of footings within areas of accumulated water is to be avoided and all standing water should be removed.
- If the footings are to be stepped, this should be done so that a line connecting the closest edges of two footings is no steeper than 2 H to 1 V (Horizontal to Vertical). Where this





cannot be achieved, the lower wall should be designed to accommodate the footing surcharge. The base of the footing should be below a 1 H to 1 V line projected up from the base of any adjacent excavation undertaken for installation of buried utilities.

- The geotechnical engineer should be present onsite at the time of site stripping, to verify the soil and groundwater conditions and to confirm the available bearing capacity.

#### 5.4 Excavation/Utility Trench

Where excavation is required and exceeds a depth of 1.2 m, WorkSafe B.C. guidelines for stable excavations should be followed, to ensure a safe working area.

Bedding material for utility trenches should have Type 1 gradation, in accordance with Master Municipal Construction Document (MMCD) specifications and should be placed and compacted in lifts to provide a minimum of 95% Modified Proctor maximum dry density (ASTM D-1557) around the pipe, including underneath its haunches. Hand-tamping equipment should not directly contact the pipe and should not be allowed to compact above the pipe until the full 300 mm bedding zone has been placed above it.

Imported trench backfill should consist of pit-run gravel or approved equivalent fill material that follows MMCD guidelines and should be placed only within the zone of trench backfill, above the pipe bedding zone. Trench backfill should be compacted to a minimum of 95% Modified Proctor maximum dry density.

#### 5.5 Slab-on-Grade

Floors formed as concrete slab-on-grade construction should be underlain with a minimum 100 mm-thick layer of 19 mm clear crushed gravel, or alternatively clean cohesionless well-graded granular fill (with less than 5 percent passing the 0.075 mm sieve), compacted to a minimum of 95% of Standard Proctor maximum dry density (ASTM D-698). A moisture barrier, such as 6 mil polyethylene sheeting should be installed underneath the slab to minimize potential for slab dampness. A thin layer of sand can be placed underneath the poly to avoid puncture due to gravels.

#### 5.6 Structural Fill

Structural fill is defined as fill placed beneath any load bearing area. Imported structural fill should consist of inorganic, clean cohesionless (less than 8 percent passing the 0.075 mm sieve), well-graded granular material.

Structural fill should extend beyond the edge of the footing and paved areas by a distance equal to, or greater than the depth of structural fill below these structural elements. Structural fill should be placed in maximum 0.3 m lifts. Table 3 summarizes the compaction recommendations for structural fill for various structural components



**Table 3: Compaction Requirements for Structural Fill**

<b>Structural Component</b>	<b>Minimum Compaction</b>
Beneath building envelope, slab-on-grade, and basement wall backfill (non-structural loading)	95% SPMDD*
Beneath pavements and footings (structural loading)	100% SPMDD*

\*Standard Proctor maximum dry density

Laboratory Proctor and field density testing should be conducted to confirm that the standards are met. Prior to importing to the site, sources of structural fill should be reviewed by the geotechnical engineer for approval.

## 6. CONSTRUCTION REVIEW

WesternGeo should be notified during the construction stage in order to facilitate and complete necessary field reviews. As a minimum, the following field reviews are necessary at the following stages:

- Field subgrade review for buildings during site stripping;
- Confirmation of subsoil bearing capacity for building footings; and,
- Compaction testing and review of structural fill.

Upon request, WesternGeo can issue Schedule B for geotechnical aspects of the Building Permit Application for the individual buildings constructed for this project. To ensure commitment to field reviews, WesternGeo must be notified when the work commences, to conduct the necessary field reviews during construction. WesternGeo cannot assume responsibility or liability for the adequacy of its recommendations when they are used in the field without WesternGeo being retained to review and approve the actual soil conditions during construction.

## 7. LIMITATIONS

The recommendations in this report are provided on the assumption that the contractor will be suitably qualified and experienced. In the event of report revisions, additional funds may be required. The subsurface conditions may vary between boreholes and with time. The interpretation of subsurface conditions provided is an opinion and not a certification. Stratigraphic variations in ground conditions are expected due to its historic nature. As such, all explorations involve an inherent risk that some conditions will not be detected.

Environmental considerations are outside the scope of this geotechnical report. Our recommendations do not constitute a design of any proposed structural element. Incorporation of our recommendations into the design does not constitute us as designers. The designers of such elements must consider the appropriateness of our recommendations.



Samples obtained from site will be retained in our laboratory for 60 days. Should no instructions be received to the contrary, these samples will then be discarded. This report has been made in accordance with the generally accepted soil and foundation engineering practices.

No other warranty, expressed or implied, is made. If the project does not start within 2 years of the report date, the report may become invalid and further review may be required. This report has been prepared for the exclusive use of the client, City of Abbotsford and their "Approved Users" for specific application to the development mentioned in the report. WesternGeo and its employees accept no responsibility to another party for loss or liability incurred as a result of use of this report. Any use of this report for purposes other than the intended, should be approved in writing by WesternGeo. Contractors should rely upon their own explorations for costing purposes.

The above referenced report "the Report" may be relied upon by the as if the Report was directly issued to the City of Abbotsford, subject to the following conditions:

- The City of Abbotsford will only use the Report for the specific project that is the recipient and subject of the Report.
- To the extent required by law and subject to the Freedom of Information and Protection of Privacy Act, R.S.B.C., 1996, c. 165, as amended, the City of Abbotsford agrees not to disclose or distribute the Report furnished hereunder to any third party unless City of Abbotsford on the first page of the Report places a prominent statement that "THIS REPORT MAY NOT BE RELIED UPON WITHOUT THE EXPRESS WRITTEN CONSENT OF THE AUTHOR OF THE REPORT".



## 8. CLOSURE

We appreciate the opportunity to be of service to you. If you have any questions regarding the contents of this report, or if we can be of further assistance to you on this project, please call any of the undersigned.

Yours truly,

**Western Geotechnical Consultants Ltd.**

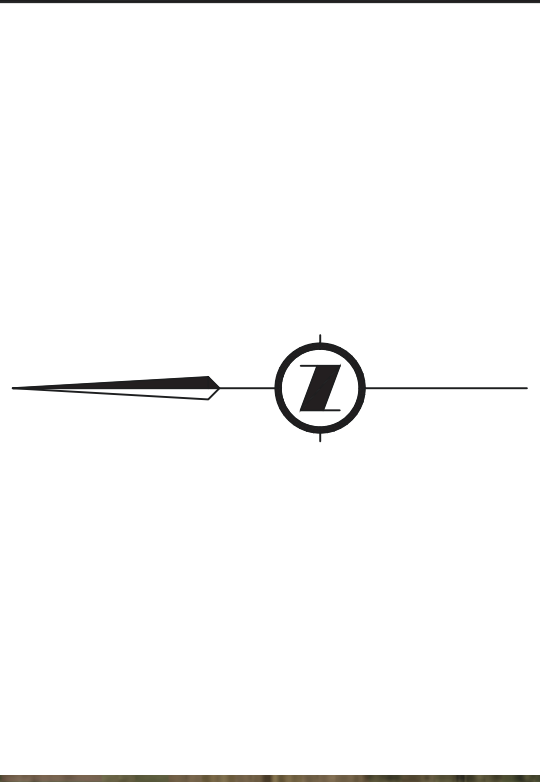
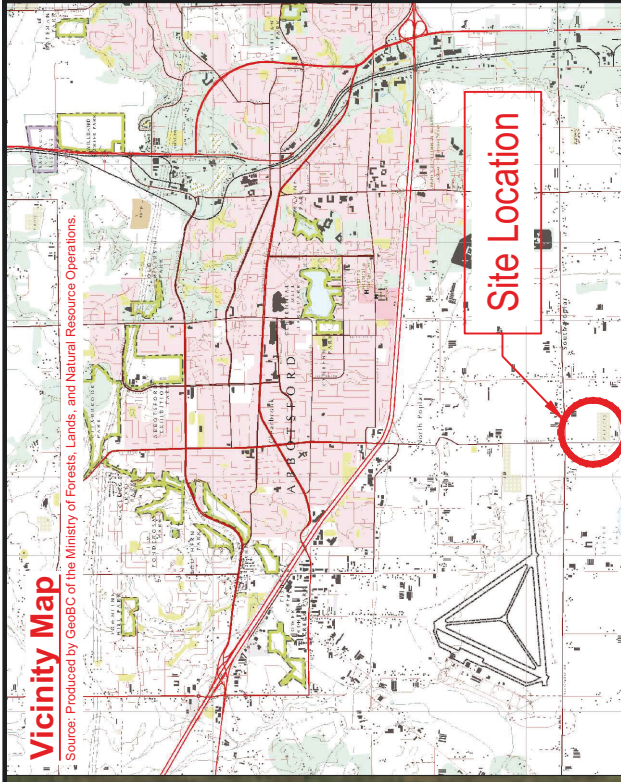
Prepared by:

Loni Nickel, E.I.T  
Geotechnical Engineer in Training

Reviewed by:

John Meng, P.Eng., Ph.D.  
Geotechnical Engineer

**Attachments:**     **Figure 1: Borehole Location Plan**  
                             **Soil Logs**



Source: Underlay image provided by Google Imagery 2017

Legend:

 Borehole Location (approximate)

Professional Seal:

Client:	Public Works Canada
Project Number:	WG1-1186
Drawing Number:	Figure 1
Date of Drawing:	2017-11-22
Drawn By:	C. Schentag
Reviewed By:	NTS
Scale:	NTS

**WESTERN**  
**GEOTECHNICAL CONSULTANTS LTD.**  
 QUALITY INNOVATIVE SOLUTIONS  
 103-19162 22nd Ave.  
 Surrey, B.C. V3Z 3S6  
 t. 604.385.4244  
 f. 604.385.4245  
 e. email@westerngeo.ca  
 www.westerngeo.ca



OQMP  
 Occupational Quality Management Program  
 Reviewed by: \_\_\_\_\_



# SOIL LOG

AH-01

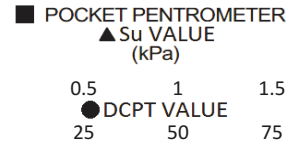
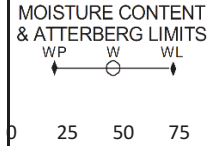
CLIENT NAME: Public Works Canada  
 PROJECT NAME: Clearbrook Equipment Shed  
 LOCATION: 510 Clearbrook Road, Abbotsford B.C.  
 TEST METHOD: Track Mounted Solid Stem Auger Rig

GWT (ft): N/A  
 TEST DATE: 11/22/2017

PROJECT NO. WG1-1186  
 ELEVATION:  
 NORTHING:  
 EASTING:

Western Geotechnical Consultants Ltd

SOIL DESCRIPTION



SOIL SYMBOL	SOIL CLASSIFICATION	DEPTH (m)	DEPTH (ft)	SOIL DESCRIPTION		
	TS	0.1	0.3	TOPSOIL: silty, some sand, organics and rootlets, loose, dark brown, moist	0	
	ML	0.6	2	SILT: trace sand, soft, low plasticity, medium brown, moist	2	
	SW	6	20	SAND: gravelly, medium to coarse, sub rounded, dense to very dense, brownish grey, moist  Becomes less gravelly with depth.	4 6 8 10 12 14 16 18 20	4 6 8 10 12 14 16 18 20

Note: Backfilled with auger cuttings and filter sand

Logged by: CS

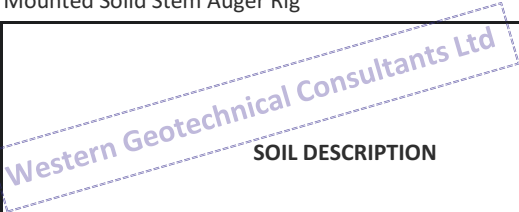
# SOIL LOG

AH-02

CLIENT NAME: Public Works Canada  
 PROJECT NAME: Clearbrook Equipment Shed  
 LOCATION: 510 Clearbrook Road, Abbotsford B.C.  
 TEST METHOD: Track Mounted Solid Stem Auger Rig

GWT (ft): N/A  
 TEST DATE: 11/22/2017

PROJECT NO. WG1-1186  
 ELEVATION:  
 NORTHING:  
 EASTING:



SOIL SYMBOL	SOIL CLASSIFICATION	DEPTH (m)	DEPTH (ft)	SOIL DESCRIPTION	MOISTURE CONTENT & ATTERBERG LIMITS WP      W      WL	POCKET PENTROMETER ▲ Su VALUE (kPa) ● DCPT VALUE
	FILL	0.3	1	FILL (Driveway); pitrun sand and gravel, compact, dark brown, moist		●
	ML	0.9	3	SILT: trace sand, soft to firm, low plasticity, medium brown, moist		●
	SW	4.6	15	SAND: gravelly, medium to coarse, sub rounded, compact to dense, brownish grey, moist  Loose to compact at 10 ft - 12 ft below ground  Becomes less gravelly with depth.		●

Note: Backfilled with auger cuttings and filter sand

Logged by: CS

# SOIL LOG

AH-03

CLIENT NAME: Public Works Canada  
 PROJECT NAME: Clearbrook Equipment Shed  
 LOCATION: 510 Clearbrook Road, Abbotsford B.C.  
 TEST METHOD: Track Mounted Solid Stem Auger Rig

GWT (ft): N/A  
 TEST DATE: 11/22/2017

PROJECT NO. WG1-1186  
 ELEVATION:  
 NORTHING:  
 EASTING:



SOIL SYMBOL	SOIL CLASSIFICATION	DEPTH (m)	DEPTH (ft)	SOIL DESCRIPTION	MOISTURE CONTENT & ATTERBERG LIMITS	POCKET PENTROMETER & Su VALUE (kPa)
TS		0.3	1	TOPSOIL: silty, some sand, organics and rootlets, loose, dark brown, moist		
ML		1	3.3	SILT: trace sand, soft, low plasticity, medium brown, moist		
SW		4.5	15	SAND: gravelly, medium to coarse, sub rounded, dense to very dense, brownish grey, moist  Becomes less gravelly with depth.		

Note: Backfilled with auger cuttings and filter sand

Logged by: CS



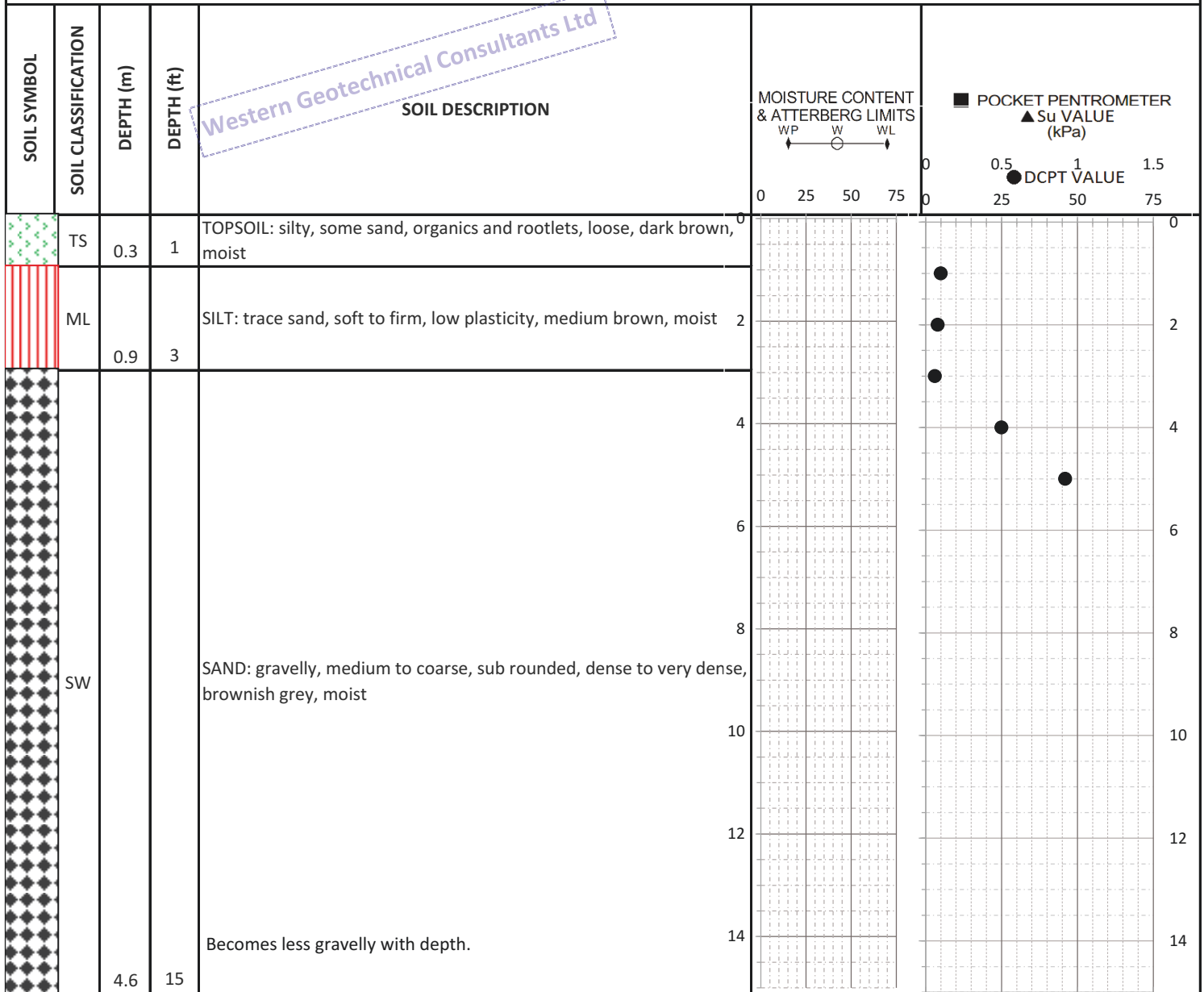
# SOIL LOG

AH-04

CLIENT NAME: Public Works Canada  
 PROJECT NAME: Clearbrook Equipment Shed  
 LOCATION: 510 Clearbrook Road, Abbotsford B.C.  
 TEST METHOD: Track Mounted Solid Stem Auger Rig

GWT (ft): N/A  
 TEST DATE: 11/22/2017

PROJECT NO. WG1-1186  
 ELEVATION:  
 NORTHING:  
 EASTING:



Note: Backfilled with auger cuttings and filter sand

Logged by: CS